

Broward County,
Florida



SOUTH BROWARD COUNTY RESOURCE RECOVERY PROJECT, INC.

Solid Waste Energy Recovery - Application for Power Plant Site Certification

**MALCOLM
PIRNIE**

Volume I -
Route 441
Technical Submittal

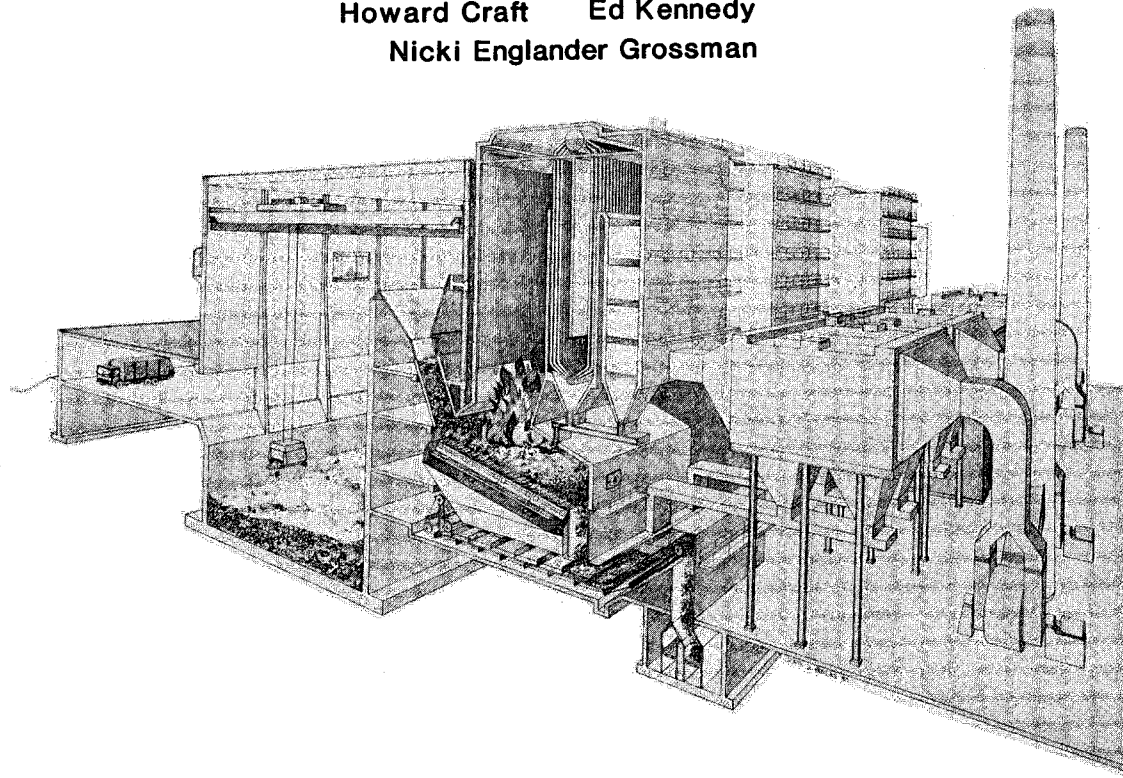
South Broward County Resource Recovery Project, Inc.

Solid Waste Energy Recovery Facility Application for Power Plant Site Certification

Volume I - Route 441 - Technical Submittal

Submitted By
The Broward County
Board of County Commissioners

Scott I. Cowan, Chairman
Gerald Thompson, Vice Chairman
Marcia Beach Howard Forman
Howard Craft Ed Kennedy
Nicki Englander Grossman



Floyd T. Johnson, County Administrator
Thomas M. Henderson, Director, Resource Recovery Office

March 1985

**MALCOLM
PIRNIE**





Resource Recovery Office

Room 521, 115 South Andrews Avenue
Fort Lauderdale, Florida 33301
(305) 357-6458

March 29, 1985

State of Florida
Department of Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32301

Attention: Mr. Hamilton Oven, P.E.
Power Plant Siting Section

Re: Power Plant Site Certification Application
South Broward County Resource Recovery Project, Inc.

Gentlemen:

(On behalf of the Broward County Board of County Commissioners,
an application for certification under Chapter 17-17 FAC for
construction and operation of the referenced project is
herewith submitted for Departmental review. Also herewith
transmitted, in conjunction with the application itself, is the
requisite \$25,000 fee per FAC Rule 17-17. This application has
been prepared in accordance with the intent of the Power Plant
Siting Act as set forth in Section 403 Florida Statutes, the
requirements of the Electrical Power Plant Siting Regulations
as set forth in Florida Administrative Code Rule 17-17, and the
format and informational requirements of Electrical Power Plant
Site Certification Applications as set forth in Florida
Department of Environmental Regulation Form 17-1.211(72).)

Please note that the applicant for this certification (the
South Broward County Resource Recovery Project, Inc.), as owner
and operator of the referenced project, constitutes a legal
corporation in the State of Florida duly established by the
authority of the Broward County Board of County Commissioners.
Certain rights and obligations of said corporation may be
transferred, at a future date, to a full-service vendor
selected to enter into a long-term contractual service
agreement with Broward County.

As you are aware, the subject application addresses both the
resource recovery facility and the unprocessable waste/ash
residue landfill components of the referenced project. Both
facilities are to be located at the site proposed and described
by the application and together constitute the subject of the
Certification herein requested.

BROWARD COUNTY BOARD OF COUNTY COMMISSIONERS

Marcia Beach Scott I. Cowan Howard Craft Howard Forman Nicki Englander Grossman Ed Kennedy Gerald Thompson

An Equal Opportunity Employer

Broward County has, since 1981, been engaged in planning and engineering studies designed to implement a sound program of solid waste management. The resource recovery program identified through these efforts, of which the referenced project is an integral part, will provide Broward County a proven and reliable means of solid waste disposal which is necessary to resolve the capacity limitations of its existing landfills. Indeed, expeditious implementation of the identified program is critical to the continued ability of Broward County to dispose of such waste in an environmentally and economically acceptable manner and thereby help maintain the current standard-of-living and well-being of the County citizenry.

Over the past year, several significant accomplishments have marked efforts to implement the proposed resource recovery program and realize the above-stated objective. Firstly, as reflected in the special study report "Compilation of Information-Route 441 Zoning and Land Use" submitted in conjunction with the subject application in conformance with FAC Rule 17-17.121(3)(1), diligent efforts by Broward County have successfully secured legal control of the site for the referenced project and have achieved appropriate zoning and land use classifications for same. Secondly, Broward County has recently received proposals from two full-service vendors (Signal RESCO, Inc. and the American Ref-Fuel Company) competing for the right to enter into a long-term contract with the County for the design, construction and operation of the referenced project. Certain information from these vendor proposals has been incorporated into the subject application; review of the proposals is currently being undertaken by Broward County. Thirdly, the County has recently secured financing for the proposed program through the issuance of Industrial Development Bonds which, with a total bond issue in excess of 500 million dollars, represents the largest bond issue undertaken to date in the United States for a single resource recovery program. Finally, Broward County has received certain key regulatory agency approvals necessary to construct the referenced project at the proposed site.

Regulatory approvals obtained to date for the referenced project are particularly germane to the subject application. On February 6, 1984 the County received approval from the U.S. Department of Transportation, Federal Aviation Administration to construct the referenced project at the proposed site (see Appendix 10.1.6 of the subject application). With respect to

dredge and fill activities necessary to construct the referenced project at the proposed site, the U.S. Department of Defense, Army Corps of Engineers issued a letter to the County on July 13, 1984 stating its intent to grant the required permit under Section 404 of the Clean Water Act upon issuance of a Water Quality Certification by the State of Florida pursuant to Section 401 of the Clean Water Act. On September 14, 1984 the County received notice of Intent to Issue from the Florida Department of Environmental Regulation concerning the required State dredge and fill permit and associated Water Quality Certification. We understand that further action by the State toward issuing those permits will be encompassed by final approval under the Power Plant Site Certification process for which the present application is transmitted this date. While we understand such action is necessary to comply with Section 403 Florida Statutes and rules promulgated thereunder, we trust that further detailed review of this aspect of the project will not be necessary since the present scope and magnitude of proposed dredge and fill activities (as well as the mitigation plan already approved by the agency) remain unchanged from that which has already been found acceptable to the agency and upon which the referenced notice of Intent to Issue was based. In this regard, we wish to note that Broward County has invested considerable resources evaluating potential impacts of the proposed program on air, water and land resources and in obtaining regulatory approval for dredge and fill activities required for the referenced project, including the expenditure of over 7 million dollars to date in support of the mitigation program which has been reviewed and found acceptable by both the U.S. Army Corps of Engineers and the Florida Department of Environmental Regulation. Correspondence pertaining to the required dredge and fill permits has been incorporated into the subject application (see Appendix 10.1.4 relative to the U.S. Army Corps of Engineers permit and Appendix 10.4 relative to the Florida Department of Environmental Regulation permit).

In addition to the above, we wish to advise that several other permit applications for the referenced project were individually submitted to the appropriate Bureaus and Divisions of the Department of Environmental Regulation in the recent past. These submittals were based on a lower projected throughput capacity for the referenced project with an associated standing electrical generating capacity of less than 50 megawatts. Because the projected capacity, as reflected in the present application, has since been increased resulting in greater than 50 megawatt standing electric generating capacity,

it is now necessary to seek certification under the Power Plant Siting Act through which such required permit program approvals will be consolidated. While those permit applications previously submitted (with the exception of the State dredge and fill permit noted above) have not been formally acted upon to date, much basic information contained therein remains applicable to the referenced project. Therefore, we are hopeful that the familiarity gained by the Department through its previous review of the referenced project will, at a minimum, result in a timely and expeditious review of same under the Electrical Power Plant Site Certification process.

As discussed above, it is imperative that the proposed resource recovery program be implemented at the earliest possible time in order for Broward County to provide solid waste disposal services for its citizenry in the near future. Failure to do so will jeopardize not only the future social vitality of Broward County but may, in the absence of available disposal alternatives, compromise the existing quality of environmental resources in the area by continuing reliance on landfill practices for disposal of the total County solid waste stream. Therefore, Broward County is prepared to commit, consistent with applicable regulatory requirements and provisions, those resources necessary for expeditious implementation of the referenced project. Our current schedule, which is based on having the referenced project facilities on-line and available to serve Broward County needs by mid-1988, dictates that construction commence on the proposed site by the end of 1985. Your cooperation and assistance toward realization of this goal will be sincerely appreciated.

Very truly yours,



Thomas M. Henderson
Project Director
Broward County Resource Recovery Office
and
Attorney-in-Fact
South Broward County Resource Recovery Project, Inc.

**SOUTH BROWARD COUNTY
RESOURCE RECOVERY PROJECT, INC.
SOLID WASTE ENERGY
RECOVERY FACILITY**

**APPLICATION FOR
POWER PLANT SITE CERTIFICATION -
ROUTE 441 SITE**

**Submitted By
The Broward County Board of
County Commissioners**

March 1985



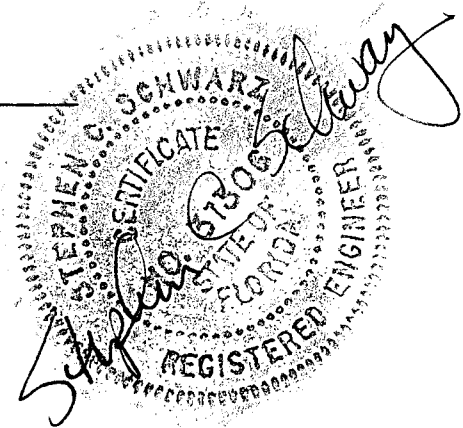
SOUTH BROWARD COUNTY RESOURCE RECOVERY PROJECT, INC.
SOLID WASTE ENERGY RECOVERY FACILITY

POWER PLANT SITE CERTIFICATION APPLICATION
ROUTE 441 SITE

SUBMITTED BY

BROWARD COUNTY BOARD OF COUNTY COMMISSIONERS
Broward County Governmental Center
115 S. Andrews Avenue
Fort Lauderdale, Florida 33313

MARCH 1985



MALCOLM PIRNIE, INC.
2 Corporate Park Drive
P.O. Box 751
White Plains, New York 10602

**MALCOLM
PIRNIE**

SUN BANK/SOUTH FLORIDA N.A.
P.O. BOX 5100
FORT LAUDERDALE, FLORIDA 33310

BOARD OF COUNTY COMMISSIONERS

BROWARD COUNTY

FORT LAUDERDALE, FLORIDA

63-607
670

NO. 0041151

PAY

EXACTLY*****25,000**DOLLARS AND CENTS

DATE CHECK NO.

AMOUNT

03/18/85 41151

*****25,000.00*



TO
THE
ORDER
OF

STATE OF FLORIDA
DEPT OF ENVIRON REG
2600 BLAIR STONE RD
TALLAHASSEE FLA 32301

VOID AFTER (90) NINETY DAYS

CHAIRMAN BOARD OF COUNTY COMMISSIONERS

AUTHORIZED SIGNATURE

[REDACTED]

SOUTH BROWARD COUNTY RESOURCE RECOVERY PROJECT, INC.
SOLID WASTE ENERGY RECOVERY FACILITY
APPLICATION FOR POWER PLANT SITE CERTIFICATION
BROWARD COUNTY, FLORIDA

APPLICANT INFORMATION

Applicant's Official Name: South Broward County Resource Recovery
Project, Inc.

Address: c/o CT Corporation System
8751 West Broward Boulevard
Plantation, Florida 33324

Business Entity: A Florida Corporation

Name and Title of Business Head: Andrea K. Feirstein
Member, Board of Directors

Name, Title and Address of
Representative Responsible
for Obtaining Certification Thomas M. Henderson
Attorney-in-Fact
Room 521
115 South Andrews Avenue
Ft. Lauderdale, Florida 33301

Site Location: County: Broward
Address: 4400 South State
Road 7
Ft. Lauderdale, Florida 33301
(Unincorporated Area)

Latitude: 26° 04' 07" N

Longitude: 80° 12' 19" W

UTM Zone: 17

UTM x coordinate: 579.54 km

UTM y coordinate: 2883.34 km

Township and Range:
T505S, R41E, Sections 24 and 25
T505S, R42E, Sections 19 and 30

Location of Any Directly
Associated Transmission
Facilities: Florida Power and Light Company (across
canal to east from Project Site)

SOUTH BROWARD COUNTY RESOURCE RECOVERY PROJECT, INC.
SOLID WASTE ENERGY RECOVERY FACILITY
APPLICATION FOR POWER PLANT SITE CERTIFICATION
BROWARD COUNTY, FLORIDA

APPLICANT INFORMATION (continued)

Nameplate Generating Capacity
of Proposed Facility:

68.5 megawatts

Ultimate Generating Capacity
for Certification

96.1 megawatts

Purpose of Project:

The purpose of the proposed solid waste-fired electrical power plant is to dispose of solid waste and recover energy and possibly materials. This proposed facility will afford Broward County a method of solid waste disposal as a substitute for the present sanitary landfilling operations and in doing so generate enough electricity to service over 50,000 homes annually.

BROWARD COUNTY, FLORIDA
SOLID WASTE ENERGY RECOVERY FACILITY
APPLICATION FOR POWER PLANT SITE CERTIFICATION

TABLE OF CONTENTS

	<u>Page</u>
ABBREVIATIONS AND ACRONYMS	A-1
EXECUTIVE SUMMARY	ES-1
1. NEED FOR POWER AND THE PROPOSED FACILITIES	
1.1 Overview	1-1
1.2 Introduction	1-1
1.3 South Broward Resource Recovery Project	1-3
1.4 Consistency of Project With State Energy Policy	1-3
1.5 Consistency of Project with the Proposed State Plan Goals and Policies	1-4
2. SITE AND VICINITY CHARACTERIZATION	
2.1 Site and Associated Facilities Delineation	2-1
2.2 Socio-Political Environment	2-5
2.2.1 Governmental Jurisdictions	2-5
2.2.2 Zoning and Land Use Plans	2-8
2.2.3 Demography and Ongoing Land Use	2-13
2.2.4 Easements, Title, Agency Works	2-14
2.2.5 Regional Scenic, Cultural and Natural Landmarks	2-15
2.2.6 Archaeological and Historic Sites	2-18
2.2.7 Socioeconomics and Public Services	2-18
2.2.7.1 Social and Economic Characteristics	2-18
2.3 Bio-Physical Environment	2-26
2.3.1 Geohydrology	2-26
2.3.1.1 Geologic Description of the Site Area	2-26
2.3.1.2 Detailed Site Lithologic Description	2-29
2.3.1.3 Geologic Maps	2-32
2.3.1.4 Bearing Strength	2-32
2.3.2 Subsurface Hydrology	2-33
2.3.2.1 Subsurface Hydrologic Data for the Site	2-33
2.3.2.2 Karst Hydrogeology	2-40
2.3.3 Site Water Budget and Area Users	2-40
2.3.3.1 Site Water Budget	2-40
2.3.3.2 Area Water Uses	2-43
2.3.3.3 Well Inventory	2-44
2.3.4 Surficial Hydrology	2-47
2.3.4.1 Hydrologic Characterization	2-47
2.3.4.2 Measurement Programs	2-53

TABLE OF CONTENTS (continued)

	<u>Page</u>
2. SITE AND VICINITY CHARACTERIZATION (continued)	
2.3.5 Vegetation/Land Use	2-53
2.3.5.1 Wetlands	2-53
2.3.5.2 Urban Wilderness	2-60
2.3.5.3 Sensitive Plant Species	2-61
2.3.6 Ecology	2-63
2.3.6.1 Species-Environmental Relationships	2-66
2.3.6.2 Pre-Existing Stresses	2-66
2.3.6.3 Measurement Programs	2-66
2.3.7 Meteorology and Ambient Air Quality	2-67
2.3.7.1 Meteorology	2-67
2.3.7.2 Ambient Air Quality	2-80
2.3.7.3 Measurement Programs	2-84
2.3.8 Noise	2-85
2.3.9 Other Environmental Features	2-86
3. THE PLANT AND DIRECTLY ASSOCIATED FACILITIES	
3.1 Background	3-1
3.1.1 Technology Selection	3-1
3.1.2 Site Selection	3-6
3.1.3 Vendor Procurement	3-9
3.2 Site Layout	3-10
3.2.1 Resource Recovery Facility	3-12
3.2.2 Unprocessable Ash/Residue Landfill	3-15
3.2.3 Habitat Enhancement	3-18
3.2.3.1 Resource Recovery Facility Mitigation	3-19
3.2.3.2 Landfill Mitigation	3-20
3.2.3.3 Landfill On-Site Mitigation	3-20
3.2.3.4 Landfill Off-Site Mitigation	3-21
3.2.3.5 North New River Mitigation Area	3-21
3.2.3.6 Tree Tops Parks Mitigation	3-22
3.2.3.7 Everglades Restoration Area Mitigation	3-23
3.3 Fuel	3-24
3.3.1 General	3-24
3.3.2 Waste Stream Control	3-24
3.3.3 Waste Quantity	3-25
3.3.4 Seasonal Variations	3-26
3.3.5 Waste Composition and Type	3-26
3.3.6 Daily Variations	3-28
3.3.7 Population Projections	3-31
3.3.8 Facility Sizing	3-31
3.3.9 Residue and Unprocessable Waste Disposal	3-33

TABLE OF CONTENTS (continued)

	<u>Page</u>
3. THE PLANT AND DIRECTLY ASSOCIATED FACILITIES (continued)	
3.4 Air Emissions and Controls	3-34
3.4.1 Air Emission Types and Sources	3-34
3.4.2 Air Emission Controls	3-37
3.4.2.1 Particulate Matter	3-40
3.4.2.2 Sulfur Dioxide	3-42
3.4.2.3 Nitrogen Oxides & Carbon Monoxide	3-42
3.4.2.4 Other Pollutants	3-43
3.4.2.5 Test Methods to Demonstrate Compliance	3-44
3.4.3 Best Available Control Technology	3-44
3.4.3.1 Particulate Matter	3-44
3.4.3.2 Sulfur Dioxide	3-47
3.4.3.3 Nitrogen Oxides and Carbon Monoxide	3-50
3.4.3.4 Other Pollutants	3-50
3.4.4 Design Data for Control Equipment	3-51
3.4.5 Design Philosophy	3-52
3.5 Plant Water Use	3-52
3.5.1 Heat Dissipation System	3-52
3.5.1.1 System Design	3-52
3.5.1.2 Source of Cooling Water	3-55
3.5.1.3 Dilution System	3-55
3.5.1.4 Blowdown, Screened Organisms, and Trash Disposal	3-57
3.5.1.5 Injection Wells	3-57
3.5.2 Domestic/Sanitary Wastewater	3-57
3.5.3 Potable Water Systems	3-57
3.5.4 Process Water Systems	3-58
3.6 Chemical and Biocide Waste	3-58
3.7 Solid and Hazardous Waste	3-59
3.7.1 Solid Waste (Ash Residue)	3-60
3.7.1.1 Handling System for Ash Residue	3-61
3.7.1.2 Disposal of Ash Residue	3-62
3.7.2 Hazardous Waste	3-62
3.8 On-Site Drainage System	3-63
3.8.1 General	3-63
3.8.2 Water Quality Design Criteria	3-63
3.8.3 Peak Discharge Criteria	3-64
3.8.4 Seasonal Water Table Elevation/ Control Elevation	3-64
3.8.5 Resource Recovery Facility	3-64
3.8.6 Residue/Unprocessble Waste Landfill	3-66
3.8.6.1 Preclosure Operation	3-66
3.8.6.2 Post Closure Operation	3-69

TABLE OF CONTENTS (continued)

	<u>Page</u>
3. THE PLANT AND DIRECTLY ASSOCIATED FACILITIES (continued)	
3.9 Materials Handling	3-70
3.9.1 Facility	3-70
3.9.2 Landfill	3-70
4. EFFECTS OF SITE PREPARATION, AND PLANT AND ASSOCIATED FACILITIES CONSTRUCTION	
4.1 Land Impact	4-2
4.1.1 General Construction Impacts	4-2
4.1.1.1 Land Disturbance	4-2
4.1.1.2 Staging, Material, Lay Down, and Work Force Parking Areas	4-3
4.1.1.3 Impact on Solid Waste Gen- eration and Disposal	4-4
4.1.2 Roads	4-5
4.1.3 Flood Zones	4-5
4.1.4 Topography and Soils	4-5
4.2 Impact on Surface Water Bodies and Uses	4-7
4.2.1 Impact Assessment	4-7
4.2.2 Measuring and Monitoring Programs	4-7
4.3 Groundwater Impacts	4-8
4.4 Ecological Impacts	4-8
4.4.1 Impact Assessment	4-8
4.4.2 Measuring and Monitoring Programs	4-9
4.5 Air Impact	4-9
4.5.1 Fugitive Dust and Mobile Source Emissions	4-9
4.5.2 Mitigation Measures	4-9
4.6 Impact on Human Populations	4-12
4.6.1 Sensitive Receptors	4-12
4.6.2 Work Force	4-12
4.6.3 Traffic Associated with Construction	4-13
4.6.4 Noise	4-14
4.7 Impact on Landmarks and Sensitive Areas	4-14
4.8 Impact on Archaeological and Historic Sites	4-15
4.9 Special Features	4-15
4.10 Benefits From Construction	4-15
4.11 Variances	4-16
5. EFFECTS OF PLANT OPERATION	
5.1 Effects of the Operation of the Heat Dissipation System	5-1
5.1.1 Temperature Effect on Receiving Body of Water	5-1
5.1.2 Effects on Aquatic Life	5-1
5.1.3 Biological Effects of Modified Circulation	5-2

TABLE OF CONTENTS (continued)

	<u>Page</u>
5. EFFECTS OF PLANT OPERATION (continued)	
5.1.4 Effects of Offstream Cooling	5-2
5.1.5 Measurement Program	5-2
5.2 Effects of Chemical and Biocide Discharges	5-2
5.2.1 Industrial Wastewater Discharges	5-2
5.2.2 Cooling Tower Blowdown	5-3
5.2.3 Measurement Programs	5-3
5.3 Impacts on Water Supplies	5-3
5.3.1 Surface Water	5-10
5.3.2 Groundwater	5-11
5.3.3 Drinking Water	5-13
5.3.4 Leachate and Runoff	5-14
5.3.4.1 General	5-14
5.3.4.2 Leachate Production	5-16
5.3.4.3 Leachate Control	5-17
5.3.5 Measurement Programs	5-18
5.3.5.1 Recommended Permanent Long-Term Ground Water Monitoring Network	5-18
5.3.5.2 Proposed Long-Term Ground Water Sampling Program	5-20
5.3.5.3 Proposed Long-Term Surface Water Monitoring Program	5-23
5.4 Solid/Hazardous Waste Disposal Impacts	5-24
5.4.1 Solid Waste	5-24
5.4.2 Hazardous Waste	5-25
5.5 Sanitary and Other Waste Discharges	5-25
5.6 Air Quality Impacts	5-25
5.6.1 Impact Assessment	5-25
5.7 Noise	5-33
5.8 Changes in Non-Aquatic Species Populations	5-35
5.8.1 Impacts	5-35
5.8.2 Monitoring	5-36
5.9 Other Plant Operation Effects	5-36
5.10 Archaeological Sites	5-36
5.11 Resources Committed	5-38
5.12 Variances	5-39
6. TRANSMISSION LINES AND OTHER LINEAR FACILITIES	
6.1 Electrical Power	6-1
6.2 Projected Interconnection Costs	6-2

TABLE OF CONTENTS (continued)

	<u>Page</u>
7. ECONOMIC AND SOCIAL EFFECTS OF PLANT CONSTRUCTION AND OPERATION	
7.1 Socio-Economic Benefits	7-2
7.1.1 State and Local Government Tax Revenues	7-2
7.1.2 Creation of Temporary and Permanent New Jobs	7-2
7.1.3 Recreation and Wetland Habitat Enhancement Benefits	7-3
7.1.4 Local Road Improvements	7-5
7.1.5 Environmental Benefits	7-5
7.1.6 Creation of a Source of Heated Discharge	7-9
7.1.7 Visitor Accomodations	7-9
7.1.8 Economic Benefits	7-9
7.1.9 Energy Benefits	7-10
7.2 Socio-Economic Costs	7-11
7.2.1 Temporary External Costs	7-15
7.2.2 Long-Term External Costs	7-16
8. SITE AND DESIGN ALTERNATIVES	
8.1 Alternative Sites	8-1
8.2 Proposed Site Design Alternatives	8-7
8.2.1 Cooling System	8-7
8.2.2 Biological Fouling Control	8-9
8.2.3 Intake System	8-9
8.2.4 Discharge System	8-9
8.2.5 Chemical Waste Treatment	8-9
8.2.6 Sanitary Waste System	8-10
8.2.7 Solid Waste Disposal System	8-10
8.2.7.1 Ash Wastes	8-10
8.2.7.2 Other Solid Wastes	8-10
8.2.8 Multiple Uses	8-10
8.2.9 Other Systems	8-11
9. COORDINATION	9-1
10. APPENDICES	10-1
11. REFERENCES	11-1

TABLES

<u>Tables</u>	<u>Description</u>	<u>Page Number</u>
2.2.1	Zoning and Land Use Chronology	2-10
2.2.2	Consistency with the Comprehensive Plan	2-11
2.2.3.1	Resident Population by Census Tract	2-13A
2.2.3.2	Resident Population by Municipality	2-13B
2.2.7.1	Unemployment Rate (Unadjusted)	2-19
2.2.7.2	Average Annual Non-Agricultural Employment	2-20
2.2.7.3	Existing Housing Information, 1980	2-22
2.2.7.4	Residential Building Permits Issue by Municipality Broward County, 1983 and 1970-1983	2-23
2.2.7.5	Residential Building Permits Issued	2-24
2.2.7.6	Average Value of Owner-Occupied Units Non-Condo and Condo	2-25
2.3.1.1	Typical Lithology - USGS Well G575	2-28
2.3.1.2	Route 441 Site Characteristics and Properties of Soils	2-31
2.3.2.1	Ground Water Elevations in Piezometers Route 441 Site	2-37
2.3.2.2	Historic Chloride Concentrations in Ground Water from Well S-862	2-39
2.3.2.3	Ground Water Quality at the Route 441 Site, Broward County, Florida, March 1984	2-41
2.3.3.1	Dixie Well Construction Details	2-46
2.3.3.2	USGS Monitor Wells	2-48
2.3.4.1	Summary of South Fork of New River Water Quality Data on March 15, 1984	2-52
2.3.5.1	List of Vascular Plants Identified During Field Reconnaissance, June, 1983	2-54

TABLES (continued)

<u>Tables</u>	<u>Description</u>	<u>Page Number</u>
2.3.5.2	Vegetation, Reported from Broward County, Considered to be Rare (R), Threatened (T), or Endangered (E)	2-62
2.3.6.1	Vertebrates, Reported from Broward County, Considered to be Endangered (E), Threatened (T), Rare (R), A Species of Special Concern (SSC), or of Status Undetermined (SU)	2-64
2.3.6.2	Vertebrates Found On-Site or Near the Site of the Proposed Broward County Resource Recovery Facility and Landfill	2-65
2.3.7.1	Temperature Means and Extremes (°F) Measured at Miami International Airport, Miami, Florida -- 1951 to 1980	2-68
2.3.7.2	Precipitation and Diurnal Relative Humidity Measured at Miami, Florida	2-70
2.3.7.3	Mean Diurnal Mixing Depths at Miami International Airport, Miami, Florida	2-72
2.3.7.4	Frequency of Occurrence of Pasquill's Stabilities for Miami, Florida -- 1969 to 1974	2-73
2.3.7.5	Joint Frequency Distribution of Wind and Pasquill Stability Class Miami, Florida, 1969 through 1974	2-74
2.3.7.6	Ambient Air Monitoring Sites in Broward County During 1983	2-81
2.3.7.7	1983 Ambient Air Quality Data for Monitoring Stations within 10 km of the Proposed Facility	2-83
2.3.8.1	Average Ambient Noise Readings, February 23, 1984	2-86
3.3.1	Comparison of Proximate Analyses - Garbage Fraction	3-29
3.3.2	Comparison of Ultimate Analyses - Garbage Fraction	3-30

TABLES (continued)

<u>Tables</u>	<u>Description</u>	<u>Page Number</u>
3.3.7.1	Broward County Population Projections	3-32
3.4.1.1	Solid Waste Charging Rate and Location of the Proposed Facility	3-35
3.4.1.2	Stack and Operating Parameters for the Projected Capacities of the Proposed Facility Considered in the Air Quality Modeling	3-36
3.4.1.3	Pollutant Emission Factors for Proposed Facility	3-38
3.4.1.4	Maximum Hourly and Annual Average Emission Rates for the Proposed Facility	3-39
3.4.4.1	Environmental Data	3-52
3.5.1.1	1982 Average Annual Water Quality Values for the Broward County System 3-A Plant	3-56
3.9.2.1	Equipment List	3-71
4.5.1	Construction Activities Impacting Fugitive Dust	4-10
4.5.2	Construction Activities Impacting Noise and Emissions from Construction Equipment	4-11
5.3.5.1	Sampling Parameters	5-22
5.6.1.1	Predicted Maximum Concentration for the Proposed BCRR Facility at Initial Projected Operation (115 Percent of Nameplate Capacity) using Screening Modeling Methods	5-26
5.6.1.2	Predicted Maximum Concentrations for the Proposed BCRR Facility at Initial Projected Operation (115 Percent of Nameplate Capacity) using Refined Modeling Methods	5-27

TABLES (continued)

<u>Tables</u>	<u>Description</u>	<u>Page Number</u>
5.6.1.3	Predicted Maximum Concentrations for the Proposed BCRR Facility at Maximum Projected Operation (115 Percent of Nameplate Capacity) Using Screening Modeling Methods	5-28
5.6.1.4	Predicted Maximum Concentrations for the Proposed BCRR Facility at Maximum Projected Operation (115 Percent of Nameplate Capacity) Using Refined Modeling Methods	5-29
5.6.1.5	Predicted Maximum Concentrations at the PSD Class I Area Due to the Proposed BCRR Facility at Initial Projected Load (115 Percent of Nameplate Capacity)	5-31
5.6.1.6	Predicted Maximum Concentrations at the PSD Class I Area Due to the Proposed BCRR Facility at Maximum Projected Load (115 Percent of Nameplate Capacity)	5-32
5.7.1	Projected Noise Impacts	5-34
5.7.2	Common Noise Levels	5-34A
5.9.1	Projected Traffic Impacts	5-37
7.2.1	Capital Cost	7-13
7.2.2	Annual Operating Costs and Revenues	7-14
8.1.1	Ranking of the Southern Sites	8-8
9.1	Coordination During Land Use Amendment Rezoning and Preparation of Power Plant Site Certification Application	9-2
9.2	Additional Parties Contacted	9-13

LIST OF PLATES

<u>Plates</u>	<u>Description</u>	<u>Following Page</u>
Plate 1	Sketch of Description of the Route 441 Site	2-1
Plate 2	Aerial Photograph of the Route 441 Site	2-1

FIGURES

<u>Figures</u>	<u>Description</u>	<u>Following Page</u>
1.1.1	Approximate Southern Resource Recovery Facility Service Area	1-1
2.1.1	Conceptual Development and Environmental Enhancement Plan for the Route 441 Site	2-1
2.1.2	Civil Site Plan	2-3
2.1.3	Proposed Landfill Design - Southern Resource Recovery Facility	2-4
2.2.1.1	Governmental Jurisdictions and Regional Scenic, Cultural and Natural Landmarks	2-5
2.2.2.1	Land Use Plan Map	2-12
2.2.2.2	Existing Land Use 5-Mile Area	2-12
2.2.3.1	1980 Census Tracts	2-13
2.2.3.2	Solid Waste Centroid Locations for Southern Broward County Communities	2-13B
2.2.7.1	1980 Census Tracts - Five Mile Radius Around Site	2-18
2.3.1.1	Dixie Area Well Logs	2-21
2.3.1.2	Dixie Area Geologic Cross Sections	2-28
2.3.1.3	Dixie Area Geologic Cross Sections	2-28
2.3.1.4	Well and Surface Water Monitoring Sites	2-28
2.3.1.5	Location Plan for Route 441 Test Borings, Monitoring Wells, and Lines of Section	2-29

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FIGURES (continued)

<u>Figures</u>	<u>Description</u>	<u>Following Page</u>
2.3.1.6	Route 441 Site Soil Map	2-29
2.3.1.7	Route 441 Site - Geologic Cross Section	2-31
2.3.1.8	Route 441 Site - Geologic Cross Section	2-31
2.3.2.1	Typical Water Level Extremes	2-34
2.3.2.2	Annual Fluctuations of Water Levels at Three Large Well Fields in Broward County	2-35
2.3.2.3	Regional Water Level Contour Map - Biscayne Aquifer, October 1983	2-35
2.3.2.4	Site Specific Water Level Contour Map	2-36
2.3.2.5	1,000 mg/l Isochlor for Biscayne Aquifer	2-37
2.3.2.6	Locations of Major Well Fields and Monitoring Wells	2-38
2.3.2.7	Average Dixie Well Water Quality	2-38
2.3.2.8	Well Chlorine Trends	2-38
2.3.2.9	Well Chlorine Trends	2-38
2.3.3.1	Total Monthly Precipitation, Inches, Fort Lauderdale, Florida	2-43
2.3.3.2	Diagramatic Portrayal of Recharge to and from the Aquifer in Broward County	2-43
2.3.3.3	Existing Wellfield Zones of Influence	2-44
2.3.4.1	South Fork New River Sampling Location	2-51
2.3.4.2	Route 441 Site Water Quality Sampling Locations	2-52
2.3.5.1	National Wetlands Inventory Land Classifications	2-53
2.3.5.2	Vegetation Map	2-53
2.3.5.3	Existing Land Use and Development Trends	2-61

FIGURES (continued)

<u>Figures</u>	<u>Description</u>	<u>Following Page</u>
2.3.6.1	Endangered Species Critical Habitats	2-63
2.3.7.1	Average Monthly and Annual Wind Roses for Miami, Florida 1969-1974	2-80
2.3.8.1	Ambient Noise Reading Locations	2-85
3.1.2.1	General Location 16 Potential Resource Recovery Sites Considered	3-7
3.2.1	Broward County Resource Recovery Program	3-11
3.2.1.1	General Facility Arrangement Section	3-13
3.2.1.2	Operational Floor Plan "A-A"	3-14
3.2.1.3	Operational Floor Plan "B-B"	3-15
3.2.1.4	Operational Floor Plan "C-C"	3-15
3.2.1.5	Turbine Building	3-15
3.2.1.6	Ash Handling System	3-15
3.2.1.7	East Facility Elevation	3-15
3.2.1.8	North Facility Elevation	3-15
3.2.3.1	Southern Broward Resource Recovery Facility Mitigation Site Plan	3-18
3.2.3.2	Southern Broward Resource Recovery Facility Mitigation Area Section A-A	3-18
3.2.3.3	South Folk New River Mitigation Area	3-18
3.2.3.4	Southern Broward Residue/Unprocessable Waste Landfill Mitigation Site Plan	3-18
3.2.3.5	Southern Broward Residue/Unprocessable Waste Landfill Mitigation Area Section A-A	3-18
3.2.3.6	Landfill Mitigation Area	3-18
3.2.3.7	North New River Land Mitigation Area Existing Plan	3-21

FIGURES (continued)

<u>Figures</u>	<u>Description</u>	<u>Following Page</u>
3.2.3.8	North New River Land Mitigation Area Proposed Site Plan	3-21
3.2.3.9	Tree Tops Park Mitigation Area	3-22
3.2.3.10	Site Location Map - Everglades Restoration Area	3-23
3.4.5.1	Simplified Mass Balance	3-54
3.5.1	Preliminary Water Balance	3-54
3.8.5.1	Site Plan - Southern Resource Recovery Facility	3-64
3.8.6.1	Proposed Landfill Design	3-66
4.1	Estimated Field Construction Schedule	4-2
4.1.1	Cut and Fill Areas - Southern Resource Recovery Facility	4-2
4.1.2	Cut and Fill Areas - Southern Residue/ Unprocessable Waste Landfill	4-2
4.1.3	Staging, Material, Laydown and Work Force Areas	4-3
4.1.4	Estimated Solid Waste Generated During Construction	4-4
4.1.3.1	100 Year Flood Elevation Map	4-5
4.6.2.1	Estimated Work Force Requirements During Construction	4-13
4.6.3.1	Traffic Associated with Plant Construction	4-13
5.1.3.1	Utility Locations Adjacent to the Route 441 Site	5-2
5.3.1	Proposed Leachate Collection System	5-5
5.3.2	Contingency Collection System	5-5

FIGURES (continued)

<u>Figures</u>	<u>Description</u>	<u>Following Page</u>
5.3.3	Site Drainage Control	5-5
5.3.4	Final Grade	5-5
5.3.5	Construction Phases	5-5
5.3.6	Sections and Details	5-5
5.3.7	Plans, Sections and Details	5-5
5.3.5.1	Regional Water Level Contour Map - Biscayne Aquifer, October 1983	5-18
5.3.5.2	Recommended Locations for Permanent Monitoring Wells	5-19
5.6.1.1	Comparison of Facility Air Quality Impacts - Initial Projected Capacity	5-29
5.6.1.2	Comparison of Facility Air Quality Impacts - Maximum Projected Capacity	5-29
6.1.1	Resource Recovery Site and Utility Locations	6-1
6.1.2	Resource Recovery Electrical Interconnection Schematic - Route 441 Site	6-1
7.1.3.1	Mitigation Area Vicinity Map	7-3
7.1.5	Landscape Plan	7-6
7.1.8.1	Estimated Solid Waste Disposal Cost	7-9

ABBREVIATIONS AND ACRONYMS

AADT	-	Average annual daily traffic
AAQS	-	Ambient air quality standard
ADT	-	Average daily traffic
agl	-	Above grade level
AQCR	-	Air Quality Control Region
AQS	-	Air quality standards
ASHRAE	-	American Society of Heating, Refrigerating and Air Conditioning Engineers
BACT	-	Best available control technology
BCEQCB	-	Broward County Environmental Quality Control Board
CEC	-	Cation exchange capacity
CO	-	Carbon Monoxide
CUPS	-	Consumptive Use Permits
CY	-	Cubic yards
DAHRM	-	Division of Archives History and Records Management (Florida Department of State)
dBA	-	Decibel (A-weighted scale)
DER	-	Florida Department of Environmental Regulation
DRC	-	Broward County Development Review Committee
DO	-	Dissolved Oxygen
DRI	-	Development of Regional Impact
ESP	-	Electrostatic precipitator
FAA	-	Federal Aviation Administration
FAAQS	-	Florida Ambient Air Quality Standards
FAC	-	Florida Administrative Code
FDER	-	Florida Department of Environmental Regulation
FEMA	-	Florida Emergency Management Agency
FIRM	-	Flood Insurance Rate Map
FLUCCS	-	Florida Land Use and Cover Classification System
FML	-	Flexible membrane liners
FP&L	-	Florida Power and Light Company
GEP	-	Good Engineering Practice
gpd	-	Gallons per day
gpm	-	Gallons per minute
gr/dscf	-	Grains per dry standard cubic foot
HDPE	-	High Density Polyethylene
HSR	-	Highest Second Highest Concentration
Hz	-	Hertz
ILA	-	Interlocal Agreement for Solid Waste Disposal Service
ISCST	-	Industrial Source Complex Short-Term Model
JTU	-	Jackson Turbidity Units

ABBREVIATIONS AND ACRONYMS (continued)

kips	-	Kilopounds (1000 pounds)
km	-	Kilometers
kv	-	Kilovolt
kw	-	Kilowatt
LAER	-	Lowest Available Emission Rate
Ldn	-	Day-Night Energy Equivalent Noise Level
Leq	-	Energy Equivalent Noise Level
LQS	-	Level Of Service
M ³	-	Cubic meter
MCL	-	Maximum Contaminant Level
mgd	-	Million gallons per day
mps	-	Meters per second
MSL	-	Mean Sea Level
mw	-	Megawatts
NAAQS	-	National Ambient Air Quality Standards
NGVD	-	National Geodetic Vertical Datum
NHPA	-	National Historic Preservation Act
NOAA	-	National Oceanographic and Atmospheric Administration
NPDES	-	National Pollutant Discharge Elimination System
NSSFC	-	National Severe Storms Forecast Center
NSPS	-	New Source Performance Standards
NWI	-	National Wetlands Inventory
NWS	-	National Weather Service
NO ₂	-	Nitrogen Dioxide
PFU	-	Plaque Forming Units
ppm	-	parts per million
PSC	-	Public Service Commission
PSD	-	Prevention of Significant Deterioration
psi	-	pounds per square inch
P.U.D.	-	Planned Unit Development
PURPA	-	Public Utility Regulatory Policies Act
PVC	-	Polyvinyl Chloride
RCRA	-	Resource Conservation & Recovery Act
RFP	-	Requests for Proposals
SCS	-	Soil Conservation Service
SELS	-	Severe Local Storms
SHPO	-	State Historic Preservation Officer
SIA	-	Significant Impact Area
SIL	-	Significant Impact Level
SIP	-	State Implementation Plan
SO ₂	-	Sulfur Dioxide
SR	-	State Road
SW	-	Solid Waste
SFWMD	-	South Florida Water Management District

ABBREVIATIONS AND ACRONYMS (continued)

tpd	-	tons per day
tpy	-	tons per yard
TSP	-	Total Suspended Particulates
USCOE	-	U.S. Army Corps of Engineers
USEPA	-	United States Environmental Protection Agency
USFWS	-	United States Fish and Wildlife Service
USGS	-	United States Geological Survey
vpd	-	vehicles per day
vph	-	vehicles per hour
WWTP	-	Wastewater Treatment Plant

EXECUTIVE SUMMARY

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Introduction

Broward County can no longer rely on conventional landfilling as its only method of solid waste disposal for practical, environmental, economic and social reasons. As in many other urban Florida counties, the expansion of existing, or siting and development of new, landfills has become increasingly difficult. The decreasing availability of land, stricter regulation of both the development and operation of landfills and neighborhood opposition have all contributed to this situation. At the same time, State policies have encouraged local governments to look more and more to the recovery of the material and energy resources found in solid waste.

Broward County's decision to build a solid waste energy recovery facility is the result of nearly seven years of research, analysis and planning. Since 1978, the Broward County Board of County Commissioners has been working to find a viable long-term alternative to sanitary landfilling. The County started this effort soon after the State of Florida enacted Section 403.706, Florida Statutes, requiring urbanized counties like Broward to submit resource recovery and solid waste management plans. Numerous studies, commissioned by the County since 1978, have demonstrated the need for resource recovery as a long-term solution to the County's solid waste disposal needs. The filing of this application for the South Broward County Resource Recovery Project, Inc. represents the County's continuous efforts to reach its solid waste disposal objectives.

Purpose of Proposed Facility

The purpose of the facility is to dispose of solid waste generated predominantly within Southern Broward County. Non-combustibles and inert ash residue resulting from the plant's combustion process will be landfilled at an ash residue/un-processable landfill located on the Project site. The

electrical power derived from the combustion of the refuse is an additional benefit of the Project. Electrical energy sales to Florida Power and Light Company will help offset the overall cost of the Project. The County will contract with a full-service vendor to design, construct, and operate the Project for 20 years with two renewal option periods totaling fifteen years. The County will lease the land to the vendor. The vendor will own the plant.

The Project is designed to meet the State's goal of enhancing environmental quality and preserving natural resources. Broward County is committed to protecting its groundwater and surface water resources by among other things, reducing its reliance on sanitary landfilling of solid wastes. The best alternative for Broward County in achieving these goals is through a solid waste-fired electrical power plant.

Site Location

Pursuant to Section 403.505, Florida Statutes, Broward County is applying for certification for a solid waste-fired electrical power plant on a 248 acre tract in unincorporated Broward County at the southeast quadrant of the intersection of U.S. Route 441 and State Road 84. The facility site is located directly across the South Fork New River Canal from a Florida Power and Light Company power plant. The Project site is located near the solid waste centroid for Southern Broward County.

Facility Description

The Project will be a mass-burn resource recovery facility with an initial continuous design rated capacity of 2352 tons per day of solid waste and a gross electrical generating capacity of approximately 68.5 megawatts. In anticipation of future disposal needs, Broward County is seeking certification for ultimate site electrical generating capacity of approxi-

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Site Location

Pursuant to Section 403.50~~56~~⁵⁶, Florida Statutes, Broward County is applying for certification for a solid waste-fired electrical power plant on a 248 acre tract in unincorporated Broward County at the southeast quadrant of the intersection of U.S. Route 441 and State Road 84. The facility site is located directly across the South Fork New River Canal from a Florida Power and Light Company power plant. The Project site is located near the solid waste centroid for Southern Broward County.

Facility Description

The Project will be a mass-burn resource recovery facility with an initial continuous design rated capacity of 2352 tons per day of solid waste and a gross electrical generating capacity of approximately 68.5 megawatts. In anticipation of future disposal needs, Broward County is seeking certification for ultimate site electrical generating capacity of approxi-

mately 96.1 megawatts (gross), using 3300 tons per day of solid waste.

Application Overview

This application has been prepared in accordance with the State of Florida Department of Environmental Regulation (DER) Chapter 17-17 Rules and follows the format prescribed in DER Form 17-1.211(1), F.A.C. (Instruction Guide for Certification Applications: Electrical Power Plant Site, Associated Facilities, and Associated Transmission Lines).

This application consists of three (3) volumes:

Volume I (Application) - contains the Applicant Information Sheet, Sections 1-9 as presented in the DER Instruction Guide, and a listing of references.

Volume II (Appendices) - contains Section 10, Appendices 10.1 through 10.8 of the application.

Volume III (Appendices) - contains Section 10, Appendices 10.9 through 10.18 of the application.

As required by Rule 17-17.121 (3) (a), F.A.C. three (3) copies of materials which show the procedures taken to accomplish compliance of the site with existing land use plans and zoning ordinances is included as well. This compilation of information is referred to as the "Compliance Document".

Principle Findings

The Project will be designed and operated to meet all applicable Federal, State, Regional and County standards. As planned, the Project will have minimal impact on the surrounding environment. In the case of the Mitigation Plan, the Project will actually enhance and preserve natural wetland habitat. The analysis presented in this application supports these findings and is summarized as follows:

- o Air Quality - As discussed in Sections 3.4, Air Quality, the combustion process for the facility will be environmentally sound. The results of the

Prevention of Significant Deterioration (PSD) analysis indicate:

- Best Available Control Technology/Lowest Achievable Emission Rate (BACT/LAER) for the proposed source is the use of emission controls inherent to the system design with Electrostatic Precipitators (ESP) designed to meet an outlet grain loading well within federal state regulations;
 - The facility will operate in compliance with the Prevention of Significant Deterioration (PSD) increments, National Ambient Air Quality Standards (NAAQS), and Florida Ambient Air Quality Standards (FAAQS) for all criteria pollutants;
 - Fugitive dust created during construction of the facility is addressed in Section 4.5. With suggested standard mitigative measures, there will be no adverse effects due to fugitive emissions;
 - Total suspended particulates (TSP) are examined in Section 5.6.1 and Appendix 10.1.5. The proposed resource recovery facility emissions will result in an ambient impact well within Florida Ambient Air Quality Standards for TSP;
 - As discussed in Section 3, the tipping area and refuse bunker will be enclosed and under negative air pressure. Thus, odors will be contained within the resource recovery building. Odors within the building will be drawn into the furnace and destroyed through the combustion process; and
 - The emissions from the facility will not have any adverse effect on surrounding soils, vegetation or visibility.
- o Land Use and Zoning - A series of advertised formal public hearings have been conducted concerning site rezoning. At those hearings, public input, testimony, and documents were entered into the record as land use and zoning issues were evaluated. As noted in Section 2.2.2, the Broward County Development Review Committee, Broward County Zoning Board, Broward County Office of Planning and Planning Council and the Broward County Board of County

Commissioners each concluded that the proposed solid waste energy recovery project is consistent with all portions of the Broward County Comprehensive Plan; and compatible and in compliance with land use and zoning patterns in the area. Accordingly, the Board of County Commissioners rezoned the project site to Planned Unit Development for Special Complexes on March 16, 1984 to ensure orderly development in strict compliance with local, state and federal regulations.

- o Noise - As discussed in Section 5.7, during operation of the resource recovery facility noise levels at the closest residence would not increase by a level perceptible to the human ear.
- o Traffic - As discussed in Section 5.9, the solid waste energy recovery facility will increase daily traffic by approximately one percent on Route 441 and less than one percent on State Road 84. The analysis shows that there will be no capacity problems with this additional traffic.
- o Surface Water and Groundwater - As discussed in Section 4.2 and 4.3, all plant process water will be drawn from municipal or county supply facilities and all wastewater will go to the Hollywood Wastewater Treatment Plant. Potable water will be used in small quantities in the personnel areas of the plant. All plant water will be recycled whenever possible. Runoff from vegetated areas, paved areas, and rooftops will be collected in onsite stormwater retention/detention basins. Refuse storage and ash/residue handling unit operations within the proposed facility will be covered and therefore, will not come into physical contact with precipitation or associated runoff. There will be no influence on groundwater quality as a result of the planned construction or facility operation.
- o Soil and Foundation Conditions - As discussed in Section 2.3.1, preliminary subsurface data indicate that certain surface conditions at the project will require specific site preparation and subsurface foundation design. These subsurface conditions are considered typical of those normally encountered in the immediate area and will be addressed by appropriate site preparation and foundation design.
- o Plant and Animal Communities - No special plants, terrestrial/palustrine natural communities or

aquatic natural communities are known or expected to occur within five miles of the project site. While the site and adjacent areas provide habitats for a variety of terrestrial and aquatic organisms, none of these habitats are considered critical and therefore, it is not anticipated that the proposed project will have any significant effects on area ecology.

- o Aesthetics - As discussed in Section 3.2.2, there will be a visual height impact associated with the facility. The facility will be designed to be aesthetically pleasing and architecturally compatible with the surrounding area.
- o Archaeological Sites and Historic Preservation Areas - As discussed in Section 5.10, there are no historic or prehistoric resources known to be present within the project site boundaries as confirmed by field investigations. Projected use of the project site will therefore not impact any historic or prehistoric cultural resources.

Project Status

The full-service vendor procurement process for the Project is in progress with selection of a vendor expected by June 1985. The selected vendor will be required through a contract with the County to guarantee compliance with all terms and conditions of the Site Certification and Development Order conditions.

Construction is scheduled to begin in January 1986. The projected in-service date for the facility is July 1, 1988. The projected capital cost for the initial project development is approximately \$266 million. The County has issued \$521 million in adjustable rate industrial revenue bonds to cover the cost of developing the project and other associated solid waste disposal projects.

The County and FP&L are presently discussing the details and means of providing an interconnection with FP&L's system and the rates to be paid for electrical energy sales. Based on FP&L's preliminary investigation of electrical intercon-

nection requirements, there does not appear to be a need for new transmission line corridors or any other long narrow siting corridors (e.g., rail lines, or influent or effluent pipelines) that would leave the area near the proposed facility.

The County has acquired all parcels necessary for the Project including mitigation lands and is in the process of finalizing an Interlocal Agreement for Solid Waste Disposal Service (ILA) with the County's twenty-eight municipalities.

NEED FOR POWER AND THE PROPOSED FACILITIES

SOUTH BROWARD COUNTY RESOURCE RECOVERY PROJECT, INC.
SOLID WASTE ENERGY RECOVERY FACILITY
APPLICATION FOR POWER PLANT SITE CERTIFICATION

SECTION 1

NEED FOR POWER AND THE PROPOSED FACILITY

1.1 Overview

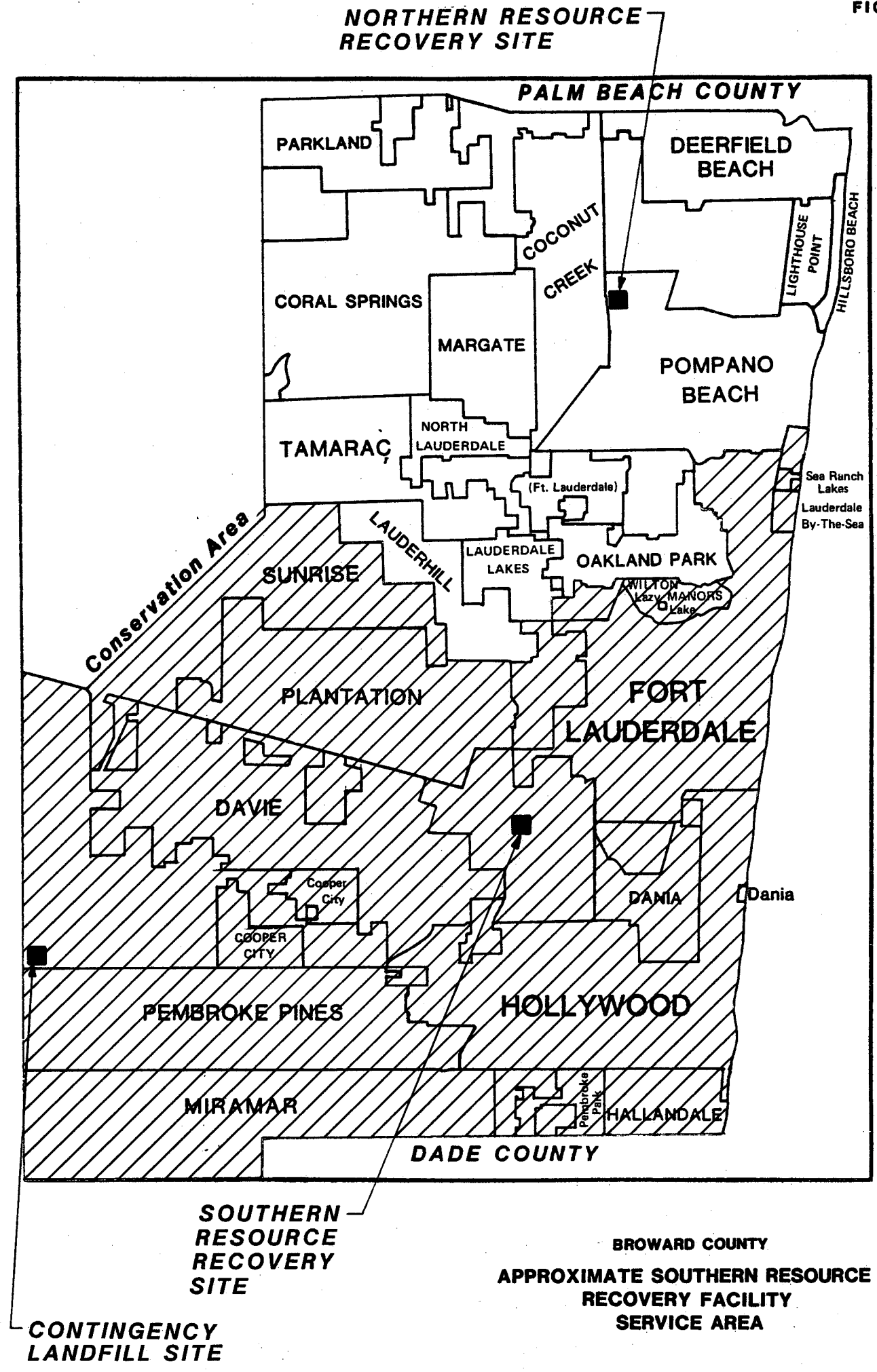
The Broward County Resource Recovery System has been selected as the best alternative for meeting Broward County's long-term solid waste disposal needs. This system will:

- o dispose of garbage and trash in an environmentally sound manner;
- o reduce the need for siting and developing a raw garbage landfill;
- o recover energy by using solid waste as a fuel to produce electricity and;
- o create new opportunities for recreation and wetland habitat enhancement through extensive mitigation.

Broward County is proposing to develop as initial parts of the system two mass-burning resource recovery facilities, attendant landfills, and a contingency landfill site (see Figure 1.1.1). The proposed southern facility, which is the subject of this Application, will be located on a 248 acre tract in unincorporated Broward County at the southeast quadrant of the intersection of U.S. Route 441 and State Road 84.

1.2 Introduction

Broward County occupies an area of approximately 1,200 square miles and is located in the southeastern portion of the State of Florida. Broward County is bounded on the north by Palm Beach County, on the east by the Atlantic Ocean, on the south by Dade County and on the west by Hendry and Collier Counties. The estimated 1983 population of the County was 1.1 million persons.



Nearly 1.2 million tons of solid waste are generated in Broward County each year. This amount is expected to increase to over 2 million tons by the year 2010. The County, at the present time, depends solely on landfills for disposing of solid waste. Given the present generation rate of solid waste (approximately 3,300 tons per day) the County's two landfills will reach the end of their useful lives within a few years. The County owned and operated landfill in Davie has been recently expanded to its maximum capacity, but will be completely filled in 1987. The Waste Management, Inc., Central Disposal Site located near Pompano Beach will be expanded in the next few years, but will reach its maximum capacity in the mid-1990's.

As in many other urban Florida counties, the expansion of existing or siting and development of new landfills has become increasingly difficult. The decreasing availability of land, stricter regulation of both the development and operation of landfills and neighborhood opposition have all contributed to this situation. At the same time, State policies have encouraged local governments to look more and more to the recovery of the material and energy resources found in solid waste.

In 1981, the Broward County Board of County Commissioners authorized an investigation of solid waste management alternatives. The following year, the Commission approved a plan which called for deemphasizing landfilling as a primary means of solid waste disposal. Further studies led in 1983 to a decision to proceed with development of two resource recovery facilities utilizing mass burning technology. Mass burning is a mature technology which requires no pre-processing or sorting of wastes. Several hundred plants around the world utilize this technology.

1.3 South Broward County Resource Recovery Project

The proposed South Broward County Resource Recovery Facility will be designed to initially generate approximately 68.5 megawatts of electrical power using solid waste generated predominantly in the southern region of the County (see Figure 1.1.1 for the approximate boundaries of the facility's service area). In anticipation of future needs, certification is being sought for an ultimate electric generating capacity of 96.1 megawatts.

A petition was filed with the Florida Public Service Commission on March 13, 1985, under Section 403.519, F.S. and Section 25-22.80 of the Florida Administrative Code requesting a Determination of Need for the proposed facility. A copy of the petition is included in Appendix 10.6 of this Application.

1.4 Consistency of Project with State Energy Policy

As early as 1974, the Florida Legislature recognized the need to look for new solutions to an ever growing solid waste problem. The Legislature found in the Florida Resource Recovery and Management Act (Section 403.702 (i)(e) F.S.) that "The failure or inability to economically recover material and energy resources from solid waste results in the unnecessary waste and depletion of our natural resources, and, therefore, maximum recycling and reuse of such resources must be considered goals of the State." (emphasis added)

Last year the Florida Legislature acting to "protect the health, prosperity, and general welfare... of its citizen's" declared Chapter 84-198, Laws of Florida that the "combustion of solid waste by small power production facilities for the production of electricity not only represents conservation efforts well directed towards that goal, but also represents an environmentally preferred alternative to conventional solid waste disposal" for the State of Florida (emphasis added).

Broward County's proposed solid waste disposal system is consistent with the State's policy to pursue resource recovery as a long-term solution for waste disposal. The use of proven mass burn technology will provide a technically and economically feasible solution to the County's long-term disposal needs.

1.5 Consistency of Project with the State Plan Goals and Policies

The South Broward County Resource Recovery Project is consistent with the following State Plan goals.

The Project will:

- o help maintain the overall level of water quality in surface and underground systems that have not been degraded by reducing the need to rely on sanitary landfills (State Plan, p. 15);
- o offset losses in wetlands by protecting and restoring the ecological functions of wetlands systems to ensure their long-term environmental, economic and recreational value (State Plan, p. 18, Policy NE 29, p. 20); and
- o assist in reducing per capital energy consumption by reducing the need for new power plants by using solid waste as fuel to recover energy, (State Plan p. 22, Policy NE 44).

As stated in the State Plan on page 23, "The scarcity of disposal sites, together with the possibility of recycling valuable materials and generating energy, is leading to increased emphasis on resource recovery. Several Florida communities already have taken the lead with resource recovery facilities".

SITE AND VICINITY CHARACTERIZATION

SECTION 2

SITE AND VICINITY CHARACTERIZATION

2.1 Site and Associated Facilities Delineation

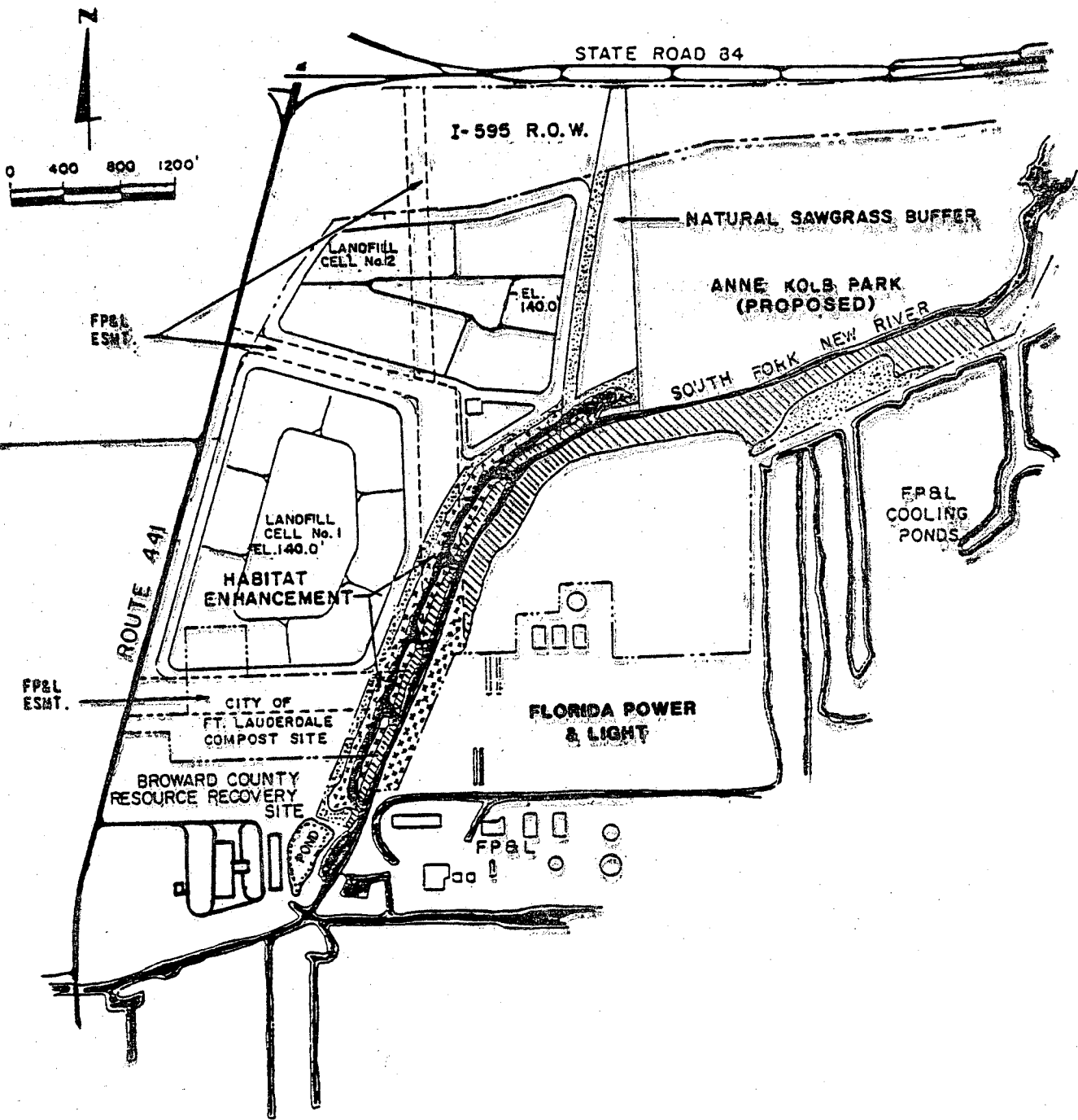
Drawing No. 10575C, Plate 1 - Sketch of Description of the Route 441 Site provides the current dimensions and legal description of the proposed site. The Project site consists of 248 acres.

As illustrated, the project site is located at the southeast intersection of U.S. Route 441 (State Road 7) and State Road 84. The southern and eastern site boundaries are formed by the South Fork New River Canal. Figure 2.1.1 illustrates the conceptual development and environmental enhancement plan for the Project site and adjacent property uses. Located to the east of the site is Florida Power & Light (FP&L). FP&L's property and associated facilities, including cooling ponds, border the entire length of the east bank of the South Fork New River across from the Project site. An aerial photograph of the site and adjacent land uses is provided on the following page.

The development of the site will consist of the resource recovery facility in the southern quadrant, and landfill cell development in the middle and northern quadrants. Two independent landfill cells will comprise the landfill development plan. The cells will be divided by a buffer zone presently underlined by FP&L easement.

The conceptual development plan was prepared in recognition of the following constraints:

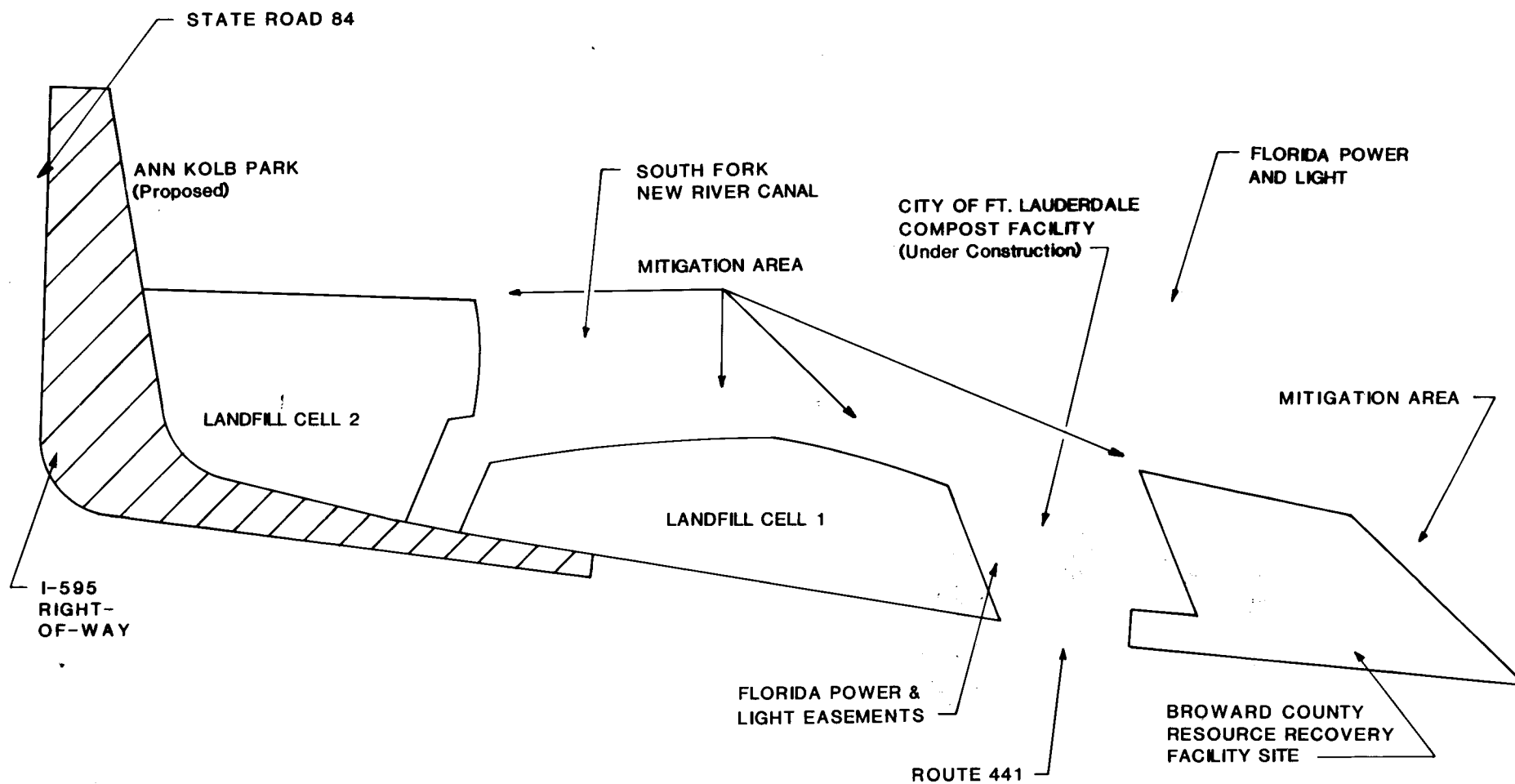
- o An 130 acre pond apple slough area owned by the Department of Natural Resources for I-595 mitigation adjacent to the northeastern portion of the site.
- o A sludge composting facility owned by the City of Fort Lauderdale will occupy approximately 30 acres between the landfill and the facility. This facility has been under construction since January, 1985.



LEGEND

-  MARSH
-  CYPRESS
-  EXISTING VEGETATION

BROWARD COUNTY
 RESOURCE RECOVERY
 CONCEPTUAL DEVELOPMENT AND
 ENVIRONMENTAL ENHANCEMENT PLAN
 FOR THE ROUTE 441 SITE
 NOT TO SCALE





Burch Air Photo Service, Inc.

- o Approximately 20 acres in the northern portion of the site are reserved for Interstate 595 (under construction).
- o Existing Florida Power & Light powerline easements.

A plan has been developed in coordination with FDOT (see Appendix 10.3) and the City of Fort Lauderdale such that none of the above proposed uses will either be affected or have an effect on the proposed resource recovery development. Details of site utilization for both the resource recovery facility and ash residue/unprocessable waste landfill are contained in Figures 2.1.2 and 2.1.3, respectively.

Resource Recovery Facility

Figure 2.1.2, illustrates a general development plan for the resource recovery facility as proposed by American Ref--Fuel. American Ref-Fuel is one of three vendors prequalified by the County in 1983 for this Project. The other two prequalified vendors are Waste Management, Inc. and Signal RESCO, Inc. This figure is reflective of the type of development that will occur. This plan does not indicate a preference for a particular vendor's system, and it may be revised depending upon eventual vendor selection.

The facility will be bounded by Route 441 to the west; by the South Fork New River Canal to the east and south; and by a composting facility for the City of Fort Lauderdale (under construction) to the north.

Although a wetlands area is located in the northeastern portion of the site, discussions with the U.S. Army Corps of Engineers (USCOE) indicate that this wetlands area has no special significance in terms of environmental habitat or species. Utilization of this area for the development of the proposed facility requires that a dredge and fill permit be obtained from the USCOE. Preapplication conferences were held with the USCOE and Florida Department of Environmental Regu-

lation (DER) concerning these dredge and fill permits in early November 1983. The County subsequently submitted formal permit applications with appropriate technical support documentation. The USCOE has indicated in its intent to grant the permit via correspondence dated July 13, 1984 (see Appendix 10.1.4), dependent upon the acceptability of the proposed project and associated environmental mitigation program. Likewise, the Florida DER issued a Letter of Intent to issue a dredge and fill permit on September 14, 1984.

A portion of the Project site is within an area Broward County has proposed designating as an Urban Wilderness Area for the preservation of the existing vegetation and habitat. As Figure 2.1.1 illustrates, the proposed facility location and layout provides for substantial buffers between the facility and the remaining sections of the proposed urban wilderness area, South Fork New River Canal and proposed habitat enhancement area.

As indicated on Figure 2.1.2, the resource recovery facility will include a gatehouse/weigh station, receiving and handling building, furnace boilers, turbine-generators, ash disposal area, cooling system, and electrical substation. Security measures will be the responsibility of the selected vendor. Facility access will be via Route 441. To avoid traffic impacts that could result from vehicles queuing on to this public roadway a southbound left turn lane, northbound deceleration an acceleration lane, as well as appropriate traffic signals will be provided by Florida Department of Transportation as part of a widening of Route 441. Roadways supporting internal traffic flow will be arranged to provide congestion-free operation and smooth-functioning facilities.

The facility will include a scale house and three scales. The scales will be on each side of the scale house to accommodate traffic in either direction. The basic traffic flow will be east and west, to and from the receiving area. Once in the

[illegible]

REVISIONS						DATE	BY	ENG.	AUTH.	NO.	REFERENCE DRAWINGS	PRINT RECORD				ENG. RECORD		DRAWING STATUS	
X												DATE ISSUED				ISSUED		DATE	
X												REVISION NO.				CORRECTION		FOR COMMENTS AND/OR	
X												FOR				MEEN CO		CONSTRUCTION	
X												CUSTOMER'S				SHEET NO.		REVISED BY	
X												PUBL.				INSTR. NO.		REVISED DATE	
X												INTD. NO.				APPROVED		FOR CONSTRUCTION	

CIVIL SITE PLAN

L'AMOUR COUNTY RESOURCE (SOUTH) FACILITY

SCALE: 1" = 50'

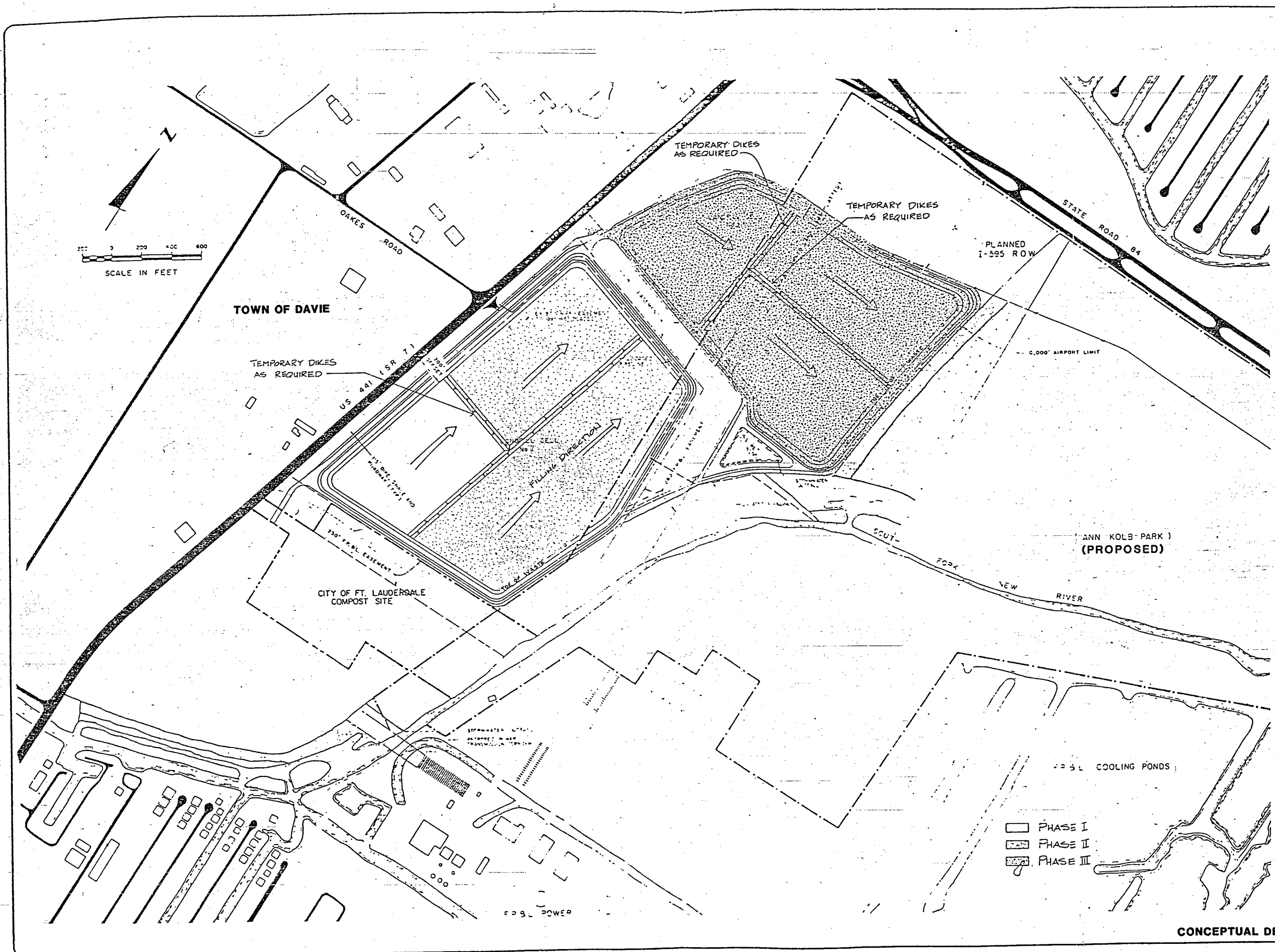
DESIGNED BY: [Signature]

DRAWN BY: [Signature]

CHECKED BY: [Signature]

DATE: 10-10-89

FIGURE 2.1.3



REV	DESCRIPTION	DATE	BY



BROWNING-FERRIS INDUSTRIES
ENGINEERING SERVICES
3400 NORTH WILSON STREET, SUITE 100, FORT LAUDERDALE, FL 33309-4000

1"=300'	10/30/84	24-HR	J. J. JAMES	REVIEWED BY	DATE
CONSTRUCTION PHASES					
PROPOSED LANDFILL DESIGN					
SOUTHERN RESOURCE RECOVERY FACILITY					
BROWARD COUNTY, FLORIDA					

CONCEPTUAL DESIGN



receiving area, will move easterly through the facility processes.

The receiving area includes the enclosed turning platform, tipping floor, overhead crane, control room and refuse pit. A separate administrative office building is located to the south of the main process building. Directly east of the receiving area are the furnaces/boilers and auxiliary equipment. Three furnace boiler process lines are to be initially installed with provisions for a fourth system, should future conditions dictate such expansion. To the immediate south of the boiler will be the water treatment system. To the east will be the turbine generators. The air pollution control equipment (electrostatic precipitators) will be located just to the east end of the boilers. The stack will be positioned at the east end of the facility. The electrical substation, necessary to tie into the Florida Power and Light (FP&L) grid system will be located to the north of the facility's stack. This configuration locates the facility stack with a significant buffer from the precision landing approach surface for Runway 9L at the Fort Lauderdale-Hollywood International Airport. In addition, the facility will include: steam and condensate pipelines, storage facilities, and maintenance areas.

As part of the stormwater management plan developed for the project, a stormwater retention pond(s) will be included in the development of the resource recovery facility.

Ash Residue/Unprocessable Waste Landfill

Figure 2.1.3, Proposed Landfill Design Southern Resource Recovery Facility, illustrates the proposed site utilization and development plan for the two landfill cells and associated facilities. As was the case with Figure 2.1.2, this figure is based upon a vendor proposal, does not indicate a preference for a particular vendor, and may require minor revisions prior

to final design. The landfill site is to be located just north of the City of Fort Lauderdale Compost Site (under construction). The landfill will require development of approximately 150 acres. It has been designed to provide the best environmental protection available.

As indicated, on Figure 2.1.3, the landfill area contains two cells: Cell 1, located nearest to the facility will be constructed and filled first; Cell 2, located further north will be developed and filled as quantities of incoming residue and unprocessable wastes dictate such a need. The arrows on Figure 2.1.3 indicate the landfiling plan for each cell.

The entire Route 441 site is located within the 100-year flood zone. The entire site will be excavated to remove peat and muck, etc. Once removed, appropriate fill material will be utilized to raise the entire site to the 100-year flood elevation (+7 feet MSL). A double synthetic liner system with a leachate collection system will then be installed to ensure against contamination of the underlying aquifer. Details of the design are contained in Section 5.3.

2.2 Socio-Political Environment

2.2.1 Governmental Jurisdictions

The area contained within a five-mile radius of the proposed facility is part of the metropolitan development area of Broward County.

The approximate boundaries of this area are:

- o North Boundary - 1/2 mile north of Sunrise Boulevard
- o East Boundary - 3/4 mile west of John U. Lloyd State Park
- o South Boundary - Pembroke Road
- o West Boundary - 1/2 mile west of Golden Shoe Road, Davie

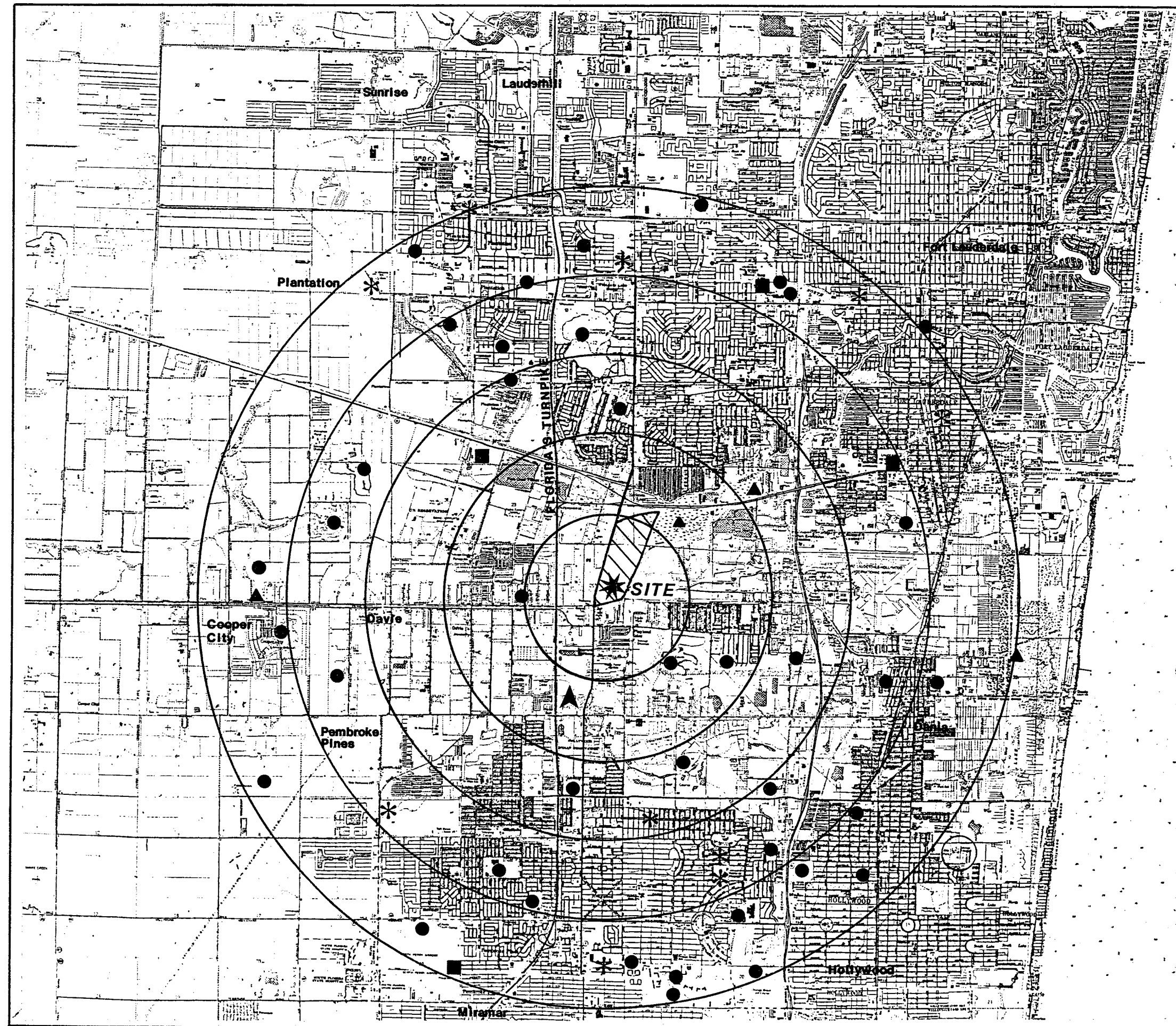
LEGEND

- Parks, & Golf Courses
- ▲ Unique Natural Areas
- Memorials
- * Hospitals
- ▲ Indian Reservation
- ★ Proposed Location of Facility Stack

SCALE:



**MALCOLM
PIRNIE**



**BROWARD COUNTY
GOVERNMENTAL JURISDICTIONS
AND
REGIONAL SCENIC, CULTURAL
AND
NATURAL LANDMARKS**

As shown on Figure 2.2.1.1, portions of the following cities are within five miles of the site:

- o Fort Lauderdale
- o Plantation
- o Dania
- o Hollywood
- o Davie
- o Pembroke Pines
- o Miramar
- o Cooper City
- o Lauderhill
- o Sunrise

In order to identify local, regional, state and federal areas located within a five mile radius of the site, appropriate agencies were contacted. A list of all agency contacts appears in Section 9.

The following areas of concern were identified and plotted on the five mile region map (Figure 2.2.1.1):

- o Memorials
- o Monuments
- o State Parks
- o County Parks
- o City Parks
- o Areas of Critical State Concern & Unique Natural Areas
- o Recreation Lands
- o An Indian Reservation
- o Medical Facilities

As shown on this map, the following specific areas of concern have been identified:

Memorials and Monuments

J.F.K. Memorial Park
Lauderdale Memorial Gardens
West Lawn Memorial Gardens
Lauderdale Memorial Park Cemetery

Parks, Golf Courses, and Indian Reservations & Type of Ownership

Delevoe Park	County
Griffin Park	County
Tree Tops Park	County
Topeekeegee Yugnee (TY)	South Broward Park District
Tigertail Lake Park	County
Snyder Park	Ft. Lauderdale (City)
2-Dania City Parks	City
Survive	County
4-Plantation City Parks	City
Boggs Field City Park	Hollywood (City)
4-Hollywood City Parks	City
David Park	Hollywood (City)
Plantation Heritage Park	County
St. George Park	County
New River Park	State
Brian Piccolo Park	County
Washington Park	County
1-Pembroke Pines City Park	City
West Kenlark Park	County
1-Davie City Park	Davie (City)
Rotary Park	Hollywood (City)
Girl Scout Camp	Davie
Indian Reservation (Seminole)	Federal

Private and Public

Oakridge Country Club	Private
Rolling Hills Golf Course	Public
Arrowhead Country Club & Golf Course	Private
Pines Par Three	Private
Fort Lauderdale Country Club	Private
Plantation Country Club	Private
Sunset Golf Course	Public
Orangebrook Golf Course	Public
Cooper Colony Golf Club	Private
Hillcrest Country Club & Golf Course	Private

Unique Natural Areas and Areas of Critical State Concern

Westlake Mangroves
Pine Island Ridge
Red Mangrove Swamp Site
South Fork New River Site
Secret Woods Nature Center

Hospitals

Pembroke Pines General Hospital
Bennett Community Hospital
Hollywood Psychiatric Pavilion Hospital
Ambulatory Surgical Facility
Broward General Medical Center
Hollywood Medical Center
Hollywood Memorial Hospital
Plantation General
West Broward Hospital

Research has indicated that the presence of wildlife refuges, conservation lands, marine sanctuaries, or critical habitats of endangered species do not exist within five miles of the site. A copy of the on-site and off-site mitigation plan is contained in Appendix 10.7.

2.2.2 Zoning and Land Use Plans

On March 16, 1984, the Broward County Board of County Commissioners rezoned the South Broward County Resource Recovery Project site to Planned Unit Development (PUD) which allows for the proposed development. A copy of the Development Review Order implementing this zoning is contained in Appendix 10.2.

As required by FAC Rule 17-17.121(3)(1), three copies of supplemental materials specifying the procedures to accomplish compliance of the site with existing land use plans and zoning ordinances have been submitted to the Florida Department of Environmental Regulation along with this application for site certification. The Compilation of Information Study Report consists of actual Committee meeting minutes, review orders,

public hearing information and actual ordinances. The following list is an itemization of the contents of that report:

- o Development Review Committee Meeting - January 19, 1984.
- o Broward County Zoning Board Meeting - February 1, 1984
- o Broward County Board of County Commissioners Meeting - March 16, 1984
- o Copy of Ordinance #84-6(Z) - April 23, 1984
- o Copy of Ordinance #84-7(Z) - April 23, 1984

A summary of these documents and their dates are presented in chronological order (Table 2.2.1).

The proposed resource recovery facility is consistent with the Broward County Comprehensive plan and projected land use development. Specifically, there appears to be no distinction made that would preclude the development of resource recovery project at this site in any of the Broward County Comprehensive Plan Subelements.

Specific project parameters have been outlined with respect to their consistency with Broward County Comprehensive Plan Subelements and are presented on Table 2.2.2.

Existing land use on the site includes industry by Powell Brothers, Inc., a marine construction contractor with an office adjacent to U.S. Route 441 and fabrication yard adjacent to the South Fork New River Canal. The extreme north-eastern corner of the site is a proposed Urban Wilderness Area. The resource recovery facility will be located at least 400 feet from the nearest area zoned residential.

Figure 2.2.2.1 illustrates the major surrounding land use categories for a 5 mile radius around the site. The major land use categories are:

- o Low Residential
- o Medium Residential
- o High Residential

TABLE 2.2.1

ZONING AND LAND USE CHRONOLOGY

- January 25, 1983 - The Board of County Commissioners authorizes staff to obtain appraisals, title information, owners' authority to proceed to rezone and to proceed with rezoning and begin negotiations toward the acquisition of two resource recovery/ash residue disposal sites (Agenda Item No. 65D).
- April 12, 1983 - The Board of County Commissioners:
- Adopts the recommendation of the March 1983 Site Evaluation Report prepared by Malcolm Pirnie, Inc. (Agenda Item No. 68A).
- Authorizes staff to secure all necessary information and to conduct negotiations for acquisition of the Route 441 site for resource recovery/disposal facilities (Agenda Item No. 68B).
- January 19, 1984 - The Broward County Development Review Committee votes to recommend to the Broward County Zoning Board the rezoning of the Route 441 Resource Recovery Project site from A-1, Limited Agricultural; B-3, General Business; M-1, Light Industrial, M-3, General Industrial and M-4, Limited Heavy Industrial to Planned Unit Development for Special Complexes.
- February 1, 1984 - The Broward County Zoning Board votes to recommend to the Board of County Commissioners the rezoning of the Route 441 Resource Recovery Project site from A-1, Limited Agricultural; B-3, General Business; M-1, Light Industrial; M-3, General Industrial and M-4, Limited Heavy Industrial to Planned Unit Development for Special Complexes.
- March 16, 1984 - The Board of Commissioners approve the rezoning of the Route 441 Resource Recovery Project site from A-1. Limited Agriculture; B-3, General Business; M-1, Light Industrial; M-3, General Industrial and M-4, Limited Heavy Industrial to Planned Unit Development for Special Complexes.

TABLE 2.2.2

CONSISTENCY WITH THE COMPREHENSIVE PLAN¹

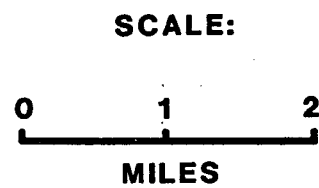
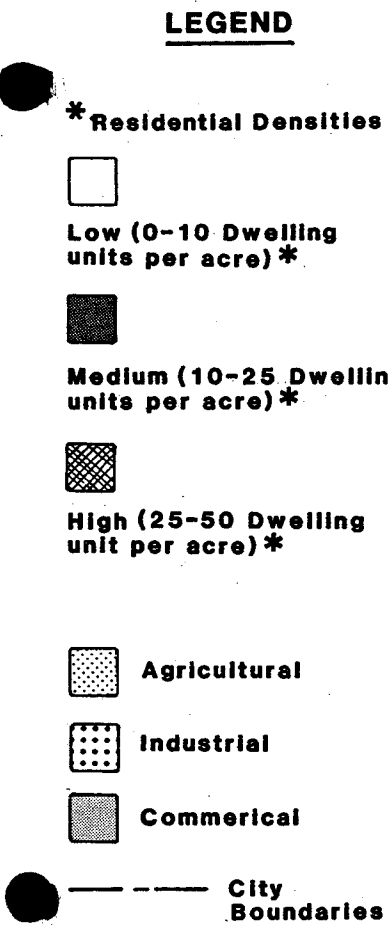
<u>Element of Comprehensive Plan</u>	<u>Project Consistency Summary</u>
Solid Waste	o The energy recovery facility is the culmination of years of solid waste management planning.
Economic	- o There will be no externalized impacts from the facility, the system will employ proven technology, and the program is more economically sound than landfilling. - o The energy recovery facility is a new industry for Broward County. - o Resource recovery has long-term beneficial economic, environmental and societal impact to the County.
Land Use	- o The energy recovery facility has been deemed compatible with existing and future land use by the Broward County Board of County Commissioners. - o The energy recovery facility is inter-related with other light industrial activities in the area. - o The energy recovery facility incorporates modern design techniques. The facility will not have adverse external impacts and is compatible with the surrounding area.
Traffic Circulation and Mass Transit	- o Transportation has been reviewed during the land use plan amendment and rezoning processes. - o The site location minimizes truck route distances for solid waste collection and disposal.
Aviation	o The project has been approved by the Federal Aviation Administration.
Port Everglades	o This element is not directly applicable to the proposed project.

TABLE 2.2.2

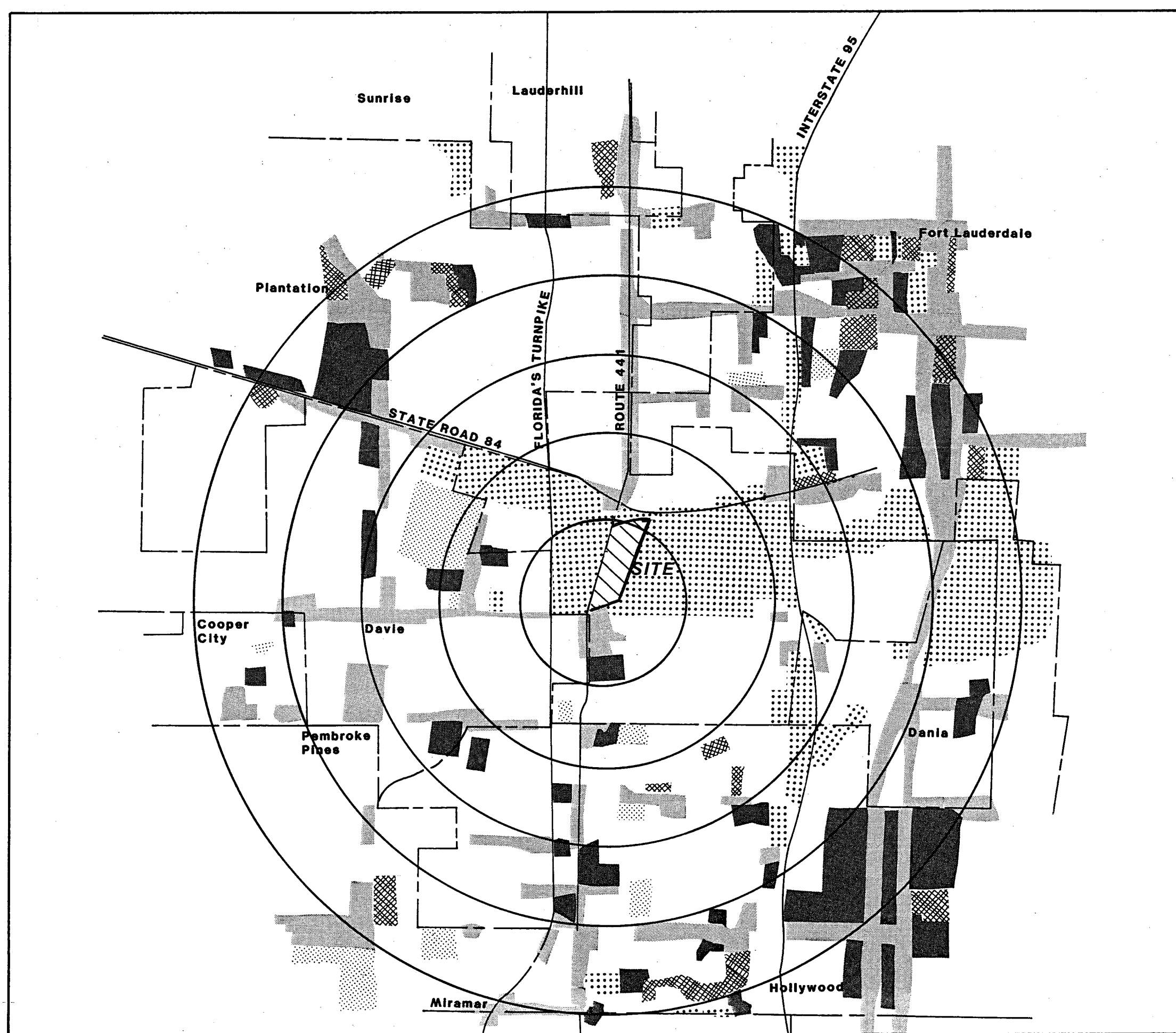
CONSISTENCY WITH THE COMPREHENSIVE PLAN¹ (continued)

<u>Element of Comprehensive Plan</u>	<u>Project Consistency Summary</u>
Housing	o The energy recovery facility will not impact the creation or maintenance of healthy and viable living environment.
Water and Sewer	o The Hollywood Wastewater Treatment Plant will treat discharges from the energy recovery facility.
Drainage	o The proposed stormwater drainage system meets the requirements of the South Florida Water Management District and DER.
Utility	- o The Public/Semi-Public Land Use designation serves to inform the public of the location of the energy recovery facility. - o The energy recovery facility helps Florida Power and Light meet its goals and objectives in the Electric Utility Subelement.
Parks, Recreation and Open Space	o Open space resources were taken into consideration during site selection activities. New recreation areas will be created through mitigation.
Conservation	o The energy recovery facility was sited to avoid impacts to conservation/reservation areas.
Coastal Zone Protection	o The energy recovery facility by means of the mitigation plan will enhance the area next to the South Fork New River Canal.
Intergovernmental Coordination	o Power Plant Siting Act process includes coordination of the project with comprehensive planning.

1. This table does not present all of the policy statements of the Comprehensive Plan. It shows the general thrust of the policies in each element and the general consistency of the project.



**MALCOLM
PIRNIE**

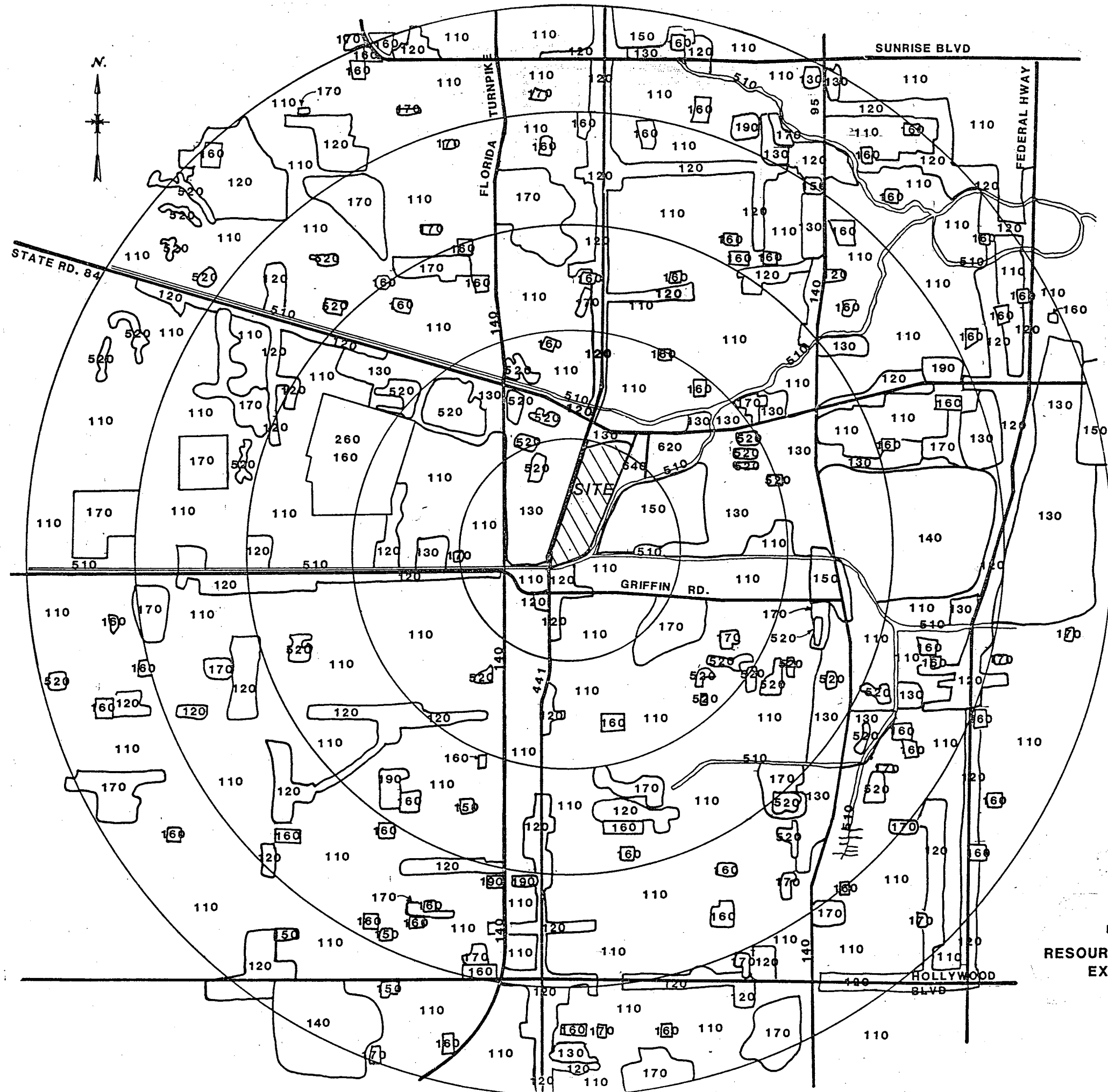


**BROWARD COUNTY
LAND USE PLAN MAP
MARCH 1985**

**FLORIDA LAND USE AND COVER
CLASSIFICATION SYSTEM (LEVEL II)**

- 110 RESIDENTIAL
- 120 COMMERCIAL & SERVICES
- 130 INDUSTRIAL
- 140 TRANSPORTATION
- 150 COMMUNICATIONS & UTILITIES
- 160 INSTITUTIONAL
- 170 RECREATIONAL
- 180 MIXED
- 190 OPEN LAND & OTHER
- 210 CROPLAND & PASTURELAND
- 220 ORCHARDS, GROVES (EXCEPT CITRUS)
- 230 CITRUS GROVES
- 240 CONFINED FEEDING OPERATIONS
- 250 SPECIALTY FARMS
- 260 OTHER AGRICULTURE
- 310 GRASSLAND
- 320 SHRUB AND BRUSHLAND
- 330 MIXED RANGELAND
- 410 CONIFEROUS FOREST
- 420 HARDWOOD FOREST
- 430 MIXED FOREST
- 440 PLANTED FOREST
- 450 CLEARCUT AREAS
- 510 STREAMS & CANALS
- 520 LAKES
- 530 RESERVOIRS
- 540 BAYS & ESTUARIES
- 550 OPEN MARINE WATERS
- 560 OTHER WATER AREAS
- 610 WETLAND-CONIFEROUS FOREST
- 620 WETLAND-HARDWOOD FOREST
- 630 WETLAND-MIXED FOREST
- 640 WETLAND-VEGETATED, NON-FORESTED
- 650 NON-VEGETATED WETLANDS
- 710 BEACHES
- 720 SAND OTHER THAN BEACHES
- 730 EXPOSED ROCK
- 740 ALTERED LANDS
- 750 EXTRACTIVE
- 760 OTHER BARREN LANDS

SCALE



BROWARD COUNTY
RESOURCE RECOVERY PROJECT
EXISTING LAND USE
5-MILE AREA
MARCH 1985

- o Commercial
- o Industrial
- o Agricultural

Using Level II categories of the Florida Land Use and Cover Classification System, additional land uses are provided for the 5 mile area around the site on Figure 2.2.2.2.

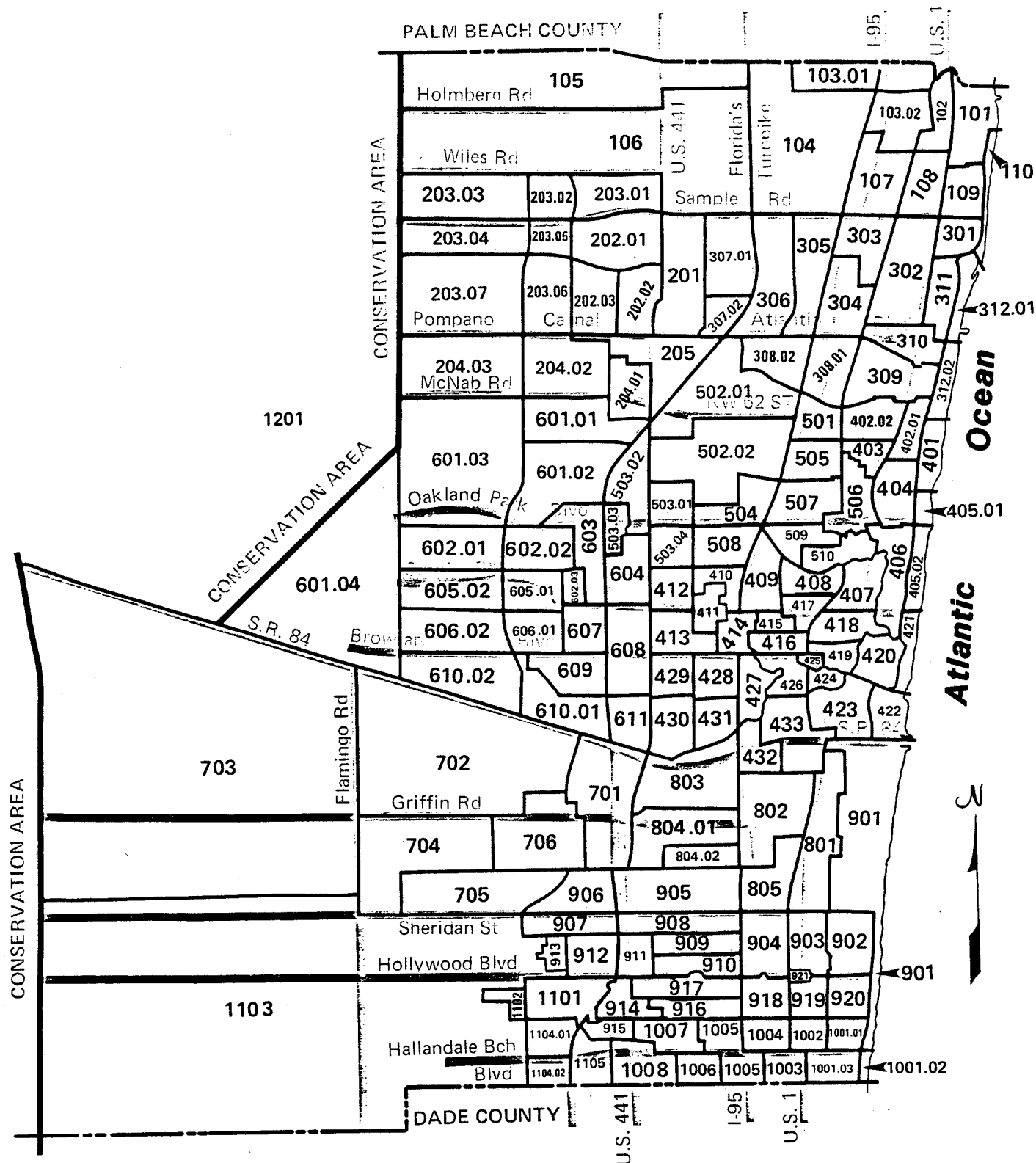
2.2.3 Demography and Ongoing Land Use

Figure 2.2.3.1 is a 1980 census tract map of Broward County. Existing resident population data corresponding to each census tract is presented in Table 2.2.3.1. Resident population by municipality is provided on Table 2.2.3.2.

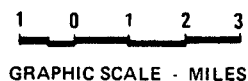
As illustrated in the previous section on Figures 2.2.2.1 and 2.2.2.2, the ongoing land use for the five mile area surrounding the site is primarily low residential and light industrial. Details for both the five mile and one mile radii are provided on these drawings. Appendix 10.3 contains a letter from the Broward County Planning Council certifying that information provided on the land use map is current and valid (Exhibit B, Appendix 10.3). Detailed information on vegetation and land use is provided in Section 2.3.5.

In November 1984, the County conducted a Solid Waste Centroid Analysis specifically aimed at tracking the movement of population in the area servicing the southern Broward communities. The purpose of this study was to identify projected shifts in population that might have an effect on facility siting. Figure 2.2.3.2 illustrates the movement of population for the years 1980 through 2020. As illustrated, presently, the solid waste centroid is located adjacent to the site. Projected movement of the centroid, in a southwesterly direction is consistent with County projections for growth and development in that region. There are no abnormal changes in population trends or industrial patterns anticipated for this

FIGURE 2.2.3.1



SOURCE: BROWARD COUNTY STATISTICAL SUMMARY 1983



BROWARD COUNTY, FLORIDA
1980
CENSUS TRACTS

TABLE 2.2.3.1

Census Tract	April 1 1970	April 1 1980	Census Tract	April 1 1970	April 1 1980
101	7,749	8,945	503	12,639	27,994
102	3,370	6,239	503.01		6,249
103	6,963	10,785	503.02		9,105
103.01		4,219	503.03		6,396
103.02		6,566	503.04		6,244
104	923	17,390	504	4,719	4,375
105	289	1,057	505	6,650	7,970
106	391	2,489	506	7,238	7,385
107	5,524	10,132	507	5,645	7,818
108	5,014	6,031	508	3,695	5,731
109	5,222	6,033	509	6,591	6,738
110	713	1,554	510	4,405	6,035
201	56	2,517	601	3,290	41,237
202	7,071	23,912	601.01		9,684
202.01		6,025	601.02		8,194
202.02		7,585	601.03		14,774
202.03		10,302	601.04		8,585
203	1,626	38,231	602	7,398	29,878
203.01		4,362	602.01		15,829
203.02		3,685	602.02		9,229
203.03		7,663	602.03		4,820
203.04		6,771	603	2,077	14,345
203.05		4,655	604	6,591	14,126
203.06		8,084	605	1,642	9,485
203.07		3,011	605.01		5,737
204	4,502	30,236	605.02		3,748
204.01		9,081	606	2,981	8,491
204.02		17,133	606.01		6,380
204.03		4,022	606.02		2,111
205	1,740	10,576	607	3,440	3,305
301	4,507	4,413	608	8,249	7,623
302	8,373	8,430	609	5,655	5,226
303	5,031	8,948	610	1,212	10,227
304	7,802	8,206	610.01		6,824
305	2,693	3,512	610.02		3,403
306	3,910	5,358	611	6,132	6,212
307	1,363	5,690	701	5,272	9,068
307.01		3,149	702	2,562	13,680
307.02		2,541	703	1,729	12,724
308	2,416	6,983	704	2,535	10,973
308.01		3,745	705	622	4,511
308.02		3,238	706	1,909	4,455
309	11,122	11,593	801	4,677	7,225
310	5,624	6,942	802	2,150	1,712
311	5,466	5,703	803	1,301	2,583
312	6,324	11,651	804	6,094	11,499
312.01		6,087	804.01		8,992
312.02		5,564	804.02		2,507
401	3,539	3,876	805	6,503	6,104
402	10,535	11,883	901	4,054	8,877
402.01		3,618	902	2,366	2,405
402.02		8,265	903	6,956	6,851
403	4,518	4,756	904	9,625	10,459
404	4,169	5,918	905	2,710	10,584
405	6,109	8,328	906	7,691	9,280
405.01		5,445	907	3,712	3,981
405.02		2,883	908	6,966	8,175
406	7,182	6,690	909	6,245	5,659
407	5,870	6,403	910	4,906	4,227
408	7,027	8,433	911	4,549	5,033
409	7,159	8,267	912	10,473	10,007
410	3,672	3,442	913	3,979	3,991
411	4,360	4,845	914	5,946	5,290
412	3,885	5,299	915	4,365	4,458
413	9,080	9,452	916	2,192	4,917
414	4,112	4,860	917	6,042	5,705
415	6,102	4,638	918	7,180	7,183
416	6,562	7,173	919	6,317	6,290
417	3,639	4,479	920	3,229	2,233
418	5,983	6,730	921	—	366
419	3,967	3,853	1001	6,214	17,764
420	3,675	3,903	1001.01		4,745
421	1,725	2,607	1001.02		8,418
422	3,388	3,701	1001.03		4,601
423	5,421	6,148	1002	4,207	6,296
424	2,926	2,434	1003	4,509	5,523
425	229	85	1004	7,158	4,590
426	4,559	5,563	1005	4,436	5,449
427	5,024	5,713	1006	5,566	5,037
428	7,162	7,194	1007	5,128	5,618
429	6,256	5,729	1008	4,843	7,272
430	9,028	8,502	1101	7,198	6,640
431	4,459	4,856	1102	1,611	1,001
432	3,401	3,557	1103	7,052	35,358
433	7,284	7,403	1104	12,586	13,245
501	6,009	4,223	1104.01		9,053
502	3,748	8,738	1104.02		4,192
502.01		4,840	1105	6,488	6,464
502.02		3,898	Total	620,100	1,018,200

SOURCE: U.S. Department of Commerce,
Bureau of the Census

BROWARD COUNTY, 1970 AND 1980

RESIDENT POPULATION BY
CENSUS TRACT

RESIDENT POPULATION BY MUNICIPALITY ---- 1920 -- 1983

CITY / YEAR (April 1)	1920	1930	1940	1950	1960	1970	1980	1981	1982	1983***
Coconut Creek	----	----	----	----	----	1,359	6,288	8,527	9,816	12,319
Cooper City	----	----	----	----	550	2,535	10,140	11,053	11,526	11,753
Coral Springs	----	----	----	----	----	1,489	37,349	40,849	44,272	46,830
Dania	----	1,674	2,902	4,540	7,065	9,013	11,796	12,151	12,222	12,287
Davie	----	----	----	----	----	5,859	20,515	22,756	30,006	32,502
Deerfield Beach	----	1,483	1,850	2,088	9,573	16,662	39,193	40,138	41,232	41,782
Ferncrest Village*	----	----	----	----	93	1,029	----	----	----	----
Fort Lauderdale	2,065	8,666	17,996	36,328	83,648	139,590	153,279	153,814	153,167	153,185
Hacienda Village****	----	----	----	----	125	35	126	126	128	128
Hallandale	----	1,012	1,827	3,886	10,483	23,849	36,517	36,872	37,413	37,443
Hillsboro Beach	----	----	----	84	437	1,181	1,554	1,562	1,562	1,554
Hollywood	----	2,869	6,239	14,351	35,237	106,873	121,323	121,955	122,680	123,363
Hollywood Ridge Farms**	----	----	----	----	108	302	----	----	----	----
Lauderdale-by-the-Sea	----	----	----	234	1,327	2,879	2,639	2,622	2,628	2,617
Lauderdale Lakes	----	----	----	----	----	10,577	25,426	25,538	26,286	26,376
Lauderhill	----	----	----	----	132	8,465	37,271	37,893	37,997	39,287
Lazy Lake	----	----	----	----	49	48	31	32	31	32
Lighthouse Point	----	----	----	----	2,453	9,071	11,488	11,421	11,474	11,427
Margate	----	----	----	----	2,646	8,867	35,900	37,596	38,388	38,678
Miramar	----	----	----	----	5,485	23,997	32,813	33,332	34,276	34,946
North Lauderdale	----	----	----	----	----	1,213	18,653	19,320	20,006	20,057
Oakland Park	----	463	815	1,295	5,331	16,261	23,035	23,100	23,343	23,537
Parkland	----	----	----	----	----	165	545	658	735	825
Pembroke Park	----	----	----	----	569	2,949	5,326	5,361	6,014	6,036
Pembroke Pines	----	----	----	----	1,429	15,496	35,776	40,070	41,784	42,062
Plantation	----	----	----	----	4,772	23,523	48,653	50,420	51,476	51,650
Pompano Beach	----	----	4,427	5,682	15,992	38,587	52,618	55,911	56,704	57,119
Sea Ranch Lakes	----	----	----	----	170	660	584	584	584	575
Sunrise	----	----	----	----	----	7,403	39,681	42,406	44,022	44,901
Tamarac	----	----	----	----	----	5,078	29,376	30,104	31,158	31,223
Wilton Manors	----	----	----	883	8,257	10,948	12,742	12,658	12,629	12,544
Unincorporated	3,070	3,927	3,738	14,562	138,015	124,137	167,620	164,483	163,485	162,051
Total	5,135	20,094	39,794	83,933	333,946	620,100	1,018,257	1,047,313	1,067,044	1,079,089

*Disincorporated July 1, 1970

**Annexed to Pembroke Park, July 1, 1970

*** Preliminary

SOURCE: U.S. Department of Commerce, Bureau of the Census, 1920-1980

Bureau of Economic and Business Research, University of Florida, 1981-1983

****Annexed to Town of Davie, September 4, 1984

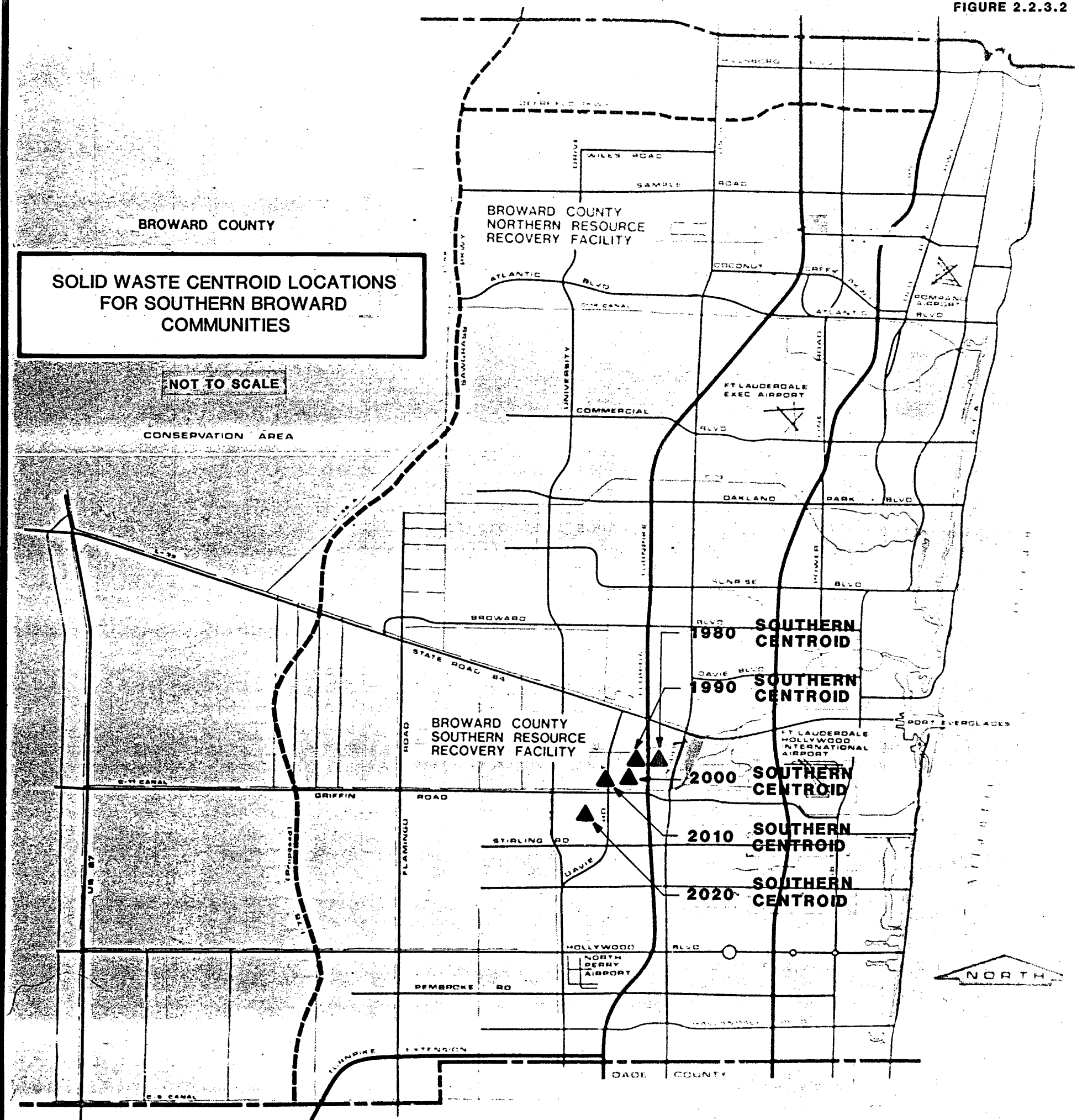
Image Quality

As you review the next group of images, Please note that the original documents were of poor quality.

BROWARD COUNTY SOLID WASTE CENTROID ANALYSIS

To establish solid waste centroids for the Broward County communities projected to utilize the proposed southern interim/contingency landfill, Malcolm Pirnie employed its centroid analysis computer program. Population data provided by The Economic Research Section of the Plan Implementation Division, Broward County Office of Planning was used as input for the centroid analysis program for the years 1980, 1990, 2000, 2010 and 2020. Centroids were then independently, calculated for each year.

**MALCOLM
PIRNIÉ**



area. As a result, the siting of the resource recovery facility at the Route 441 site will accommodate projected County population growth as well as remain at a close proximity to the projected solid waste centroid.

2.2.4 Easements, Title, Agency Works

As previously mentioned in Section 2.1, development of the site will consist of the resource recovery facility in the southern portion of the site and ash residue unprocessable waste landfill cell development in the middle and northern portion of the site. The two independent landfill cells will be separated from the resource recovery facility by the City of Ft. Lauderdale Compost Facility (under construction). Thus, internal traffic will be required to cross Fort Lauderdale property for disposal of unprocessable waste and ash residue. Existing Florida Power & Light (FP&L) power line easement crossing the site from the north (State Road 84) to Oaks Road will be relocated adjacent to the existing power line easement crossing the site from the west (Route 441) along Oaks Road. In addition, a 6-inch diameter Sunniland Pipe Line Company petroleum pipe line located in the north south easement will be relocated to the east west easement (Oaks Road). Florida Gas has also indicated that their 16 inch diameter gas line located in the Oaks Road easement will be joined by another 18-inch line. The two lines will require 15 feet of space between them. Broward County has continued to interface with FP&L concerning easement use. The easement will serve as a buffer zone and will be used for stormwater retention.

Broward County and the Florida Department of Transportation entered into a joint acquisition agreement involving those parcels common to the landfill site, construction of Interstate 595, and the Route 441/Interstate 595 intersection. Subsequently, agreement was reached whereby Broward County has

acquired all of the acreage necessary for development of the resource recovery facility and unprocessable waste landfill and associated facilities.

To the immediate northeast of the site, 20 acres are reserved for Interstate 595. Additionally, an 130 acres area known as the proposed Anne Kolb Park (also known locally as the pond apple slough) is owned by the Department of Natural Resources for I-595 mitigation adjacent to the northeastern portion of the site. The aforementioned projects, both proposed and under construction, and the land easements that exist on or around the site will not adversely affect project development.

2.2.5 Regional Scenic, Cultural and Natural Landmarks

In addition to the information provided in Section 2.2.1, Governmental Jurisdictions, the following regional scenic, cultural and natural landmarks were identified to exist within 5 miles of the site:

- o Tourist Attractions
- o Shopping Malls
- o Educational Facilities
- o Airports

The following educational facilities, tourist attractions, airports and shopping malls were identified to exist outside of the one mile radius of the facility but within the five mile radius. No like educational, tourist attractions, airports, or shopping malls are located within one mile of the site.

Elementary and Middle Schools

Apollo Middle School
Attucks Middle School
Bethune, Mary M. Elementary
Boulevard Heights Elementary
Broward Estates Elementary
Collins Elementary
Cooper City Elementary

Croissant Park Elementary
Dania Elementary
Davie Elementary
Driftwood Elementary
Driftwood Middle School
Edgewood Elementary
Eisenhower D.D. Elementary
Foster, Stephen Elementary
Harbordale Elementary
Hollywood Hills Elementary
Hollywood Park Elementary
Hortt Elementary
Larkdale Elementary
Meadowbrook Elementary
New River Middle School
North Fork Elementary
Nova Middle School
Oakridge Elementary
Olsen Middle School
Orangebrook Elementary
Parkway Middle School
Pasadena Lakes Elementary
Pembroke Pines Elementary
Peters Elementary
Pineridge Elementary
Pines Middle School
Pioneer Middle School
Plantation Elementary
Plantation Middle School
Plantation Park Elementary
Riverland Elementary
Rogers Middle School
Sasal Palm Elementary
Seminole Middle School
Sheridan Hills Elementary
Sheridan Park Elementary
Stirling Elementary
Sunland Park Elementary
Tropical Elementary
Walker Elementary
West Hollywood Elementary
West Heights Elementary

High Schools

Cooper City High School
Hollywood Hills High School
McArthur High School
Nova High School
South Broward High School
South Plantation High School

Stranahan High School
St. Thomas Aquinas High School

Other Educational Facilities

Board of Public Instruction
Downtown Adult Center
ITV Center (Instructional T.V.)
Melrose Park Center
The Quest Center
Reading Center
Seagull School
Sheridan Vocational Center
Southside (Cyesis) Center
Wingate Oaks Center
University of Florida Agricultural Exp. Stat.
South Florida Educational Center
Broward Community College
Nova University

Principal County Tourist Attractions or Shopping Malls (within
5 Miles)

Broward Mall
Hollywood Mall
Lauderhill Mall
Archaeological Museum/Historical Commission
Atlantis, The Water Kingdom
Beuhler Planetarium
Castle Park
Dania Jai-Alai Fronton
Davie-Cooper City Rodeo
Discovery Center
Ft. Lauderdale Historical Society
Giant Waterslide
Grand Prix Race O-Rama
I-95 Grand Prix & Games
King - Cromartie House
Museum of Art
Ocean World
Bob Roth's New River Groves
Seminole Indian Rodeo
Spykes Grove & Tropical Gardens

None of these areas of cultural interest will be affected
by the proposed plant or its emissions.

2.2.6 Archaeological and Historic Sites

The State of Florida, Division of Archives, History and Records Management, reviewed a map of the area for evaluation of known or potential historic or archaeological resources at the site. The results of this review indicate that the probability of any significant occurrence of historic or archaeological resources is very low. Therefore, no further investigation is required prior to construction. Appendix 10.18 provides further details on this issue.

2.2.7 Socioeconomics and Public Services

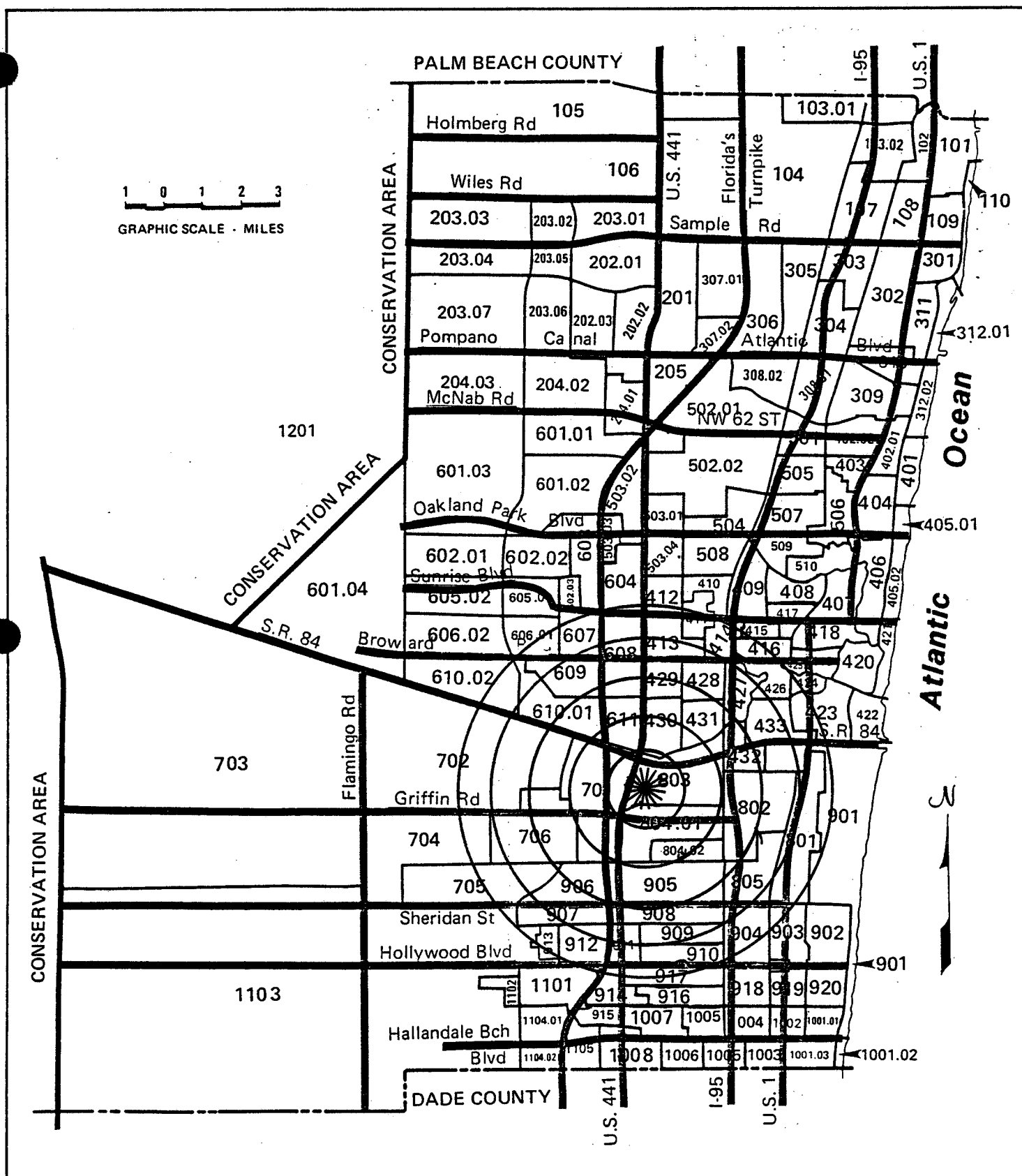
2.2.7.1 Social and Economic Characteristics

Current Population. In 1980, total Broward County population as recorded by the U.S. Bureau of Labor, Department of Census was 1,018,200. It is anticipated that approximately 60 percent of the total Broward County population will be serviced by the southern resource recovery facility. Figure 2.2.7.1 details the 1980 census population counts for those census tracts partially or wholly located within five miles of the site. The site is located in census tract 803. In 1980 the population of census tract 803 was 2,583. In aggregate, 1980 census populations for all census tracts located within 5 miles of the site was 353,839.

Labor Force. The civilian labor force in Broward County as a whole totaled 370,100 in 1983. This represents a 5 percent increase since 1980. The unadjusted unemployment rate in January of 1983 was 9.1 percent. In July of 1984 the unemployment rate had fallen to 5.4 percent. This compares to national unadjusted unemployment rate figures for the same period of 11.4 percent and 7.5 percent, respectively. Table 2.2.7.1 presents a compilation of unemployment data from January 1982 through August of 1984.

Employment by Occupation in the Industrial Sector. Table 2.2.7.2 presents 1983 employment statistics by occupation (except agriculture) for Broward County.

FIGURE 2.2.7.1



SOURCE: BROWARD COUNTY STATISTICAL SUMMARY 1983

BROWARD COUNTY
1980 CENSUS TRACTS
FIVE MILE RADIUS AROUND SITE

TABLE 2.2.7.1

UNEMPLOYMENT RATE (UNADJUSTED)
BROWARD COUNTY, STATE OF FLORIDA, UNITED STATES
JANUARY 1982-JUNE 1983

Year	Month	Broward	Florida	United States
1982	January	6.0%	7.7%	9.4%
	February	5.7	7.1	9.6
	March	7.0	8.6	9.5
	April	6.4	7.9	9.2
	May	6.0	7.3	9.1
	June	6.1	7.7	9.8
	July	5.8	7.5	9.8
	August	6.2	7.8	9.6
	September	6.7	8.2	9.7
	October	7.6	9.2	9.9
	November	8.0	9.5	10.4
	December	7.8	9.5	10.5
	Annual Average	6.6	8.2	9.7
1983	January	9.1	10.4	11.4
	February	8.3	9.5	11.3
	March	7.6	8.9	10.8
	April	7.3	8.4	10.0
	May	7.7	8.7	9.8
	June	7.6*	8.8	10.2
	July	6.7	8.2	9.4
	August	6.7	8.2	9.2
	September	6.4	8.1	8.8
	October	7.0	8.6	8.4
	November	6.6	8.1	8.1
	December	6.1	7.5	8.0
1984	January	6.1	7.4	8.8
	February	4.9	6.1	8.4
	March	4.3	5.4	8.1
	April	4.6	5.7	7.6
	May	5.0	6.1	7.2
	June	5.3	6.6	7.4
	July	5.4	6.8	7.5
	August	4.7*	6.2*	7.3
	September	N/A	N/A	7.1

*Preliminary

Source: State of Florida, Department of Labor and Employment
Security, Bureau of Labor Statistics

TABLE 2.2.7.2

AVERAGE ANNUAL NON-AGRICULTURAL EMPLOYMENT
BY INDUSTRY DIVISION
BROWARD COUNTY, 1983

<u>Industry</u>	<u>Employment</u>	
	<u>Number</u>	<u>Percent</u>
Construction	25,900	7.0
Manufacturing	41,600	11.2
Durables	31,300	8.4
Non-Durables	10,300	2.8
Transportation, Public Utilities	18,100	4.9
Trade	107,800	29.1
Retail	88,900	24.0
Wholesale	18,900	5.1
Finance, Insurance, Real Estate	33,200	9.0
Services and Miscellaneous	94,200	25.5
Government	49,300	13.3
Total	370,100	100.0%

Source: Florida Department of Labor and Employment Security

General Income Characteristics. Within the 5 mile radius of the proposed Route 441 site there is a combination of high and low median household incomes. The City of Plantation contains a majority of the upper income households. The City of Fort Lauderdale contains a majority of the lower income households. Median household income for residences within a one mile radius of the proposed site falls within the lower fifty percentile of Broward County averages.

Source of Income. Throughout the eleven cities in the area, the primary source of income is wages and salary. Approximately 55 percent of the land in the area is used for light residential housing (see Figure 2.2.2.1).

Average Wage and Salary Income. For those census tracts either partially or wholly within five miles of the site, private services account for the primary source of income. Private services provided more jobs in 1983 for this area than any other industrial sector in Broward County.

Existing Housing Stock. Housing statistics are shown in Table 2.2.7.3. Cooper City has the greatest proportion of owner-occupied housing units (89%), while the City of Dania has the lowest (46%).

Building Activity. Multi-family housing units represented the largest proportion of building activity in Broward County between 1970 and 1983. Table 2.2.7.4 presents municipality building activities based on building permits issued to build within five miles of the proposed site. Table 2.2.7.5 presents information pertaining to residential building permits issued for the entire County.

Housing Costs. Of those census tracts partially or wholly within the 5 mile radius of the site, average median housing value is highest in Plantation. Median housing values and condominium values for the same area are shown in Table 2.2.7.6.

TABLE 2.2.7.3

EXISTING HOUSING INFORMATION, 1980

<u>Municipality</u>	<u>Total Housing</u>	<u>Occupied Year Round Housing Units</u>			<u>Vacant Year-Round Housing Units</u>			
		<u>Total</u>	<u>Owner Occupied</u>	<u>Renter Occupied</u>	<u>Total</u>	<u>For Sale</u>	<u>For Rent</u>	<u>Other</u>
Cooper City	3,388	3,292	3,007	285	96	12	5	79
Dania	6,057	5,051	2,813	2,238	1,006	49	226	731
Davie	8,081	7,503	5,531	1,972	578	160	116	302
Fort Lauderdale	78,242	67,623	38,012	29,611	10,619	754	2,492	7,373
Hacienda Village ¹	93	72	54	18	21	1	-	20
Hollywood	56,857	50,764	34,289	16,475	6,093	340	1,403	4,350
Lauderhill	19,561	16,525	9,416	7,109	3,036	771	419	1,846
Miramar	12,145	11,647	9,860	1,787	498	102	57	339
Pembroke Pines	14,349	12,691	11,196	1,495	1,658	95	59	1,504
Plantation	17,882	16,810	14,247	2,563	1,072	288	156	628
Sunrise	17,225	16,022	13,310	2,712	1,203	85	131	987

1. Abolished through annexation to Town of Davie via referendum approved by voters on September 7, 1984.

TABLE 2.2.7.4

RESIDENTIAL BUILDING PERMITS ISSUED, BY MUNICIPALITY,
BROWARD COUNTY, 1983 AND 1970-1983

Municipality	1983				1970-1983			
	Single Family	Duplex	Multi- Family	Total	Single Family	Duplex	Multi- Family	Total
Cooper City	532	-	-	532	3,335	30	174	3,539
Dania	5	4	24	33	470	348	1,854	2,672
Davie	345	10	110	465	3,274	382	5,699	9,355
Fort Lauderdale	34	44	62	140	2,153	1,222	13,766	17,141
Hacienda Village ¹	-	-	-	-	-	2	-	2
Hollywood	63	42	455	560	3,191	1,044	11,500	15,735
Lauderhill	294	-	317	611	4,893	294	15,380	20,567
Miramar	321	2	173	496	2,748	422	1,084	4,254
Pembroke Pines	389	-	227	616	7,924	2	6,908	14,834
Plantation	154	24	921	1,099	5,028	296	7,325	12,649
Sunrise	499	134	782	1,415	7,532	250	13,784	21,566
Total	2,636	260	3,071	5,967	40,548	4,292	77,474	122,314
	44%	4.4%	51.5%		33.2%	3.5%	63.3%	

1. Now part of Town of Davie via referendum approved by voters on September 7, 1984.

TABLE 2.2.7.5

RESIDENTIAL BUILDING PERMITS ISSUED
BROWARD COUNTY, 1970 - AUGUST, 1984

<u>Year</u>	<u>Single Family</u>		<u>Duplex</u>		<u>Multi-Family</u>		<u>Total</u>	
	<u>Number</u>	<u>%</u>	<u>Number</u>	<u>%</u>	<u>Number</u>	<u>%</u>	<u>Number</u>	<u>%</u>
1970	6,200	30.7	1,096	5.4	12,924	63.9	20,200	100.0
1971	7,999	27.3	1,274	4.4	20,014	68.3	29,287	100.0
1972	9,664	21.3	1,544	3.4	34,090	75.3	45,298	100.0
1973	11,071	16.9	1,496	2.3	52,981	80.8	65,548	100.0
1974	3,585	17.5	602	2.9	16,367	79.6	20,554	100.0
1975	3,334	63.4	396	7.5	1,532	29.1	5,262	100.0
1976	4,871	59.9	458	5.6	2,803	34.5	8,132	100.0
1977	6,951	49.8	392	2.8	6,613	47.4	13,956	100.0
1978	8,143	35.9	464	2.0	14,078	62.1	22,685	100.0
1979	6,304	39.4	444	2.8	9,247	57.8	15,995	100.0
1980	5,078	32.8	499	3.2	9,920	64.0	15,497	100.0
1981	2,987	34.3	431	5.0	5,279	60.7	8,697	100.0
1982	1,828	28.4	272	4.2	4,334	67.4	6,434	100.0
1983	4,696	33.0	476	3.4	9,042	63.6	14,214	100.0
1984*	3,647	32.9	346	3.1	7,089	64.0	11,082	100.0

*Through August

Source: Fort Lauderdale News/Sun Sentinel

TABLE 2.2.7.6

AVERAGE VALUE OF OWNER-OCCUPIED UNITS
NON-CONDOMINIUM AND CONDOMINIUM

<u>Municipality</u>	<u>Non-Condo</u>	<u>Condo</u>
Cooper City	\$ 82,242	\$ 48,388
Dania	58,902	48,303
Davie	88,051	54,620
Fort Lauderdale	84,013	81,295
Hacienda Village ¹	37,666	-
Hollywood	66,554	58,963
Lauderhill	66,583	51,957
Miramar	60,253	49,459
Pembroke Pines	73,254	58,485
Plantation	105,895	56,599
Sunrise	65,061	43,374

1. Now part of Town of Davie via referendum approved by voters on September 7, 1984.

2.3 Biophysical Environment

2.3.1 Geohydrology

The following subsections describe the major geologic features of the site and associated facility areas. This information includes the results of the geotechnical studies which were undertaken to determine the structural and environmental suitability of the site. The study description includes identification and justification of the sampling pattern, sampling method, and analytic techniques.

Because the facility will incorporate an ash residue/un-processable waste landfill, a detailed description of site-specific hydrogeologic characteristics has been included in this section. In addition, the site-specific aquifer and surface water characteristics have been developed in order to assist in defining a surface water management plan which will conform with South Florida Water Management District (SFWMD) requirements.

2.3.1.1 Geologic Description of the Site Area

The most common geologic materials in Broward County to a depth of approximately 300-400 feet are limestone and some sand which range in age from Pleistocene to Late Miocene (from 1 million to 25 million years old).

The Biscayne Aquifer system, the major potable water source for south Florida, underlies all of Broward County with the exception of certain coastal areas where salt water intrusion has occurred. This system is comprised of highly permeable limestones and sandstones and overlying younger deposits of sand. The Biscayne Aquifer extends from land surface to a depth of more than 200 feet along the coast, thins westward to a depth of about 70 feet in central Broward County, and pinches out near the western county line. At various locations, it may be composed of: the upper part of the Tamiami formation, small erosional remnants of the Caloosahatches marl, the Anastasia formation, the Fort

Thompson formation, the Miami oolite, and the Pamlico sand. The aquifer grades into a predominantly sandy phase in the Fort Lauderdale area and contains so much unconsolidated material that wells often must be cased to the main water horizon, and screens may be required to provide the well finish. It is underlain by a thick sequence of relatively impermeable clayey materials which in turn overlies the permeable limestone formations of the Floridan Aquifer. The confined Floridan Aquifer extends from a depth of about 900 feet to more than 3,000 feet and is overlain by a 500 to 600-foot section of clay, silt, and marl of low permeability. Parker, et al. (1955), presents a comprehensive description of the geology of southeastern Florida.

The typical lithology in the area is shown by the log of USGS well G515 (Table 2.3.1.1), and the logs depicted in Figures 2.3.1.1, 2.3.1.2, and 2.3.1.3. The lithologic and permeability description in Table 2.3.1.1 are an interpretation of the USGS and show that low and high permeabilities are generally associated with sand and rock zones, respectively. Although the lithology is highly variable, Figure 2.3.1.1 shows that about 60 feet of low permeability sand overlies at least 140 feet of highly permeable limestone interbedded with sandstone and sand. In some areas, the deposits below a depth of 60 feet are predominantly sand or sandstone and sand. The wells depicted in Figure 2.3.1.1 are located on Figure 2.3.1.4.

There is also some evidence of a low-permeability zone at the base of the Biscayne Aquifer. Many of the wells in Figures 2.3.1.1., 2.3.1.2 and 2.3.1.3 show the presence of sand or marl beds at depths below 180 feet, and the lithologic interpretation of Table 2.3.1.1 associates similar beds with low to very low permeabilities. The presence of salty water near the base of the aquifer (Vorhis, 1948) also suggests that a low-permeability zone may have entrapped connate water or relict seawater by retarding ground water movement.

TABLE 2.3.1.1

TYPICAL LITHOLOGY - USGS WELL G515⁽¹⁾

Location: N.E. 1/4 S.W. 1/2 Section 12, T. 50 S., R. 41E., in center of Fort Lauderdale Golf and Country Club, near City Well 6.

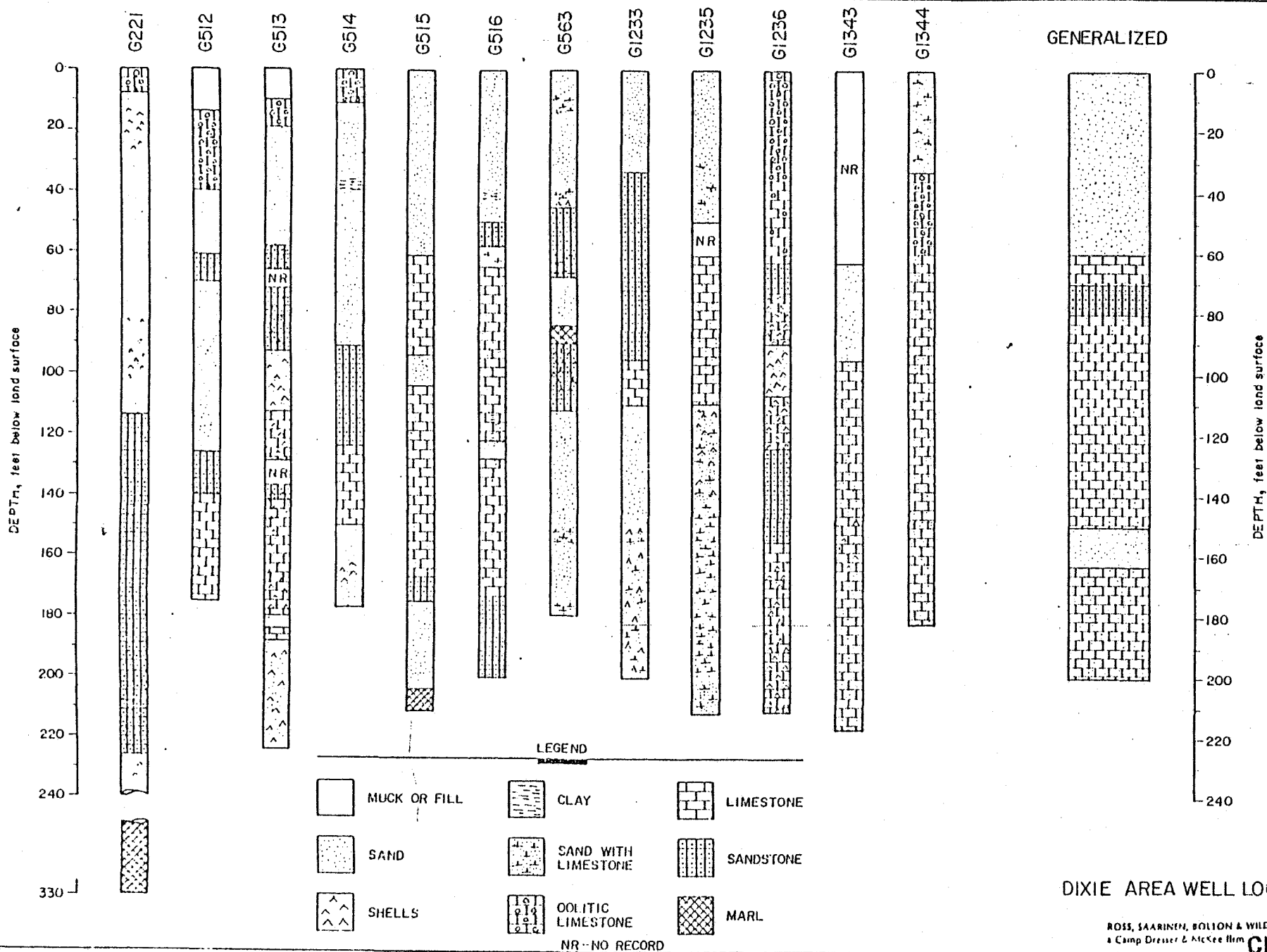
Elevation of land surface: about 9.0 feet above mean sea level.

	<u>Depth in feet below land surface</u>
Sand, quartz, grayish-white.	0 - 3
Sand, quartz, dark-brown, medium-grained, containing a large amount of organic material. Moderately permeable.	3 - 31
Sand, quartz, fine-grained.	31 - 42
Sand, quartz, very fine-grained with some admixed clay. Low permeability.	42 - 61
Limestone, sandy, cavernous, with some quartz sand. Limestone has weathered appearance. Moderately permeable.	61 - 68
Limestone, sandy, and quartz sand. Each have peppered appearance due to presence of collophane. Medium to low permeability.	68 - 94
Sand, quartz, very fine-grained, peppered with collophane and ilmenite. Low permeability.	94 - 104
Limestone, sandy, and calcareous sandstone, fossiliferous. Very permeable between 107 and 123 feet; low, between 123 and 167 feet.	104 - 167
Sandstone, calcareous. Permeable.	167 - 175
Sand, quartz, interbedded with thin layers of clay. Low permeability.	175 - 204
Marl, clayey, gray-green with thin lenses of quartz sand containing some ilmenite. Very low permeability.	204 - 211

Note:

1. As interpreted by the United States Geological Survey.

FIGURE 2.3.1.1

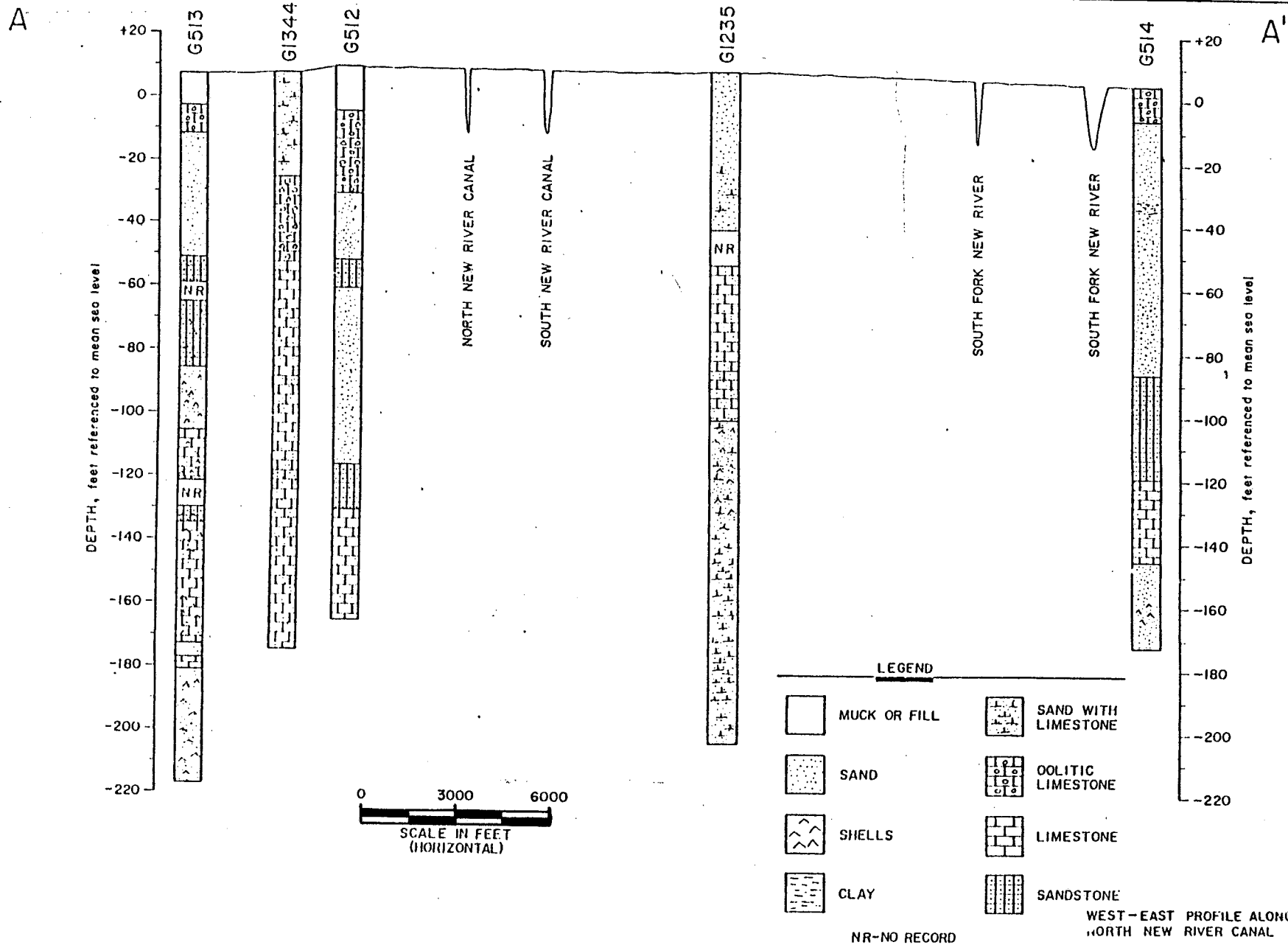


DIXIE AREA WELL LOGS

ROSS, SAARINEN, BOLTON & WILDER
a Camp Dresser & McKee firm

CDM

FIGURE 2.3.1.2



ROSS, SAARINEN, BOLTON & WILDER
a Camp Dresser & McKee firm

CDM

Note: See Figure 2.3.1.4 for Line of Section

FIGURE 2.3.1.3

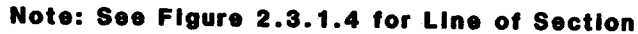
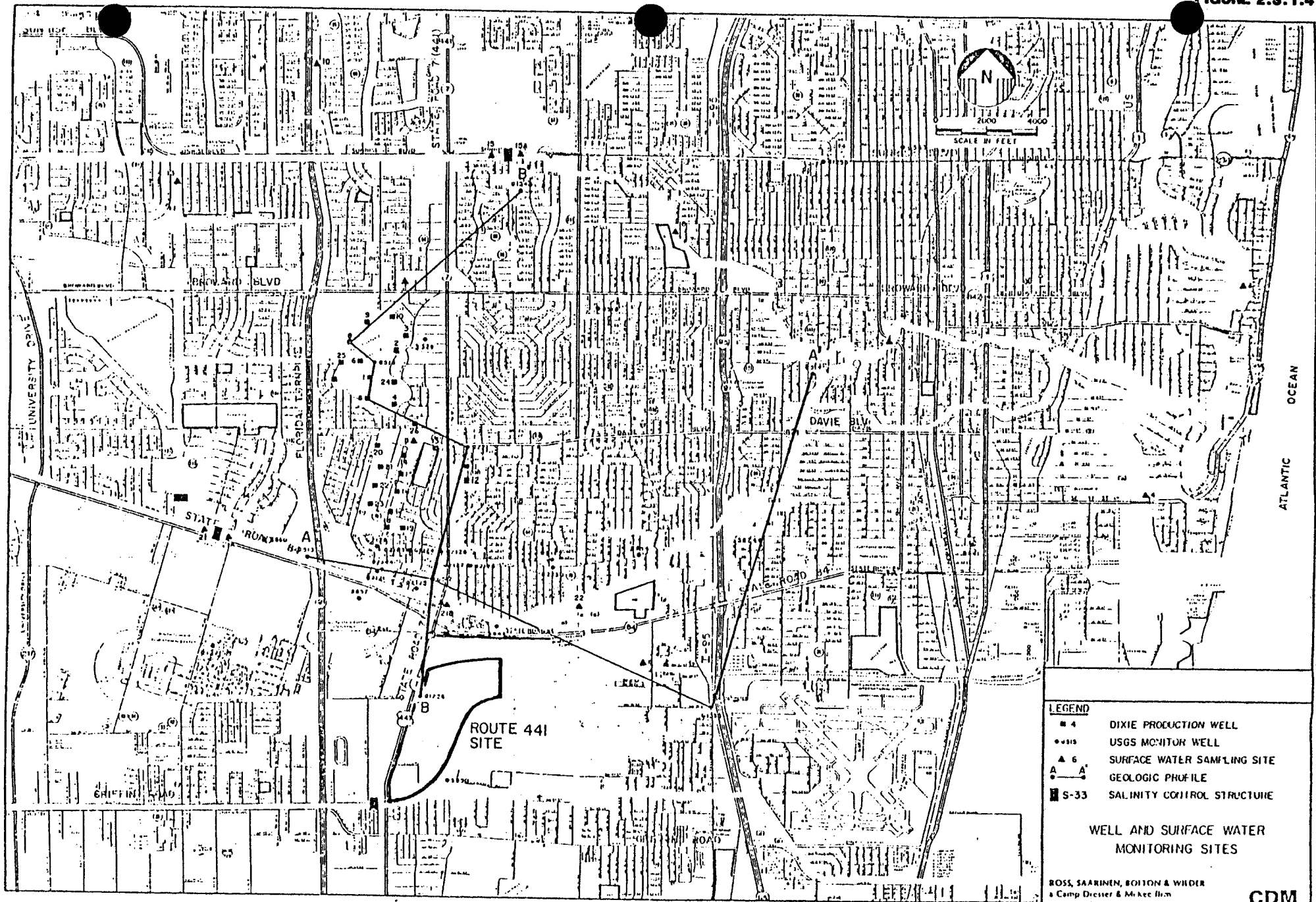


FIGURE 2.3.1.4



Note: Cross Sections Shown on Figures 2.3.1.2 and 2.3.1.3

2.3.1.2 Detailed Site Lithologic Description

Information contained in this section has been developed from exploratory borings taken as part of the site selection and geotechnical investigation efforts of Broward County's Resource Recovery Program. Specifically, the following geotechnical studies were performed at the facility site in the areas specified:

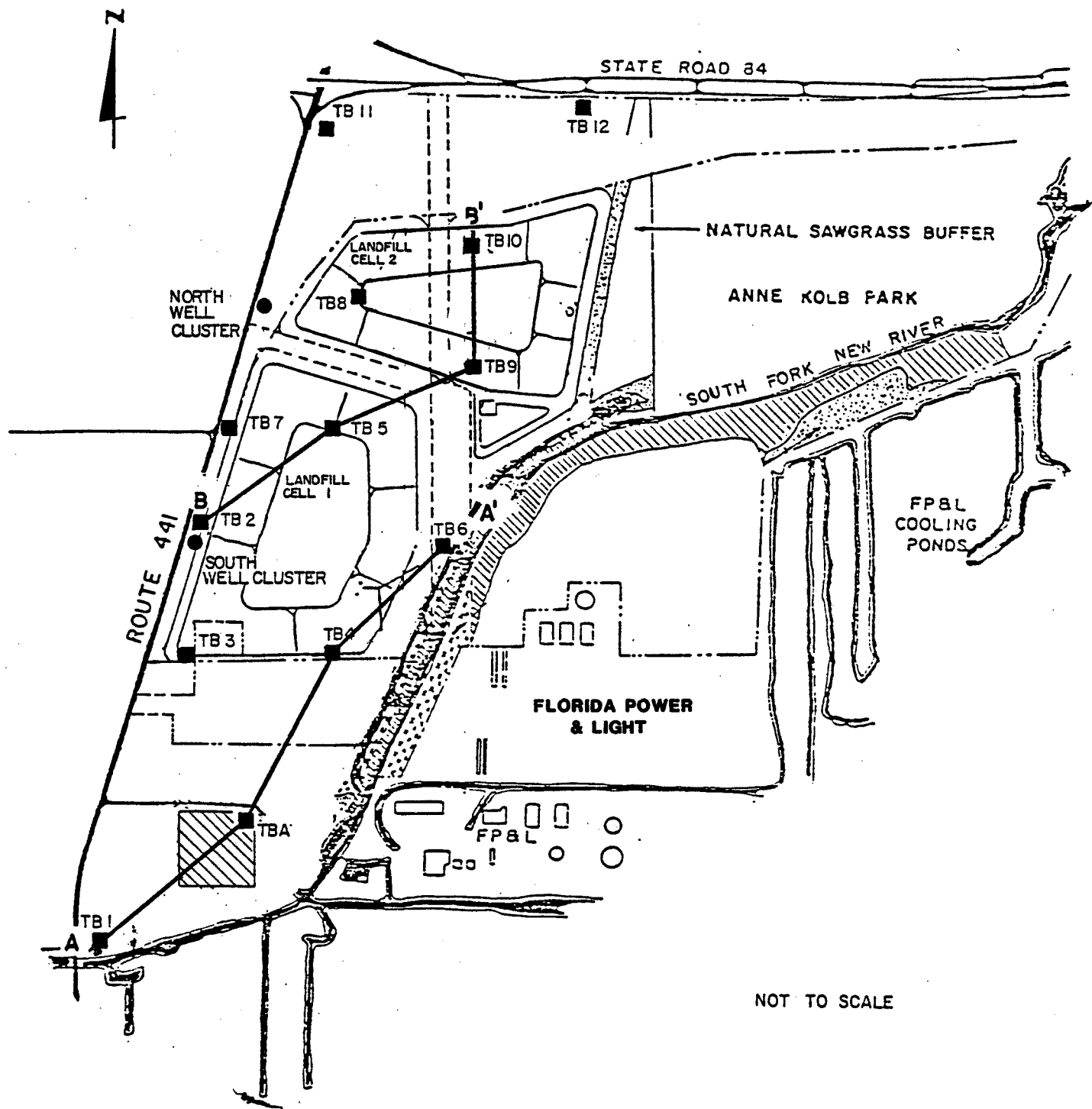
- o Malcolm Pirnie, Inc. drilled two (2) groundwater test well clusters located in the Residue/Unprocessable Waste Landfill and numerous test borings throughout both the landfill and resource recovery facility project sites (Figure 2.3.1.5).
- o KBC Consultants, Inc. conducted a detailed geotechnical analysis of the City of Fort Lauderdale's Sludge Composting Facility located immediately adjacent to the resource recovery facility.
- o East Coast Testing and Engineering performed a study of the Powell Brothers Industrial Tract which is located within Cell No. 1 of the residue/unprocessable waste landfill.
- o Florida Testing and Engineering studied the Griffey Tract which coincides with the eastern portion of the landfill Cell No. 2.

The four reports are corroborative on soil types, groundwater elevations, and depth to rock layer. Analyses were made by standard field and laboratory geotechnical methodologies. Copies of the reports are provided in Appendix 10.8.

Due to the corroborative nature of the above referenced reports, the following description of site soils and lithology represents a summary incorporating data from each report.

Site Soils

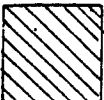
Information on existing soils at the Route 441 site was obtained from the Broward County Soil Survey (U.S.D.A. Soil Conservation Service, 1976) and verified by geotechnical investigations to provide additional background soil and hydrogeologic data. Figure 2.3.1.6 delineates the principal



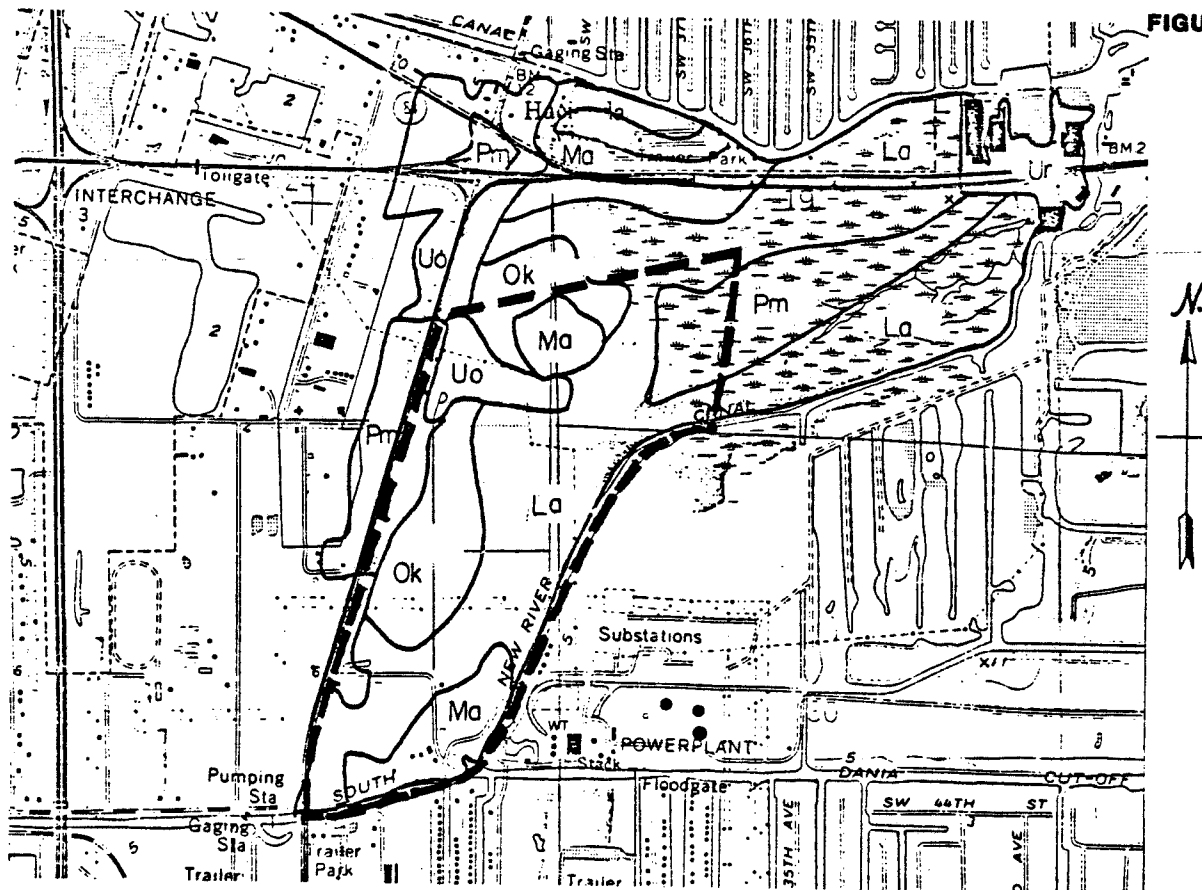
LEGEND

-  MARSH
-  CYPRESS
-  EXISTING VEGETATION

A—A' LINE OF SECTION
(Shown in figures 2.3.1.7 and 2.3.1.8)

-  TEST BORINGS
-  PERMANENT MONITORING WELL CLUSTERS
-  GEOTECHNICAL TEST BORINGS

LOCATION PLAN FOR ROUTE 441
TEST BORINGS, MONITORING WELLS,
AND LINES OF SECTION



Soil Mapping Units

SCALE: 1:24,000

La: Lauderhill muck
 Ma: Margate fine sand
 Ok: Okeelanta muck
 Pm: Plantation muck
 Un: Udorthents
 Uo: Udorthents
 Ur: Udorthents

Soil Boundary: 
 Site Boundary: 

Note:

1. Taken from Soil Survey of Broward County, Florida, U.S.D.A. Soil Conservation Service.

soil units at the site. Selected soil morphological characteristics and engineering properties are presented in Table 2.3.1.2.

The Route 441 site is covered by a 0.5 to 4 foot thick layer of peat and muck. The peat and muck layer overlies silica and/or calcareous sand with limestone and shell fragments. Semi-consolidated bedrock is encountered between 2 to 10 feet below ground surface and is composed of limestone and oolitic limestone interlayered with sand and marl.

Except for disturbed portions (Udorthents) the site is subject to seasonal flooding. The Broward County soil survey classifies the on-site soils as being poorly drained (soils wet for long periods of time; drainage mottles in mineral soil are between 0 and 10 inches from ground surface).

Site Lithology

The geologic logs developed from borings installed by Malcolm Pirnie (Figure 2.3.1.5) were used to construct the geologic cross sections shown on Figures 2.3.1.7 and 2.3.1.8. Site-specific shallow geologic conditions appear to be similar to conditions within 1 to 2 miles of the site as can be noted by a comparison of Figures 2.3.1.1 (Dixie area well logs), 2.3.1.2, and 2.3.1.3 (regional cross sections shown on Figure 2.3.1.4) with Figures 2.3.1.7 and 2.3.1.8 (site-specific cross sections). The shallow subsurface materials at the site are predominantly oolitic limestone with discontinuous layers of unconsolidated sand and marl. Both cross sections demonstrate the variability in lithology throughout the site which is generally a result of solutioning of large portions of the limestone zones and subsequent filling with sand from the upper unconsolidated zones. Geologic Cross Section A-A' (Figure 2.3.1.7) shows a continuous layer of naturally occurring peat (average thickness of 3 feet) from the canal on the eastern limits of the site to Route 441 (State Road 7) on the western limit of the site. This is underlain by a layer of

TABLE 2.3.1.2

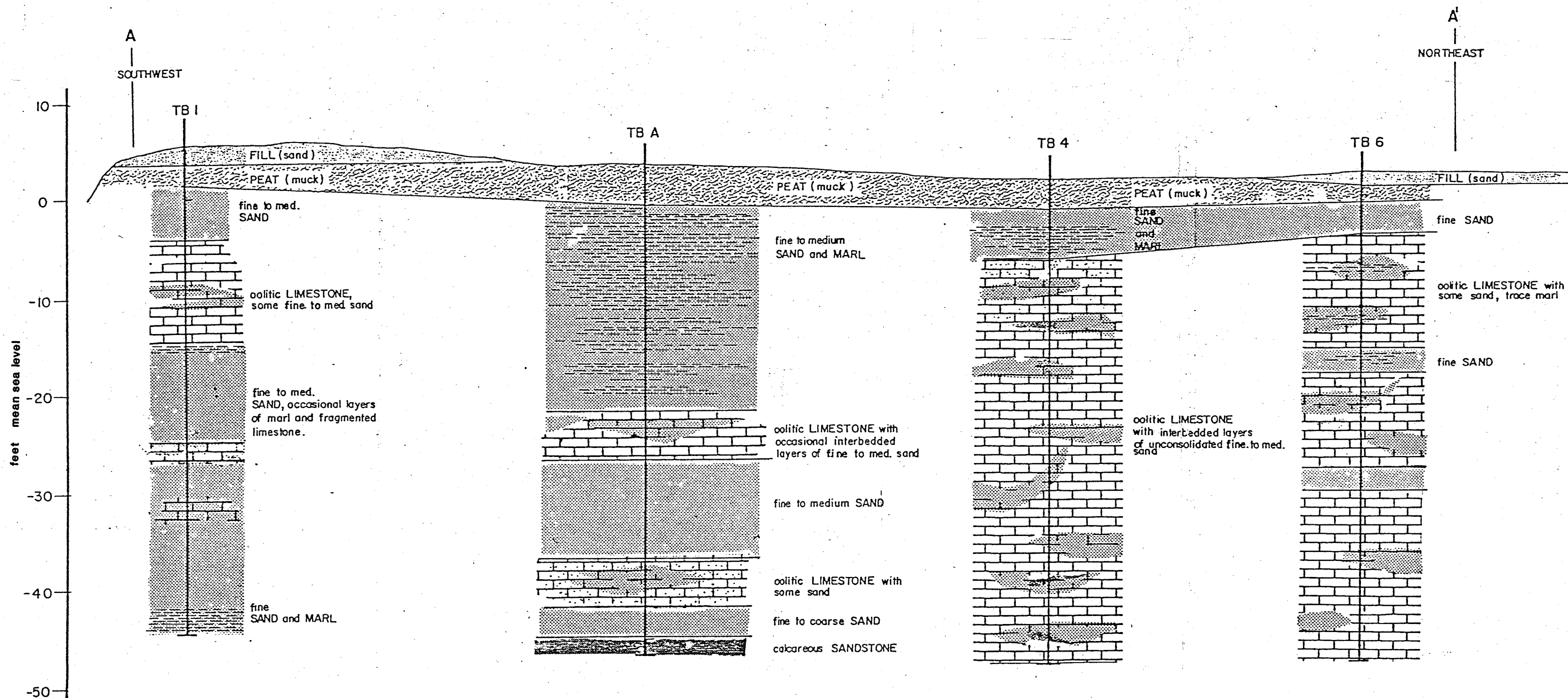
ROUTE 441 SITE
CHARACTERISTICS AND PROPERTIES OF SOILS

Mapping ⁽¹⁾ Unit Symbol	Name ⁽¹⁾	Texture ^(1,2)	Drainage ^(1,2) Class	Slope ^(1,2) (Percent)	Perme- ^(1,2) ability (in/hr)
La	Lauderhill muck	Muck over occasional sand	Poorly drained	0-3	6-20
Ma	Margate fine sand	Fine sand over limestone	Poorly drained	0-3	6-20
Ok	Okeelanta muck	Muck over fine sand	Poorly drained	0-3	6-20
Pm	Plantation muck	Muck over fine sand	Poorly drained	0-3	6-20
Un, Uo, Ur	Udorthents	Variable	20-60 inches to water	2-40	-

Notes:

1. Date obtained from Soil Survey of Broward County Area, Florida, U.S.D.A. Soil Conservation Service.
2. Data obtained/verified during site visits and/or test borings.

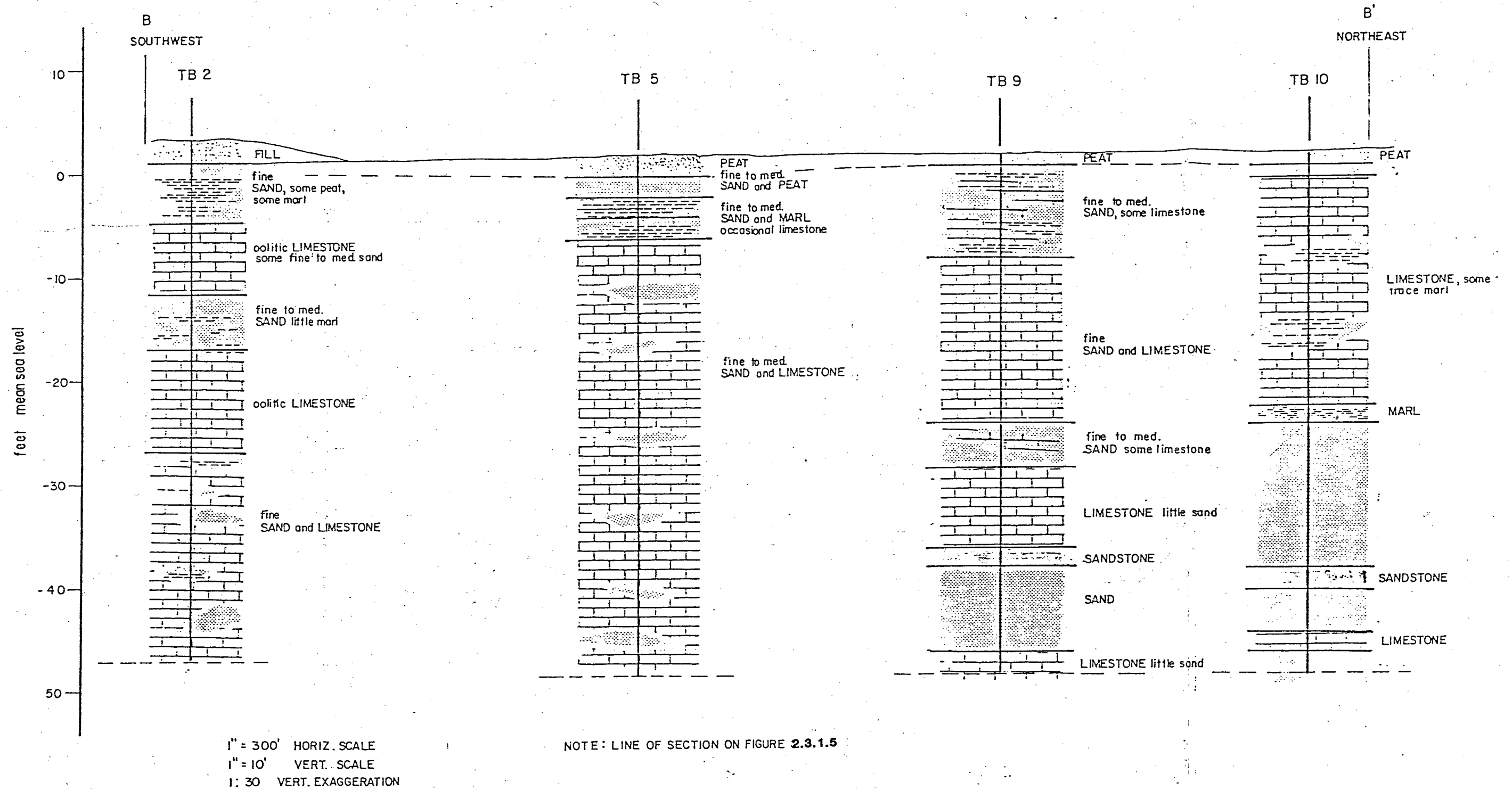
FIGURE 2.3.1.7



1" = 300' HORIZONTAL SCALE
 1" = 10' VERTICAL SCALE
 1:30 VERT. EXAGGERATION

NOTE:
 LINE OF SECTION SHOWN ON FIGURE 2.3.1.5

BROWARD COUNTY
 RESOURCE RECOVERY
 HYDROGEOLOGIC INVESTIGATION
 ROUTE 441 SITE
 GEOLOGIC CROSS SECTION A-A



fine unconsolidated calcareous sand and marl with the thickest portion of this layer occurring at the south end of the site with a thinning trend, and occasional pinching out towards the north end of the site. This sandy layer overlies a very loose, porous, and quartz sandy oolitic limestone which is poorly cemented and very weathered at various depths with isolated layers of fine to medium sand and shell fragments throughout.

2.3.1.3 Geologic Maps

In general, uniform geologic conditions, typical of the Broward County area, prevail throughout the site.

Fifty foot test wells were drilled throughout the landfill areas. The material below the muck consisted mainly of very porous limestone with sand filling in the pores. There were a few sand layers with a fraction of marl but no continuous confining layer. A few lenses were discovered at various depths. The closest confining layer would be the layer below the Biscayne Aquifer, which consists of marl and lime clay. Above that the ground is open and the water is uncontained.

Detailed geotechnical reports are provided in Appendix 10.8. Figures 2.3.1.7 and 2.3.1.8 show geological sections of the project site.

2.3.1.4 Bearing Strength

Of the four firms which performed geotechnical studies at the Project site (as outlined in Subsection 2.3.1.2) two of them, KBC Consultants and Florida Testing and Engineering, gave specific recommendations for foundation design, foundation construction and geotechnical site preparation considering the in-situ geologic conditions encountered. These recommendations are provided along with the geotechnical reports in Appendix 10.8.

It is the general consensus of these two firms that the soils and lithology encountered on the site are typical of the Broward County area and that with proper site preparation and

foundation design, soil bearing strength should not be considered a significant factor for foundation suitability. In general foundation design considerations include the following:

- o Removal of the surface strata of muck and sandy marl and replacement with select fill. This would allow for shallow foundation design (slab, footings) supported by the native limestone formation providing a bearing value of 2,500 to 3,000 pounds per square foot.
- o By-pass the surface soils with a deep pile system.

Since construction details will not become available until after vendor selection definitive recommendations are not being made at this time. In general, however, potentially limiting conditions, i.e. the existence of highly compressible surface soils, can be overcome by appropriate site preparation and foundation design.

2.3.2 Subsurface Hydrology

This section contains two subsections which describe the physical, chemical, and hydrological characteristics of subsurface waters that have potential to be affected by the construction or operation of the proposed plant, residue/un-processable waste landfill, and associated facilities. Even though facility construction and operations will not have an effect on subsurface water, the environmentally sensitive nature of the Biscayne Aquifer (i.e. unconfined aquifer with high horizontal and vertical hydraulic conductivities, and it being the sole source aquifer for the potable water supply in Broward County) has made it necessary to perform detailed aquifer analyses for proper facility design.

2.3.2.1 Subsurface Hydrologic Data for the Site

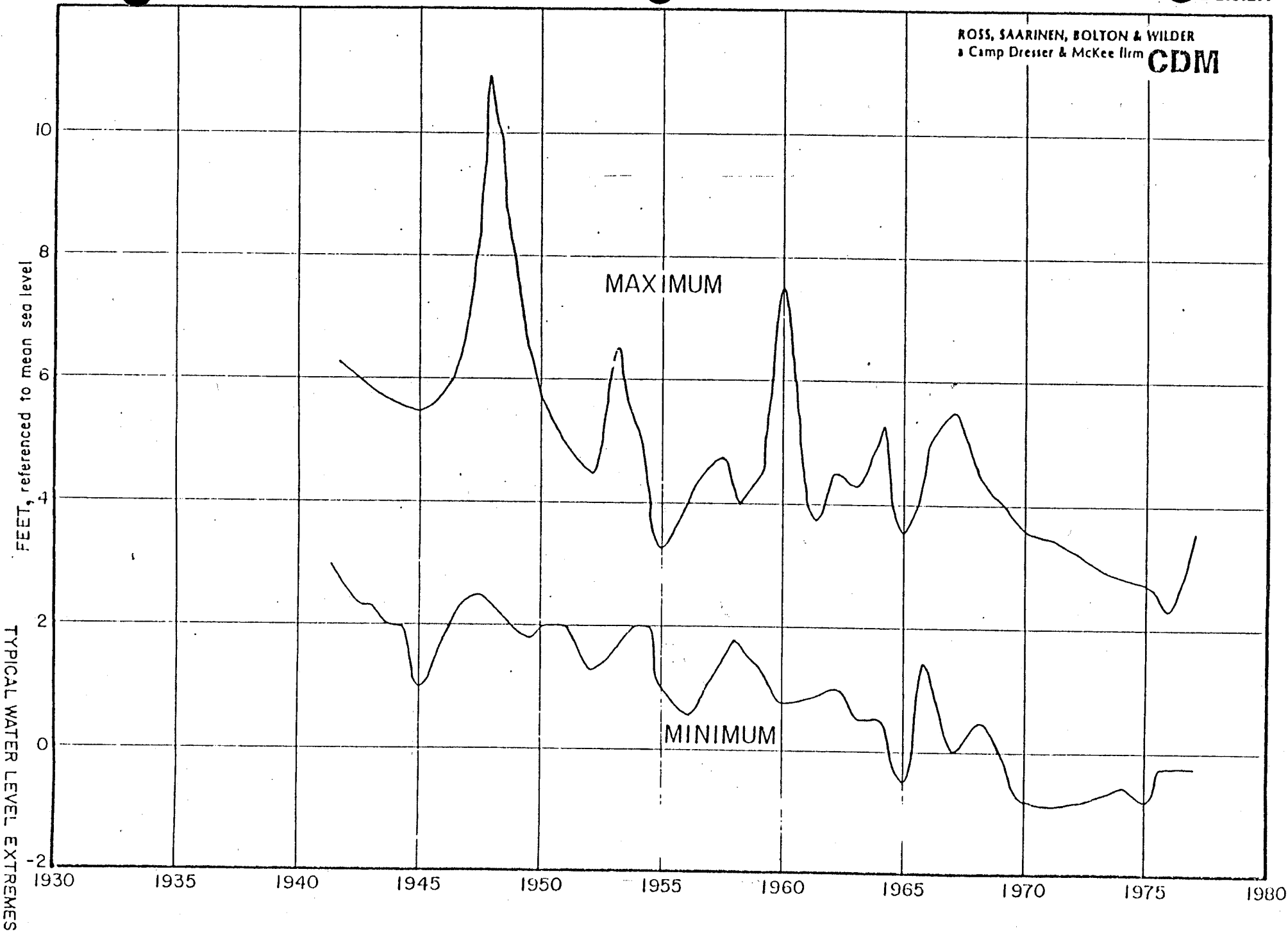
Highly permeable limestones and sandstones, and overlying younger deposits of sand are the geologic units of particular importance to groundwater conditions in the area which constitute the Biscayne Aquifer system. The thickness of the

unconfined Biscayne Aquifer is more than 200 feet in coastal Broward County. It is underlain by a thick sequence of relatively impermeable clayey materials which in turn overlies the permeable limestone formations of the Floridan Aquifer. The confined Floridan Aquifer extends from a depth of about 900 feet to more than 3,000 feet and is overlain by a 500 to 600-foot section of clay, silt, and marl of low permeability (Parker, et al., 1955). Due to the separation between the Biscayne and Floridan Aquifers, the Floridan Aquifer will not be considered further.

Aquifer pumping tests have been conducted at the Fort Lauderdale Dixie Well Field which is located approximately one mile north of the Route 441 Site. The test data indicated a transmissivity of 1.2×10^6 gallons per day per foot (gpd/ft). Previous studies estimated the transmissivity of the upper sand layer (± 60 feet) of the Biscayne Aquifer to be 1.25×10^4 gpd/ft. Transmissivities for the limestone portion of the Biscayne Aquifer range from 4.0×10^5 gpd/ft in northern Broward County to 2.5×10^6 in southern Broward County. The lower range in transmissivities reflect a decrease in the permeability of the consolidated section of the aquifer due to increased sand content in the limestone beds (porosity decrease). No storage coefficients have been reported for the Ft. Lauderdale area. However, an apparent storage coefficient of approximately 0.015 was reported for the Prospect Well Field.

Water levels in the Biscayne Aquifer fluctuate in response to recharge and discharge and are influenced to some extent by tidal fluctuations. Figure 2.3.2.1 exhibits typical water level extremes in the northern part of the Dixie well field. Maximum water levels usually occur in October and minimum levels in April and May. The average difference between maximum and minimum water levels is ± 4 feet. Annual fluctuations of water levels at the three largest well fields

ROSS, SAARINEN, BOLTON & WILDER
a Camp Dresser & McKee firm **CDM**



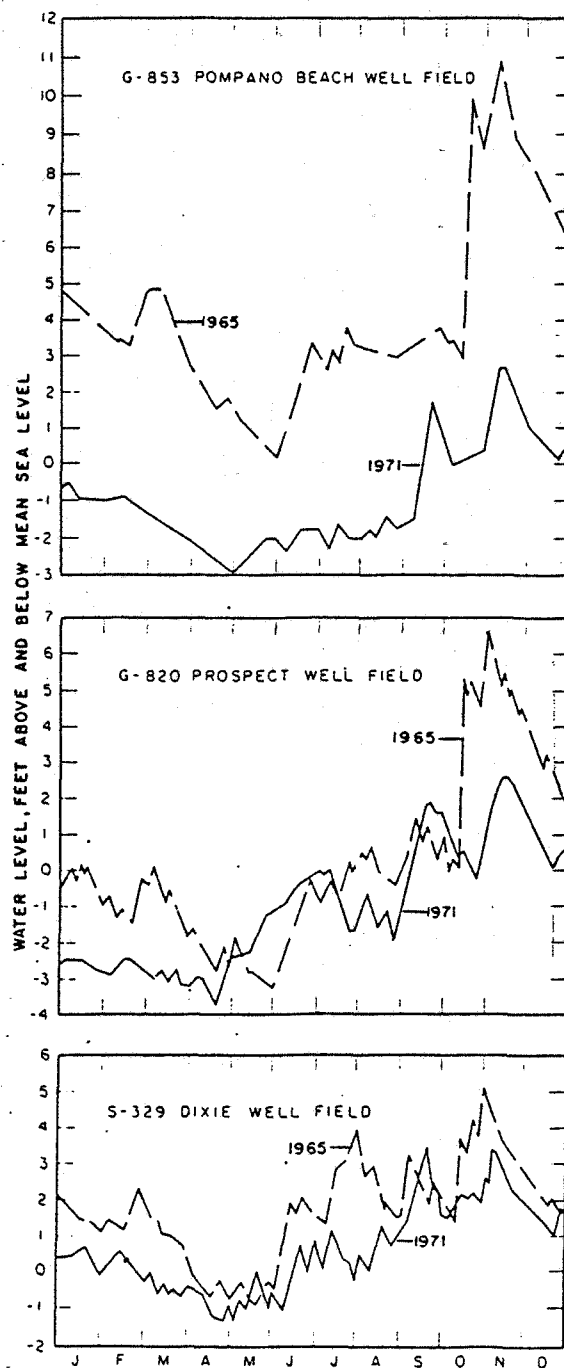
(Pompano, Prospect, and Dixie) for a dry year (1971) and a wet year (1965) are shown on Figure 2.3.2.2. Water level declines are most pronounced in the first five months of the year when recharge is minimal and discharges from the well fields are maximum. Water levels rise from June through October because of seasonal rainfall and decreased pumping. The difference in water levels between the low period of the dry year (1971) and the high period of the wet year (1965) were as much as 14 feet.

From an examination of available water level contour maps it appears that the water table gradient is in a general south/southeast direction, except near the coast where it is seaward. The most recent water level contour map (Figure 2.3.2.3), compiled by the USGS, indicates that ground water flow is in a general easterly direction in the vicinity of the Route 441 site. (Note this map probably represents ground water flow conditions within the medium to deeper portions of the Biscayne Aquifer.) The Dixie Well Field pumpage has caused a cone of depression north of the site and a water level divide just south of the well field.

Site-Specific

The thickness of the unsaturated zone varies very little across the site except along the perimeter where the site has been artificially built-up for road construction and various structures. The unsaturated zone ranges from less than a foot in the low lying areas up to 4 or 5 feet in thickness along the perimeter of the site. It should be pointed out that the water level measurements were taken from January 1984 (beginning of the dry season) through March 1984. During this period water levels declined about 0.5 feet on the average.

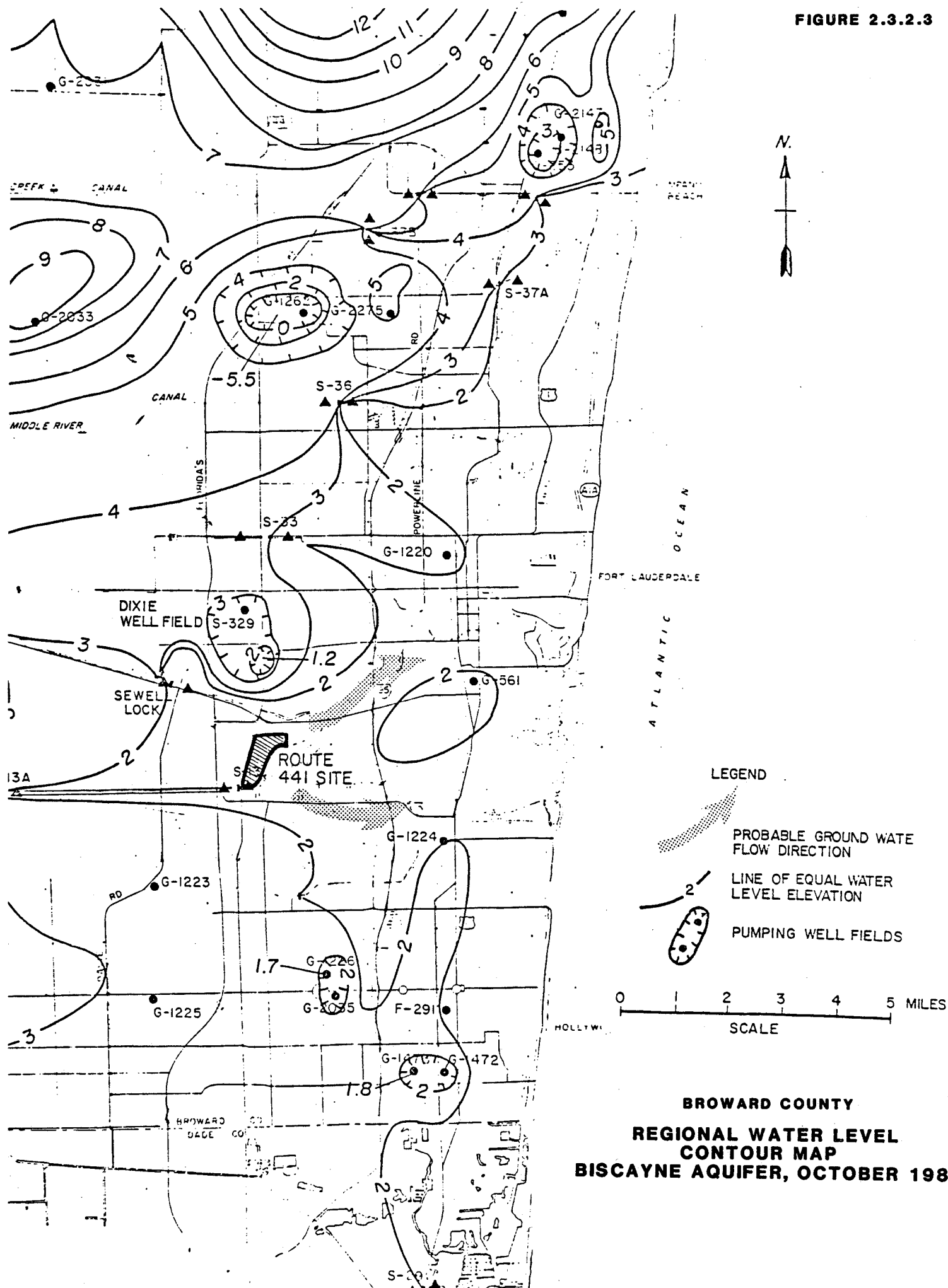
These water level measurements were used to construct a water level contour map that depicts shallow ground water flow conditions at the site. Shallow ground water flow



Hydrographs of wells in the Pompano Beach well field and the Fort Lauderdale Dixie and Prospect well fields, 1965 and 1971.

ANNUAL FLUCTUATIONS OF WATER LEVELS
AT THREE LARGE WELL FIELDS
IN BROWARD COUNTY

FIGURE 2.3.2.3



is in a south to southeast direction and under a very low hydraulic gradient (toward the South Fork New River Canal) as shown on Figure 2.3.2.4. Table 2.3.2.1 provides water level and measuring point elevations referenced to mean sea level.

An estimate of the upper zone permeability for the site was determined by the use of slug injection tests on Piezometers 1 and 12, and short term pumping tests on permanent monitoring wells.

The slug injection test involves the (instantaneous) injection of a known volume of water into a well; calculation of the values of residual head(s) and reciprocal of time ($1/t_m$) and a plot of corresponding values of (s) and $1/t_m$ on rectangular coordinate graph paper. The plotted values should define a straight line through the origin; finally, transmissivity can be calculated from the coordinate of any point on the straight line. As a supplement to the slug injection tests, short-term pumping tests were performed on the monitoring wells.

An estimated range of permeability coefficients on the order of 10^{-3} cm/sec to 10^{-4} cm/sec has been determined from the data collected during these tests. The actual permeability of the sand and occasional limestone and marl lenses could vary widely in both directions from the aforementioned values.

Ground Water Quality Conditions

The Route 441 Site overlies the Biscayne Aquifer, and the available information suggest that the fresh water/brackish water interface underlies the site, probably in the lower portion of the aquifer. The 1,000 mg/L (brackish) isochlor for the 1983 dry season is shown on Figure 2.3.2.5.

This is substantiated in part by chloride data for Wells G1236 and Well S830. Well G1236, which is located at the western boundary of the site and screened at about 200 feet, showed chloride concentrations on the order of 980 mg/L.

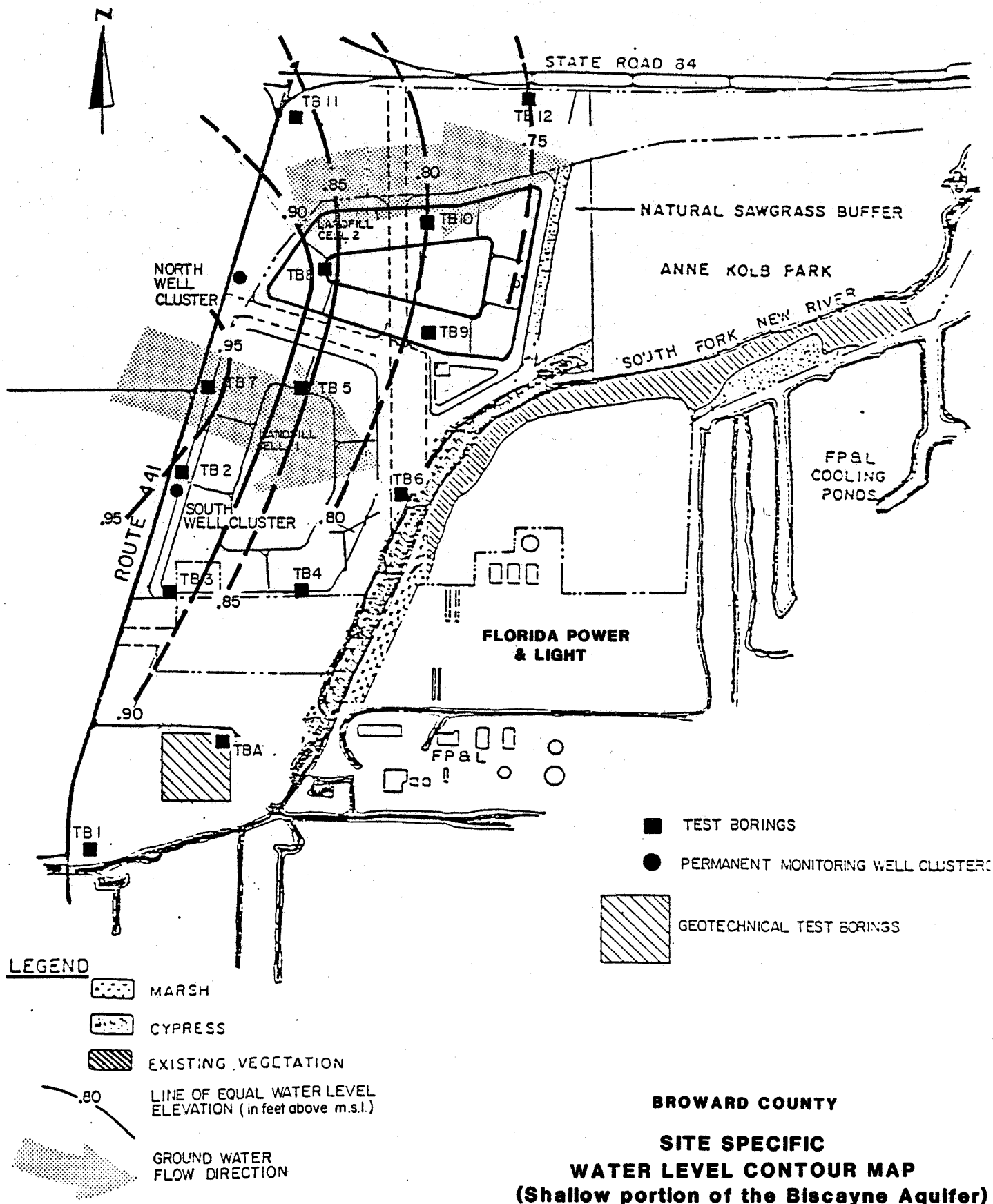


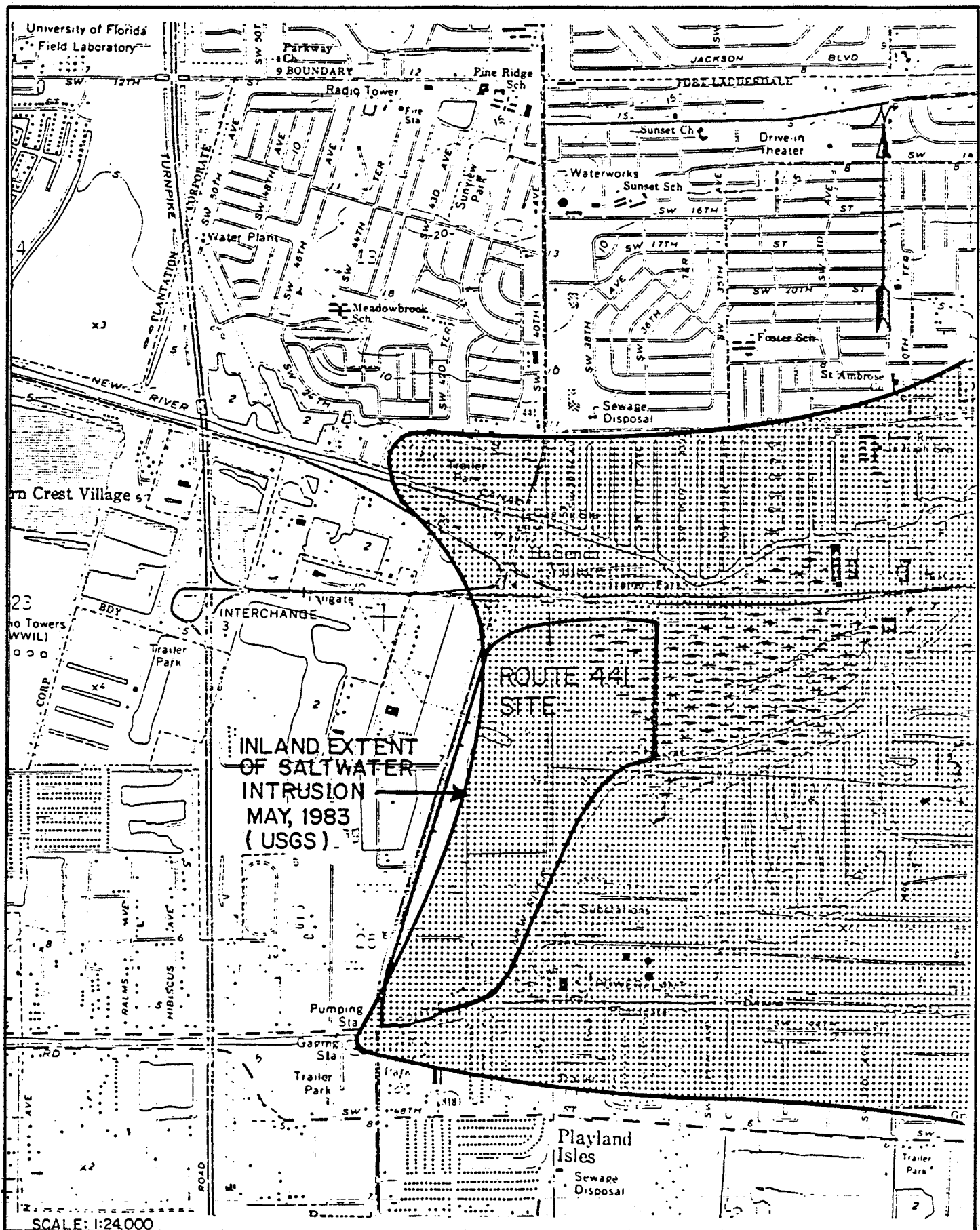
TABLE 2.3.2.1

GROUND WATER ELEVATIONS IN PIEZOMETERS
ROUTE 441 SITE, BROWARD COUNTY, FLORIDA

<u>Boring Number</u>	<u>Elevation of Boring (ft. Above MSL, Ground Surface)</u>	<u>Ground Water Elevation (ft. above MSL)</u>
TB 1	5.4	0.93
TB 2	3.2	0.93
TB 3	1.4	0.89
TB 4 (1)	1.4	-
TB 5	1.5	0.85
TB 6 (1)	-	-
TB 7	4.4	0.97
TB 8	1.9	0.90
TB 9	1.6	0.78
TB 10	1.4	0.81
TB 11	1.7	0.86
TB 12	4.7	0.75

Note:

1. No water levels obtained. Piezometers TB-4 and TB-6 destroyed.



**BROWARD COUNTY
RESOURCE RECOVERY
ROUTE 441 SITE
1,000mg/l ISOCHLOR
FOR BISCAYNE AQUIFER**

Well S830, which is located on the Florida Power and Light Company property (southeast of the site), is screened at about 130 feet and showed chloride concentrations in the range of 1,000 to 3,500 mg/L.

This information strongly suggests that the fresh/brackish water interface lies between these two wells and runs through the site. Based on this information, it would appear that significant development of the Biscayne Aquifer to the east of the site would be constrained as a result of natural water quality conditions. Additionally, any plans for increased pumpage/expansion of existing well fields north and west of the site would have to address the potential for brackish water intrusion.

The Dixie Well Field is by far the largest well field within proximity to the site (Figure 2.3.2.6). Figure 2.3.2.7 shows trends in the overall water quality of the Dixie Well Field raw pumpage from 1963 to 1978. The concentrations of total dissolved solids, total hardness, total alkalinity, calcium, magnesium and iron are representative of carbonate waters. All these levels tend to remain stable with a slight rise for selected constituents during the mid 1970's.

The proximity of the Dixie Well Field to the fresh water/brackish water interface was of enough concern to warrant the installation of monitoring wells to the south and east for chloride monitoring (Figure 2.3.2.6). Chloride data from some of these wells are shown on Figures 2.3.2.8 and 2.3.2.9. Chloride levels appear have been fairly stable in all of these observation wells between 1975 and 1979.

Chloride data are available for well S-862, a private supply well immediately north of the site, from 1948 to 1966 (Table 2.3.2.2). Although construction details are not available for this well, the data suggest that the brackish water/fresh water interface may have moved slightly northward during these years.

The map displays the Dixie Well Field and surrounding areas. Key features include:

- Well Fields:** Dixie Well Field, SYSTEM No. 3 Well Field.
- Drawdown Contours:** 30 DAY, 210 DAY.
- Legend:**
 - PRODUCTION WELLS
 - OBSERVATION WELLS
- Geographic Labels:** BROADVIEW PARK, FERNCREST, ROUTE 441 SITE, FLORIDA POWER AND LIGHT, SYSTEM No. 3 WELL FIELD.
- Infrastructure:** INTERCHANGE, ROUTE 441, DANIA CUT-OFF, JACKSON BLVD, SW 12TH, SW 16TH, SW 17TH, SW 20TH, SW 30TH, SW 35TH, SW 46TH, SW 32D AVE.
- Other Labels:** G2128, G2122, G2126, G2127, G2128, G2129, G2130, G2121, G1344, G2123, G2124, S850, S852, S857, S830, S834, S835, S836, S837, S838, S839, S840, S841, S842, S843, S844, S845, S846, S847, S848, S849, S850, S851, S852, S853, S854, S855, S856, S857, S858, S859, S860, S861, S862, S863, S864, S865, S866, S867, S868, S869, S870, S871, S872, S873, S874, S875, S876, S877, S878, S879, S880, S881, S882, S883, S884, S885, S886, S887, S888, S889, S890, S891, S892, S893, S894, S895, S896, S897, S898, S899, S900, S901, S902, S903, S904, S905, S906, S907, S908, S909, S910, S911, S912, S913, S914, S915, S916, S917, S918, S919, S920, S921, S922, S923, S924, S925, S926, S927, S928, S929, S930, S931, S932, S933, S934, S935, S936, S937, S938, S939, S940, S941, S942, S943, S944, S945, S946, S947, S948, S949, S950, S951, S952, S953, S954, S955, S956, S957, S958, S959, S960, S961, S962, S963, S964, S965, S966, S967, S968, S969, S970, S971, S972, S973, S974, S975, S976, S977, S978, S979, S980, S981, S982, S983, S984, S985, S986, S987, S988, S989, S990, S991, S992, S993, S994, S995, S996, S997, S998, S999, S1000.

BROWARD COUNTY

RESOURCE RECOVERY

ROUTE 441 SITE

LOCATIONS OF MAJOR WELL FIELDS

AND MONITORING WELLS

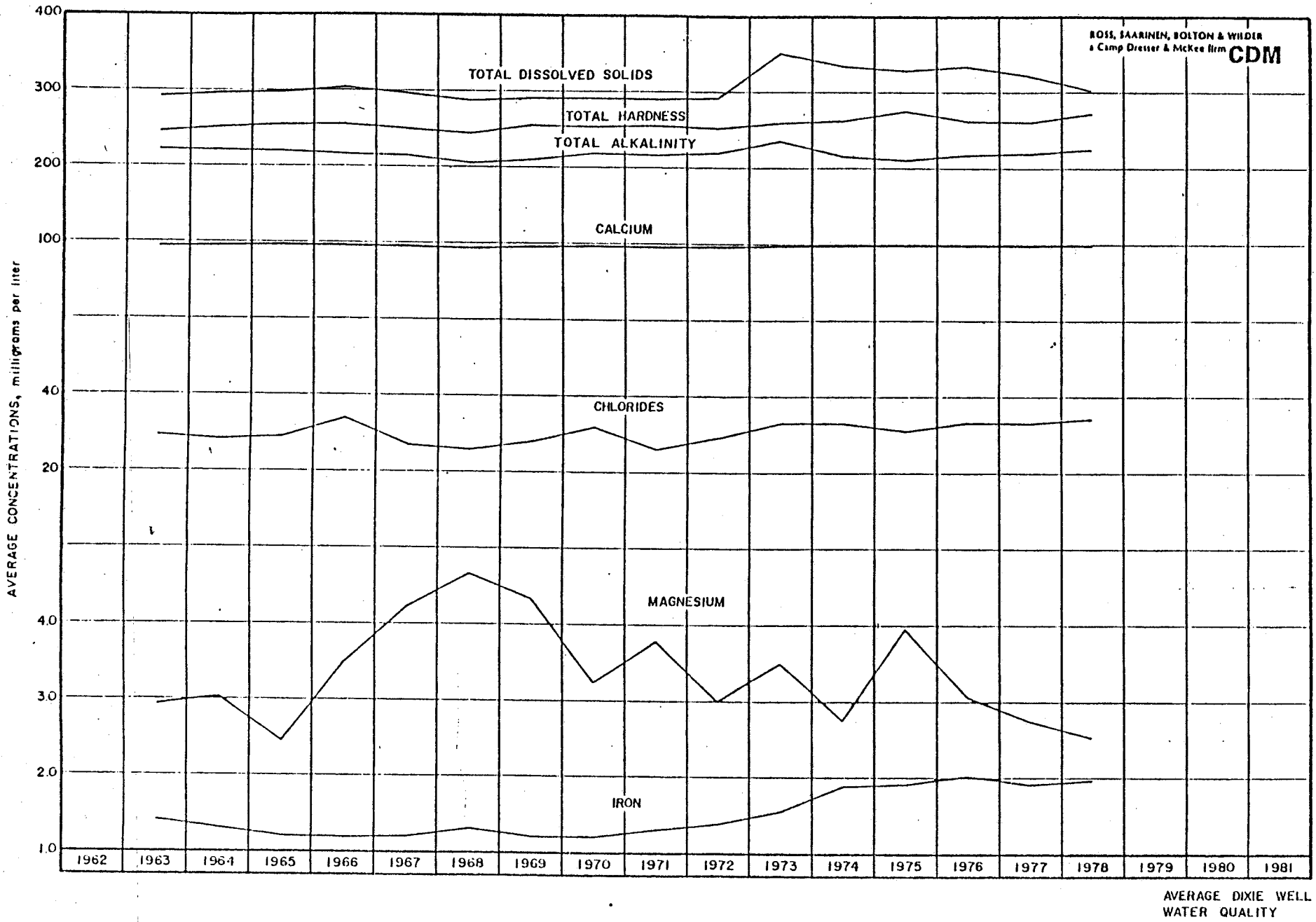


FIGURE 2.3.2.7

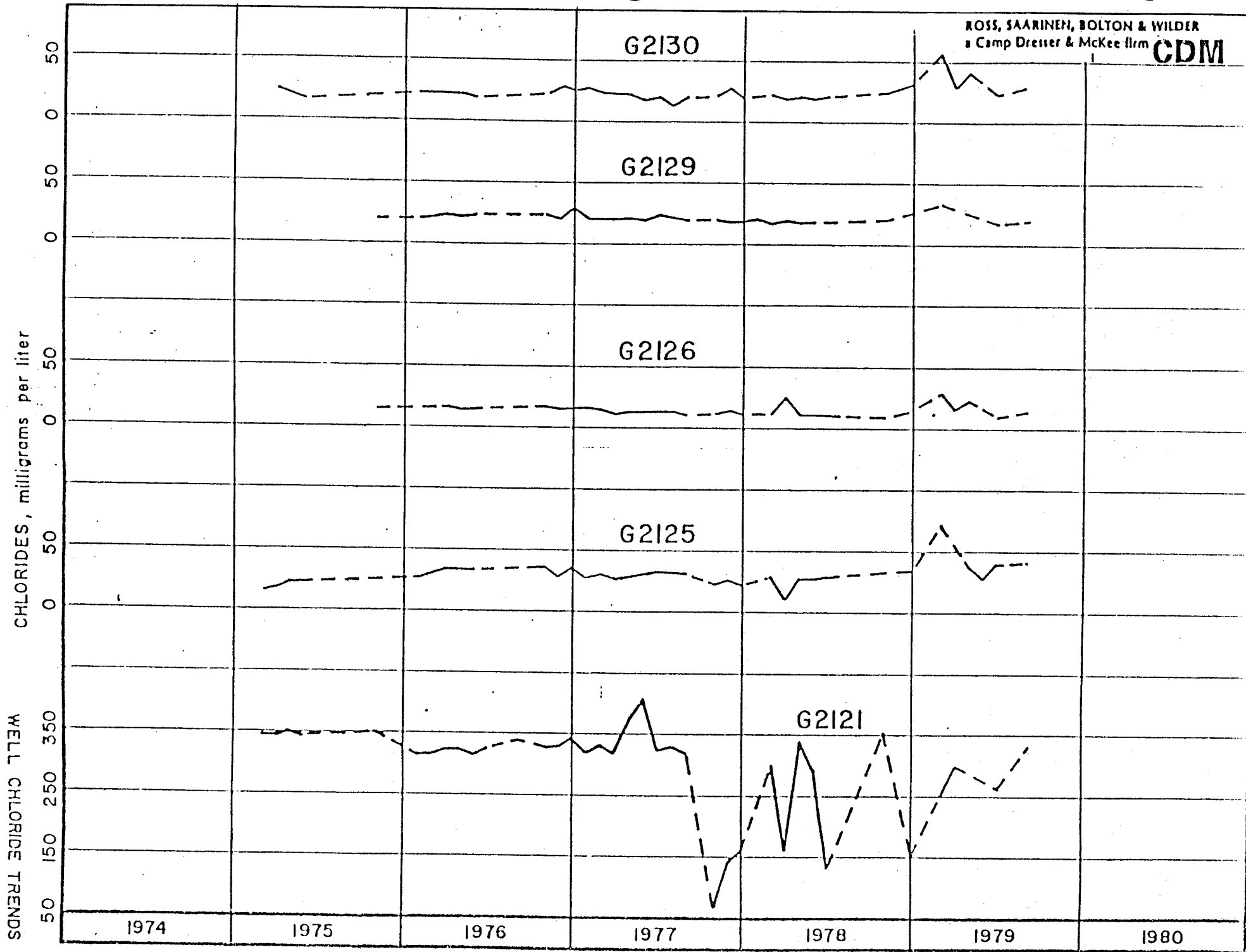


FIGURE 2.3.2.8

WELL CHLORIDE TRENDS

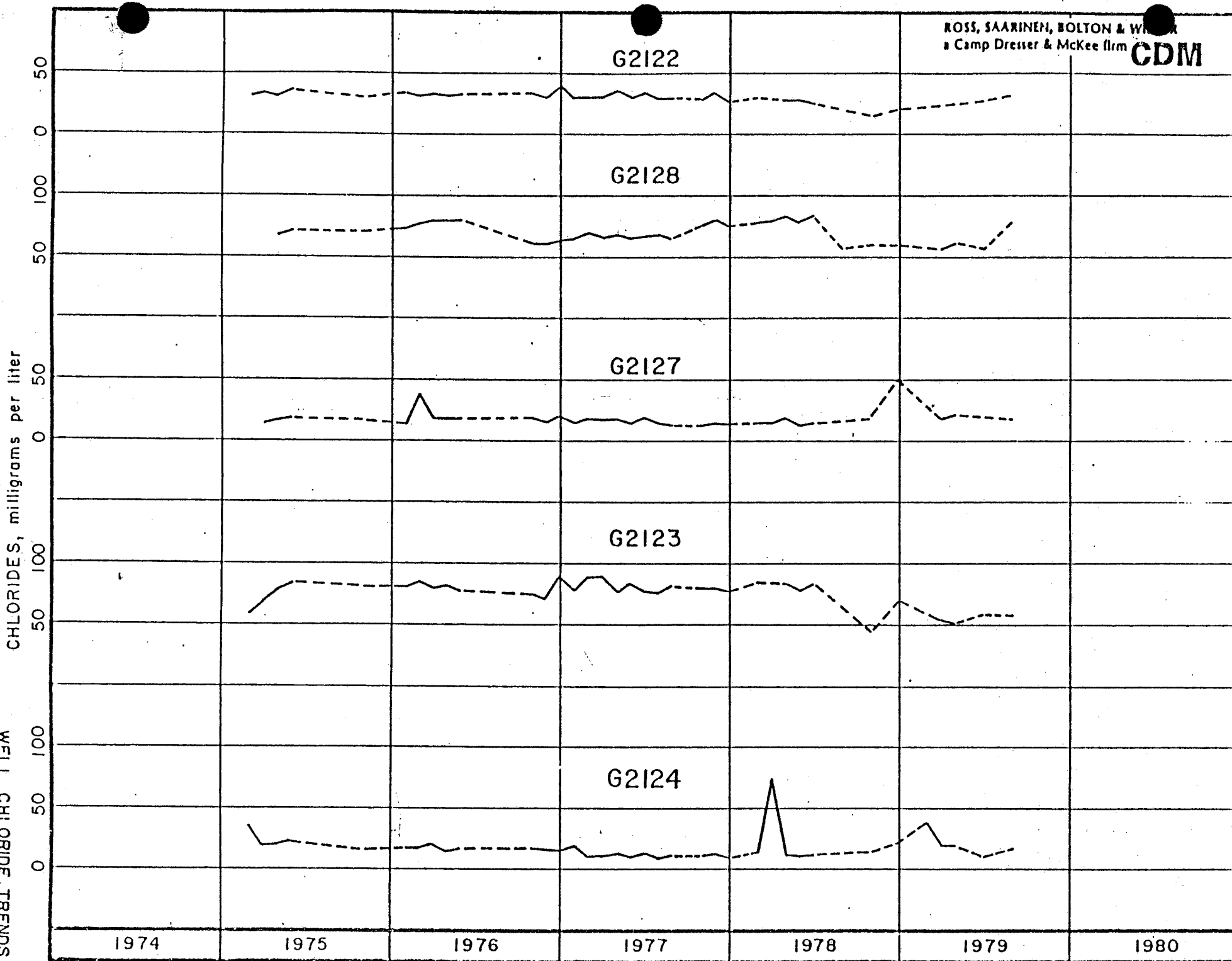


FIGURE 2.3.2.9

TABLE 2.3.2.2

HISTORIC CHLORIDE CONCENTRATIONS
IN GROUND WATER FROM WELL S-862

<u>Date</u>	<u>Concentration</u>	<u>Date</u>	<u>Concentration</u>
10-22-46	103	9-15-52	59
10-25-46	82	12-15-52	16
1-20-47	60	3-24-53	14
4- 7-47	236	6-25-53	16
5- 7-47	89	12-22-53	23
6-24-47	95	3-25-54	24
7-16-47	37	6-24-54	15
1-16-48	204	9- 2-55	27
2-26-48	45	3- 2-56	38
3-16-48	65	6-19-56	32
4-22-48	38	11-20-56	43
6-17-48	26	2-15-57	76
8-18-48	27	7-19-57	39
10-21-48	104	11-15-57	28
12-14-48	47	4-28-58	30
2-16-49	21	12-19-58	66
4-14-49	24	5- 6-59	127
6-15-49	26	3-30-60	15
8-16-49	20	6-27-60	18
10-17-49	19	9- 6-60	25
12-13-49	20	12-15-60	14
3-23-50	19	4-20-61	15
6-15-50	22	8- 3-61	18
11- 8-50	21	12-12-61	20
2-19-51	23	3-14-62	34
5-22-51	69	6- 1-62	46
8- 8-51	17	1-24-63	88
11-15-51	15	5- 6-63	114
2-12-52	18	8- 8-63	130
6-11-52	16	5-25-64	170
		10-20-64	151
		4- 6-66	236

Site-Specific

Prior to the collection of ground water samples for a chemical analysis, a sampling protocol and list of chemical parameters to be analyzed were submitted to the Florida DER for their approval. After concurrence by the DER with the proposed sampling program, water samples were collected from the newly installed monitoring wells at the Route 441 Site on March 9, 1984. The results of the laboratory analyses are presented in Table 2.3.2.3. The constituents were analyzed for indicators of landfill and ash residue leachate. The data show elevated levels of calcium and bicarbonate indicative of natural carbonate waters, as well as high iron and manganese concentrations. Most of the heavy metal constituents were below detection limits. These data represent upgradient (background) water quality conditions.

2.3.2.2 Karst Hydrogeology

The topography of the Broward County area is not characterized as Karst. Karst generally refers to characteristic terrain features which develop in purer limestone. The Biscayne Aquifer in this portion of Broward County is typically a carbonaceous sand indicative of an ancient offshore depositional environment where strong tidal currents had once prevailed.

2.3.3 Site Water Budget and Area Users

2.3.3.1 Site Water Budget

The important water sources in the project area which have potential to be impacted by project implementation are the Biscayne aquifer and the South Fork of the New River Canal (C-11 Canal). In the project area, the Biscayne Aquifer system is recharged from rainfall (during the rainy season) and infiltration from canals and other surface water bodies (during the dry seasons). Discharge from the aquifer is by evapotranspiration, ground water flow to canals and other

TABLE 2.3.2.3

GROUND WATER QUALITY AT THE ROUTE 441 SITE
BROWARD COUNTY, FLORIDA, MARCH 1984

<u>Parameter</u>	<u>North Well Cluster</u>		<u>South Well Cluster</u>	
	<u>Deep</u>	<u>Shallow</u>	<u>Deep</u>	<u>Shallow</u>
Total Organic Carbon (TOC)	19	14	19	17
Chemical Oxygen Demand (COD)	268	224	72	80
pH (Std. Units)	7.6	7.2	7.1	7.2
Specific Conductance (umhos)	450	440	482	462
Nitrate-N	<0.1	<0.1	<0.1	<0.1
Sulfate	11	12	<1	2
Chloride	63	35	67	63
Sodium	66	74	78	63
Potassium	1.7	1.9	3.9	4.6
Magnesium	13	9.5	30	4.6
Calcium	120	280	120	96
Ammonia	<0.1	<0.1	0.17	0.56
Bicarbonate (as HCO ₃)	292.8	1482.3	683.2	671.0
Total Alkalinity	240	1215	560	550
Iron	10.76	1.72	7.88	0.18
Manganese	0.18	0.09	0.24	<0.05
Arsenic	0.005	0.016	0.014	0.015
Beryllium	<0.001	<0.001	<0.001	<0.001

TABLE 2.3.2.3

GROUND WATER QUALITY AT THE ROUTE 441 SITE
 BROWARD COUNTY, FLORIDA, MARCH 1984¹
 (continued)

<u>Parameter</u>	<u>North Well Cluster</u>		<u>South Well Cluster</u>	
	<u>Deep</u>	<u>Shallow</u>	<u>Deep</u>	<u>Shallow</u>
Cadmium	<0.01	<0.01	<0.01	<0.01
Total Chromium	<0.05	<0.05	<0.05	<0.05
Copper	<0.05	<0.05	<0.05	<0.05
Cyanide	<0.01	<0.01	<0.01	<0.01
Lead	<0.01	<0.01	<0.01	<0.01
Mercury	<0.001	<0.001	<0.001	<0.001
Nickel	<0.05	<0.05	<0.05	<0.05
Selenium	<0.001	<0.001	<0.001	<0.001
Silver	<0.01	<0.01	<0.01	<0.01
Thallium	<0.05	<0.05	<0.05	<0.05
Zinc	0.005	0.016	0.0011	0.177

Note:

1. All units in milligrams per liter (mg/L) unless given.

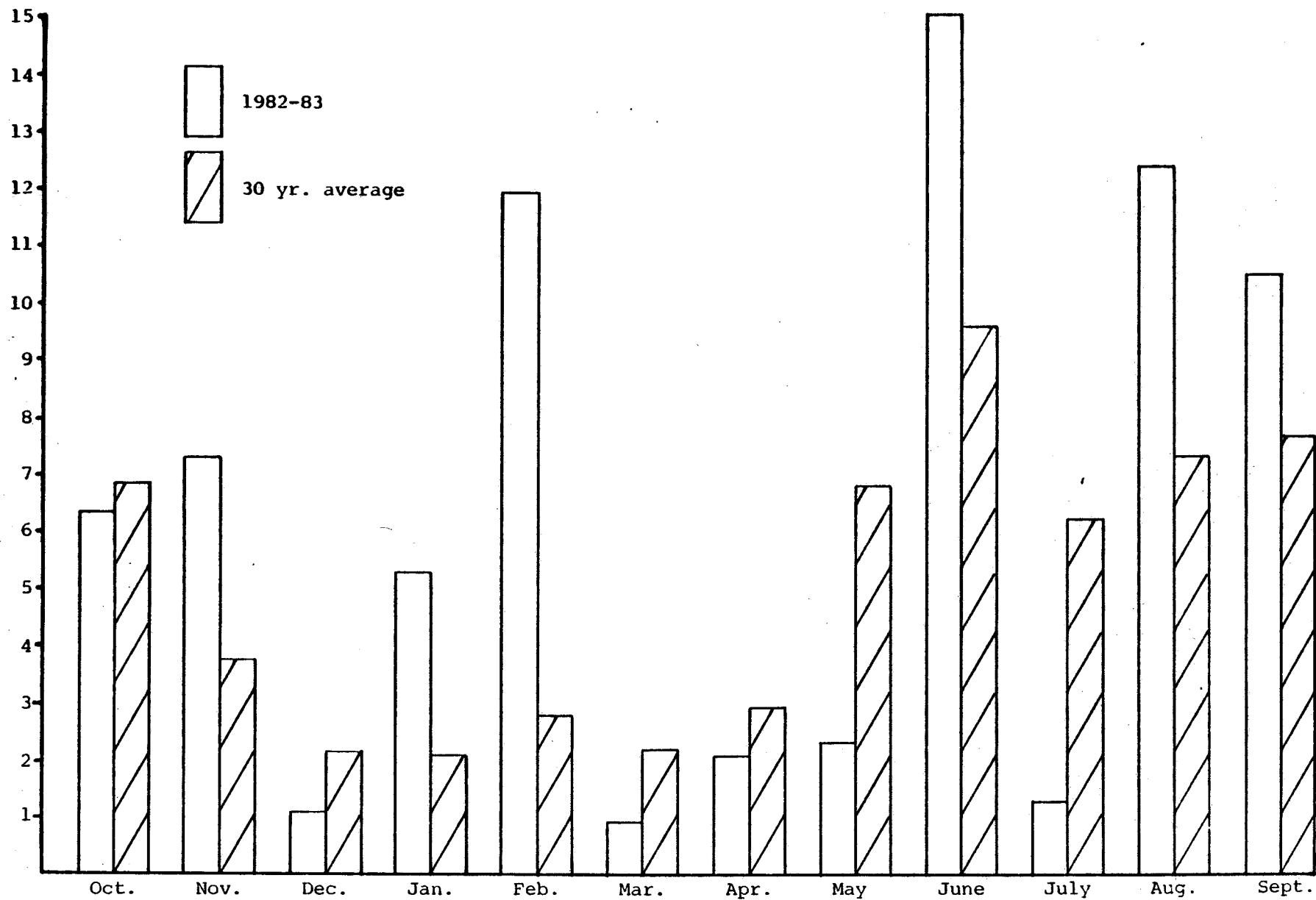
surface water bodies (greatest during rainy season) and by pumping from wells (greatest during the dry season). The average annual rainfall is approximately 60 inches; approximately 70 percent of the total recharge from rainfall occurs in the period June through October. Figure 2.3.3.1 provides the total (1982-83) and average monthly rainfall data in the vicinity of the project site. Based on previous studies about 40 inches infiltrates to the water table. About 50 percent (20 inches) of the average annual rainfall which infiltrates to the water table is lost from the aquifer by evapotranspiration. The remaining 50 percent (20 inches) is available to flow toward wells and canals. Figure 2.3.3.2 provides a diagrammatic portrayal of recharge to and discharge from the Biscayne aquifer in Broward County. Average temperatures range from about 82° Fahrenheit in the summer to about 68° Fahrenheit in the winter. Mean annual temperature is 73° Fahrenheit.

2.3.3.2 Area Water Uses

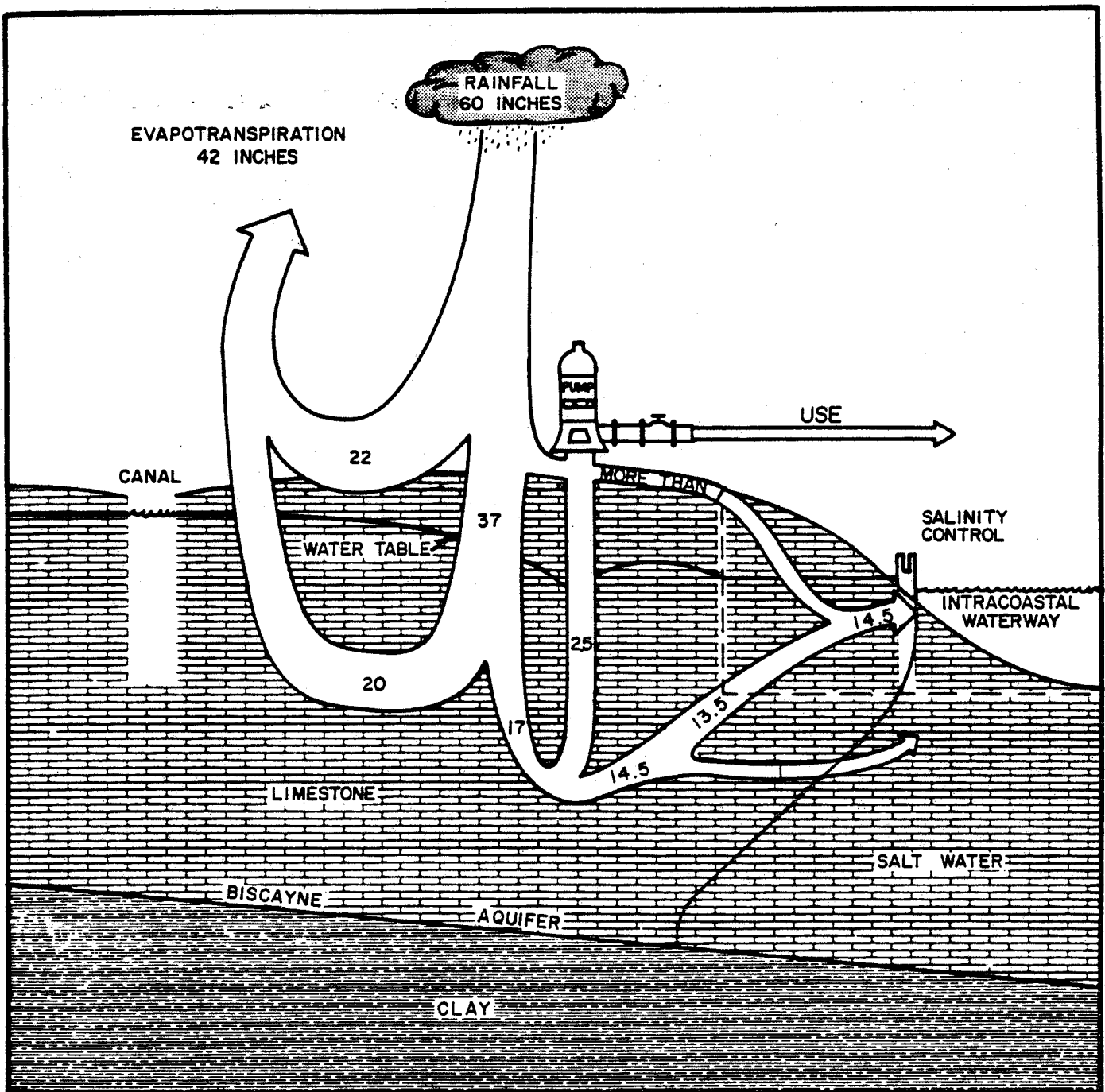
All surface waters of the State have been classified according to their designated uses, as follows:

- Class I - Potable Water Supply
- Class II - Shellfish Propagation or Harvesting
- Class III - Recreation, Propagation and Management of Fish and Wildlife
- Class IV - Agricultural Water Supplies
- Class V - Navigation, Utility and Industrial

Broward County is entirely within The Lower Florida River Basin (No. 28). All surface waters in this basin are classified as Class III - Recreation Propagation and Management of Fish and Wildlife with the exception of a small abandoned rockpit in North Broward which is classified as Class I - Potable Water Supply (F.A.C. 17-3). The main functions of the canals in Broward County are to provide drainage in low-lying areas and prevent salt water intrusion. A further discussion of the canal system is provided in Section 2.3.4, Surficial Hydrology.



**TOTAL MONTHLY PRECIPITATION,
INCHES FT. LAUDERDALE, FL**



SOURCE: FACILITY PLAN ON WASTEWATER MANAGEMENT SYSTEMS FOR BROWARD COUNTY, FLORIDA, 1978

BROWARD COUNTY
 DIAGRAMMATIC PORTRAYAL OF
 RECHARGE TO AND DISCHARGE
 FROM THE AQUIFER
 IN BROWARD COUNTY

The source of all potable water in Broward County is groundwater from the Biscayne Aquifer. This Aquifer has been designated as the sole source of drinking water for the area by U.S.E.P.A. Figure 2.3.3.3 depicts the existing areas of influence of the major wellfields in the County within a five mile radius of the project site as provided by the Broward County Department of Public Works, Division of Water Resource Management.

2.3.3.3 Well Inventory

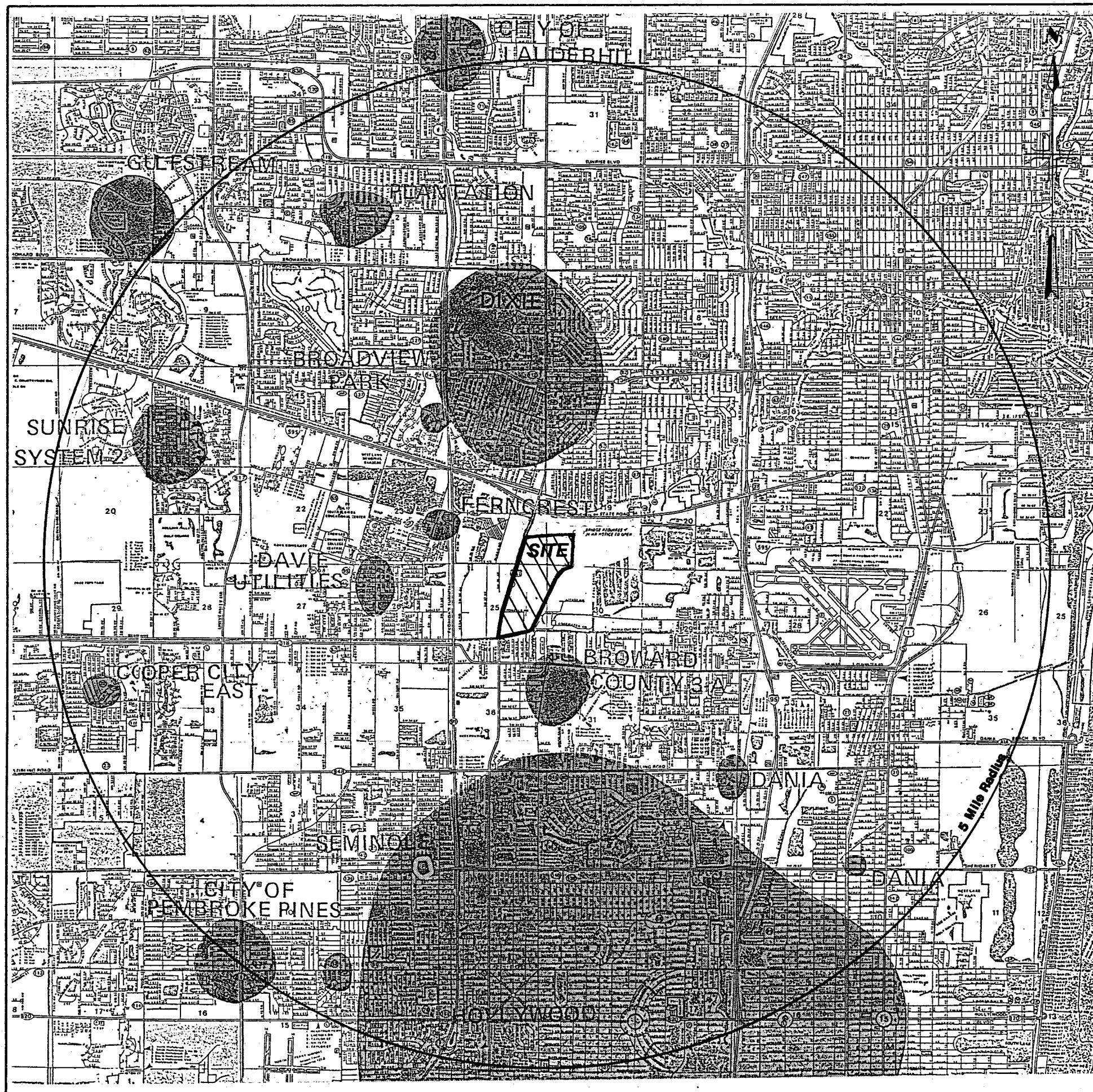
An inventory was made of production wells and monitoring wells within 1 to 1.5 miles of the proposed southern resource recovery facility and unprocessable/ash residue landfill site. The inventory was conducted through personal visits and discussions with representatives of the United States Geological Survey (USGS) in Miami, the South Florida Water Management District in West Palm Beach, the Broward County Water Resource Management Division and the Environmental Quality Control Board, and from existing reports such as Camp, Dresser and McKee's Dixie Well Field Stress Analysis, 1980.

From our review of the available information, there are four major well fields within 1.5 miles of the site boundaries:

	<u>Number of Wells</u>	<u>Estimated Pumpage</u>
1. Dixie Well Field	±26	13 mgd
2. Ferncrest Well Field	3	1 mgd
3. Broadview Park Well Field	3	1 mgd
4. Broward County Department of Utilities System No. 3	3	2 mgd

Additionally, Florida Power and Light, Company operates a production well southeast of the site. The locations of the major well fields and USGS monitoring wells are shown on Figure 2.3.2.6.

City of Fort Lauderdale's Dixie Well Field is by far the largest well field in proximity to the site. Four of the two dozen production wells within the Dixie Well Field are located



LEGEND

 Existing Wellfield Zone of Influence

SCALE:



BROWARD COUNTY

EXISTING WELLFIELD ZONES OF INFLUENCE

within one mile of the northern site boundary and an additional 12 wells are within $1\frac{1}{2}$ miles of the northern site boundary (Figure 2.3.2.6). A typical Dixie Well was constructed in the 1940s with casing to 100 feet, 12-inch diameter open hole to 125 feet and a capacity of about 500 gpm. Construction details are provided in Table 2.3.3.1.

To the south, Broward County Utilities Division System No. 3 Well Field has three wells within one mile of the site (Figure 2.3.2.6). These wells are generally cased to 60 feet and open hole to 70 feet below grade with well capacities of about 600 gpm.

Ferncrest Utilities, which supplies an area immediately to the west of the site, has three active closely spaced production wells within 1 to 1.5 miles of the western site boundary. These wells are cased to about 80 feet and have a combined capacity of about 1500 gpm.

The Broadview Park Water Company Well Field is located 1 to 1.5 miles northwest of the site and immediately west of the Dixie Well Field. The magnitude of Broadview Park pumpage is comparable to that of Ferncrest.

Florida Power and Light Company, immediately to the southeast of the site, pumps about 250 gpm for a steam electrical plant.

As part of Broward County's long-range aquifer protection plan, cones of depression for major pumping centers in the county were determined from long-term water level changes in observation wells. These data were translated into travel time contours to the major pumping centers and were plotted on aerial photos as contours of equal travel time to pumping wells, i.e., 10 days, 30 days, 210 days. In certain cases (e.g., Dixie Well Field) a one-foot drawdown contour was also plotted.

TABLE 2.3.3.1

DIXIE WELL CONSTRUCTION DETAILS

<u>Well No.</u>	<u>Depth (feet)</u>	<u>Cased (feet)</u>	<u>Open Hole (feet)</u>	<u>Inside Diameter (inches)</u>	<u>Drilled (year)</u>	<u>Well Capacity (gpm)</u>
2	125	110	15	12	1926	600
3	125	110	15	12	1926	600
4	125	110	15	12	1926	600
5	99	87	12	12	1971	600
6	189	181	7	12	1971	600
7	125	110	15	12	1940	600
8	104	89	15	12	1971	600
9	125	110	15	12	1945	600
10	148	82	66	12	1945	600
11	126	110	16	10	1926	600
12	126	110	16	12	1926	600
13	125	110	15	12	1947	400
14	125	110	15	12	1947	400
15	125	110	15	12	1947	400
16	125	110	15	12	1947	400
17	125	110	15	12	1947	400
18	125	110	15	12	1947	400
19	125	110	15	12	1947	400
20	114	89	25	10	1952	500
21	114	87	27	10	1952	500
22	115	89	26	10	1952	500
23	114	87	27	10	1952	500
24	115	89	26	10	1952	500
25	115	89	26	10	1952	500
26	114	89	25	10	1952	500

Cones of depression and travel time contours for the above mentioned well fields are shown on Figure 2.3.2.6. Of significance are the one-foot drawdown contour for the Dixie Well Field and the 210 travel contours for the System No. 3 Well Field and Broadview Park Well Field. Travel time contours were defined only for a 10-day time span at the Ferncrest Well Field.

Based on the information made available to us by the BCEQCB, it appears that the Route 441 site does not lie within a 210-day travel contour or a one-foot drawdown contour for any of the nearby well fields.

The principal water quality concern for all water supply wells near the Route 441 site is the potential for salt water intrusion/upconing. As previously discussed in the Section 2.3.2, the base of the Biscayne Aquifer is brackish/saline in the study area.

Numerous observation wells have been installed southeast of the Dixie Well Field to monitor for salt water intrusion. Many of the "sentry" observation wells are within one mile of the northern site boundary (Figure 2.3.2.6). Also, there is one USGS well at the western boundary of the site and a few others within 1½ miles of the site not directly associated with the Dixie Well Field. Geologic logs for many of the observation wells were presented in Section 2.3. USGS monitoring well details are provided in Table 2.3.3.2.

2.3.4 Surficial Hydrology

2.3.4.1 Hydrologic Characterization

Regional

Due to Florida's high local precipitation rates, low land surface elevation, and general flat topography, much of Broward was originally swamp or marsh lands. Upon completion of several drainage projects, Broward County was rendered developable. Drainage areas are exceptionally difficult to

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MISSING FROM THIS DOCUMENT AT THE TIME OF
SCANNING.

TABLE 2.3.3.2

USGS MONITOR WELLS

<u>Well Number</u>	<u>Well Depth</u> ^{a/}	<u>Casing Depth</u>	<u>Beginning of Record</u>	<u>Sampling Frequency</u>
G515	211	N/A ^{b/}	4/67	Quarterly
S830	118	N/A	5/64	Quarterly
G254	206	N/A	12/65	Quarterly
S857	65	N/A	4/67	Quarterly
S860	40	N/A	4/67	Quarterly
S862	N/A	N/A	4/67	Quarterly
S874	73	N/A	4/68	Quarterly
G1235	212	201	3/64	Quarterly
G1343	210	199	3/68	Quarterly
G1344	182	177	3/68	Quarterly
G2121	185	N/A	5/74	Quarterly
G2122	134	N/A	5/74	Quarterly
G2123	182	N/A	5/74	Quarterly
G2124	111	N/A	5/74	Quarterly
G2125	58	N/A	5/74	Quarterly
G2126	169	N/A	9/75	Quarterly
G2127	190	N/A	3/75	Quarterly
G2128	61	N/A	4/75	Quarterly
G2129	177	N/A	10/75	Quarterly
G2130	60	N/A	3/75	Quarterly

^{a/} Feet below ground

^{b/} Not available

the samples were taken at the correct depth. A summary of the results of the chemical analysis of the grab samples are listed below. The sampling locations are shown in Figure 2.3.4.1. Actual data for the grab sample analysis is provided in Appendix 10.9.

The sampling program was performed in the following manner:

- o The grab samples for locations A, B, C, D, E, F, and G were taken on the third iteration of D.O. measurements, a niskin bottle was used to collect the mid-depth and bottom samples, the surface samples were collected directly.
- o For each grab sample, water temperature, stream depth, time and date were recorded.
- o GeoTec, Inc. was responsible for recording, transportation, and analysis of all grab samples.

The results of the program can be summarized as follows: Collection and analysis of all the parameters measured were performed in accordance with Methods for Chemical Analysis of Water and Wastes (U.S. Environmental Protection Agency, 1979). All the heavy metals such as copper, mercury, and cadmium were analyzed with Atomic Absorption Spectroscopy (AAS). The nutrients such as Total Kjeldahl Nitrogen (TKN) and total phosphorus were measured with an auto analyzer. The specific conductance and salinity were measured with their corresponding meters which utilize a semi-permeable membrane. The results are listed in Table 2.3.4.1 with all the pertinent information included.

In May 1984, a second sampling program was initiated by Hazen & Sawyer in order to determine bacteriological quality of the surface waters.

During sampling, weather and tide information were recorded. Samples were taken at mid-depth along the river center line at the designated sample stations as shown in

Figure 2.3.4.1. All samples were taken within two (2) hours, stored on ice and then transported to Spectrum Laboratories.

Spectrum Laboratories, Inc. used the Membrane Filter test procedure in accordance with the latest edition of Standard Methods. Colonies were counted and the number per 100 ml was reported for each sampling station. The total and fecal counts data are provided in Table 2.3.4.1.

In addition to the two sampling programs described above, data on surface water quality was obtained from the Broward County Environmental Quality Control Board (BCEQCB). The BCEQCB currently monitors surface water in sixteen rivers and canals plus the Intracoastal Waterway. The sampling program consists of monthly monitoring at 88 separate sites. Water quality parameters tested include: biochemical oxygen demand, total and fecal coliform, fecal streptococcus, phosphorus, nitrogen, temperature, salinity, pH and turbidity. Figure 2.3.4.2 illustrates the location of those monitoring stations relevant to the proposed project site (sample stations 19, 20 and 27). Available BCEQCB river quality data from 1980 is included as part of Appendix 10.9.

In summarizing the water quality data described above and noting the drainage patterns which occur in southern Broward County, the water quality of the South Fork of New River Canal adjacent to the project site is affected by the following sources:

- o Freshwater discharge from SFWMD Pump Station S-13 located upstream of the site. The upstream tributary area is the SFWMD C-11 east drainage basin. The SFWMD Pump Station operation is regulated to provide flood control in upstream reaches as well as maintain adequate groundwater elevations to mitigate salt water migration.
- o Tidal waters from the New River moving up the reaches of the South Fork. The range of tidal water level variation is between elevation ± 1.65 feet (flood tide) and elevation -0.02 feet (ebb tide), relative to mean sea level.

FIGURE 2.3.4.1

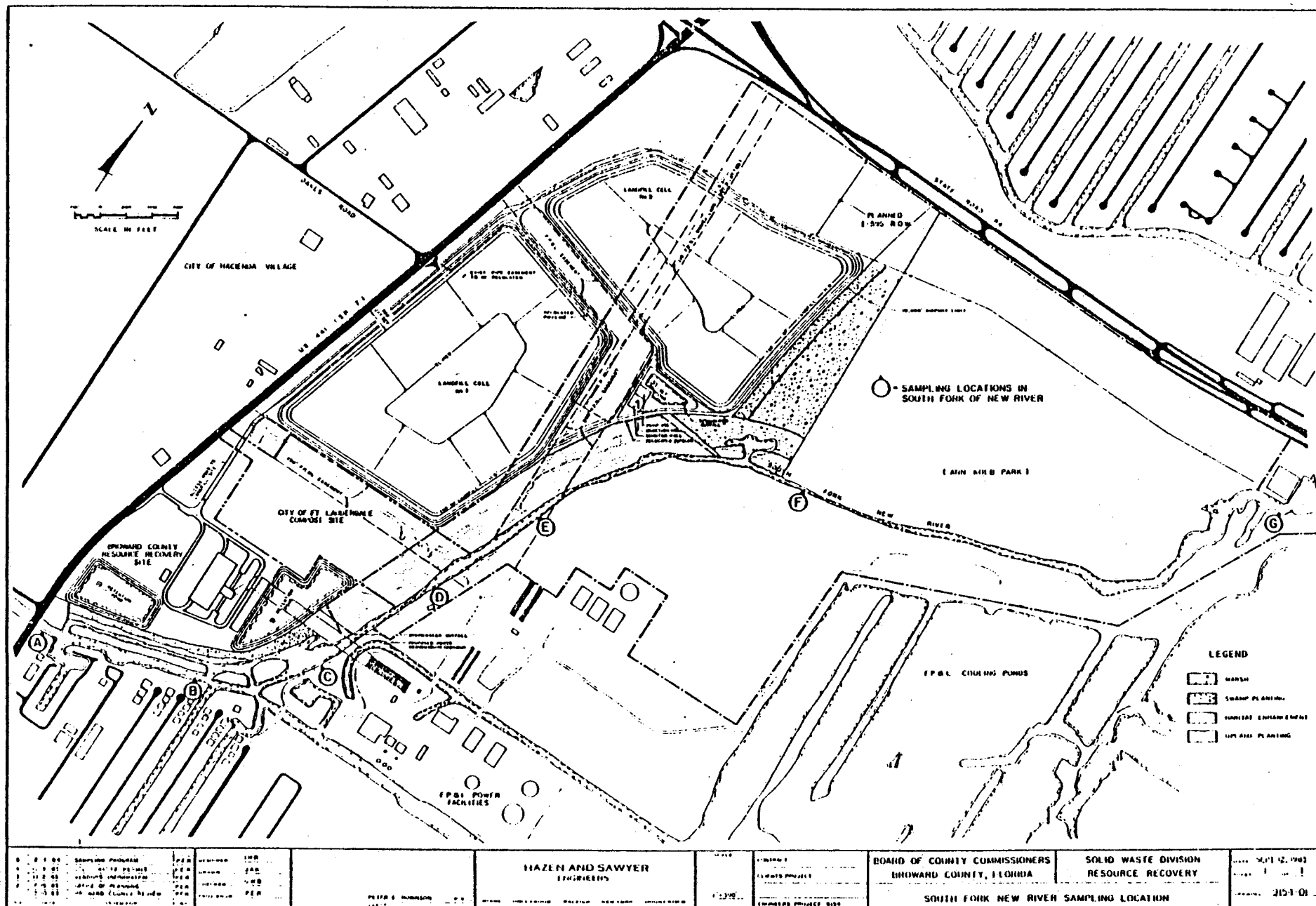


TABLE 2.3.4.1

SUMMARY OF SOUTH FORK OF NEW RIVER
WATER QUALITY DATA ON MARCH 15, 1984

<u>Parameters</u>	<u>Class III Standards</u>	<u>No. of Samples</u>	<u>Typical Values</u>	<u>Range of Values</u>
DO	5.0	149	4.5	2.2 - 6.3
BOD	-	15	4	2 - 11
TSS	-	15	7	4 - 180
Oil & Grease	5.0	15	<1	<1 - 4.0
pH	6.0-8.5	15	6.8	6.6 - 7.1
K. Nitrogen	-	15	2.1	1.8 - 3.7
T. Phosphorus	-	15	2.3	1.4 - 6.7
Lead	0.03	15	0.002	0.01 - 0.06
Zinc	0.03	15	<0.004	<0.004
Mercury	0.002	15	<0.001	<0.001
Copper	0.03	15	0.005	0.003 - 0.02
Cadmium	0.012	15	0.008	0.003 - 0.015
Nitrates	-	15	0.37	0.19 - 0.39
Iron	1.0	15	0.20	0.11 - 3.0
Nickel	0.1	15	<0.006	<0.006
COD	-	15	80	62 - 467

Notes: All values in mg/liter except pH (pH Units).

Higher range of values usually associated with
bottom samples where sediment may have been stirred up.

BACTERIOLOGICAL QUALITY ON MAY 2, 1984

	<u>Class III Standards</u>	<u>No. of Samples</u>	<u>Typical Value</u>	<u>Range of Values</u>
Fecal Coliform	800	7	320	70 - 1200
Total Coliform	2400	7	1200	500 - >2000

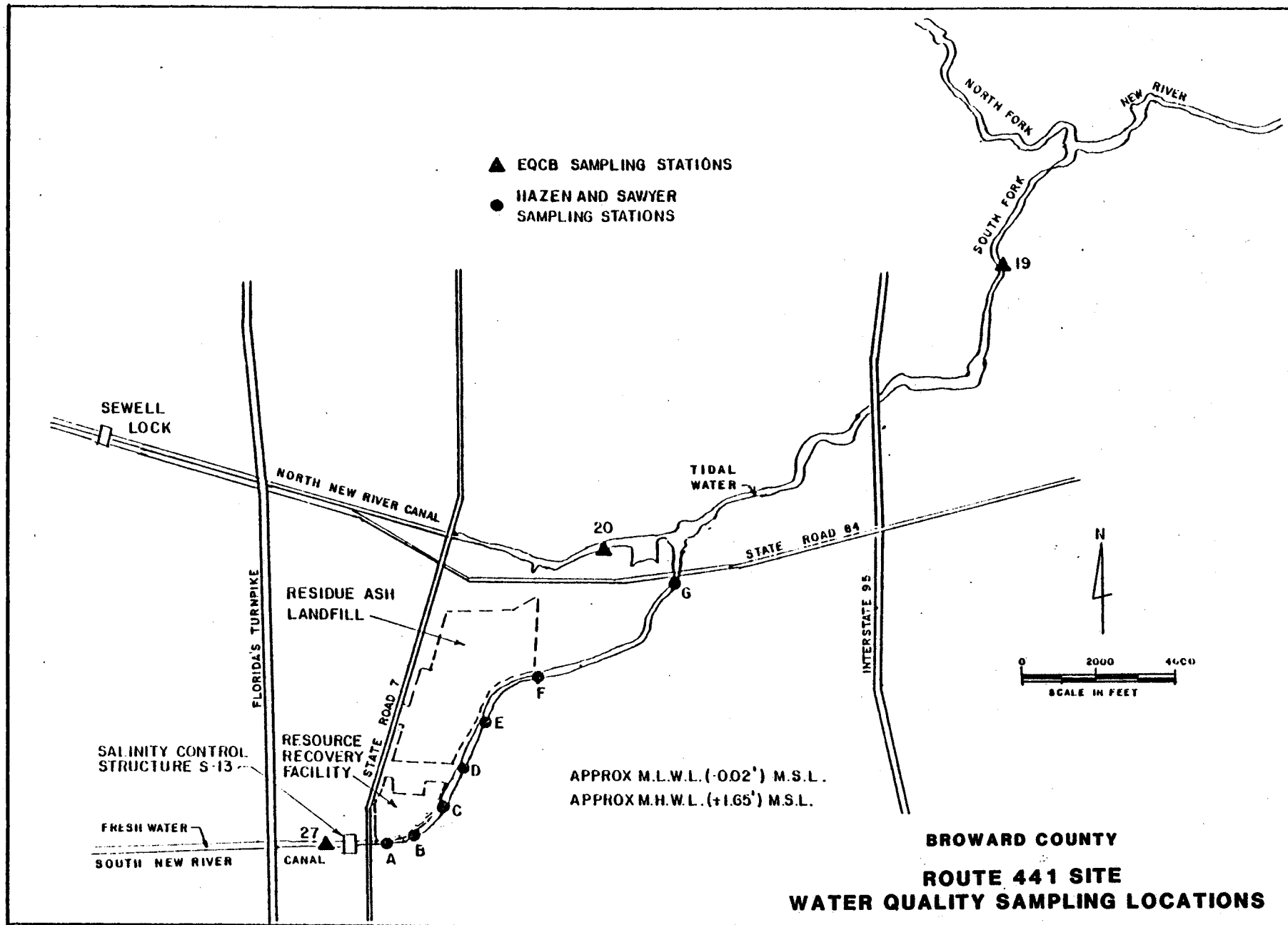


FIGURE 2.3.4.2

- o Local run-off from adjacent properties. Some developed areas front the river on the south near U.S. 441.

The water quality of the South Fork of New River Canal is typical of that found in the manmade canals in South Florida. The waters are nutrient rich. Sources are run-off (fertilizers) and treated effluent discharges.

2.3.4.2 Measurement Programs

The programs and methods for measuring background physical and chemical parameters of surface waters which have potential of being affected during construction and/or operation of the resource recovery facility and associated landfill have been described in Section 2.3.4.1, Hydrologic Characterization.

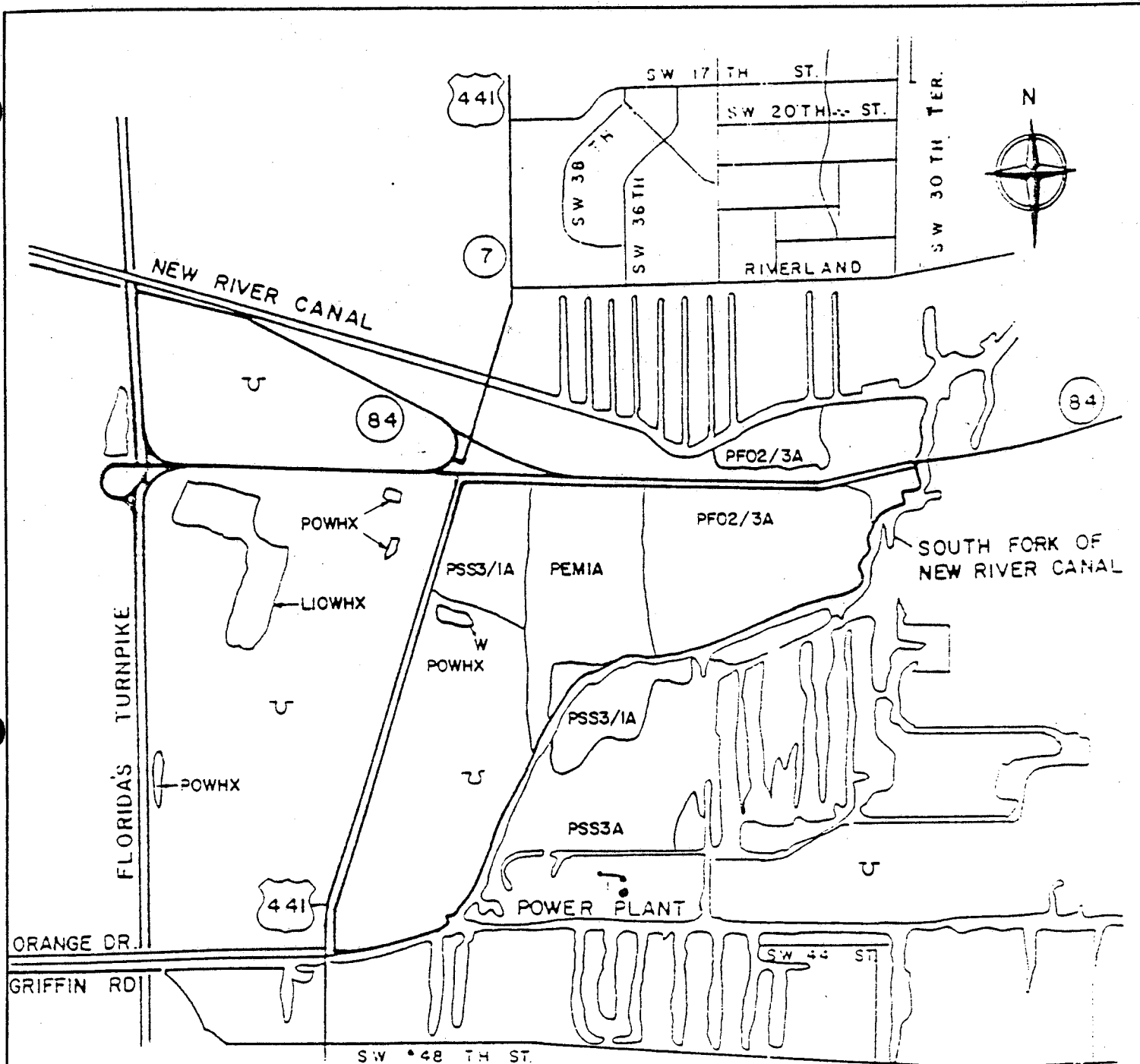
2.3.5 Vegetation/Land Use

Much of the site remains covered with natural vegetation. Portions of the site have been identified as wetlands by National Wetlands Inventory mapping (Figure 2.3.5.1). Field studies for this project identified more wetlands than identified on the National Wetlands Inventory mapping (Figure 2.3.5.2), however, the majority of these wetlands have been extensively disturbed. A comprehensive plant species list was developed during the field studies and is presented in Table 2.3.5.1.

2.3.5.1 Wetlands

The wetlands of the site consist of marsh, shrub swamp, wax myrtle pasture, open water, and swamp forest. They have been extensively disturbed. First, when the South Fork New River Canal was dredged, the spoil material was placed adjacent to the river. The spoil bank forms a barrier between New River and the adjacent wetlands; consequently, wetland values have been significantly diminished. In addition, the wetlands have been dissected and isolated by utility corridors. Most

FIGURE 2.3.5.1

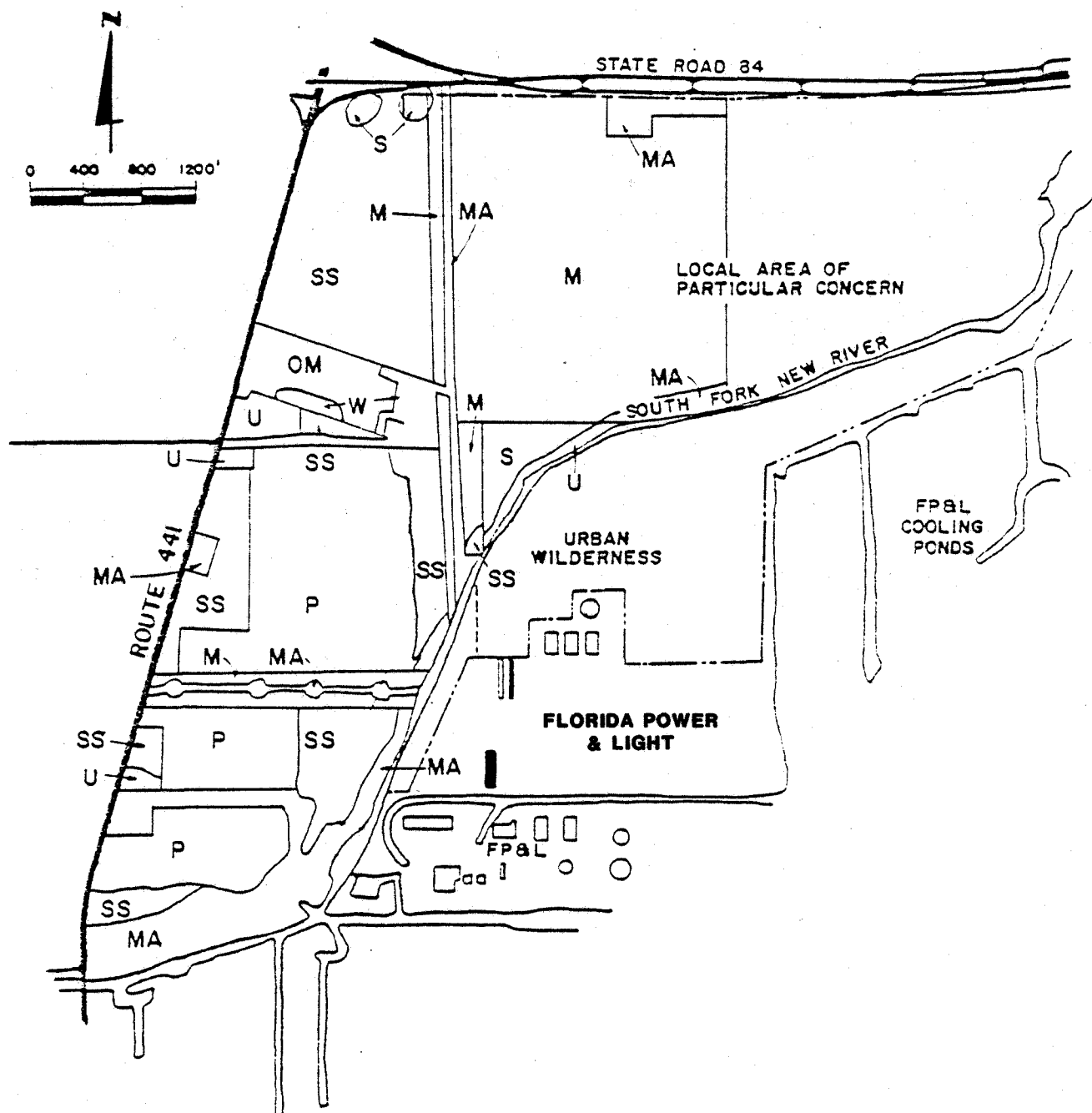


LEGEND

- PSS3/1A - PALUSTRINE, BROAD-LEAVED EVERGREEN, BROAD-LEAVED DECIDUOUS SHRUB SWAMP TEMPORARILY FLOODED, NONTIDAL
- PEMIA - PALUSTRINE, PERSISTENT EMERGENT VEGETATION, TEMPORARILY FLOODED NONTIDAL
- PFO2/3A - PALUSTRINE, NEEDLED LEAVED DECIDUOUS/BROAD-LEAVED EVERGREEN TEMPORARILY FLOODED, NONTIDAL
- POWHX - PALUSTRINE, PERMANENTLY FLOODED OPEN WATER EXCAVATED
- U - UPLAND

**NATIONAL WETLANDS INVENTORY
LAND CLASSIFICATIONS**

FIGURE 2.3.5.2



LEGEND

- W - OPEN WATER
- M - CATTAIL AND SAWGRASS MARSH
- S - CYPRESS AND RED
MAPLE SWAMP
- SS - MIXED SHRUB SWAMP
- P - WAX MYRTLE PASTURE
- MA - MAINTAINED HABITATS
- U - UPLAND HARDWOODS

VEGETATION MAP

TABLE 2.3.5.1

List of vascular plants identified during field reconnaissance, June, 1983, of the U.S. 441 Resource Recovery Facility site, Broward County, Florida. Nomenclature follows that of Godfrey and Wooten (1979, 1981), Long and Lakela (1971), or Lakela and Long (1976).

<u>Scientific Name</u>	<u>Common Name</u>
<u>Acalypa setosa</u>	(Three-seeded mercury)
<u>Acer rubrum</u>	Red maple
<u>Acrostichum danaeifolium</u>	Giant leather fern
<u>Agalinis fasciculata</u>	(Gerardia)
<u>Albizia lebbek</u>	Woman's tongue
<u>Alternanthera philoxeroides</u>	Alligator weed
<u>Amaranthus spinosus</u>	Spiny pigweed
<u>Ambrosia artemesiifolia</u>	Ragweed
<u>Ampelopsis arborea</u>	Pepper-vine
<u>Andropogon glaucopsis</u>	(Broomsedge)
<u>Andropogon virginicus</u> var. <u>abbreviatus</u>	(Broomsedge)
<u>Anemia adiantifolia</u>	Pine fern
<u>Annona glabra</u>	Pond-apple
<u>Apios americana</u>	Potato-bean
<u>Asclepias incarnata</u>	Swamp milkweed
<u>Aster</u> sp.	(Aster)
<u>Axonopus furcatus</u>	(Carpet grass)
<u>Baccharis glomeruliflora</u>	(Groundsel-tree)
<u>Bacopa caroliniana</u>	Blue-hyssop
<u>Bidens pilosa</u>	(Beggar ticks)
<u>Blechnum serrulatum</u>	(Blechnum fern)
<u>Boehmeria cylindrica</u>	Bog-hemp
<u>Borreria terminalis</u>	n.c.n.
<u>Buchnera floridana</u>	(Bluehearts)
<u>Bulbostylis ciliatifolia</u> var. <u>ciliatifolia</u>	n.c.n.
<u>Capraria biflora</u>	n.c.n.
<u>Casuarina equisetifolia</u>	Australian pine
<u>Centella asiatica</u>	False pennywort
<u>Cephalantus occidentalis</u>	Cotton buttonbush
<u>Cestrum diurnum</u>	Day jessamine
<u>Chenopodium ambrosioides</u>	Mexican tea
<u>Chloris glauca</u>	Fingergrass
<u>Chrysobalanus icaco</u>	Cocoa-plum
<u>Cladium jamaicense</u>	Saw-grass
<u>Coccoloba uvifera</u>	Sea-grapes
<u>Commelina</u> sp.	(Dayflower)
<u>Conoclinium coelestinum</u>	Mistflower
<u>Conyza canadensis</u>	Dwarf horseweed
<u>Crinum americanum</u>	Swamp-lily
<u>Crotalaria retusa</u>	(Rattlebox)
<u>Cynanchum angustifolium</u>	(Sand-vine)

TABLE 2.3.5.1
(continued)

<u>Scientific Name</u>	<u>Common Name</u>
<u>Cyperus compressus</u>	(Galingale)
<u>Cyperus elegans</u>	(Galingale)
<u>Cyperus globulosus</u>	(Galingale)
<u>Cyperus haspan</u>	(Galingale)
<u>Cyperus ligularis</u>	(Galingale)
<u>Cyperus polystachyos</u>	(Galingale)
<u>Cyperus rotundus</u>	Nut-grass
<u>Cyperus sesquiflorus</u>	(Galingale)
<u>Cyperus strigosus</u>	(Galingale)
<u>Cyperus surinamensis</u>	(Galingale)
<u>Desmodium canum</u>	(Tick trefoil)
<u>Dichromena colorata</u>	White-top sedge
<u>Digitaria serotina</u>	(Crabgrass)
<u>Echinochloa crusgalli</u>	Barnyard grass
<u>Eclipta alba</u>	n.c.n.
<u>Eleocharis atropurpurea</u>	(Spikerush)
<u>Eleocharis cellulosa</u>	(Spikerush)
<u>Eleocharis interstincta</u>	(Spikerush)
<u>Eragrostis sp.</u>	(Love grass)
<u>Erechtites hieracifolia</u>	Fireweed
<u>Eremochloa ophiuroides</u>	Centipede grass
<u>Erianthus giganteus</u>	Giant plumegrass
<u>Erigeron vernus</u>	(Fleabane)
<u>Eupatorium capillifolium</u>	Dog-fennel
<u>Eupatorium mikanioides</u>	(Boneset)
<u>Eustoma exaltatum</u>	Catchfly-gentian
<u>Ficus aurea</u>	Strangler fig
<u>Fimbristylis spathacea</u>	n.c.n.
<u>Fuirena squarrosa</u>	(Umbrella-grass)
<u>Galium tinctorium var. tinctorium</u>	(Bedstraw)
<u>Gaura angustifolia</u>	Southern gaura
<u>Heliotropium polyphyllum</u>	(Heliotrope)
<u>Heterotheca subaxillaris</u>	(Golden aster)
<u>Hydrocotyle umbellata</u>	(Water pennywort)
<u>Hydrolea corymbosa</u>	(Waterleaf)
<u>Hypericum brachyphyllum</u>	(St.-John's-wort)
<u>Hypericum myrtifolium</u>	(St.-John's-wort)
<u>Hypericum tetrapetalum</u>	(St.-John's-wort)
<u>Hyptis alata</u>	(Bitter mint)
<u>Ilex cassine</u>	Dahoon holly
<u>Ipomoea sagittata</u>	(Morning-glory)
<u>Juncus marginatus</u>	(Rush)
<u>Juncus megacephalus</u>	(Rush)
<u>Juncus polycephalus</u>	(Rush)
<u>Justicia ovata</u>	n.c.n.
<u>Kosteletzkya virginica</u>	Seashore marsh-mallow
<u>Lachnanthes caroliniana</u>	Red-root

TABLE 2.3.5.1
(continued)

<u>Scientific Name</u>	<u>Common Name</u>
<u>Lactuca intyrbacea</u>	Wild lettuce
<u>Lantana camara</u>	Shrub verbena
<u>Lantana involucrata</u>	(Lantana)
<u>Lepidium virginicum</u>	Pepper grass
<u>Ludwigia alata</u>	n.c.n.
<u>Ludwigia microcarpa</u>	n.c.n.
<u>Ludwigia peruviana</u>	Primrose-willow
<u>Lythrum lineare</u>	(Loosestrife)
<u>Manisurus rugosa</u>	(Jointgrass)
<u>Melaleuca quinquenervia</u>	Cajeput
<u>Melanthera angustifolia</u>	n.c.n.
<u>Metopium toxiferum</u>	Poison-tree
<u>Mikania scandens</u>	Climbing hempweed
<u>Mitreola petiolata</u>	(Miterwort)
<u>Myrica cerifera</u>	Wax-myrtle
<u>Myrsine guianensis</u>	Myrsine
<u>Osmunda regalis</u> var. <u>spectabilis</u>	Royal fern
<u>Oxalis corniculata</u>	Lady's sorrel
<u>Panicum hemitomon</u>	Maidencane
<u>Panicum repens</u>	Torpedo grass
<u>Panicum</u> sp.	(Panic grass)
<u>Parthenocissus quinquefolia</u>	Virginia creeper
<u>Paspalum dilatatum</u>	Dallis grass
<u>Paspalum distichum</u>	Knot-grass
<u>Paspalum floridanum</u>	Florida paspalum
<u>Paspalum urvillei</u>	Vasey grass
<u>Passiflora suberosa</u>	Corky-stemmed passionflower
<u>Peltandra virginica</u>	Green arum
<u>Persea palustris</u>	Swamp-bay
<u>Phelbodium aureum</u>	Golden polypody
<u>Phragmites australis</u>	Common reed
<u>Phyllanthus nodiflora</u>	(Frog-fruits)
<u>Phyllanthus caroliniensis</u>	(Leaf-flowers)
<u>Physalis viscosa</u> ssp. <u>maritima</u>	(Ground cherry)
<u>Phytolacca americana</u>	Pokeweed
<u>Plantago major</u>	Common plantain
<u>Pluchea rosea</u> var. <u>rosea</u>	(Marsh-fleabane)
<u>Poinciana regia</u>	Royal poinciana
<u>Poinsettia heterophylla</u>	Painted leaf
<u>Polygala grandiflora</u>	(Milkwort)
<u>Polygonum punctatum</u>	(Smartweed)
<u>Polypremum procumbens</u>	n.c.n.
<u>Pontederia cordata</u> var. <u>lancifolia</u>	Lance-leaved pickerelweed
<u>Prosperpinaca palustris</u>	(Mermaid-weed)
<u>Prosperpinaca pectinata</u>	(Mermaid-weed)
<u>Psidium guajava</u>	Guava

TABLE 2.3.5.1
(continued)

<u>Scientific Name</u>	<u>Common Name</u>
<u>Psilotum nudum</u>	Whisk fern
<u>Psychotria undata</u>	(Wild coffee)
<u>Rhynchelytrum roseum</u>	Natal grass
<u>Rhynchospora caduca</u>	(Beak-rush)
<u>Rhynchospora inundata</u>	(Beak-rush)
<u>Roystonea elata</u>	Royal palm
<u>Sabal palmetto</u>	Cabbage palmetto
<u>Sagittaria lancifolia</u>	(Arrowhead)
<u>Sagittaria latifolia</u> var. <u>latifolia</u>	Common arrowhead
<u>Salix caroliniana</u>	Carolina willow
<u>Sambucus canadensis</u>	Elderberry
<u>Sarcostemma clausum</u>	Milk withe
<u>Saururus cernuus</u>	Lizard's-tail
<u>Schinus terebinthiofolius</u>	Brazilian pepper
<u>Scleria verticillata</u>	(Nut-rush)
<u>Setaria geniculata</u>	Knotroot bristlegrass
<u>Sida acuta</u>	n.c.n.
<u>Sida rhombifolia</u>	n.c.n.
<u>Smilax laurifolia</u>	Bamboo-vine
<u>Solanum americanum</u>	Common nightshade
<u>Sonchus oleraceus</u>	Common sow thistle
<u>Sporobolus indicus</u>	Smutgrass
<u>Sporobolus poiretii</u>	(Dropseed)
<u>Stachytarpheta jamaicensis</u>	Blue porterweed
<u>Taxodium ascendens</u>	Cypress
<u>Teuchrium canadense</u>	Germander
<u>Thelypteris kunthii</u>	Kunth's shield fern
<u>Thelypteris palustris</u>	Marsh-fern
<u>Tillandsia fasciculata</u>	n.c.n.
<u>Tillandsia polystachia</u>	n.c.n.
<u>Tillandsia recurvata</u>	Ball moss
<u>Tillandsia setacea</u>	n.c.n.
<u>Toxicodendron radicans</u>	Poison ivy
<u>Trema micrantha</u>	Florida trema
<u>Trifolium repens</u>	White clover
<u>Typha angustifolia</u>	Narrowleaf cat-tail
<u>Typha domingensis</u>	Southern cat-tail
<u>Typha latifolia</u>	Common cat-tail
<u>Urena lobata</u>	Bur mallow
<u>Verbestina virginica</u>	Frost-weed
<u>Vitis aestivalis</u>	Summer grape
<u>Vitis rotundifolia</u>	Muscadine grape
<u>Wedelia trilobata</u>	n.c.n.
<u>Xyris</u> sp.	(Yellow-eyed grass)
<u>Zizaniopsis miliacea</u>	Water millet

of the wax myrtle pasture and shrub swamp area exhibits evidence (drainage ditches) of past farming efforts. Disturbance factors are numerous at this project site, and these detract both from the visible integrity of the biotic community and its functional attributes.

Open Water

Permanent open water exists in the New River Canal, in a small borrow pit near the northeast corner of, and in a rectangular pond south of a nursery located on State Road 7. No rooted submerged aquatic plants were found in any of these bodies of water. The shorelines have emergent plants in a narrow fringe, but depth of water appears to be the chief limiting factor for aquatic plants.

Cattail-Sawgrass Marsh

An extensively disturbed marsh area extends from U.S. 84 south, is bounded on the east by the proposed Anne Kolb Park cypress tract, on the west by the low berm beneath a Florida Power and Light transmission line, and on the south by a berm associated with a gas pipeline. Although historic photography was not available for inspection, the location of this community and cypress stumps present indicate that it was previously covered by cypress swamp or mixed red maple-cypress-and wax myrtle. The present vegetation is characterized by scattered cabbage palmetto trees, wax-myrtle bushes, and very tall herbaceous plants including three species of cattails, sawgrass, water millet, and galingales. Shallow water areas contain colonies of swamp-lily, arrowhead, and lance-leaved pickerelweed. Many other marsh and swamp species are scattered throughout the community.

Cypress-Red Maple Swamp

This biotic community is dominated by an open canopy of mostly short deciduous trees, and with a shrub layer that is comprised of mostly evergreen woody plants, interspersed with dense colonies of sawgrass. Occasionally, in the

wetter portions, giant leather ferns are abundant. The trees that occur in this community, with the exception of infrequent Australian pines, often have a profusion of air plants, and these species contribute to the tropical or "jungle" appearance of the swamp. That portion of the project area included in this community type is far less impressive than the cypress swamp of adjacent Anne Kolb Park (proposed).

Mixed Shrub Swamp

A large tract of cutover, disturbed thicket lies east of State Road 7 in the northeast quadrant of the project area. The community contains remnant trees of red maple and cypress that would suggest that the site was formerly cypress and red maple swamp. Locally high areas are usually populated by Australian pine, or sometimes cajuput saplings. An overgrown canal extends in a north-south direction along the west margin of an FP&L utility line. Several bulldozed openings exist and usually connect with State Road 7. The area is marked with shallow depressions and dotted with small rises where stumps and slash have been pushed aside. Other areas identified as mixed shrub swamp are predominantly Florida holly, wax myrtle, buttonbush and willows. Many species occur here, both herbaceous and marshland, as well as shrubs.

Wax Myrtle Pasture

Much of the Project site is comprised of poorly improved pasture lands amid a sparse to moderately thick coppice of wax myrtle bushes. Surface disturbance by cattle insures that many seeds are pushed into the black mucky substrate; therefore, the groundcover is very diverse and many species of marshes and wet savannas are present. Occasionally on higher ground exotic species can become established, and it is not surprising to find occasional Florida holly or Australian pine seedlings or saplings in this zone. The development of the wax myrtle dominated community probably arises from abandonment of fields and frequent utilization by cattle delays the successional trend toward a forest community.

Maintained Habitats

Several types of maintained habitats exhibiting a range of conditions from dry to wet, and with mostly herbaceous to predominantly wood plants occur in the study area. Roadside shoulders are typically sandy, and covered by grasses and other herbs. The large power line corridors tend to be slightly wetter. They also contain a few woody species and several more herbaceous species than that encountered along the rights-of-way of State Road 7 and State Road 84. The gas line corridor is wet, and in places, is covered by standing water or marsh vegetation. Several disturbed areas have grown up into groves of tall Australian pines, and very few herbaceous plants are found beneath this type of forest canopy. Because of the diversity of microhabitats, this biotic community contains the greatest assortment of native and naturalized vegetation within the study area.

Upland Hardwoods

Situated mostly along the high berm of dredged material on the banks of the New River Canal, upland hardwoods show characteristics not only of drier south Florida hammocks but also of highly disturbed spoil banks found near limestone mines and by drainage canals. The rocky spoil supports ferns, various shrubs, and low but large-crowned trees. Strangler figs are present as young seedlings and as canopy plants. The edge of the uplands nearest the New River Canal may contain exotic species that have arrived by floating to the site; the side of the berm away from the canal sometimes contains swamp species that edge upward.

2.3.5.2 Urban Wilderness

The second biological concern is that portion of the project area which has been proposed as an Urban Wilderness Area, i.e. a 300 foot-wide strip of waterfront and the marsh in the northwestern corner of the site (Figure 2.3.5.3). The area is

proposed for urban wilderness status because it is considered the last vestige of natural vegetation along the South Fork of the New River Canal. The 300 foot-wide strip of urban wilderness adjacent to the river will be preserved and enhanced (Section 3.2.3 and Appendix 10.1.4). Much of the area identified as the Griffey Tract (Figure 2.3.5.3), will be utilized as the location for landfill cell 2 which is critical to the project. This area is currently a sawgrass marsh of which up to an 800 foot swath fronting State Road 84 will be required for I-595 right-of-way. Cypress stumps throughout the marsh indicate that it was previously part of the swamp forest adjacent to the west, and that the area regenerated to sawgrass after it was cut over.

2.3.5.3 Sensitive Plant Species

Nineteen plant species, considered rare, threatened or endangered (Ward, 1979; State of Florida, 1978, USDI, 1979), are known from Broward County (see Table 2.3.5.2). Of these, nine occur in wetlands similar to those found originally on site. These are:

<u>Acrostichum danaeaeifolium</u>	Leather fern
<u>Asplenium serratum</u>	Bird's Nest Spleenwort
<u>Commelina gigas</u>	Gian Dayflower
<u>Drosera intermedia</u>	Water Sundew
<u>Nemastylis floridana</u>	Fall-flowering Ixia
<u>Polygala smallii</u>	Tiny Polygala
<u>Tillandsia fasciculata</u>	Wild Pine Bromeliact
<u>Tillandsia flexuosa</u>	Twisted Air-plant
<u>Zamia floridana</u>	Florida Coontie
<u>Roystonea elata</u>	Florida Royal Palm
<u>Sabal palmetto</u>	Cabbage Palm
<u>Cocus nucifera</u>	Coconut Palm

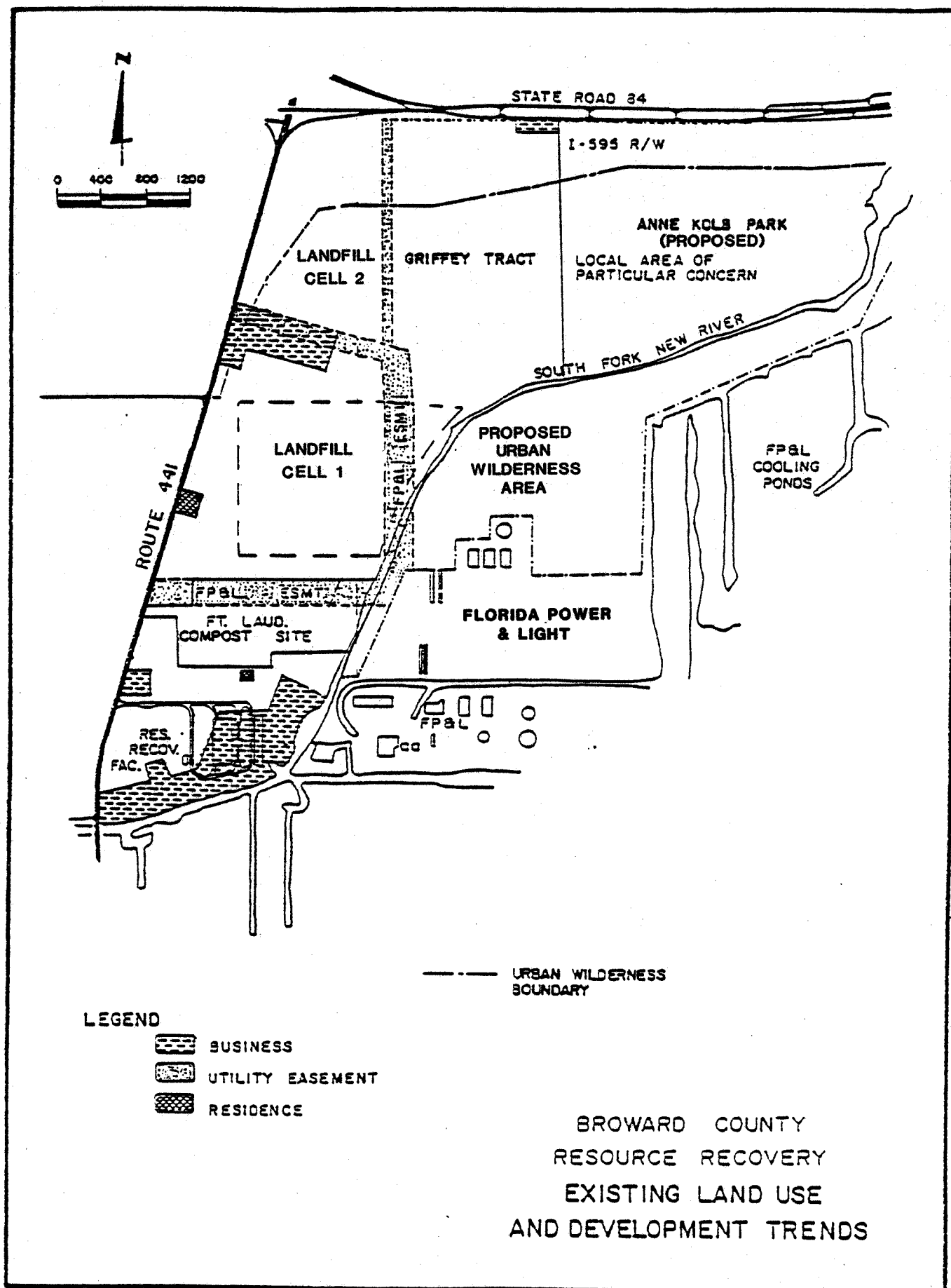


TABLE 2.3.5.2

VEGETATION, REPORTED FROM BROWARD COUNTY, CONSIDERED TO BE RARE (R),
THREATENED (T), OR ENDANGERED (E)

<u>Scientific Name</u>	<u>Common Name</u>	<u>Florida State (1978)</u> ¹	<u>REBF</u> ²	<u>Florida</u> ³ <u>Statutes</u>
Acrostichum danaeae- folium	Leather Fern		<u>T</u>	
Asplenium dentatum	Toothed Spleenwort	T	T	
Asplenium serratum	Bird's nest Spleenwort	T	E	
Coccothrinax argentata	Silver Palm	E	T	
Cocos nucifera	Coconut Palm	T		
Commelina gigas	Giant, or Climbing Dayflower	T	<u>T</u>	
Drosera intermedia	Water Sundew		R	
Ernodea littoralis	Beach Creeper		T	
Gossypium hirsutum	Wild Cotton		E	
Jacquemontia reclinata	Beach Jacquemontia		E	
Mallontonia gnaphalodes	Sea-Lavender		T	
Nemastylis floridana	Fall-flowering Ixia	T	T	
Okenia hypogaea	Burrowing Four-o'clock		E	
Ophioglossum palmatum	Hand Fern	E	E	
Pleopeltis revoluta	Star-scale Fern		E	
Polygala smallii	Tiny Polygala		E	
Remirea maritima	Beach-Star		E	
Roystonea elata	Florida Royal Palm			E —
Sabal palmetto	Cabbage Palm	T —		
Tillandsia fasciculata	Wild Pine Bromeliad			E —
Tillandsia flexuosa	Twisted Air-plant	T	T	
Zamia floridana	Florida Coontie	T	T	

1. State of Florida. 1978. Preservation of native flora of Florida. Chapter 78-72.
2. Ward, D.B. 1979. Rare and endangered biota of Florida, Vol. 5: Plants. Univ. Presses of Florida, Gainesville, 175 pp.
3. Section 581.185, Florida Statutes.

Of the twelve, five species were found--the cabbage palm, the Giant Dayflower, the leather fern, the Wild Pine Bromelaid and the Florida Royal Palm. The absence of the other species is not surprising in view of the heavy pastoral uses made on the property.

2.3.6 Ecology

Figure 2.3.6.1 illustrates endangered species critical habitats in the southern half of the State of Florida. Table 2.3.6.1 is a listing of vertebrate which are endangered, threatened or rare species or species of special concern found in the southern half of the State. Field studies during site analysis have not identified any threatened or endangered species on the project site and the probability of their presence is low. The site has been reviewed by the U.S. Fish and Wildlife Service (Jacksonville, FL) and development is not expected to impact any endangered or threatened species (Personal Communication, 12 July 1983, Don Palmer, Endangered Species Specialist, U.S. Fish and Wildlife Service). Both the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service stated by letter (Appendix 10.1.4) that the project would not jeopardize the West Indian (Florida) Manatee and the American Crocodile. Rare and endangered species of vegetation have been discussed in Section 2.3.5.

A list of vertebrates found on or near the site is presented in Table 2.3.6.2. It is not anticipated that the proposed facility will have any effect on these species. Vegetation on or near the site and the area proposed for urban wilderness designation was discussed in Section 2.3.5. The proposed urban wilderness area is the lone remaining example of a forested non-tidal wetlands system in the eastern regions of Broward County. The mitigation for the project will preserve and enhance this area (Appendix 10.1.4).

FIGURE 2.3.6.1

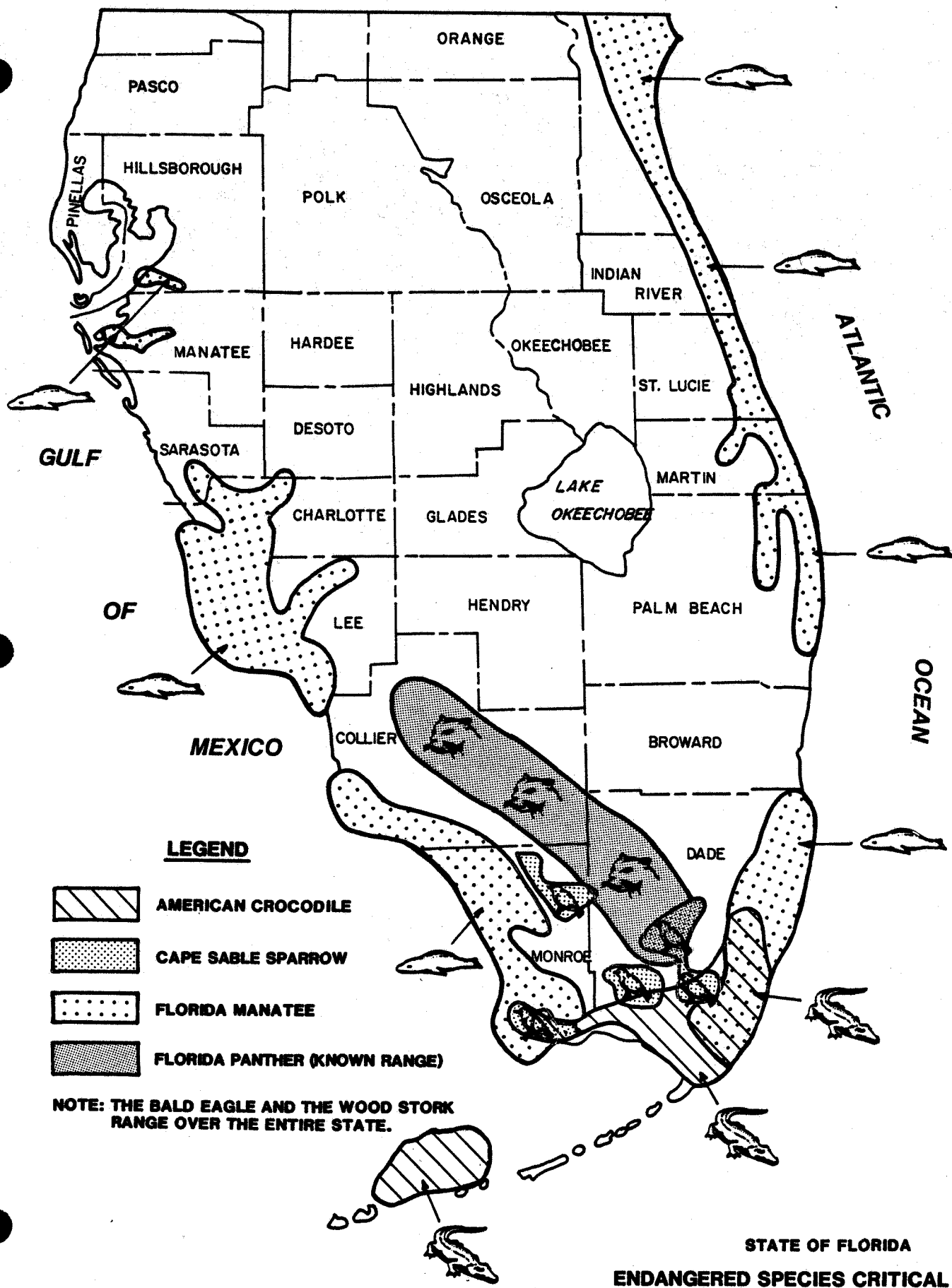


TABLE 2.3.6.1
 VERTEBRATES, REPORTED FROM BROWARD COUNTY, CONSIDERED
 TO BE ENDANGERED (E), THREATENED (T), RARE (R), A
 SPECIES OF SPECIAL CONCERN (SSC), OR OF STATUS
 UNDETERMINED (SU)

<u>Scientific Name</u>	<u>Common Name</u>	<u>USDI</u> <u>(1979)</u> ¹	<u>State of</u> <u>Fla. (1978)</u> ²	<u>Pritchard</u> <u>(1978)</u> ³
MAMMALS				
<u>Sciurus niger</u>				
<u>avicennia</u>	Mangrove Fox Squirrel	E	E	E
<u>Felis concolor coryi</u>	Florida Panther	E	E	E
<u>Ursus americanus</u>				
<u>floridanus</u>	Florida Black Bear		T	T
<u>Mustela vison</u>				
<u>evergladensis</u>	Everglades Mink		T	T
<u>Trichechus manatus</u>				
<u>latirostris</u>	Manatee	E	T	T
<u>Neofiber alleni</u>	Round-tailed Muskrat			SSC
BIRDS				
<u>Mycteria americana</u>	Wood Stork			E
<u>Rostrhamus sociabilis</u>				
<u>plumbeus</u>	Florida Everglade Kite	E		E
<u>Piccoires borealis</u>				
<u>hylonomus</u>	Red-cockaded Woodpecker	E	E	E
<u>Pelecanus occidentalis</u>				
<u>carolinensis</u>	Eastern Brown Pelican	E	T	T
<u>Fregata magnificens</u>				
<u>rothschildi</u>	Magnificent Frigate-bird		T	T
<u>Haliaeetus l.</u>				
<u>leucocephalus</u>	Southern Bald Eagle	E	T	T
<u>Pandion haliaetus</u>	Osprey		T	T
<u>Falco sparverius</u>				
<u>paulus</u>	Southeastern Kestrel		T	T
<u>Grus canadensis</u>				
<u>pratensis</u>	Florida Sandhill Crane		T	T
<u>Haematopus palliatus</u>	Oystercatcher			
<u>Sterna albifrons</u>				
<u>antiillarum</u>	Least Tern		T	T
<u>Buteo brachyurus</u>				
<u>fuliginosus</u>	Short-tailed Hawk			R
<u>Vireo altiloquus</u>	Black-whiskered Vireo			R
<u>Ardea herodias</u>				
<u>occidentalis</u>	Great White Heron		T	SSC
<u>Florida caerulea</u>	Little Blue Heron			SSC
<u>Casmerodius albus</u>	Great, Common Egret			SSC
<u>Egretta thula</u>	Snowy Egret			SSC
<u>Hydranassa tricolor</u>	Louisiana Heron			SSC
<u>Nycticorax nycticorax</u>	Yellow-crowned Night Heron			SSC
<u>Ixobrychus exilis</u>				
	Least Bittern			SSC

MALCOLM
 PIRNIE

TABLE 2.3.6.2

VERTEBRATES FOUND ON-SITE OR NEAR THE SITE
OF THE PROPOSED BROWARD COUNTY RESOURCE RECOVERY FACILITY
AND LANDFILL

<u>Mammals</u>	<u>Birds</u>
Gray squirrel	Cattle egret
Raccoon	Mourning dove
Marsh rabbit	Rock dove
Opposum	Great white heron
Manatee	Great blue heron
Mole	Yellow warbler
Field mice	Palm warbler
Cotton rat	Red-winged blackbird
	American kestrel
	Pileated woodpecker
	Barn owl
	Screech owl
<u>Reptiles</u>	<u>Amphibians</u>
Several species of snakes	Toads
Lizards	Frogs
Striped mud turtle	

Source: Field Observations/CZR Inc.

2.3.6.1 Species-Environmental Relationships

It is not anticipated that the proposed Resource Recovery Facility and Landfill will have any significant effects on area ecology. Terrestrial on-site fauna can move to the east of the site into the proposed urban wilderness area which is being preserved and enhanced (Appendix 10.1.4 and 10.7). Aquatic fauna in the New River Canal adjacent to the site will be affected only when the runoff from the on-site retention ponds exceeds storage capacity. Lastly, migratory species can relocate in nearby areas.

2.3.6.2 Pre-existing Stresses

The site is located in an area that is primarily industrial and very low residential. On-site ecological conditions do not indicate the occurrence of stress as a result of nearby industrial operations. The site has been previously altered. It has been used as pasture land, a marine construction yard, nursery, power transmission line easement, oil and gas pipeline easements, etc., which has resulted in changes in the habitats found originally and the pattern of ecological succession which would have occurred naturally.

An examination of water quality of the South Fork New River Canal (C-11 Canal) bordering the site indicates that the waters are nutrient rich. Sources are run-off (fertilizers) and treated effluent discharges.

2.3.6.3 Measurement Programs

In March 1983, a surface water sampling program was initiated at the site. The procedure and data is presented in Section 2.3.4.1. Collection and analysis of all the parameters measured were performed in accordance with Methods for Chemical Analysis of Water and Wastes (U.S. Environmental Protection Agency, 1979). In May 1984, a second sampling program was initiated in order to determine bacteriological quality of the surface waters. The procedure and data is also presented in Section 2.3.4.1. Analyses were performed in

accordance with the latest edition of Standard Methods. Also, data on surface water quality was obtained from the Broward County Environmental Quality Control Board (Appendix 10.9).

In addition, a special tree survey was conducted on site. For the purpose of the survey, trees were defined as woody vegetation with a diameter breast height of a minimum of 3 inches and an overall height of 7 feet. This tree survey is exhibited in Plate 5 of Appendix 10.1.4.

2.3.7 Meteorology and Ambient Air Quality

2.3.7.1 Meteorology

The meteorological and air quality data collected at existing monitoring stations were used to describe the local and regional climatology and air quality in the vicinity of the proposed plant. The closest existing meteorological station with complete meteorological data to the proposed plant is the primary National Weather Service (NWS) station in Miami, Florida, situated approximately 35 km south-southwest of the proposed plant site. NWS has recorded weather observations for at least the last 40 years at this site, and these data are the most complete for the region surrounding the proposed project. Existing air quality data were obtained from monitoring stations maintained and operated by the Broward County Environmental Quality Control Board (BCEQCB) and Florida Power and Light Company (FP&L).

Temperature

Temperature means and extreme for Miami are presented in Table 2.3.7.1. The climate is tropical with a large marine influence from the Atlantic Ocean and Biscayne Bay. The mean temperature varies of 75.6°F. Record extreme temperatures ranged from a low of 31°F to a record high of 98°F. Although the sun's elevation is nearly zenith during the summertime, temperatures do not exceed 100°F. The reason can be attrib-

TABLE 2.3.7.1

TEMPERATURE MEANS AND EXTREMES (°F) MEASURED AT
 MIAMI INTERNATIONAL AIRPORT, MIAMI, FLORIDA -- 1951 TO 1980

Month	Mean	Average Diurnal Maximum	Average Diurnal Minimum	Record Maximum*	Record Minimum*
January	67.1	75.0	59.2	87	31
February	67.8	75.8	59.7	89	32
March	71.7	79.3	64.1	92	32
April	75.3	82.4	68.2	96	46
May	78.5	85.1	71.9	94	53
June	81.0	87.3	74.6	98	65
July	82.4	86.7	76.2	98	69
August	82.8	89.2	76.5	98	68
September	81.8	87.8	75.7	95	68
October	77.9	84.2	71.6	95	51
November	72.8	79.8	65.8	89	33
December	68.5	76.2	60.8	87	33
Annual	75.6	82.6	68.7	98	31

*34-year period of record, 1943 to 1983.

Source: NOAA, 1983.

uted to the high relative humidities with subsequent cloud cover formation and the abundant convective-type precipitation.

Relative Humidity and Precipitation

Relative humidity, an indication of the amount of moisture in the air at a given temperature, is presented in Table 2.3.7.2 for the hours of 0100 and 0700 in the morning and 1300 and 1900 in the afternoon for specified periods. The highest humidities coexist with the coolest ambient temperatures, namely at 0700 or near dawn. Similarly, the lowest humidities coincide with the highest ambient temperatures.

Over 75 percent of the annual precipitation falls during the six warmest months, May through October. The mean annual precipitation is 58 inches, but this has varied from as little as 37 inches to over 89 inches in the last 30 years. The majority of rain is in the form of short-lived convection showers. Precipitation means and extremes are also presented in Table 2.3.7.2.

Severe Storms

Thunderstorms are the most frequent of severe storms, occurring an average of 75 days per year. These storms occur throughout the year, but nearly 75 percent occur from May through October.

Tropical cyclones, and more specifically hurricanes, have invaded the Miami area coastline infrequently since the 1960s, but always remain a threat in any given year. According to statistics compiled by Simpson and Lawrence (1971), the probability that a tropical cyclone will enter the 50-mile coastal stretch from South Miami to Pompano Beach any given year is 20 percent, with a 16-percent chance that it will be of hurricane intensity, and only a 7 percent chance that its

TABLE 2.3.7.2

PRECIPITATION AND DIURNAL RELATIVE HUMIDITY MEASURED
AT MIAMI, FLORIDA

Month	Precipitation (inches)			Humidity** (%) hour (LT)			
	Mean*	Maximum†	Minimum†	0100	0700	1300	1900
January	2.08	6.66	0.04	80	84	60	69
February	2.05	8.07	0.01	79	83	57	66
March	1.89	7.22	0.02	77	82	57	65
April	3.07	17.29	0.07	75	79	55	64
May	6.53	18.54	0.44	79	81	60	70
June	9.15	22.36	1.81	84	86	66	75
July	5.98	13.51	1.77	82	85	63	72
August	7.02	16.88	1.65	83	87	66	74
September	8.07	24.40	2.63	85	89	67	77
October	7.14	21.08	1.50	83	87	64	73
November	2.71	13.15	0.09	81	85	61	71
December	1.86	6.39	0.13	79	83	59	70
Annual	57.55	89.33	37.00	81	84	61	70

*1951-1980.

†1943-1983.

**1965-1983.

Source: NOAA, 1983.

maximum winds will exceed 124 mph, that of a great hurricane. Tropical cyclones usually approach Miami from early August to late October.

Statistics compiled by the Severe Local Storms (SELS) branch of the National Severe Storms Forecast Center (Pautz, 1969) show that 25 tornadoes (or waterspouts) were spotted within the 1° latitude by 1° longitude square centered just south and west of Miami from 1955 to 1967. This averages approximately 1.9 tornadoes per year. The tornado recurrence interval for any specific point location within the 1° square is estimated by a methodology of Thom (1963) to be 802 years. Therefore, the mean recurrence interval for a tornado striking a point within this square is 802 years. The most common tornado month is June.

Mixing Depths

The monthly and average mixing depths for Miami as estimated by Holzworth are listed in Table 2.3.7.3. The highest afternoon mixing depths occur in the spring, and the lowest morning depths occur in mid-winter. The mean high humidity and low-level cloudiness prevent mean mixing depths subsidence below 500 m.

Atmospheric Stability

Monthly and annual frequencies of Pasquill's stability classes are shown in Table 2.3.7.4. Frequent and strong sea breezes cause a predominance of neutral and stable air (D and E stabilities), counteracting the effect of high incidence of sunshine over urban Miami. The joint frequency of wind per stability class is given Table 2.3.7.5. As can be seen, there is a large easterly component of wind under neutral and stable air masses.

TABLE 2.3.7.3

MEAN DIURNAL MIXING DEPTHS* AT
 MIAMI INTERNATIONAL AIRPORT, MIAMI, FLORIDA

Month	Mean Diurnal Mixing Depth (m)	
	Morning	Afternoon
January	666	1,145
February	676	1,242
March	900	1,406
April	1,039	1,435
May	997	1,483
June	1,020	1,309
July	1,065	1,392
August	1,032	1,364
September	957	1,312
October	814	1,371
November	853	1,267
December	<u>623</u>	<u>1,258</u>
Annual	878†	1,330†

*5-year averaged data, 1960-1964.

†True weighted averages.

Source: Holzworth, 1972.

TABLE 2.3.7.4

FREQUENCY OF OCCURRENCE OF PASQUILL'S STABILITIES FOR
MIAMI, FLORIDA -- 1969 to 1974

Month	Pasquill's Stability Class (%)				
	A	B	C	D	E
January	0.0	2.9	10.3	44.1	42.7
February	0.0	2.3	8.5	52.6	36.6
March	0.0	2.1	8.5	53.2	36.3
April	0.1	4.4	12.6	50.8	32.1
May	0.3	5.2	19.0	47.9	27.6
June	0.3	11.5	19.9	32.8	35.5
July	0.3	12.8	23.0	24.3	39.5
August	0.5	9.1	20.4	31.6	38.5
September	0.2	5.7	12.2	37.4	44.5
October	0.0	4.7	8.2	46.6	40.5
November	<u>0.0</u>	<u>1.7</u>	<u>10.1</u>	<u>42.6</u>	<u>45.5</u>
Annual	0.1	5.4	13.7	42.0	38.6

Source: NOAA, 1974.

TABLE 2.3.7.5

JOINT FREQUENCY DISTRIBUTION OF WIND AND PASQUILL STABILITY CLASS
 MIAMI, FLORIDA, 1969 THROUGH 1974

DIRECTION	SPEED(KTS)						TOTAL
	0 - 3	4 - 6,	7 - 10	11 - 16	17 - 21	GREATER THAN 21	
N	0.000007	0.000057	0.0	0.0	0.0	0.0	0.000064
NNF	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NF	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENF	0.000007	0.000057	0.0	0.0	0.0	0.0	0.000064
E	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESF	0.000007	0.000057	0.0	0.0	0.0	0.0	0.000064
SE	0.000037	0.000285	0.0	0.0	0.0	0.0	0.000322
SSE	0.000079	0.000114	0.0	0.0	0.0	0.0	0.000193
S	0.000072	0.000057	0.0	0.0	0.0	0.0	0.000129
SSW	0.000079	0.000114	0.0	0.0	0.0	0.0	0.000193
SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WSW	0.000015	0.000114	0.0	0.0	0.0	0.0	0.000129
W	0.000151	0.000171	0.0	0.0	0.0	0.0	0.000322
WNW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NNW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	0.000456	0.001027	0.0	0.0	0.0	0.0	

RELATIVE FREQUENCY OF OCCURRENCE OF A STABILITY = 0.001483

RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE WITH A STABILITY = 0.000171

TABLE 2.3.7.5 (continued)

JOINT FREQUENCY DISTRIBUTION OF WIND AND PASQUILL STABILITY CLASS
MIAMI, FLORIDA, 1969 THROUGH 1974

DIRECTION	SPEED (KTS)						TOTAL
	0 - 3	4 - 6,	7 - 10	11 - 16	17 - 21	GREATER THAN 21	
N	0.001335	0.002225	0.000970	0.0	0.0	0.0	0.004530
NNE	0.000664	0.000970	0.000513	0.0	0.0	0.0	0.002148
NE	0.000240	0.000285	0.000342	0.0	0.0	0.0	0.000868
ENE	0.000314	0.000970	0.000742	0.0	0.0	0.0	0.002026
E	0.000621	0.001654	0.001997	0.0	0.0	0.0	0.004273
ESE	0.000584	0.002567	0.003537	0.0	0.0	0.0	0.006689
SE	0.000715	0.003195	0.003195	0.0	0.0	0.0	0.007105
SSE	0.000694	0.002282	0.001654	0.0	0.0	0.0	0.004631
S	0.000631	0.002054	0.001483	0.0	0.0	0.0	0.004168
SSW	0.000614	0.001312	0.000285	0.0	0.0	0.0	0.002211
SW	0.000599	0.000685	0.000171	0.0	0.0	0.0	0.001455
WSW	0.000667	0.001084	0.000799	0.0	0.0	0.0	0.002549
W	0.000965	0.001369	0.001255	0.0	0.0	0.0	0.003589
WNW	0.000723	0.000970	0.000513	0.0	0.0	0.0	0.002206
NW	0.001189	0.000970	0.000513	0.0	0.0	0.0	0.002673
NNW	0.001425	0.001084	0.000913	0.0	0.0	0.0	0.003422
TOTAL	0.011981	0.023676	0.014884	0.0	0.0	0.0	

RELATIVE FREQUENCY OF OCCURRENCE OF B STABILITY = 0.054541

RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE WITH R STABILITY = 0.000799

TABLE 2.3.7.5 (continued)

JOINT FREQUENCY DISTRIBUTION OF WIND AND PASQUILL STABILITY CLASS
 MIAMI, FLORIDA, 1969 THROUGH 1974

DIRECTION	SPEED (KTS)						TOTAL
	0 - 3	4 - 6,	7 - 10	11 - 16	17 - 21	GREATER THAN 21	
N	0.000210	0.003594	0.008957	0.009299	0.000628	0.000114	0.022803
NNE	0.000076	0.001769	0.003822	0.006276	0.001883	0.000228	0.014054
NE	0.000004	0.000399	0.006675	0.015290	0.002453	0.000399	0.025221
ENE	0.000014	0.001312	0.012380	0.026415	0.003138	0.000228	0.043487
E	0.000319	0.002967	0.031378	0.058079	0.006219	0.000571	0.099532
ESE	0.000087	0.002796	0.020938	0.031949	0.002453	0.0	0.058222
SE	0.000266	0.003423	0.012038	0.015689	0.000628	0.0	0.032044
SSE	0.000079	0.002054	0.007987	0.007702	0.000228	0.0	0.018050
S	0.000262	0.002967	0.007303	0.006960	0.001084	0.000114	0.018689
SSW	0.000254	0.002282	0.003081	0.003138	0.000571	0.000114	0.009440
SW	0.000127	0.001141	0.003252	0.002910	0.000628	0.000057	0.008174
WSW	0.000303	0.001369	0.002910	0.004678	0.000513	0.000171	0.009944
W	0.000656	0.002054	0.003309	0.003024	0.000799	0.000171	0.010012
WNW	0.000192	0.001826	0.003937	0.003880	0.000628	0.000114	0.010575
NW	0.000253	0.002168	0.006333	0.007645	0.001883	0.000057	0.018339
NNW	0.000149	0.003252	0.006789	0.009870	0.001940	0.000057	0.022057
TOTAL	0.003252	0.035372	0.141088	0.212802	0.025673	0.002396	

RELATIVE FREQUENCY OF OCCURRENCE OF D STABILITY = 0.420584

RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE WITH D STABILITY = 0.000399

TABLE 2.3.7.5 (continued)

JOINT FREQUENCY DISTRIBUTION OF WIND AND PASQUILL STABILITY CLASS
MIAMI, FLORIDA, 1969 THROUGH 1974

DIRECTION	SPEED (KTS)						TOTAL
	0 - 3	4 - 6	7 - 10	11 - 16	17 - 21	GREATER THAN 21	
N	0.000382	0.003138	0.004906	0.000513	0.0	0.0	0.008940
NNE	0.000267	0.001141	0.001597	0.000342	0.000057	0.0	0.003405
NE	0.000138	0.000742	0.002624	0.000856	0.0	0.0	0.004360
ENE	0.000031	0.001084	0.004564	0.002624	0.000114	0.0	0.008417
E	0.000302	0.002396	0.012894	0.006504	0.000171	0.0	0.022267
ESE	0.000343	0.001769	0.014833	0.005078	0.000228	0.0	0.022251
SE	0.000240	0.002282	0.012323	0.003081	0.000057	0.0	0.017983
SSE	0.000395	0.001540	0.006789	0.001826	0.000057	0.0	0.010608
S	0.000462	0.001826	0.004279	0.001027	0.000171	0.0	0.007765
SSW	0.000195	0.000685	0.001597	0.000399	0.0	0.0	0.002877
SW	0.000232	0.001997	0.001597	0.000342	0.000171	0.0	0.004340
WSW	0.000208	0.001141	0.001826	0.000285	0.000057	0.000057	0.003574
W	0.000749	0.001597	0.001769	0.000571	0.0	0.0	0.004686
WNW	0.000381	0.001027	0.002681	0.000628	0.0	0.0	0.004717
NW	0.000689	0.001540	0.001997	0.000513	0.000114	0.0	0.004853
NNW	0.000519	0.001769	0.003423	0.000399	0.000057	0.0	0.006167
TOTAL	0.005534	0.025673	0.079701	0.024989	0.001255	0.000057	

RELATIVE FREQUENCY OF OCCURRENCE OF C STABILITY = 0.137209

RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE WITH C STABILITY = 0.000856

TABLE 2.3.7.5 (continued)

JOINT FREQUENCY DISTRIBUTION OF WIND AND PASQUILL STABILITY CLASS
 MIAMI, FLORIDA, 1969 THROUGH 1974

DIRECTION	SPEED(KTS)						TOTAL
	0 - 3	4 - 6,	7 - 10	11 - 16	17 - 21	GREATER THAN 21	
N	0.007391	0.021680	0.007588	0.0	0.0	0.0	0.036658
NNE	0.001588	0.005591	0.002168	0.0	0.0	0.0	0.009347
NE	0.000476	0.004507	0.003937	0.0	0.0	0.0	0.008920
ENE	0.001443	0.009414	0.011239	0.0	0.0	0.0	0.022096
E	0.004631	0.031321	0.026700	0.0	0.0	0.0	0.062652
ESE	0.004176	0.021394	0.010497	0.0	0.0	0.0	0.036067
SE	0.005349	0.015119	0.005762	0.0	0.0	0.0	0.026230
SSE	0.005350	0.010669	0.002396	0.0	0.0	0.0	0.018414
S	0.007115	0.016260	0.002282	0.0	0.0	0.0	0.025657
SSW	0.003625	0.009071	0.001312	0.0	0.0	0.0	0.014008
SW	0.002920	0.007759	0.001883	0.0	0.0	0.0	0.012562
WSW	0.003077	0.008729	0.002396	0.0	0.0	0.0	0.014202
W	0.005131	0.011125	0.002054	0.0	0.0	0.0	0.018309
WNW	0.006123	0.010726	0.002453	0.0	0.0	0.0	0.019302
NW	0.006698	0.016203	0.004906	0.0	0.0	0.0	0.027807
NNW	0.007192	0.019683	0.007074	0.0	0.0	0.0	0.033950
TOTAL	0.072284	0.219249	0.094648	0.0	0.0	0.0	

RELATIVE FREQUENCY OF OCCURRENCE OF E STABILITY = 0.386182

RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE WITH E STABILITY = 0.011182

TABLE 2.3.7.5 (continued)

JOINT FREQUENCY DISTRIBUTION OF WIND AND PASQUILL STABILITY CLASS
 MIAMI, FLORIDA, 1969 THROUGH 1974

DIRECTION	SPEED(KTS)						TOTAL
	0 - 3	4 - 6,	7 - 10	11 - 16	17 - 21	GREATER THAN 21	
N	0.009334	0.030694	0.022421	0.009813	0.000628	0.000114	0.073003
NNE	0.002632	0.009471	0.008101	0.006618	0.001940	0.000228	0.028990
NE	0.000856	0.005933	0.013578	0.016146	0.002453	0.000399	0.039366
ENE	0.001805	0.012837	0.028925	0.029039	0.003252	0.000228	0.076086
E	0.005822	0.038339	0.072969	0.064582	0.006390	0.000571	0.188672
ESE	0.005187	0.028583	0.049806	0.037026	0.002681	0.0	0.123283
SE	0.006632	0.024304	0.033318	0.018770	0.000685	0.0	0.083708
SSE	0.006602	0.016659	0.018827	0.009528	0.000285	0.0	0.051901
S	0.008540	0.023163	0.015347	0.007987	0.001255	0.000114	0.056407
SSW	0.004779	0.013464	0.006276	0.003537	0.000571	0.000114	0.028740
SW	0.003886	0.011581	0.006903	0.003252	0.000799	0.000057	0.026479
WSW	0.004270	0.012437	0.007930	0.004963	0.000571	0.000228	0.030400
W	0.007653	0.016317	0.008387	0.003594	0.000799	0.000171	0.036920
WNW	0.007414	0.014548	0.009585	0.004507	0.000628	0.000114	0.036795
NW	0.008815	0.020881	0.013749	0.008158	0.001997	0.000057	0.053658
NNW	0.009281	0.025787	0.018199	0.010269	0.001997	0.000057	0.065591
TOTAL	0.093507	0.304997	0.334322	0.237791	0.026928	0.002453	

TOTAL RELATIVE FREQUENCY OF OBSERVATIONS = 1.000000

TOTAL RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE = 0.013407

Source: NOAA, 1974.

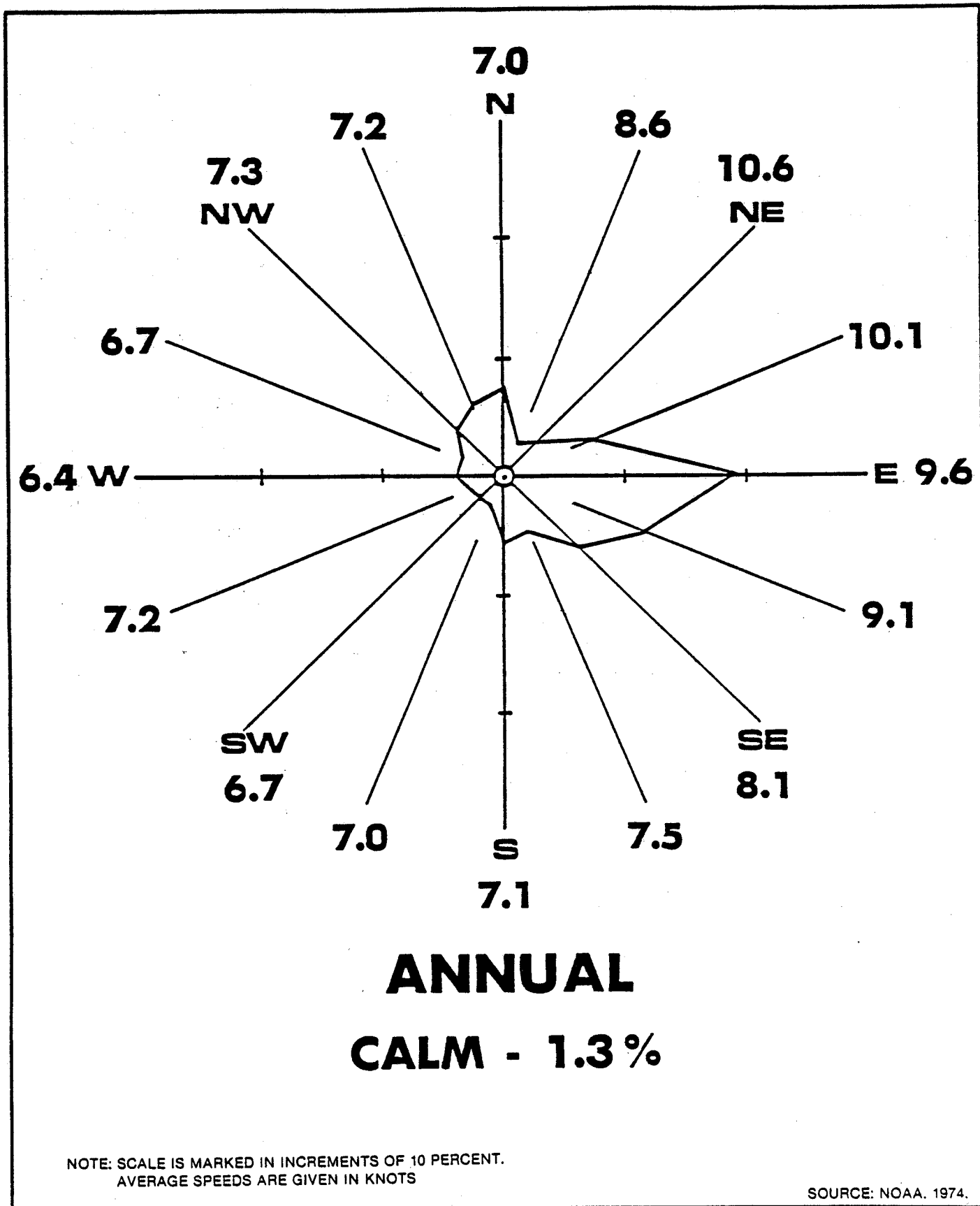
Wind Patterns

A combination of easterly trade winds superimposed on frequent easterly (onshore) sea breezes gives Miami a large dominance of easterly winds. During several months, easterly winds prevailed over 25 percent of the time, and in an annual period, almost 19 percent of the time. Figure 2.3.7.1 presents monthly and annual wind roses for the six year period from 1969 to 1974.

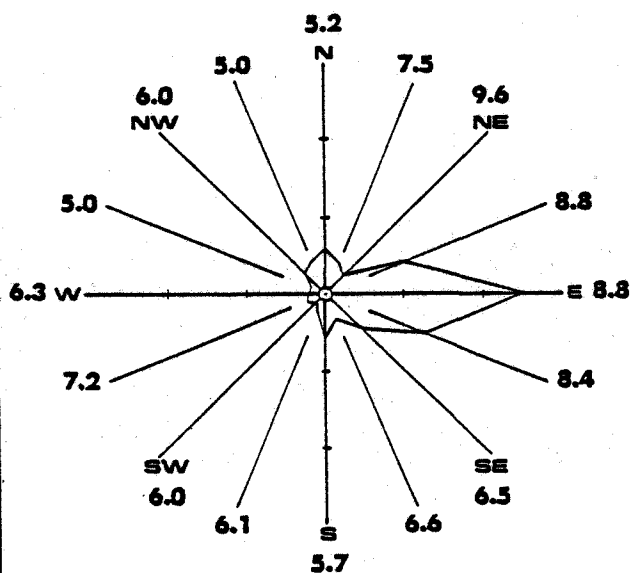
2.3.7.2 Ambient Air Quality

A listing of all the ambient monitoring locations in Broward County is presented in Table 2.3.7.6. There are currently 18 sites operated by Broward County and 3 sites operated by FP&L. Based on the PSD monitoring guidelines (USEPA, 1981), for a proposed source located in an area of multisource emissions and flat terrain, existing ambient monitoring data may be acceptable if the existing monitor is within 10 km of the proposed source or 1 km of predicted maximum impacts.

The existing monitoring sites located within 10 km of the facility are listed in Table 2.3.7.7. The maximum concentrations measured during 1983 are also presented in this table. Based on these measured maximum concentrations, pollutant concentrations within a 10-km radius from the facility are less than the national and Florida Ambient Air Quality Standards (AAQS), except for Carbon Monoxide (CO). In Table 2.3.7.7, although Broward County monitoring site No. 4 is 11.4 km from the proposed facility site, concentrations from the monitor are included since it is the closest site with SO₂ and NO₂ concentrations. It should be noted that the SO₂ and NO₂ concentrations are not measured by an acceptable technique for use in PSD applications. However, based on the data presented in Table 2.3.7.7, the measured SO₂ and NO₂ concentrations are well below AAQS.

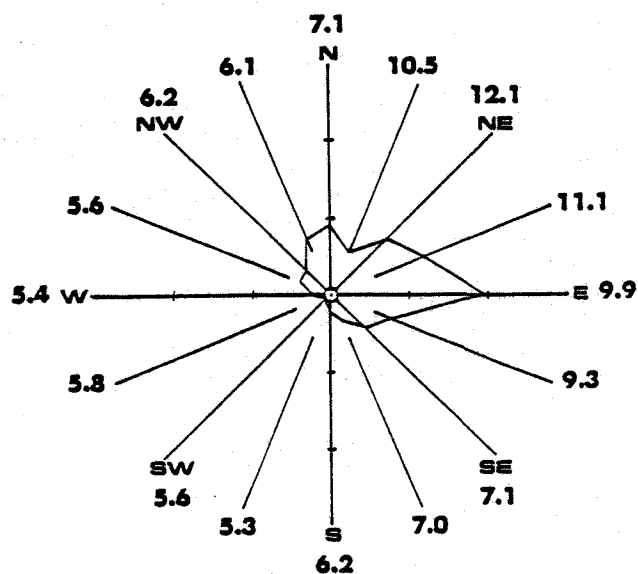


**AVERAGE MONTHLY AND ANNUAL WIND ROSES
FOR MIAMI, FLORIDA
1969-1974**



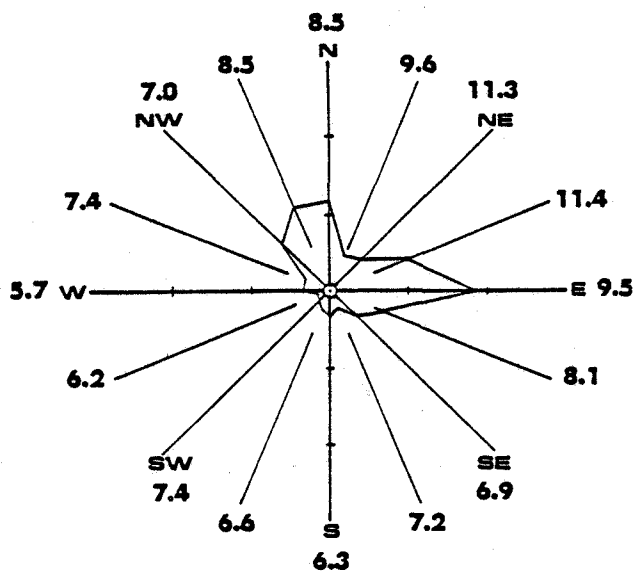
SEPTEMBER

CALM - 3.1%



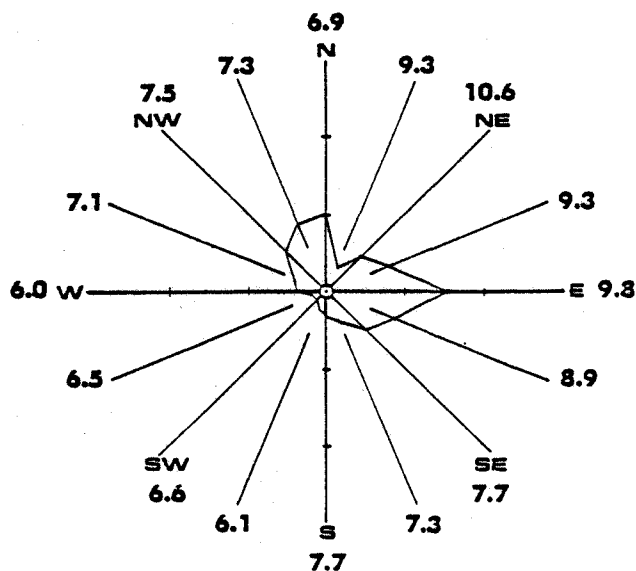
OCTOBER

CALM - 1.3%



NOVEMBER

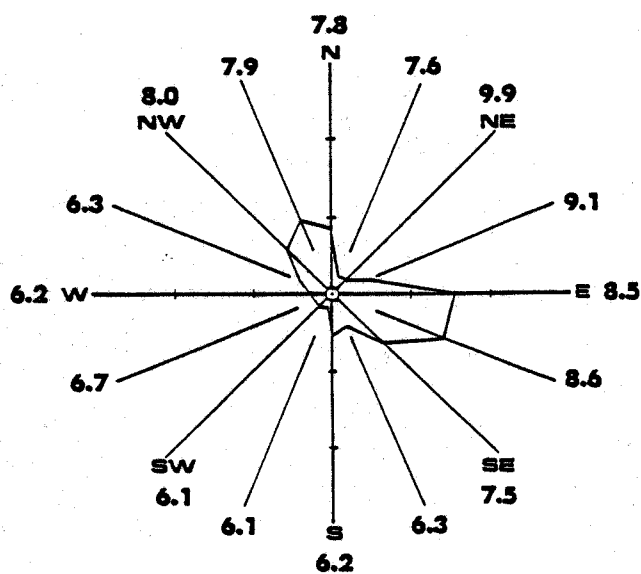
CALM - 0.2%



DECEMBER

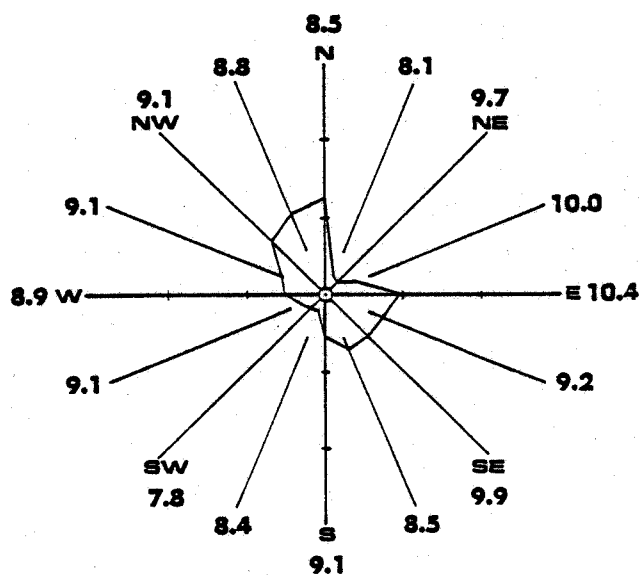
CALM - 0.6%

NOTE: SCALE IS MARKED IN INCREMENTS OF 10 PERCENT.
AVERAGE SPEEDS ARE GIVEN IN KNOTS



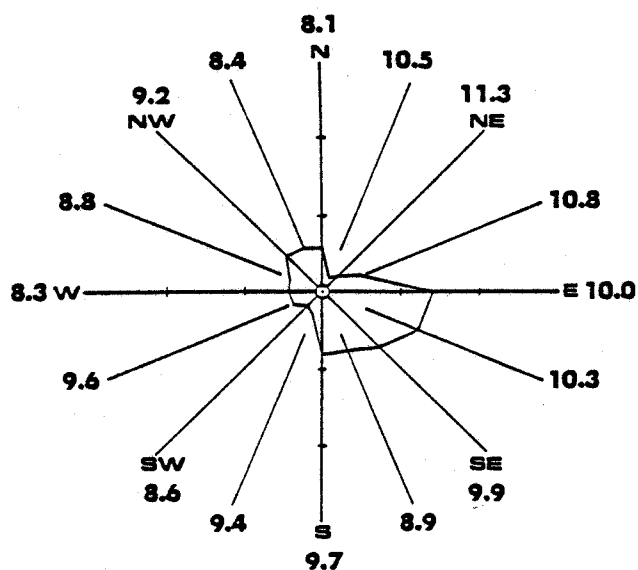
JANUARY

CALM - 1.4%



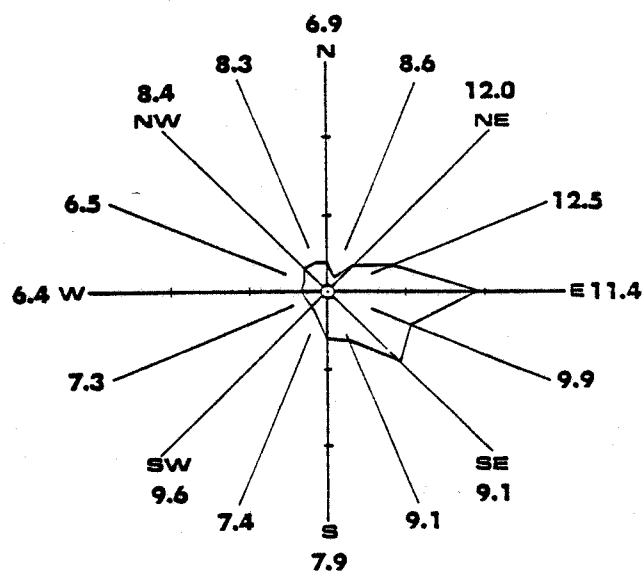
FEBRUARY

CALM - 0.4%



MARCH

CALM - 0.5%



APRIL

CALM - 0.1%

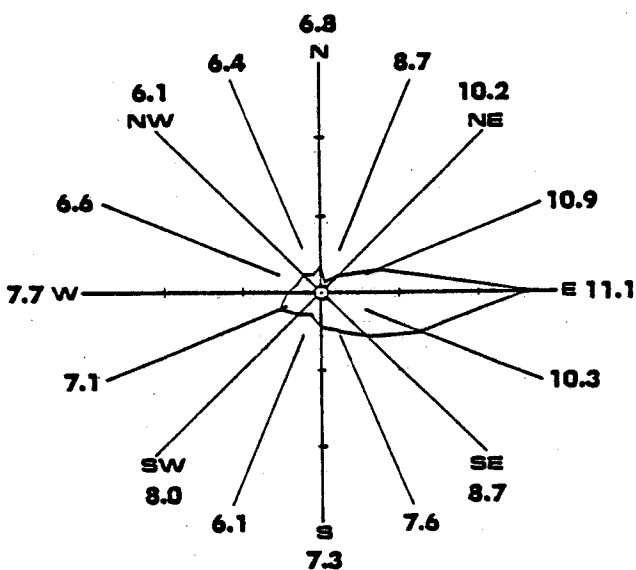
NOTE: SCALE IS MARKED IN INCREMENTS OF 10 PERCENT.
AVERAGE SPEEDS ARE GIVEN IN KNOTS

(PAGE 2 OF 4)

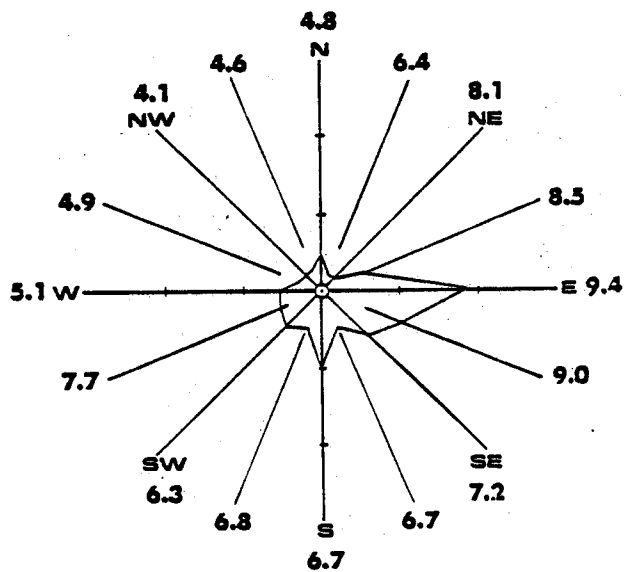
SOURCE: NOAA, 1974.

**AVERAGE MONTHLY AND ANNUAL WIND ROSES
FOR MIAMI, FLORIDA
1969-1974**

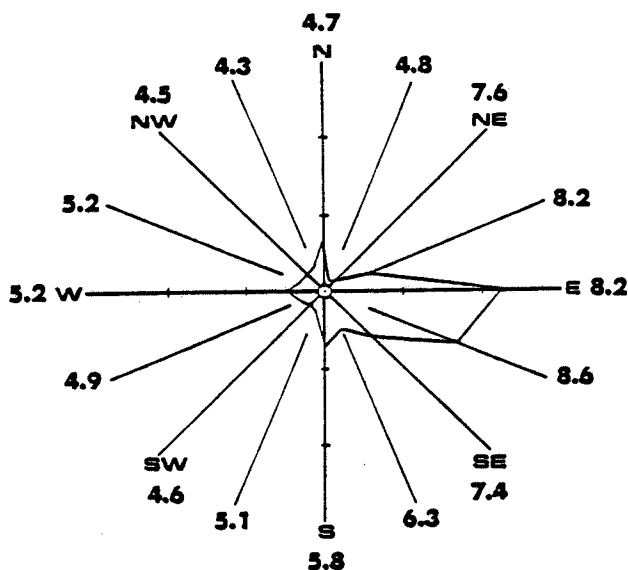
FIGURE 2.3.7.1
(Continued)



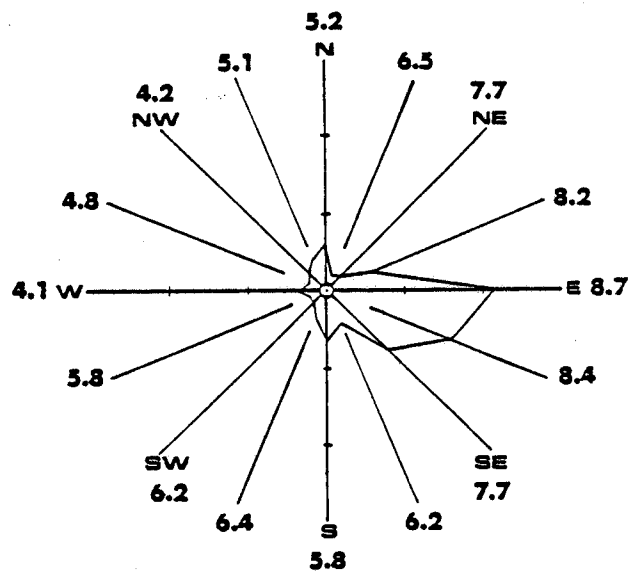
MAY
CALM - 0.7%



JUNE
CALM - 2.4%



JULY
CALM - 2.6%



AUGUST
CALM - 2.7%

NOTE: SCALE IS MARKED IN INCREMENTS OF 10 PERCENT.
AVERAGE SPEEDS ARE GIVEN IN KNOTS

(PAGE 3 OF 4)

SOURCE: NOAA, 1974.

**AVERAGE MONTHLY AND ANNUAL WIND ROSES
FOR MIAMI, FLORIDA
1969-1974**

TABLE 2.3.7.6

AMBIENT AIR MONITORING SITES IN BROWARD COUNTY DURING 1983

SAROAD No.	Broward County No. or Operator	Location		Pollutant Measured	Location with Respect to			
		City/Division	UTM, X,Y Coordinates (km)		North Facility		South Facility	
					Direc- tion (°)	Distance (km)	Direct- tion (°)	Distance (km)
3700003G01	1	Pompano Beach	590.17, 2908.00	TSP, Pb	62	7.0	23	26.8
3700002G01	3	Pompano Beach	587.85, 2902.79	TSP	117	4.3	23	21.1
2270001G01/09	4	Lauderdale Lakes	579.55, 2804.87	TSP, NO ₂ , SO ₂ , CO	204	10.9	360	11.4
3640002G01	5	Plantation	575.52, 2891.27	TSP	212	15.9	334	9.4
1260003G01	6	Ft. Lauderdale	583.11, 2890.09	TSP, NO ₂ , SO ₂ , CO, Pb	183	14.7	27	7.6
4350001G01	7	Tamarac	574.44, 2897.87	TSP	234	11.8	340	15.4
0910002G01	8	Davie	576.19, 2884.99	TSP, NO ₂ SO ₂	202	21.1	296	3.81
3530001G01	9	Pembroke Pines	575.26, 2877.44	NO ₂ , SO ₂	198	28.7	216	7.3
1840001G01	10	Hollywood	582.21, 2876.98	TSP, Pb	184	27.8	158	6.9
1640001G01	11	Hallandale	584.60, 2874.44	TSP	179	30.3	151	10.2
1260004G01/09	12	Ft. Lauderdale	585.20, 2887.20	TSP, NO ₂ , SO ₂	176	17.6	55	6.8
0420002G01	13	Hacienda Village	579.70, 2885.34	CO	192	19.9	3	2.0
0420003G03	14	Coral Springs	571.60, 2906.88	O ₃	280	12.6	341	24.9
3530002G01/09	15	Pembroke Pines	570.00, 2878.40	TSP	208	29.8	297	10.8

TABLE 2.3.7.6 (continued)

AMBIENT AIR MONITORING SITES IN BROWARD COUNTY DURING 1983

SAROAD No.	Broward County No. or Operator	Location		Pollutant Measured	Location with Respect to			
		City/Division	UTM, X,Y Coordinates (km)		North Facility		South Facility	
					Direc- tion (°)	Distance (km)	Direct- tion (°)	Distance (km)
0420004G01	16	N. Lauderdale	577.73, 2900.11	O ₃	234	7.8	354	16.9
3700004G01	17	Pompano Beach	585.34, 2900.13	CO	164	4.8	19	17.8
1840002G01	18	Hollywood	584.00, 2875.87	CO	180	28.9	150	8.6
2560002G01	19	Margate	578.86, 2903.51	TSP, Pb	257	5.3	358	20.2
1260005J02	FP&L	Ft. Lauderdale	579.28, 2882.35	TSP, NO ₂ , SO ₂	192	22.9	199	1.0
1260005J02	FP&L	Ft. Lauderdale	583.05, 2883.85	TSP, NO ₂ , SO ₂	183	20.9	81	3.5
1260007J02	FP&L	Ft. Lauderdale	589.10, 2886.85	TSP, NO ₂ , SO ₂	164	18.6	70	10.1

Source: ESE, 1985.

TABLE 2.3.7.7

1983 AMBIENT AIR QUALITY DATA FOR MONITORING STATIONS WITHIN
10 KM OF THE PROPOSED FACILITY

Broward County No. or Operator	SAROAD No.	Concentration ($\mu\text{g}/\text{m}^3$)*							
		TSP		SO ₂		NO ₂	CO†		Pb
		24-hr	Annual	24-hr	Annual	Annual	1-hr	8-hr	Quarter
5	3640002G01	84	31	-	-	-	-	-	-
6	1260003G01	115	59	11	3	48	18	9	0.7
8	0910002G01	76	33	21	9	31	-	-	-
9	3530001G01	-	-	6	3	34	-	-	-
10	1840001G01	95	45	-	-	-	-	-	0.3**
12	1260004G01	93	39	29	5	35	-	-	-
13	0420002G01	-	-	-	-	-	21**	10**	-
18	1840002G01	-	-	-	-	-	9	7	-
FP&L	1260005J02	95**	42**	19**	5**	38**	-	-	-
FP&L	1260007J02	88	36	19	5	25	-	-	-
Florida AAWS		150	60	260	60	100	30	10	1.5

*For short-term averages, second-highest concentration is shown.

†100 concentrations in mg/m^3 .

**Closest monitoring station for specified pollutant.

Source: ESE, 1985.

The only measured pollutant that approached AAQS in 1983 was CO. Within a 10-km radius of the proposed facility, the highest and second-highest 8-hour average CO concentrations equalled the 8-hour AAQS at one monitor location (i.e., Broward County Site No. 13). Based on data received through September 1983 from DER and Broward County Environmental Quality Control Board (EQCB), the highest and second-highest 8-hour average concentrations measured at Broward County Site No. 13 in 1984 were 10 and 9 mg/m³, respectively. Thus, the second-highest concentration at this site is slightly less than the AAQS of 10 ug/m³.

2.3.7.3 Measurement Programs

All information (i.e., meteorology and air quality data) was compiled from off-site monitoring stations maintained and operating by cooperating governmental agencies. Ambient air quality data were obtained from the Broward County EQCB and FP&L which operate a total of 21 monitoring stations throughout the County. No significant changes in these programs are anticipated after plant operation has begun.

Meteorological data were obtained from the NWS station in Miami. These include both surface- and upper-air data from which a 6-year (i.e., 1969 through 1974) average of the joint frequency of wind direction, wind speed, and atmospheric stability and a 5-year (i.e., 1960 through 1964) average of mixing heights were developed. Since 1957, the observing NWS station at Miami has been located 7 feet above mean sea level with wind sensors located 23 feet above grade. Regular service observations are taken just before each hour, 7 days per week. Upper-air soundings are conducted twice per day at 0700 and 1900 Eastern Standard Time.

The EPA- and DER-approved Industrial Source Complex Short-Term (ISCST) model were used to predict the maximum air quality impacts due to the proposed plant. The ISCST model is an extended version of the single-source CRSTER model. The

ISCST model is designed to calculate hourly concentrations based on hourly meteorological parameters. The hourly concentrations are processed into non-overlapping short-term (e.g., 3- and 24-hour) average periods and then summed and averaged to produce annual average concentrations. Because the impacts from the proposed plant were low and generally less than the PSD significant impact levels, only emissions from the proposed plant were considered in the air quality modeling analysis.

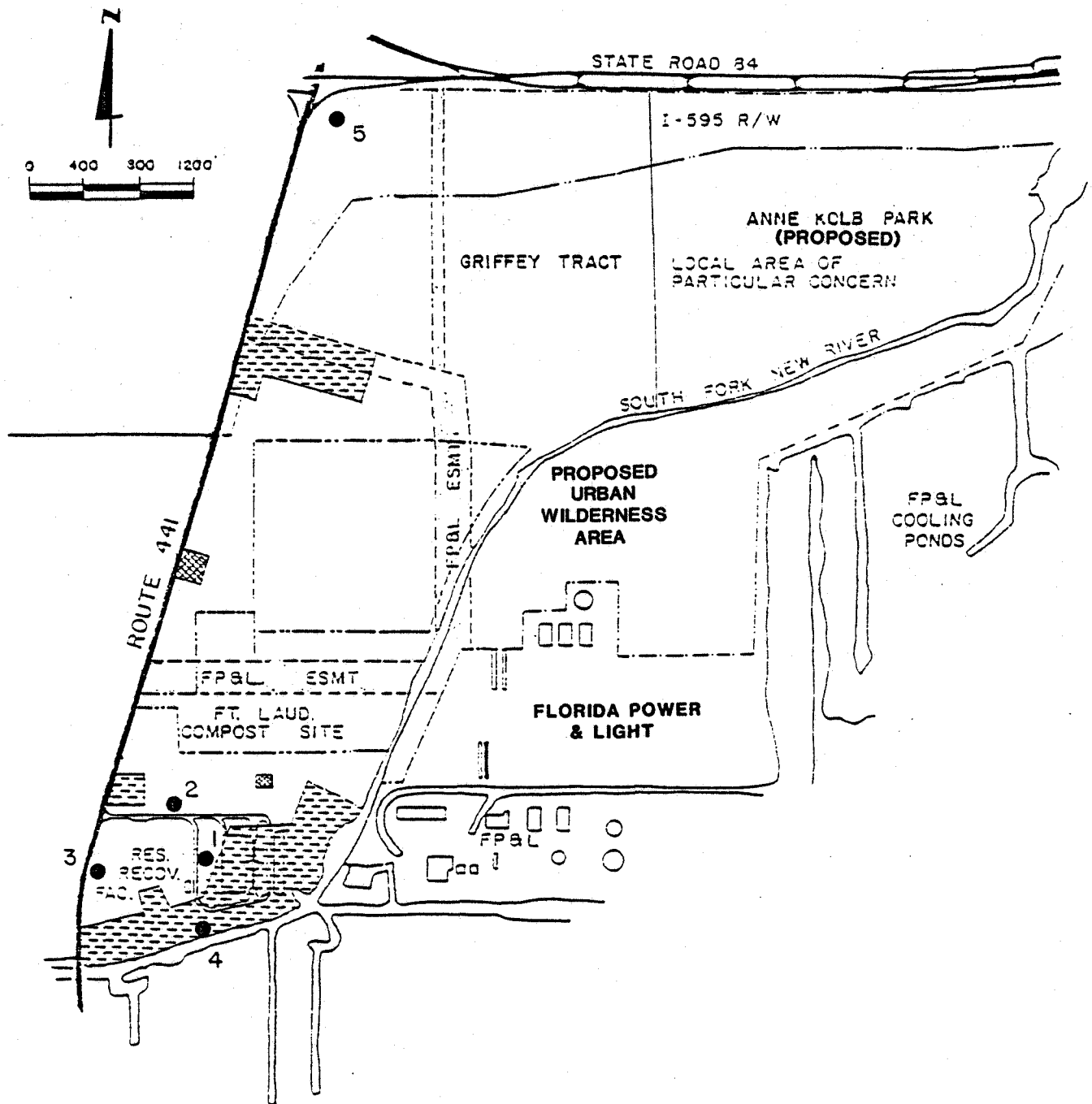
2.3.8 Noise

A technical noise analysis was performed for this application and is contained in Appendix 10.10. Existing ambient source levels were measured at five different locations around the perimeter of the site in order to establish baseline conditions during day and night-time periods. These locations are shown on Figure 2.3.8.1. Site 1 is on the east side along the road to Powell Brothers Construction Company. Site 2 is on the north side on Powell Road midway between Route 441 and the east side line. Site 3 is on the west side along Route 441. Site 4 is on the south side along the woods adjacent to the canal and is closest to a residential area. Site 5 is located at the intersection of Route 441 and State Road 84.

The average noise levels at each of the five sites are presented in Table 2.3.8.1. These levels are in decibels (dB(A)). The higher the decibel level the lower the sound. A change of ten times the energy level of the sound is presented as a 10 dB(A) change in the sound scale.

The average noise levels of 50-55 dB(A) are below or at the standards set forth in the Broward County Code of Regulations for residential zoning. Residential zoning is the most stringent sound level limit at 55 dB(A). Therefore, the ambient noise levels do not exceed the County sound level limits.

FIGURE 2.3.8.1



LEGEND

-  BUSINESS
-  UTILITY EASEMENT
-  RESIDENCE

BROWARD COUNTY
RESOURCE RECOVERY PROJECT
AMBIENT NOISE READING LOCATIONS

2.3.9 Other Environmental Features

Information pertaining to the resource recovery and associated facilities, located in Broward County at the Route 441 site, has been completely addressed in the scope of the preceding topics. Therefore, all of the environmental features of the proposed facility have been addressed.

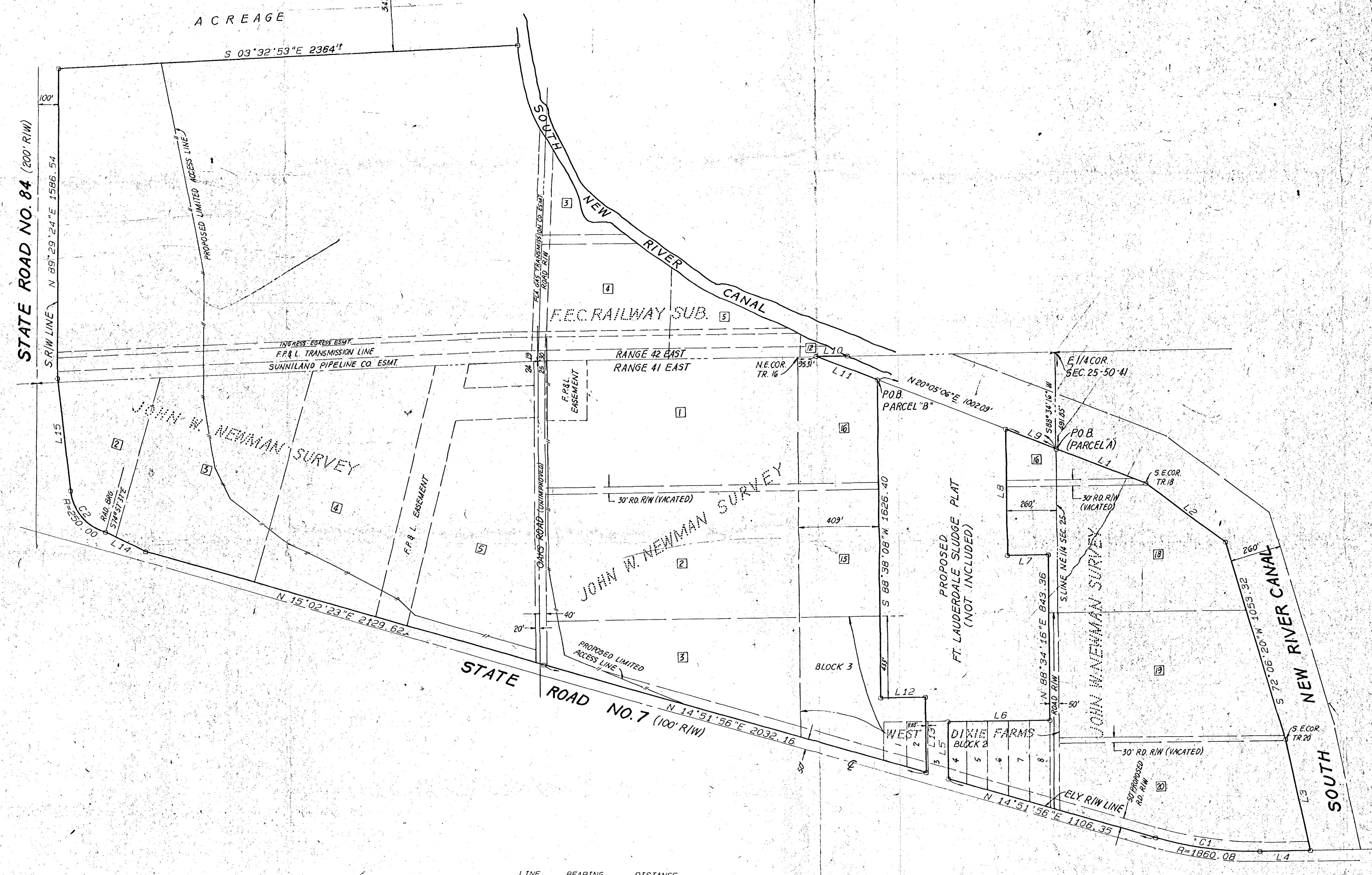
TABLE 2.3.8.1
AVERAGE AMBIENT NOISE READINGS
February 23, 1984

<u>Site</u>	<u>Time</u>	<u>Average (dB(A))</u>
1	2:30 PM	55
	9:00 PM	52
2	2:30 PM	55
	9:00 PM	51
3	2:30 PM	55*
	9:00 PM	52.5
4	2:30 PM	51
	9:00 PM	53
5	2:30 PM	55*
	9:00 PM	53

*85 dB(A) with heavy constant vehicular and truck traffic.

Note: In all locations, low flying commercial aircraft gave readings from 70 dB(A) to 85 dB(A).

SCALE: 1"=300'



LINE	BEARING	DISTANCE	
1	S 20°05'08"W	492.28	
2	S 35°44'42"W	509.13	
3	S 76°30'24"W	580.87	
4	N 01°51'23"W	259.23	
5	N 88°34'16"E	291.76	
6	S 01°42'40"E	524.08	
7	N 01°42'40"W	210.00	
8	N 88°34'18"E	648.41	
9	S 20°05'08"W	279.47	
10	N 01°46'20"W	161.16	
11	S 20°05'08"W	337.03	
12	S 01°42'50"E	229.64	
13	S 88°34'18"W	385.00	
14	N 25°51'47"E	227.77	
15	N 82°30'21"E	576.89	
CURVE	DELTA	RADIUS	ARC
1	16°43'20"	1860.08	542.88
2	67°27'58"	250.00	294.38

PARCEL "A":
A parcel of land lying within the East One (1/4) of Section 25, Township 50 South, Range 41 East, being all of Tracts 19 and 19 and a portion of Tracts 15, 16 and 20 of the John W. Newman Survey as recorded in Plat Book 2, Page 26 of the Public Records of Dade County, Florida, together with all of Tracts 4 through 8, inclusive of Block 2, West Dixie Farms as recorded in Plat Book 24, Page 34 of the Public Records of Dade County, Florida, being more particularly described as follows:

Beginning at the corner of 1/4th corner of said Section 25, thence South 88°34'16" West along the South line of the Newman Survey (written as 1/4th) of said Section 25, a distance of 492.28 feet to the westerly boundary of aforesaid Tract 16, thence north 01°42'40" East along said easterly boundary, 1002.02 feet to the point of beginning thence South 88°34'16" West along a line 1002.02 feet South of and parallel with the North line of said Tract 16, and aforesaid Tract 15 and West Dixie Farms, 1626.40 feet thence South 01°42'40" East along a line 413.00 feet West of and parallel with the East boundary of said West Dixie Farms 329.13 feet thence South 35°44'42" West along a line 8.83 feet North of and parallel with the West line of lot 1 of aforesaid Block 2, a distance of 365.00 feet to the easterly right-of-way line of State Road No. 7 (100' wide right-of-way) thence North 14°51'56" East along said right-of-way line 2,032.16 feet thence continuing along said right-of-way line North 15°02'23" East 2129.62 feet thence North 25°51'47" East along the easterly right-of-way line of the Florida Turnpike access road, 227.77 feet to a point on the arc of a constant curve (radial line thence 344 points thence South 16°57'37" West thence North 88°34'18" West thence North 25°51'47" East along the arc of said curve to the northeast corner of the 250.00 foot wide right-of-way of State Road No. 7, a distance of 294.38 feet thence North 16°43'20" East along said right-of-way line North 25°51'47" East 279.47 feet thence North 01°46'20" West along the South line of said right-of-way line for State Road No. 84 (200' wide right-of-way) 1860.08 feet thence South 01°42'50" East along a line 175.00 feet West of and parallel with the 100' wide right-of-way line of said Section 25, a distance of 27.164 feet more or less to the easterly corner of the South New River Canal thence North 01°42'50" East and easterly along the northern and westerly corners of the said South New River Canal to a point of intersection with the East line of aforesaid Tract 41 feet thence North 01°46'20" West along said East boundary 161.16 feet more or less to a point 45.31 feet South of the North corner of aforesaid Tract 16, thence South 20°05'08" West along the easterly boundary of said Tract 16, a distance of 317.04 feet to the point of beginning.

1/4th Parcel "B" within Brown County, Florida, containing 32.43 acres more or less.

Subject to rights of Easement and Easements of Record.

PARCEL "B":
A parcel of land lying within Sections 4 and 25, Township 50 South, Range 41 East, being all of Tracts 19 and 19 and a portion of Tracts 15, 16 and 20 of the John W. Newman Survey as recorded in Plat Book 2, Page 26 of the Public Records of Dade County, Florida, together with all of Tracts 4 through 8, inclusive of Block 2, West Dixie Farms as recorded in Plat Book 24, Page 34 of the Public Records of Dade County, Florida, and a portion of Tracts 3, 4 and 5 of the Florida West Coast Railway Subdivision as recorded in Plat Book 24, Page 142 of the Public Records of Dade County, Florida, being more particularly described as follows:

Beginning at the East corner of 1/4th corner of said Section 25, thence South 88°34'16" West along the South line of the Newman Survey (written as 1/4th) of said Section 25, a distance of 492.28 feet to the westerly boundary of aforesaid Tract 16, thence North 01°42'40" East along said easterly boundary, 1002.02 feet to the point of beginning thence South 88°34'16" West along a line 1002.02 feet South of and parallel with the North line of said Tract 16, and aforesaid Tract 15 and West Dixie Farms, 1626.40 feet thence South 01°42'40" East along a line 413.00 feet West of and parallel with the East boundary of said West Dixie Farms 329.13 feet thence South 35°44'42" West along a line 8.83 feet North of and parallel with the West line of lot 1 of aforesaid Block 2, a distance of 365.00 feet to the easterly right-of-way line of State Road No. 7 (100' wide right-of-way) thence North 14°51'56" East along said right-of-way line 2,032.16 feet thence continuing along said right-of-way line North 15°02'23" East 2129.62 feet thence North 25°51'47" East along the easterly right-of-way line of the Florida Turnpike access road, 227.77 feet to a point on the arc of a constant curve (radial line thence 344 points thence South 16°57'37" West thence North 88°34'18" West thence North 25°51'47" East along the arc of said curve to the northeast corner of the 250.00 foot wide right-of-way of State Road No. 7, a distance of 294.38 feet thence North 16°43'20" East along said right-of-way line North 25°51'47" East 279.47 feet thence North 01°46'20" West along the South line of said right-of-way line for State Road No. 84 (200' wide right-of-way) 1860.08 feet thence South 01°42'50" East along a line 175.00 feet West of and parallel with the 100' wide right-of-way line of said Section 25, a distance of 27.164 feet more or less to the easterly corner of the South New River Canal thence North 01°42'50" East and easterly along the northern and westerly corners of the said South New River Canal to a point of intersection with the East line of aforesaid Tract 41 feet thence North 01°46'20" West along said East boundary 161.16 feet more or less to a point 45.31 feet South of the North corner of aforesaid Tract 16, thence South 20°05'08" West along the easterly boundary of said Tract 16, a distance of 317.04 feet to the point of beginning.

1/4th Parcel "B" within Brown County, Florida, containing 32.43 acres more or less.

Subject to rights of Easement and Easements of Record.

REVISIONS		DATE 6/15/83	
		SCALE 1"=300'	
		FIELD BOOK N.A.	
		OWN. BY K.H.	
		CKD. BY L.A.H.	
		SHEET NO. 1 OF 1	
		DWN. NO. 105750	
SKETCH OF DESCRIPTION OF THE PROPOSED STATE ROAD NO. 7 LANDFILL SITE			
BROWARD COUNTY		FLORIDA	
KEITH AND SCHNARS, P.A. ENGINEERS - PLANNERS - SURVEYORS			
FT. LAUDERDALE, FL. (904) 783-3343		DEERFIELD BEACH, FL. (407) 481-0888	
GAINESVILLE, FL. (804) 372-3301		OCALA, FL. (804) 688-7182	

No.	DATE	SOLID WASTE PERMIT	ISSUED FOR	P.E.R.	BY
1	12-8-83	SOLID WASTE PERMIT	ISSUED FOR	P.E.R.	BY

THE PLANT AND DIRECTLY ASSOCIATED FACILITIES

SECTION 3
THE PLANT AND DIRECTLY ASSOCIATED FACILITIES

3.1 Background

3.1.1 Technology Selection

As previously mentioned in Section 1, a policy decision was made by Broward County not to rely on landfill as a primary long-term disposal solution, and to concentrate on alternatives that involve the recovery of materials and/or energy. The decision to build a resource recovery (waste-to-energy) system comes after years of investigation by the County into other methods for waste disposal. These investigations have included the evaluation of the following technologies:

- o Materials Recovery
- o Composting
- o Energy Recovery
 - Solid, Gaseous and Liquid Refuse Derived Fuel (RDF) Combustion Systems
 - Mass Burning Incineration

The following subsections summarize the evaluation results with respect to each of the above listed technologies.

Materials Recovery

Materials recovery encompasses methods and procedures for extracting useful materials from solid waste for return to the economy. It generally involves the mechanical separation of the solid waste constituents through use of the following equipment:

- o Size Reduction Equipment
(shredders, crushers, shear mills, etc.)
- o Air Classifiers
(rotary drums, air knives, horizontal air separators, etc.)

- o Trommel Screens
- o Magnetic Separators
- o Glass and Aluminum Separators
(heavy media separators, aluminum magnets, froth flotation units, optical sorters, etc.)
- o Miscellaneous Separation Processes
(vibrating screens, hand sorting, etc.)

The abrasive heterogenous nature of solid waste makes it difficult to handle, and can subject the above listed mechanical equipment to excessive wear. The potential for explosions also exists. In addition, the current marketability of recovered solid waste materials is not sufficient to offset the high capital, operating and maintenance cost requirements of materials recovery systems where constructed exclusively for that purpose.

Composting

Composting is the decomposition of organic material by the action of aerobic microorganisms at temperatures in excess of 60°C. The basic concept of composting, whereby organic wastes are converted to stable humus, theoretically free of pathogens and suitable for return to the environment, appears to be attractive. This concept indicates that compost product may provide a useful resource for Broward County soils.

In the United States, the composting of sewage sludge and/or vegetative matter has attained a certain degree of success. The composting of solid waste, however, has experienced numerous difficulties. At present, there are only four solid waste composting facilities operating in the United States, and two of these add sludge to the solid waste prior to the composting process. All four facilities are operating at a capacity substantially less than that required for Broward County, and three of them have been unable to develop long term market arrangements for their final compost product.

In addition, the preprocessing of solid waste required to perform the compost process involves operation and maintenance problems similar to those encountered with material recovery systems (jamming, blockage and explosions in the equipment process train).

As a result of the above observations, in particular the fact that solid waste composting has never been demonstrated in the United States on a scale comparable to Broward County, this technology was deemed inappropriate for Broward County.

Energy Recovery

Energy recovery from solid waste can have many forms, including generation of useful energy by directly incinerating as-received, unprepared solid waste in furnaces equipped with boilers (mass burning incineration) and conversion of solid waste to various types of Refuse Derived Fuels (RDF) which in turn can be fired in furnaces equipped with boilers (RDF combustion).

RDF Combustion Systems - These systems involve the physical or biological processing of solid waste to produce a solid, liquid or gaseous fuel which can subsequently be used in boilers or furnaces.

RDF can be produced in a solid, liquid, or gaseous form depending upon the method utilized to process the raw solid waste. Shredding, air classification and/or screening can be utilized to produce a solid RDF which can be incinerated as is or densified into briquets or pellets. Processes such as pyrolysis (heating in an oxygen deficient atmosphere) or anaerobic digestion can transform the organic fraction of solid waste into a gaseous or liquid fuel.

There have been a number of solid RDF systems introduced in the 1970's that have failed as a result of both technological and economic reasons. Most of these systems experienced serious problems with solid waste shredding operations, vari-

ous steps of materials separation and storage of the RDF. In addition, the RDF produced at these facilities has not been of a sufficient quality to enable successful marketing of the product. These problems have not been totally resolved to date and, therefore, represent a major setback to the successful demonstration of any full-scale municipal RDF operation.

Gaseous or liquid RDF systems generally involve solid waste processing equipment similar to that required for solid RDF systems. This equipment is subject to the same operational problems of excessive wear and explosion potential as previously discussed under solid RDF systems. In addition, gaseous and liquid RDF technology is more complex, and requires substantially higher capital costs. Although numerous processes have been developed in laboratory studies and pilot plants, none have been operational on a scale appropriate to Broward County.

Mass Burning Incineration - This technology involves the recovery of steam and/or electricity through utilization of convection (waste heat) or radiation (waterwall) boilers. These systems can consist of large field erected incinerators, or be constructed with a series of modular prefabricated incineration units.

Mass burning incineration of unprocessed solid waste, combined with heat recovery is currently the most developed and widely practiced resource recovery technique in the world. Efficient energy recovery, reduction of original waste volume and quality of ash residue are among the major assets of this technology. There are numerous mass burning stoker-fired incineration facilities in the United States, Canada, Europe and Japan that have successfully demonstrated this technology. Additional advantages of this technology include:

- o Relatively high systems on-line reliability
- o High thermodynamic efficiency

- o Available in proprietary and non-proprietary system designs
- o High volume reduction (10 percent) of input solid waste to be landfilled as ash residue
- o Marketable energy products
- o Adaptable to sewage sludge disposal

Modular Prefabricated Incinerators - Recent developments have occurred in the field of mass burning modular prefabricated incinerators. There are numerous domestic manufacturers that currently market various modular incineration systems based upon differing combustion processes. These systems require significantly less capital expenditures than the aforementioned field erected stoker-fired systems. These systems, however, have been operational only since 1977 and the majority of the operating facilities have capacities less than 100 tons per day. At present, there are no operating modular incineration systems with capacity greater than 360 tons per day nor are these facilities producing electricity.

The technical feasibility of modular incineration has therefore not been demonstrated for the capacity required for a Broward County facility. Since only proven technologies were contemplated for Broward County, modular mass burning incinerators were eliminated from further consideration.

Mass Burning Stoker-Fired Incineration Systems - This type of technology wherein waste is incinerated on stokers or grate systems in large furnace/boilers appear to represent the most viable technology available to Broward County for implementation under the proposed project. The major reasons for this recommendation are:

- o Mass burning systems firing as-received solid waste, rank the highest in technological development and demonstrated performance.

- o Mass burning systems firing as-received solid waste, rank the highest in demonstrated reliability.
- o Mass burning systems can generate either steam or electricity which is highly marketable.
- o Capital and operating and maintenance costs associated with mass burning systems are competitive with alternative solid waste processing systems.
- o To date, mass burning constitutes the only resource recovery system operating successfully at a scale similar to Broward County.

As a result, this technology was selected by Broward County for use in implementing its resource recovery project.

3.1.2 Site Selection

Details with regard to the site selection process are presented in Section 8.1, Alternative Site. Presented below are the salient aspects of that process. The first step involved the identification of five landfill sites and three resource recovery facility sites for more detailed evaluation. The criteria used to select these sites included: general location, jurisdiction, size, existing zoning, land use designation and existing land use.

The identified sites were then evaluated by Malcolm Pirnie, Inc. to assess and compare:

- o Site adequacy
- o Required transport costs
- o Acquisition and development costs
- o Access and adequacy
- o Potential air and water quality impacts
- o Wetland impacts
- o Adjacent land use

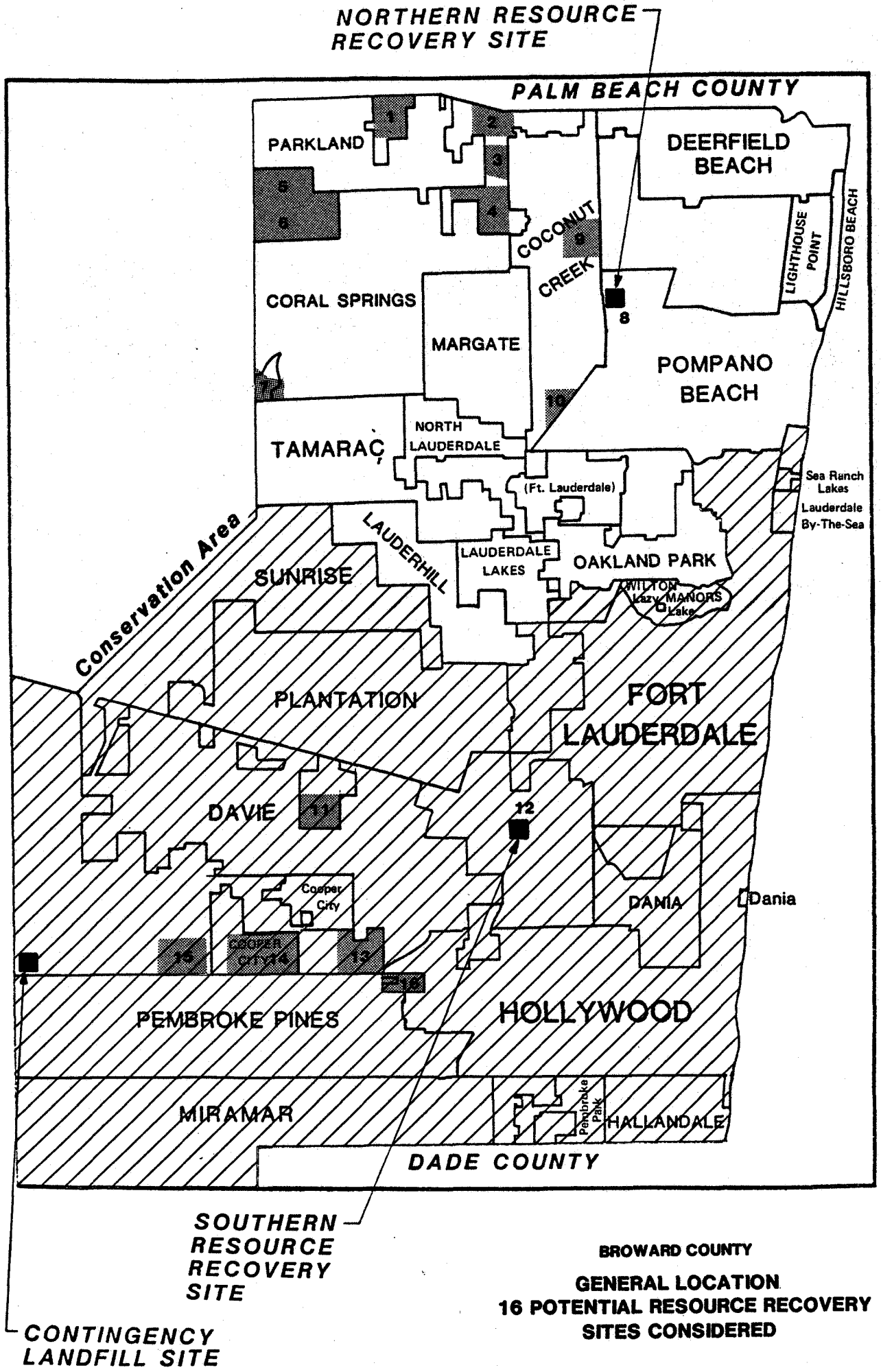
- o Zoning and land use plans
- o Traffic impacts
- o Conformance with regulations
- o Permitting approval probability

The results of this evaluation were summarized in a March, 1982 report which recommended the proposed Route 441 site for development of a resource recovery facility to serve the southern region of the County.

As mentioned in Section 8.1, verification of the results of this initial study and supplemental investigations were undertaken by the Broward County Office of Planning, which involved the identification of major undeveloped areas in the County through a review of current aerial photographs. This resulted in the identification of 97 potential sites which were assessed based upon: development status, location with respect to municipal jurisdictions, size, development of regional impact status and presence of large waterbodies. Sixteen potential sites met this criteria and were further evaluated by County staff and Malcolm Pirnie. Figure 3.1.2.1 presents the general location of the sixteen sites considered.

The County in late 1982 added the requirement of a residue/unprocessable waste landfill adjacent to the resource recovery facility and decided to re-evaluate the top three ranked southern sites. In early 1983, an analysis of the technical, environmental and regulatory aspects associated with each of the sites was undertaken. The purpose of the analysis was to rank the sites according to their acceptability for the development of the southern full service disposal project. The three sites evaluated were:

- o Broward Correctional Institute (BCI) - This site represents the area surrounding the State of Florida Woman's Correctional Institute located between



Stirling Road and Sheridan Street near U.S. 27 in West Broward.

- o Davie - This site is located adjacent to the existing Broward County Sanitary landfill at the northwest intersection of Orange Drive and Shotgun Road.
- o Route 441 - This site is located at the southeast intersection of U.S. Route 441 and State Road 84.

The results of this evaluation indicated that the Route 441 site was the most appropriate site for development of the Southern Resource Recovery Facility. Subsequent developments concerning the second ranked Davie site indicated that as a result of legal complications, the site was unacceptable for development as a resource recovery facility. These legal complications involve the uncertainty of the jurisdictional location of the Davie site. The Town of Davie, in opposition to the potential siting of the resource recovery project, alleged that the site had been annexed within the Town of Davie boundaries. Development at this site would therefore require the rezoning approval of the Town of Davie. The County concluded that the time required to complete the legal process would delay the project beyond the exhaustion of the County's current waste disposal capabilities. A legal opinion provided by the County Office of General Counsel concerning this situation is attached as Appendix 10.2.

The third site, an area adjacent to the Broward Correctional Institute, has been selected as a sanitary landfill for interim disposal during the period when the existing County landfill at Davie has exhausted its capacity and the southern resource recovery facility has not yet become operational, and for contingency disposal during periods when the southern resource recovery facility may not be operating at full capacity. Landfill design drawings and specifications are cur-

rently being prepared for site development that will satisfy the County's interim disposal and contingency disposal needs for the 20 year project planning period.

In addition, contingency disposal capability is anticipated to be available landfill capacity, current waste projections, and the current schedule for implementation of both the northern and southern resource recovery facilities.

3.1.3 Vendor Procurement

On October 12, 1982, the County authorized the procurement process for a full service vendor to provide waste disposal capability including the design, construction, start-up and operation of two mass burn resource recovery facilities, one in northern and one in southern Broward, each with an accompanying residue/unprocessable waste disposal landfill. A Prequalification of Proposers document, Request for Qualifications (RFQ) was issued on February 1, 1983 requesting information regarding the technical, managerial and financial qualifications of full service vendors interested in participating in the project. Responses from potential vendors were due March 14, 1983. Ten (10) firms submitted qualification statements for review. An evaluation of the responses was completed and the results documented in a Engineer's Report entitled "Evaluation of Contractor Qualifications, Full Service Resource Recovery Project." The evaluation concluded and the County Board of Commissioners approved in April 1983 the prequalification of the following three vendors: Browning-Ferris Industries, Inc., Signal RESCO, Inc., and Waste Management, Inc.. These three vendors were thus found eligible to submit detailed proposals in response to a Request for Proposals (RFP) to be drafted by the County. Subsequently, Browning-Ferris Industries, Inc. (BFI) agreed to market waste processing services jointly with Air Products and Chemicals, Inc. under the name American Ref-Fuel Company.

An RFP was issued in September 1983, and proposals were received in January 1984 from Waste Management, Inc. and Signal RESCO; American Ref-Fuel elected not to respond to the RFP. In June 1984, the Broward County Board of Commissioners rejected the proposals as being non-responsive and instructed the County staff and consultants to revise the RFP to reflect current conditions and reissue it to the three prequalified vendors.

The RFP was revised such that the sizing of the facilities were increased to meet solid waste disposal requirements into the early 1990's, and the County had the flexibility to award separate contracts for the northern and southern facilities, thereby enabling southern facility development unaffected by the status of the northern site. Proposals were received on November 16, 1984 on the proposed southern facility from American Ref-Fuel and Signal RESCO. These proposals are currently being evaluated by County staff and consultants. It is anticipated that a Vendor will be selected for this project during June, 1985.

3.2 Site Layout

The facility is slated to have an initial maximum installed capacity of 2,352 tons per day and an estimated projected ultimate capacity of approximately 3,300 tons per day. Since the proposed facility will utilize mass-burn technology, there will be no preprocessing of wastes at the facility prior to combustion. A schematic diagram describing the mass burn process of a typical resource recovery facility is presented in Figure 3.2.1. Solid waste will be delivered in collection trucks to the facility. It will be dumped directly into a bunker located entirely inside the main facility building. All waste will be stored inside the building, therefore no waste will be visible from the outside. Two overhead cranes will mix the solid waste in the bunker and load the charging hoppers as required.

Waste will enter the furnace via a charging hopper and will progress through the combustion chamber by means of a stoker system that agitates the waste providing the proper air/fuel mixture to complete the combustion process. The resulting ash will be quenched, and the heat from the furnace will be transferred through waterfilled steel tubes lining the furnace to produce steam. The steam will then be transmitted to turbine generators to produce electricity for internal use and sale to Florida Power and Light Company.

Each boiler will be equipped with an electrostatic precipitator (ESP) for particulate air emission control. An electrostatic precipitator is a pollution control device that removes small particles from exhaust gases. The gases pass through a strong electric field where the particles are charged and attracted to the opposite electrically charged collecting plates. The dust is then removed mechanically from these plates. The flue gas will be drawn through the ESPs by an induced draft fan located between the stack and the ESPs.

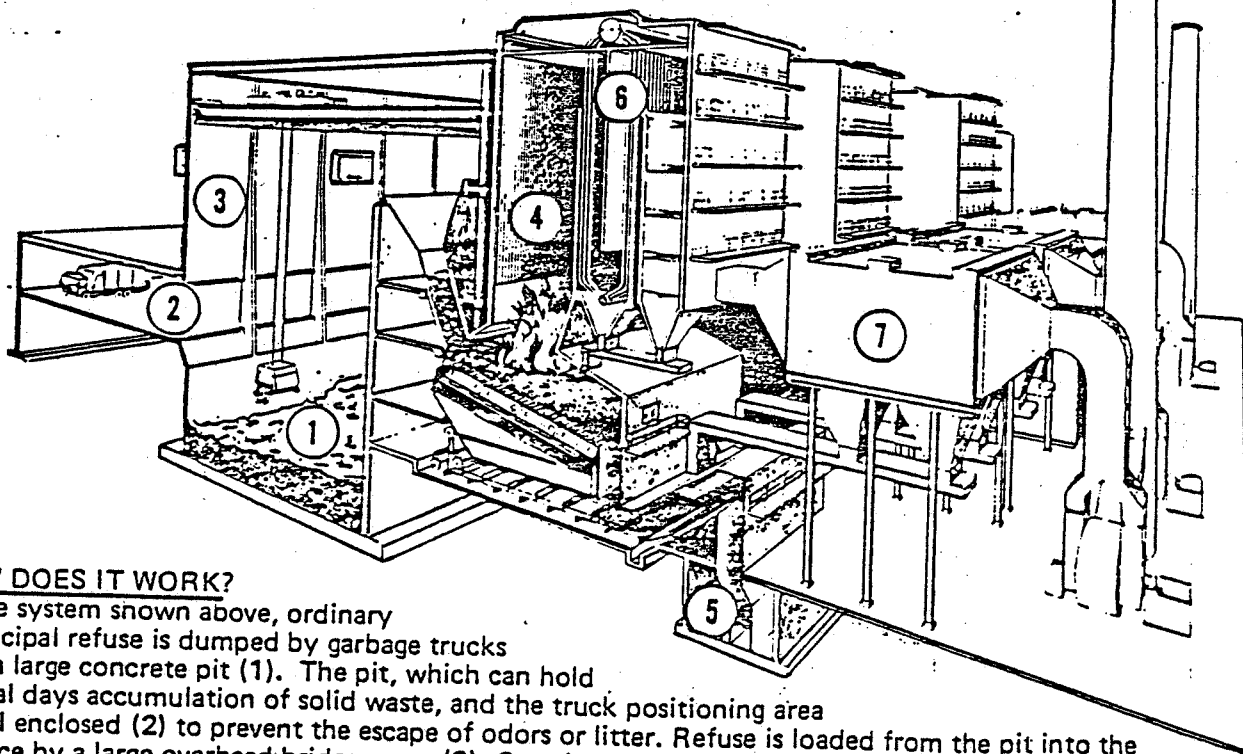
Bottom ash from the furnace and flyash from the precipitator will be mixed prior to removal from the facility. The combined ash will comprise 10 percent of the volume and 25 percent of the weight of the solid waste processed by the facility. The ash will be quenched with water to about 30 percent moisture prior to transport to the unprocessable waste landfill.

As noted above, while the proposed facility will have ultimate design capacity of approximately 3,300 tpd and four boiler units, its maximum initial installed capacity will be 2,352 tpd and three boiler units. Each boiler unit operates independently from the others. It will, therefore, be possible to routinely shut down units for periods of maintenance and inspection and still continuously operate the facility.

Questions & Answers

Broward County RESOURCE RECOVERY PROGRAM

WHAT IS RESOURCE RECOVERY? It is a solid waste disposal method producing inert residue while recovering useful energy and/or materials. The resource recovery process chosen by Broward County is called mass-fired waterwall incineration.



HOW DOES IT WORK?

In the system shown above, ordinary municipal refuse is dumped by garbage trucks into a large concrete pit (1). The pit, which can hold several days accumulation of solid waste, and the truck positioning area are all enclosed (2) to prevent the escape of odors or litter. Refuse is loaded from the pit into the furnace by a large overhead bridge crane (3). Oversized or unprocessable items (engine blocks, tree stumps, concrete rubble, etc.) which accidentally get into the pit can be removed at this point and either sent directly to the landfill, or put through a shredder for size reduction prior to being sent to landfill or sold.

In the furnace (4) the refuse is burned at high temperature and under controlled conditions of air and turbulence. The result is essentially complete destruction of organic material, (paper, plastic, wood, food wastes, etc.) leaving an ash residue (5) which contains the unburnable fraction (glass, metal, ceramics, etc.). This residue has a volume of five to ten percent of the original solid waste, thus lengthening the projected landfill lifetime by a factor of ten to twenty.

Hot gases from the combustion process pass up through the boiler portion (6) of the furnace where the heat is transferred to water-filled steel tubes. This heat is used to generate steam and ultimately electricity.

After passing through the boiler the hot gases pass through electrostatic precipitators (7) which act as giant filters removing the dust particles from the gas stream. The clean gases are then discharged at the stack.

HAS THIS METHOD OF RESOURCE RECOVERY BEEN SUCCESSFUL ELSEWHERE?

Yes. There are over 400 plants of this type in successful operation worldwide, some for as long as 30 years. There are about a dozen in the U. S., including Pinellas County, Florida; Saugus, Mass.; Hampton, Va.; Chicago, Ill.; Harrisburg, Pa.; and others. Several more are under construction.

3.2.1 Resource Recovery Facility

As illustrated on Figure 2.1.2 and described in Section 2, Site and Vicinity Characterization, the resource recovery facility will be developed such that:

- o Left turn, acceleration, and deceleration lanes will exit at the signalized intersection of U.S. Route 441 and ingress road to the facility. The main on-site roadway will provide two-way traffic (east and west).
- o A visitor parking area and administrative building will be located south of the main facility building.
- o Vehicles entering the site will be weighed at the scalehouse/weigh station located between the main facility building and site entrance.
- o A receiving area including an enclosed turning platform, tipping floor, overhead crane, and refuse pit will be located on the west side of the main facility building.
- o The furnace/boilers and auxiliary equipment will be located east of the receiving area.
- o The turbine generator will be located adjacent to the furnace/boilers.
- o The electrostatic precipitators (air pollution control equipment) will be located east of the boilers, adjacent to the ash handling area and directly in front of the plant's stack.
- o The electrical substation necessary to tie into the Florida Power and Light grid system will be located just north of the facility stack.

The following figures and descriptions have been included to provide an overview of the resource recovery facility's operations. The figures are conceptual illustrations depicting the facility from various angles and elevations. The figures were taken from respective vendor proposals and in no way reflect a preference for any one vendor design. Full details of the technical specifications required for facility design are contained in Appendix 10.11.

Figure 3.2.1.1 - General Arrangement Section
(Longitudinal Section)

A cross sectional view of the facility is provided in Figure 3.2.1.1. Refuse packer trucks will enter the reception area from the west side of the facility and dispose of their compacted loads into the refuse storage pit. The clearance from the roof truss to the tipping floor will be approximately 26 feet. The refuse storage pit will have a depth of approximately 45 feet from the tipping floor. Refuse deposited into the pit will be removed by either of two traveling, overhead, 12-ton capacity bridge cranes. Each crane will be equipped with a 7 cubic yard grapple.

The duel crane system enables one crane to feed refuse into the charging hopper while the other crane mixes the waste and removes oversized bulky wastes from the pit.

The charging hopper will accommodate approximately 100 cubic yards of solid waste. There is a hydraulically operated arch-breaker at the throat of the feedhopper to dislodge objects that might interrupt the flow. The approximate elevation of the charging hopper is 90 feet above the refuse pit floor. Refuse placed in the charging hopper is funnelled to a mass burning grate system; a hydraulic ram feeder controls the flow of refuse into the furnace. The furnace boiler and grate system is west of the receiving area and forms the heart of the facility. It is here that potential energy contained in the unprocessed raw refuse is effectively converted to steam for use in the generation of electric power.

The movement of the grate system provides for controlled combustion of the refuse. The ash and inerts are discharged at the end of the grate system and deposited for removal by the ash handling system. Heat generation caused by combustion is transferred to the boiler by water-cooled tubes thereby producing steam. The products of combustion are cleaned in

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[illegible]

electrostatic precipitators located east of the boiler furnaces prior to discharge into the atmosphere through the stack.

The longitudinal section presents three elevation composites for further consideration; Sections "A-A", "B-B", "C-C". Composite "A-A" is a cut of the facility at an elevation that is approximately 18 feet. Composite "B-B" is a cut of the facility at an elevation of approximately 30 feet. Composite "C-C" is an elevation of approximately 70 feet. These composites are presented as Figures 3.2.1.2 through 3.2.1.4 in the following sections.

Figure 3.2.1.2 - Operational Floor Plan "A-A"

A view of the operating floor at approximately elevation 18 feet is provided in Figure 3.2.1.2. This view is identified as Section "A-A" on Figure 3.2.1.1. The turning platform/tipping floor is located on the west side of the facility. The approximate size of the receiving area is 255 feet long and 112 feet wide with a floor to rafter height of approximately 26 feet. The pit will be designed to provide a minimum four days storage capacity or 32,000 cubic yards without exceeding the elevation of the tipping floor. Overall pit dimensions are approximately 75 feet by 255 feet.

At this elevation (approx. 18 ft) we can see, moving east, boiler feed pumps, the logic equipment room, control room, and the turbine generator. Still further east the induced draft system fan and stack are visible.

Figure 3.2.1.3 - Operational Floor Plan "B-B"

A view of the operating floor plan at an elevation of approximately 40 feet is provided on Figure 3.2.1.3 (Section "B-B" on Figure 3.2.1.1). At this elevation, moving east to west, is the receiving area, refuse pit, and ram feeders that move the waste through the furnace. In addition, the waste feed hoppers, boilers, and the electrostatic precipitators (ESP's) are visible.

Figure 3.2.1.4 - Operational Floor Plan "C-C"

A view of the operating floor plan (General Arrangement) at an elevation of approximately 70 feet is provided in Figure 3.2.1.4 (Section "C-C" on Figure 3.2.1.1). In addition to systems previously identified in Figures 3.2.1.2 and 3.2.1.3, the refuse crane and associated rail, crane control cabin, and charging hoppers are visible. Additionally, there is a clear view of the electrostatic precipitators located east of the boilers. As illustrated, the design calls for one stack with multiple flues.

Figure 3.2.1.5 - Turbine Building

The turbine building, will be located on the east side of the facility and is shown in Figure 3.2.1.5.

Figure 3.2.1.6 - Ash Handling System

The interior processes of the ash handling system are presented in Figure 3.2.1.6. Ash is removed from the quench tank by means of a vibrating conveyor system. The conveyor transfers the ash to the ash storage area. Movement of ash through the building is in a westerly direction. Ash is removed from storage by a 40 cubic yard ash truck and transported to the adjacent southern resource recovery residue/unprocessible waste landfill for final disposal.

Figures 3.2.1.7 and 3.2.1.8 - East and North Elevation

Typical east and north elevation views of the facility are provided in Figures 3.2.1.7 and 3.2.1.8, respectively. As these views illustrate, the facility will be designed to provide a pleasing aesthetic appearance.

3.2.2 Ash Residue/Unprocessible Waste Landfill

As illustrated on Figure 2.1.3 and described in Section 2, Site and Vicinity Characterization, the ash/residue unprocessible waste will be such that:

- o Two cell areas will be developed to handle the unprocessible and ash residue waste streams.

17 BAYS @ 15'-0" = 255'-0"

112'-0" 18'-0" 75'-0" 30'-0" 84'-0" 34'-0" 22'-6" 22'-6" 21'-0" 53'-0"

M L K J H E D C B A

TRANSFER HATCH

CRANE RAIL

CRANE

T.O.S. EL. 18'-0" T.O.C. EL. 18'-0"

MCC & LC ROOM

BOILER NO. 1

BURNER

OPEN

LOGIC EQUIPMENT ROOM

CONTROL ROOM

TURBINE GENERATOR

CHIMNEY

1.O. FAN

TO AIR-COOLED CONDENSER

1.O. FAN

1.O. FAN

TRANSFER HATCH

WATER TREATMENT ROOM

ELEV.

REFUSE BUNKER

TIPPING BAY EL. 20'-0"

CLRB

SLOPE

1 2 3 4 5 6 7 8 9 10 11 12 13 14

255'-0"

18'-0" 24'-0" 18'-0" 18'-0" 18'-0" 18'-0" 18'-0" 18'-0" 18'-0" 18'-0" 24'-0" 18'-0" 31'-0"

6'-0" 18'-0" 18'-0" 18'-0" 18'-0" 18'-0" 18'-0" 18'-0" 18'-0" 18'-0" 24'-0" 18'-0" 31'-0"

11'-0"

GENERAL NOTE

1. ARROWS ON STAIRS INDICATE DIRECTION DOWN.

CONCEPTUAL DESIGN

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GENERAL ARRANGEMENT
PLAN @ EL. 18'-0"

BROWARD COUNTY RESOURCE RECOVERY SOUTH FACILITY

REF FUEL

11-00-00

002

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REVISED										REFERENCE DRAWINGS										PRINT RECORD										ENG. RECORD										DRAWING STATUS										GENERAL ARRANGEMENT PLAN @ EL. 18'-0"										BROWARD COUNTY RESOURCE RECOVERY SOUTH FACILITY										SHEET NO. 002										11-00-00																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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GENERAL ARRANGEMENT
PLAN @ EL. 70'-0"

BROWARD COUNTY RESOURCE RECOVERY (SOUTH) FACILITY

146 x 1'-0"  AMERICAN
REF-FUEL

1-00-001

SHEET NO.
004

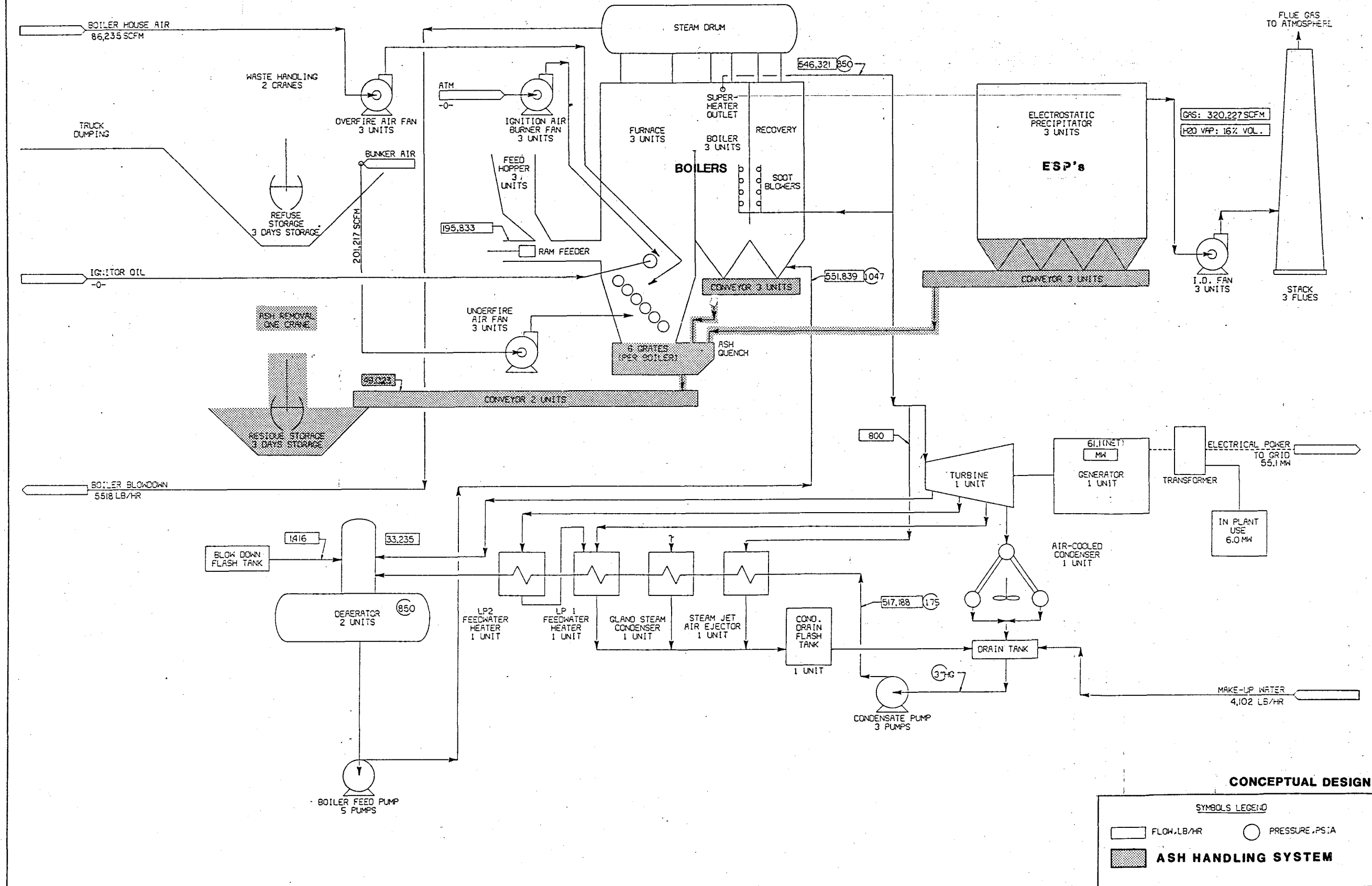


CIVIL
UTILITY PLAN

BROWARD COUNTY RESOURCE (SOUTH) FACILITY

SCALE 1" = 50'	Shearn Carruth
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FIGURE 3.2.1.6



CONCEPTUAL DESIGN

SYMBOLS LEGEND

 FLOW, LB/HR
  PRESSURE, PSIA

 **ASH HANDLING SYSTEM**

NOTES:

1. WASTE HEATING VALUE = 5000 BTU/LB.
2. 3 BOILERS AT FULL THROUGHPUT.

[illegible]

SCALE 1/16" = 1'-0"

[illegible]

SCALE	AS NOTED	DATE
DESIGN BY:	<i>[Signature]</i>	10-22-88
DRAWING BY:	<i>[Signature]</i>	10-22-88
CHECKED BY:		
SUPV. BY:		
SUBMIT TO BY:		
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BROWARD COUNTY RESCO
ELEVATIONS
SOUTH SITE



SIGNAL RESCO
Dorchester, Massachusetts

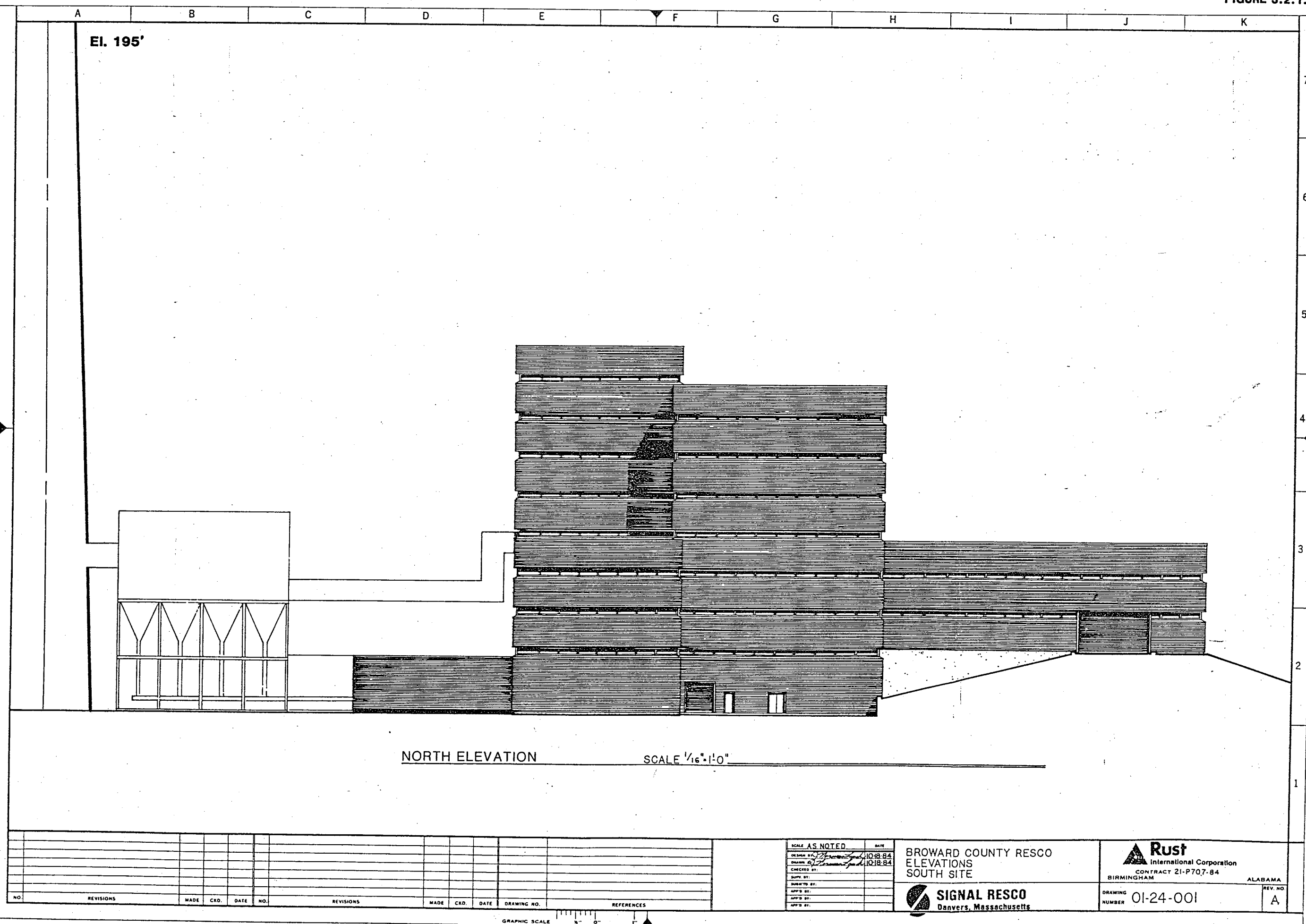


CONTRACT 21-P707-84
BIRMINGHAM

ALABAMA

DRAWING
NUMBER 01-24-003

REV. M
A



- o The landfill will be developed just north of the City of Fort Lauderdale Compost Site (under construction since January, 1985).
- o The landfill will require approximately 150 acres to develop.

Figure 2.1.1, Conceptual Development and Environmental Enhancement (Site Plan) provides details concerning the development of the southern landfill.

The project will consist of two landfill cell areas, attendant facilities for water management, and on-site mitigation adjacent to the South Fork New River Canal. The location of the proposed fill areas, landfill cell numbers 1 and 2, and their proposed final fill elevations are shown on the site plan. Ash residue from the resource recovery facility, consisting of less than 4.0 and 0.3 percent by weight of combustible and putrescible matter, respectively, will be landfilled as cover material for intermediate lifts. Earth and fill materials will be transported from off-site locations, as required.

As mentioned, the landfill is bounded by a composting facility for the City of Fort Lauderdale (under construction) to the south, by U.S. Route 441 to the west, by U.S. Route I-595 right-of-way to the north, and to the east by the proposed Ann Kolb Park and the South Fork New River Canal.

The project site is located adjacent to the South Fork New River Canal (Canal C-11) in tidal waters downstream from SFWMD Pump Station S-13. This station is regulated to provide flood control in upstream reaches as well as maintain adequate groundwater elevations to mitigate salt water migration. Annual average water elevations measured downstream of Pump Station S-13 range between elevation +1.64 (flood tide) and elevation -0.02 (ebb tide), relative to mean sea level (MSL).

Although a wetlands area is located in the eastern portion of the site, discussions with the U.S. Corps of Engineers

(USCOE) indicate that this wetlands area has no special significance in terms of environmental habitat or species. Broward County has proposed designating the area to the north-east of the selected site as an Urban Wilderness Area for the preservation of the existing vegetation and habitat. The proposed landfill has been situated to provide for substantial buffers between the facility and the proposed urban wilderness area, the South Fork New River Canal and the proposed habitat enhancement area. As shown in Figure 2.1.1, a 200 to 300-foot band of habitat enhancement is located along the eastern perimeter of the site. Enhancement in this area includes the removal of existing dredge spoils and exotic vegetation and the development of swamp and marshlands by planting such species as cypress, sawgrass and pickerelweed.

Access to the landfill cells will be from the Resource Recovery Plant Site on the western perimeter paved access road which will also serve as a dike to prevent on-site runoff from impacting off-site areas. Measures to restrict access to the site will be determined by the selected vendor. However, as a minimum, the project site will have perimeter fencing and a gatehouse at the main entrance to the site.

The surface water management system for the landfill site is designed to accommodate current and future site utilization. A detailed description of the surface water management system is provided in Section 3.8, On-Site Drainage System. Generally, stormwater runoff from active areas within a landfill subcell will be treated as if it were leachate and conveyed to a common sump in the pumping station before ultimate disposal at the Hollywood Wastewater Treatment Plant. Stormwater runoff from inactive areas will be captured in the perimeter swale system and conveyed by culverts to a stormwater retention pond established at the eastern portion of landfill Cell No. 2. During peak storm periods, discharge via stormwater outfall diversion structures to the South Fork New

River Canal will supplement the retention pond capacity for flood control purposes. The pump station located south of Cell No. 2 will pump leachate to the Hollywood Wastewater Treatment Plant. The pump station has separate facilities for collecting and pumping leachate and future stormwater runoff. The discharge will meet any pretreatment requirements of the plant but no pretreatment is anticipated to be need at this time.

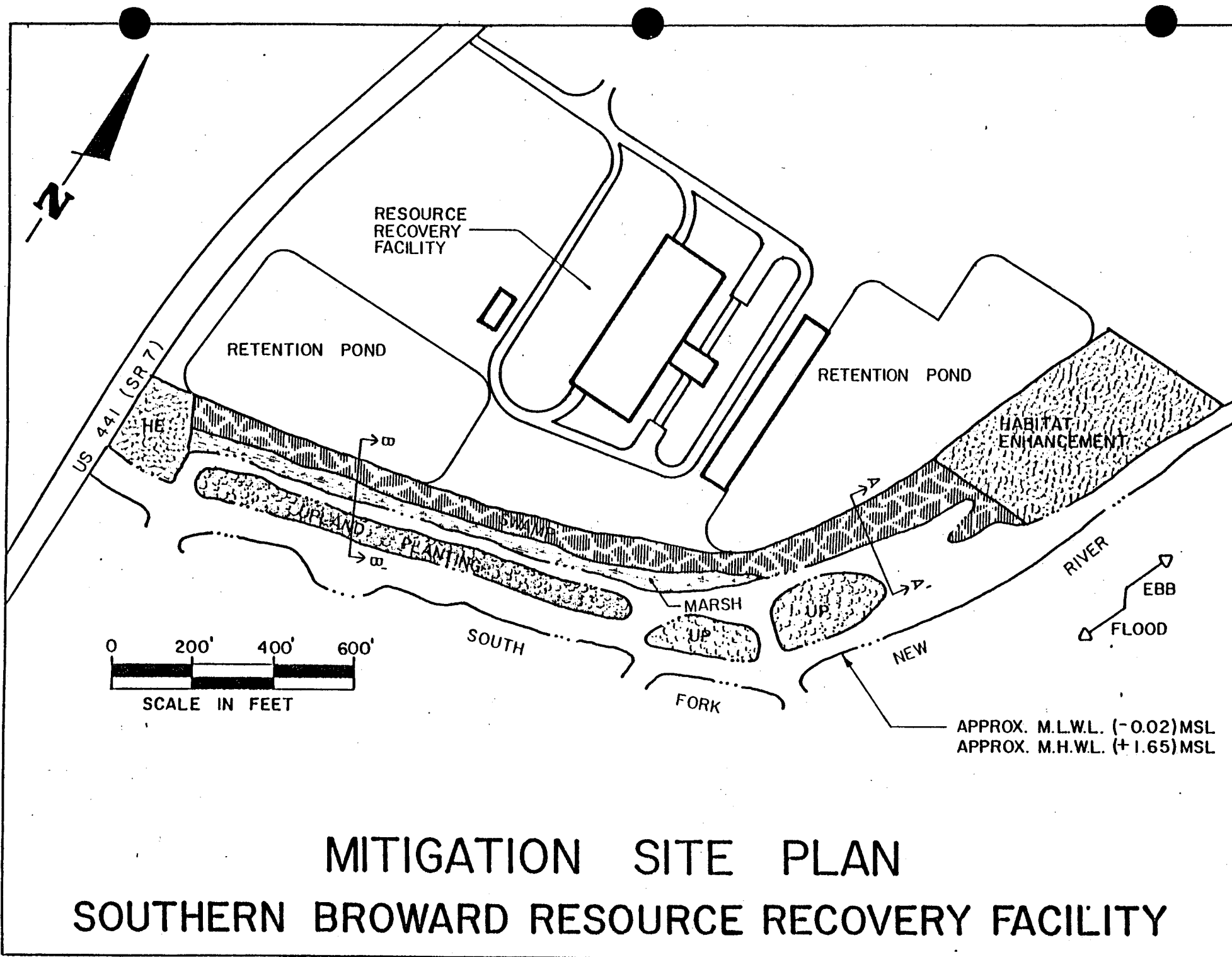
Monitoring well clusters for monitoring the water quality impact of the landfill cells will be provided and are described in the hydrogeologic program presented in Section 5.3, Impacts on Water Supplies.

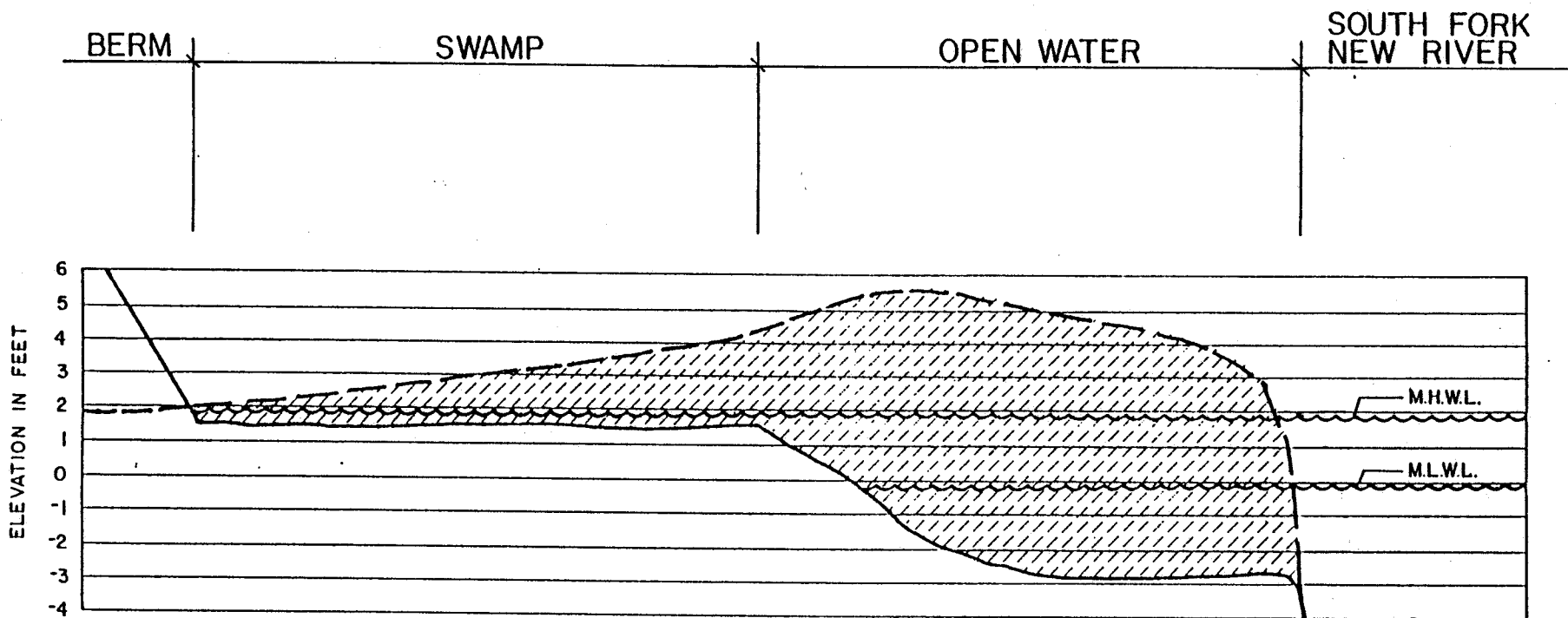
3.2.3 Habitat Enhancement

As part of the resource recovery facility and residuals landfill, habitat improvement both on and off-site will be implemented to compensate for any loss of existing wetlands. This improvement is an integral part of the project and will be accomplished in the prescribed manner to assure the existing biological integrity of the area is maintained. Figures 3.2.3.1 through 3.2.3.6 illustrate the major elements of the mitigation and habitat enhancement plan for both the area around the resource recovery facility and unprocessable ash/residue landfill.

Major elements:

- o Removal of parts of dredge spoil berms and associated exotic vegetation.
- o Reshaping the land to establish more valuable wetland habitat.
- o Planting of marsh and swamp species originally extant in the New River Swamp.
- o Controlling exotic species until the plantings become well established.





EXISTING ELEVATION

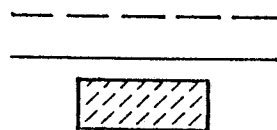
FINAL ELEVATION

AREA OF EXCAVATION

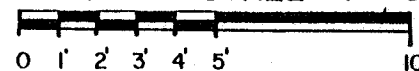
APPROX. M.H.W.L. (1.65) MSL

APPROX. M.L.W.L. (0.02) MSL

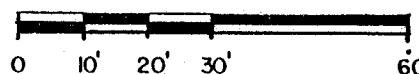
ALL FINAL SLOPES 3:1



VERTICLE SCALE 1" = 5'0"



HORIZONTAL SCALE 1" = 30'0"



MITIGATION AREA SECTION A-A' SOUTHERN BROWARD RESOURCE RECOVERY FACILITY

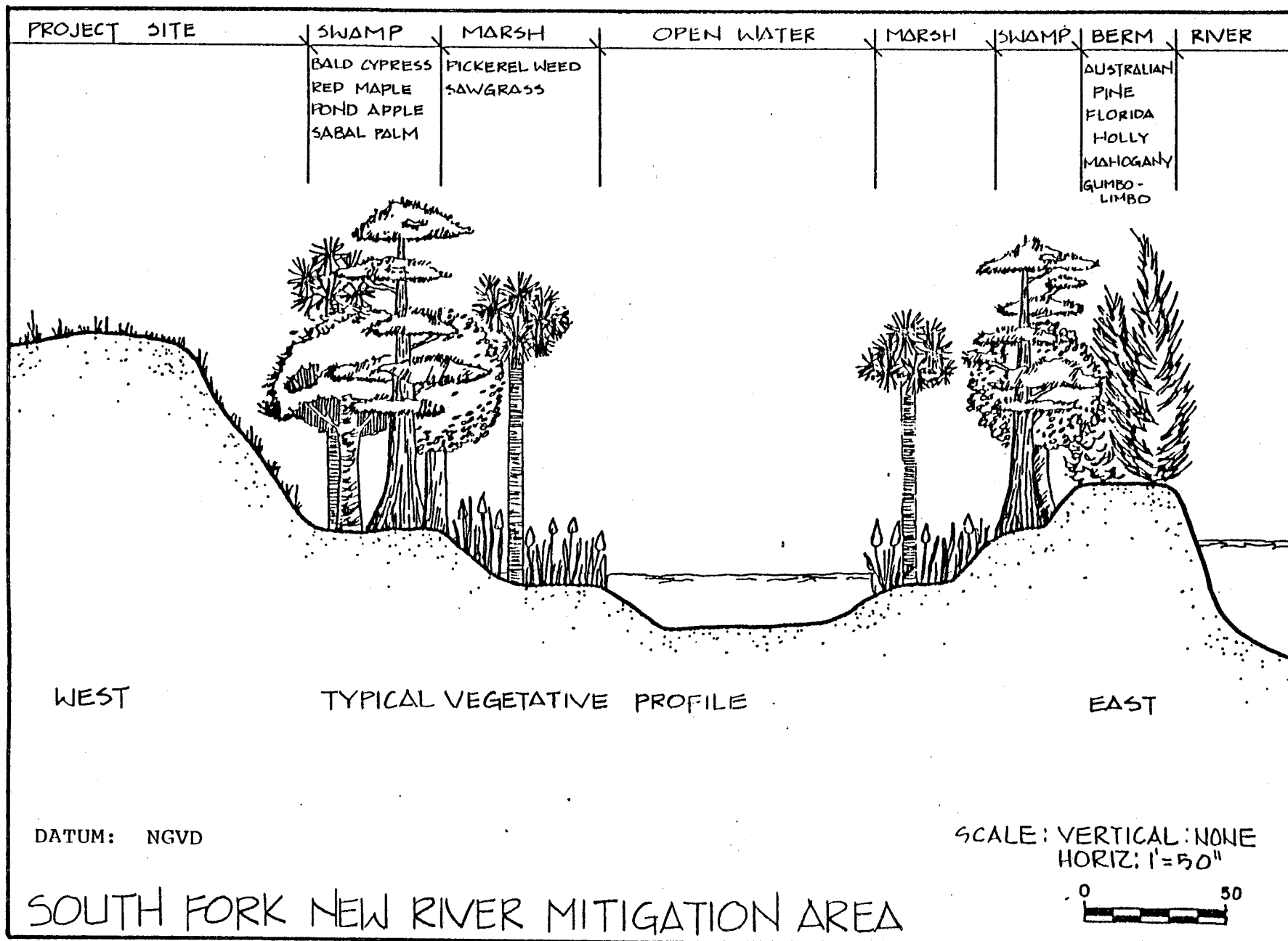
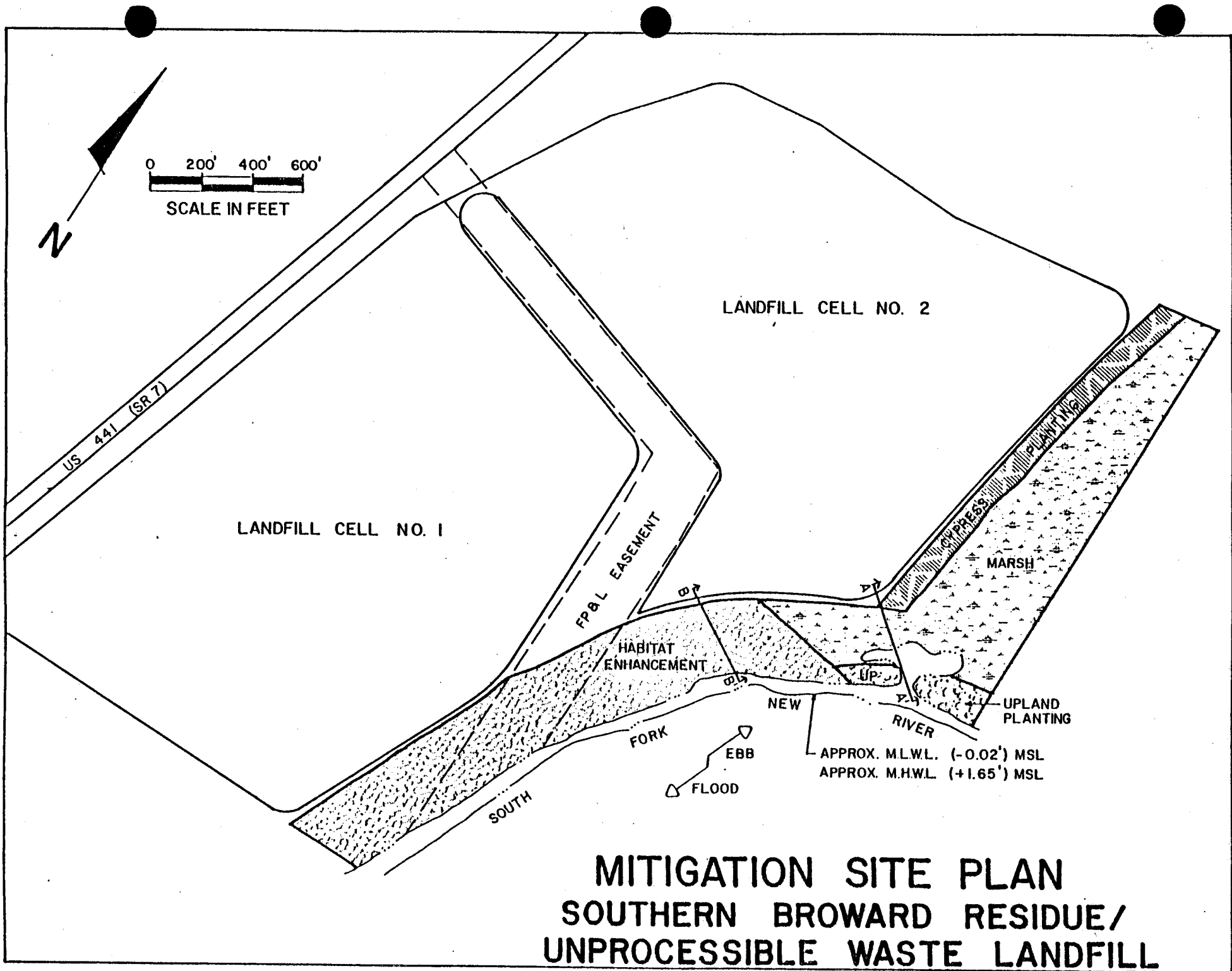
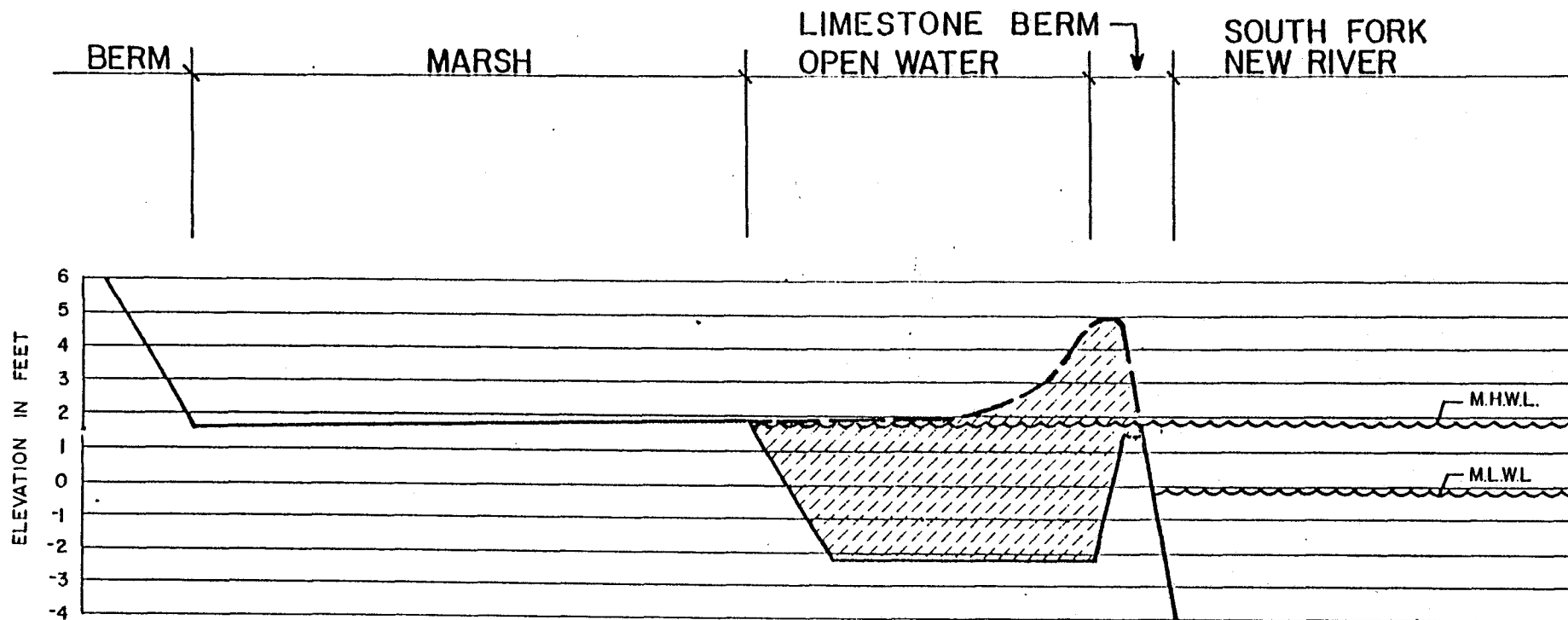


FIGURE 3.2.3.3





EXISTING ELEVATION

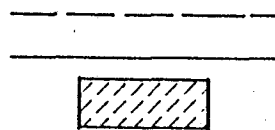
FINAL ELEVATION

AREA OF EXCAVATION

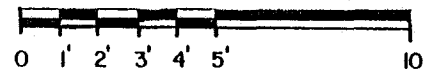
APPROX. M.H.W.L. (+1.65) MSL

APPROX. M.L.W.L. (-0.02) MSL

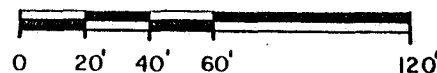
ALL FINAL SLOPES 3:1



VERTICLE SCALE 1" = 5'0"



HORIZONTAL SCALE 1" = 60'0"



MITIGATION AREA SECTION A-A'

SOUTHERN BROWARD RESIDUE/UNPROCESSIBLE WASTE LANDFILL

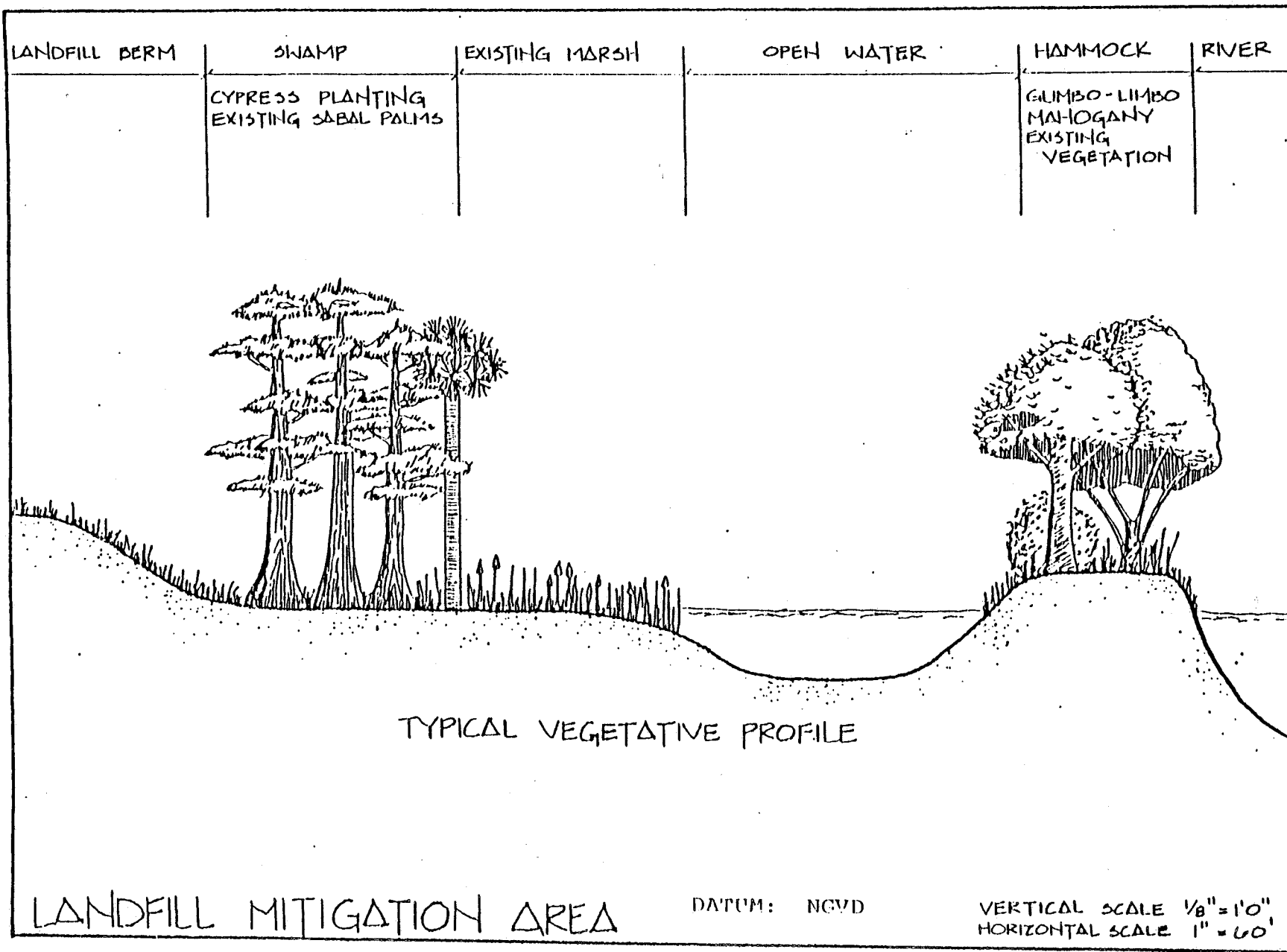


FIGURE 3.2.3.6

- o Preservation of existing wetlands through purchase of off-site wetland acreage.
- o Enhancement of off-site wetlands.

3.2.3.1 Resource Recovery Facility Mitigation

Development of the resource recovery facility will require about 15.6 acres of wetlands to be removed and filled. On-site mitigation/enhancement will be accomplished using a 15 acre strip adjacent to the South Fork New River Canal (see Appendix 10.7). This mitigation will extend the riverfront natural area from the south end of the proposed Urban Wilderness Area 200 feet wide south to the U.S. Route 441 bridge.

The first phase of the mitigation plan entails environmental enhancement by removing the discarded construction materials and equipment which litter the area. The other major elements of the on-site mitigation plan include:

- o Removal of parts of the dredge spoil berm and associated exotic vegetation.
- o Reshaping the land to establish more valuable wetland habitat similar to that which originally occurred adjacent to New River including: (1) swamp at or above average high water level; (2) marsh between average high water level and average low water level; and, (3) shallow water at depths two to three feet below mean sea level.
- o Planting marsh and swamp species originally extant in the New River Swamp. Marsh plantings would include species such as pickerel weed, duck potato, sawgrass, etc., and swamp plantings would include species such as cypress, red maple, pond apple, and cabbage palms.
- o Controlling exotic plants such as cajeput, Australian pine, and Brazilian pepper on an as needed basis until the plantings become well established.

The final elevation of the swamp will be slightly above average highwater (+1.65 MSL) and marsh elevation will be slightly below average low water (-0.02 MSL). Open water

areas will be excavated to -2.0 MSL. The swamp areas will be planted with cypress, red maple, pond apple, and sabal palms. Marsh areas are expected to quickly regenerate naturally, but they will also be planted with pickerel weed and arrow arum. Barren upland areas will be planted with mahogany and gumbo-limbo to create a hardwood hammock environment in an area presently dominated by Australian pine.

3.2.3.2 Landfill Mitigation

Development of the landfill requires use of 133 acres of wetlands. Mitigation to compensate for any loss of wetlands includes both on and off-site work.

3.2.3.3 Landfill On-Site Mitigation

On-site mitigation include the preservation and enhancement of 33 acres of the proposed urban wilderness area (see Appendix 10.7). The area east of landfill Cell 2 will be preserved as a buffer between the landfill and the cypress swamp to the east and a 50-foot strip adjacent to the landfill berm will be planted with cypress trees. A small lagoon connecting with the South Fork New River Canal will be excavated from the berm in the extreme northeastern corner of the site to provide a shallow open water habitat. This work will enhance the adjacent wetlands on an intermittent basis. Flooding, a natural phenomenon which is part of floodplain wetland ecology, has been prevented by the berm of spoil which was placed beside the river when it was dredged. A sill will be left in the mouth of the lagoon to maintain water levels at or near +1.5 MSL, thereby reestablishing a more favorable hydrologic regime in this portion of the New River Flood Plain.

*Southeastern
?*

Most of the 300-foot wide strip adjacent to the area will be preserved. It will also be enhanced by: (1) removing an accumulation of trash and discarded construction materials; (2) removing exotic vegetation (Australian pine, Brazilian

pepper and cajeput) which is overtaking native vegetation; (3) planting of wetland (cypress, red maple, etc.) and upland (mahogany, gumba limbo, etc.) species in selective locations and (4) routine flooding through the lagoon.

3.2.3.4 Landfill Off-Site Mitigation

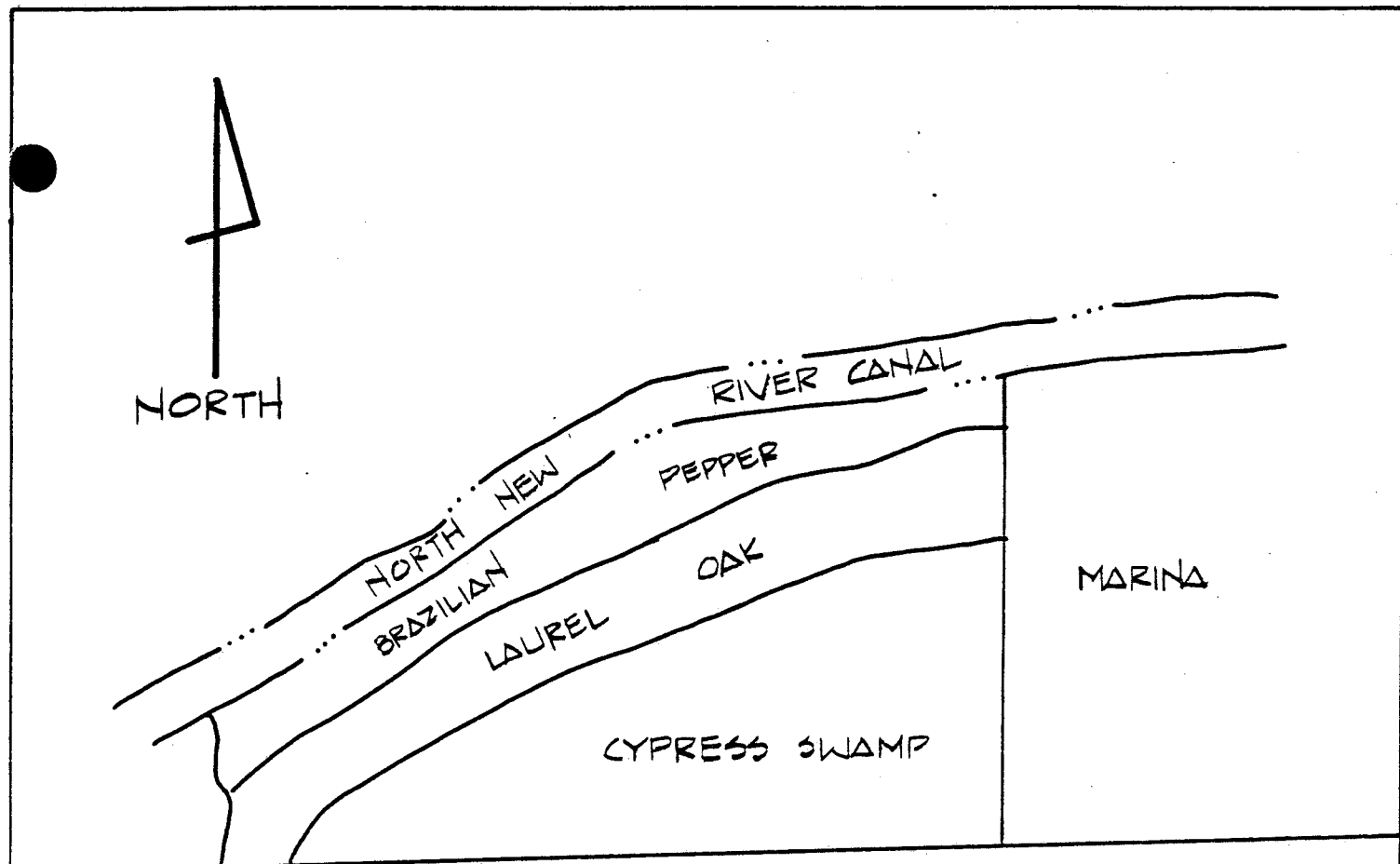
In order to augment the on-site mitigation at the landfill, three off-site mitigation areas will be utilized: North New River Canal Mitigation Area (16 acres), Tree Tops Park (15 acres) and the Everglades Restoration Area (74 acres).

3.2.3.5 North New River Mitigation Area

The last remnants of the New River Swamp exist in 3 parcels near the confluence of the North and South Forks. The largest piece (the proposed Ann Kolb Park) is immediately east of the ash residue unprocessable waste landfill (cell 2) and has recently been purchased by Florida Department of Transportation (DOT) as mitigation for I-595. Much of the second remnant piece is within Secret Woods Park, a County maintained nature preserve and educational center. The third parcel is immediately north of State Road 84 and proposed Ann Kolb park and has frontage on North Fork New River and State Road 84 (See Appendix 10.7). This third parcel comprises slightly greater than 20 acres of which 16 has been purchased for project mitigation. Besides large cypress trees typifying southern river floodplains, this site contains what may be the largest remaining stand of native laurel oaks in the County, which adds to the uniqueness of this property (Figures 3.2.3.7 and 3.2.3.8).

Mitigation plans for this site include:

1. Removal of invading Australian pines and Brazilian pepper.
2. Routine maintenance in the site to eradicate Australian pine and Brazilian pepper sprouts and seedlings.

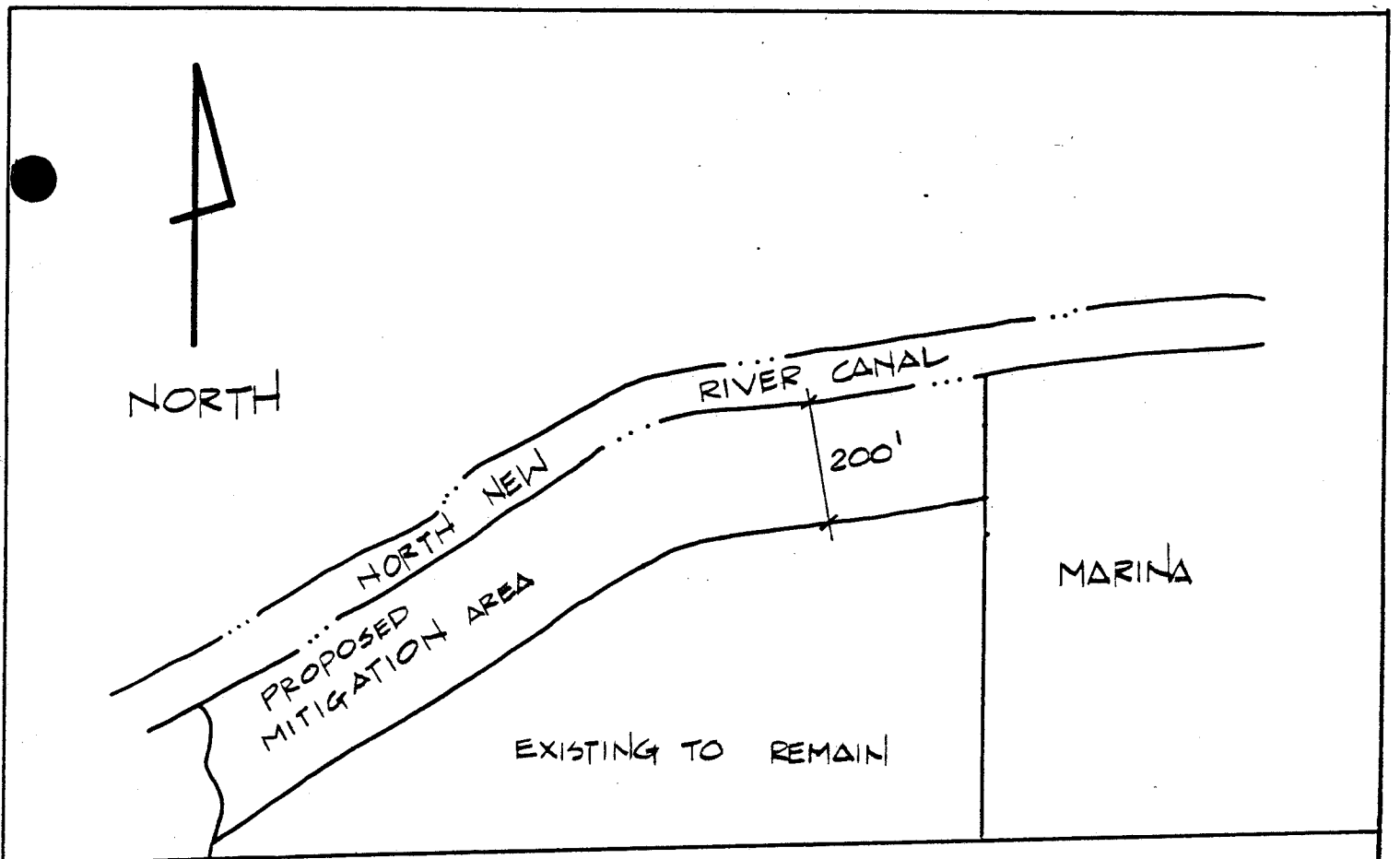


S.R. 84

EXISTING
SITE PLAN
TOTAL AREA - 16 ACRES

NORTH NEW RIVER CANAL MITIGATION AREA

SCALE 1" = 300'



S.R. 84

PROPOSED SITE PLAN

SCALE 1" = 300'

NORTH NEW RIVER CANAL MITIGATION AREA

3. Removal of trash piles which occur in the interior of the site.
4. Stabilizing the north side of the fill area which has been placed adjacent to State Road 84.

This relatively minor amount of site work will restore the site to a more natural condition and will enhance its functional and aesthetics values.

3.2.3.6 Tree Tops Park Mitigation

Tree Tops Park, a new County facility located at the corner of Orange Drive and Golden Shoe Road also will be used for the mitigation (See Appendix 10.7). The mitigation plans have been developed in close coordination with the Broward County Parks Department. For this project, mitigation entails creating a semi-permanently flooded sawgrass marsh and hardwood hammock from an existing wax myrtle-saltbush shrub thicket (Figure 3.2.3.9). The mitigation area comprises a total of 15.7 acres, 13.5 acres of which will be sawgrass marsh and 2.2. acres of which will be hardwood hammock.

The water level in the pond will be maintained approximately +2.5 feet (MSL) although the water level may occasionally rise to +3.0 feet during wet periods because the park is within one of SFWMD's retention areas. Marsh habitat will be created around the lake by lowering the surrounding area's elevation. Essentially, the edge of the lake will be a broad, shallow marsh with several tree islands (hammocks). The topography of the marsh area will range from +1.5 to +3.0. Hammocks will be at a slightly higher elevation (+5.0). Except on hammocks, the trail will be at (+4.0) and will incorporate culverts to insure water interchange throughout the marsh.

Creation of 15.7 acres of marsh and hammocks in Tree Tops Park provides a mitigation area which will result in a high quality wetland/open water/hammock environment similar to the

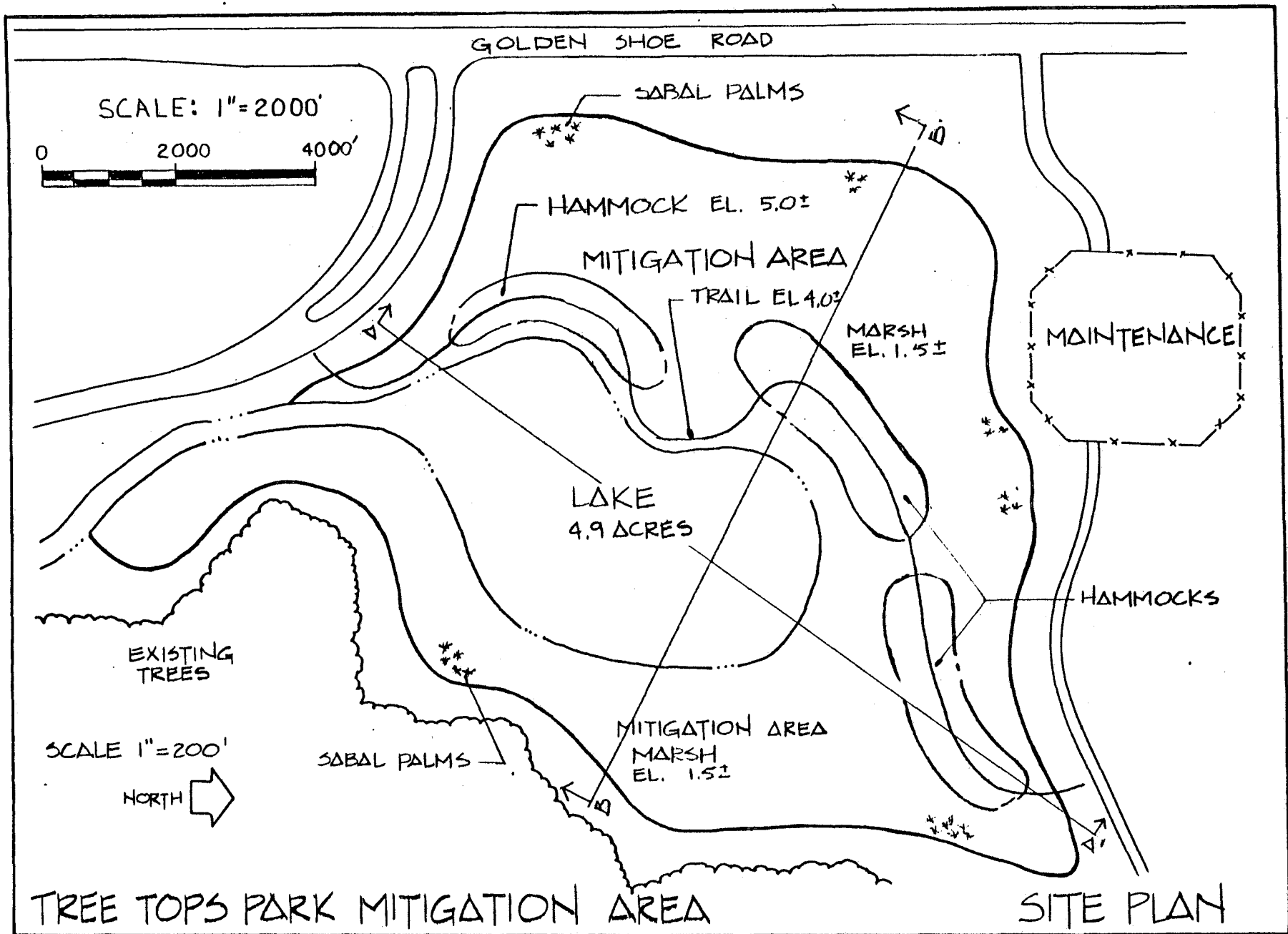


FIGURE 3.2.3.9

Everglades. Besides serving as a more valuable functioning wetland, the Tree Tops Park area will provide a valuable educational opportunity for the people of Broward County.

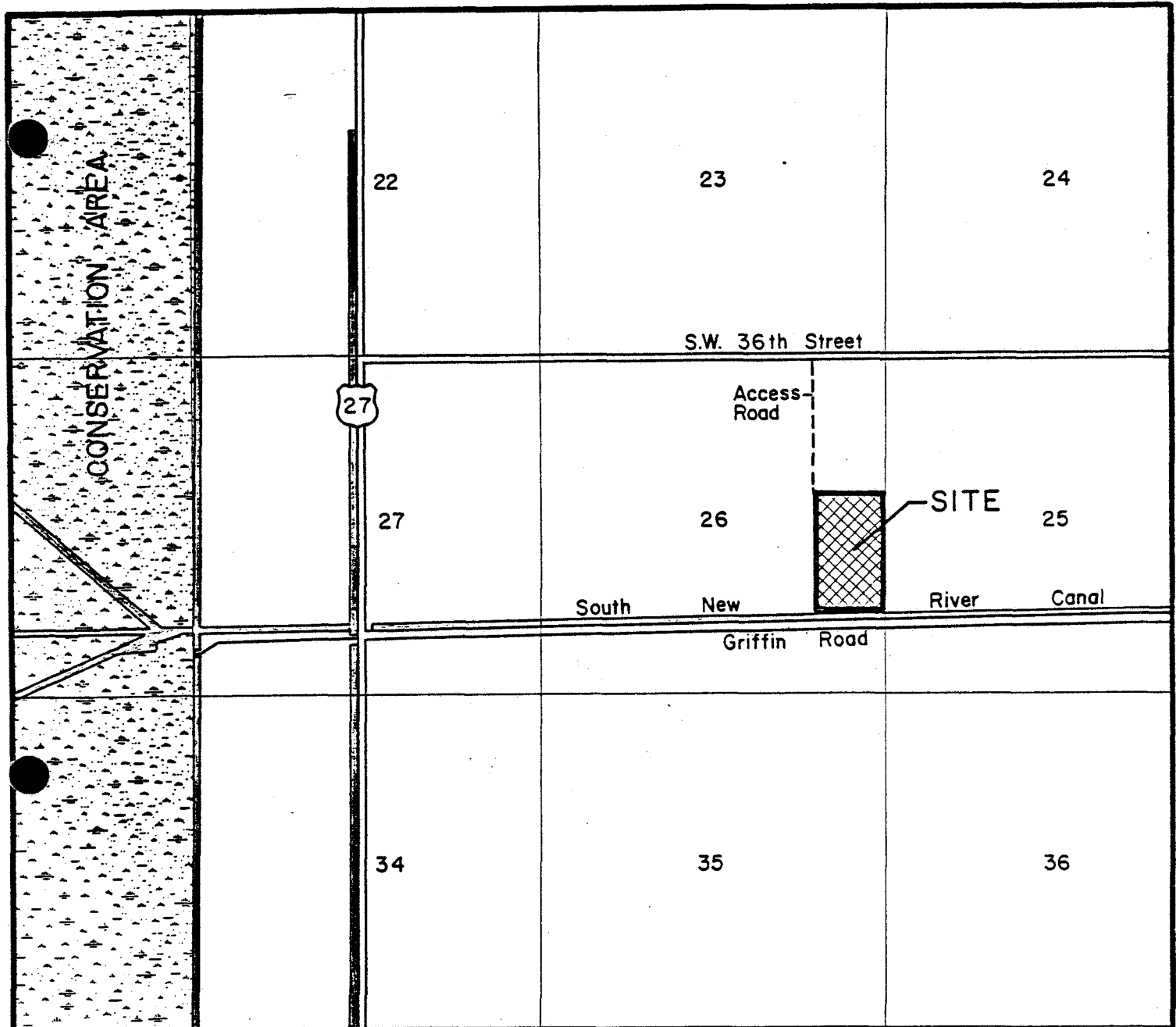
3.2.3.7 Everglades Restoration Area Mitigation

The largest mitigation site (74 acres) for the landfill is the Everglades Restoration Area, located immediately north of south New River Canal and Griffin Road, approximately 1-1/4 miles east of U.S. 27 (Figure 3.2.3.10). This site is former Everglades marsh which is no longer flooded. The site has been impacted by drainage on all sides, but Everglades conditions will be restored by reflooding the site. The site has been reviewed by biologists from South Florida Water Management District (SFWMD), U.S. Fish and Wildlife Service (USFWS), Florida Game and Freshwater Fish Commission, (FGFWFC) and U.S. Environmental Protection Agency. All agencies concur that a viable, functioning marsh can be recreated at this 74 acre site.

Specific restoration methodology is currently being studied in a joint planning effort with the project consultants and SFWMD, FGFWFC, and USFWS. Current plans are to berm the site and flood it by pumping.

This site provides a unique opportunity to reclaim Everglades habitat which is rapidly disappearing east of the conservation area. The area will function as a water retention area, wildlife and fish habitat, and recreational and educational area. Deed restrictions will ensure that it will remain as wetlands in perpetuity for the people of Broward County.

Mitigation at these three areas as well as on site enhancement fulfills the requirement to offset wetland losses associated with project development. Acquisition, mitigation and enhancement activities, and maintenance work to keep exotic vegetation from becoming reestablished will ensure that all mitigation areas will remain productive and viable wet-



— SITE LOCATION MAP —

EVERGLADES RESTORATION AREA

SITE DATA

- 74 ACRES
- SECTION 26, TOWNSHIP 50S, RANGE 39 E
- AGRICULTURAL ZONING
- INDIAN TRACE DRAINAGE DISTRICT

0 1000' 3000'



Scale in Feet

CZR, INCORPORATED
1001 U.S. HIGHWAY 1
JUPITER, FL 33458

lands. The mitigation work will preserve a valuable but disappearing resource for the people of Broward County.

In consideration of all factors, the approved mitigation plan results in: 1) one-to-one replacement of wetlands lost; 2) produces wetlands of greater overall value per unit area than those lost to development; 3) satisfies requirements of regulatory agencies; 4) consistency with the County's Parks and Recreation Division Master Plan and 5) provides beneficial environmental, social and recreational values to the people, wildlife and water resources of Broward County. A more detailed discussion of the South Broward County Resource Recovery Project Mitigation Plan can be found in Appendix 10.7.

3.3 Fuel

3.3.1 General

The fuel to be utilized to generate electricity through the mass-burn technology of the resource recovery facility will be processable solid waste. Processable municipal solid waste is simply that portion of the total incoming waste stream to the facility that can be burned in stoker fired furnaces and waterwall boilers. Processable waste includes: all forms of garbage, commercial waste, rubbish, leaves and brush, paper and cardboard, plastics, wood and lumber, rags, carpeting, a limited amount of tires, wood furniture, mattresses, stumps, wood pallets, timber, tree limbs, ties, and logs, and not separated and recycled at the source of generation, and minor amounts of pathological and biological wastes. Since solid waste is the fuel, the following provides details on the quantity and character of the fuel stream.

3.3.2 Waste Stream Control

Broward County currently controls approximately 165,000 tons per year of solid waste. This volume represents waste

generated in unincorporated Broward County. Approximately 1,030,000 tons per year of additional Broward County solid waste is delivered to the County owned and operated sanitary landfill at Davie and to the Central Disposal landfill at Pompano, owned and operated by Waste Management Inc. (WMI). The origin of these wastes are the Broward municipalities, of which Fort Lauderdale and Hollywood, Florida, represent the largest fraction. Broward is currently in the process of negotiating an Interlocal Agreement (ILA) with a committee of the Broward County League of Cities for waste commitments from the individual Broward municipalities.

3.3.3 Waste Quantities

The following table presents the total quantities of solid waste landfilled at the two existing Broward County landfills from 1981 through 1983.

LANDFILL WASTE QUANTITIES (1981-1983)
(TONS PER DAY)

<u>Year</u>	<u>Central Disposal Landfill</u>		<u>Davie Landfill</u> ²		<u>Out of County Waste</u> ¹	<u>Total</u>
	<u>Garbage</u>	<u>Trash</u>	<u>Garbage</u>	<u>Trash</u>		
1981	1430	540	660	310	(300)	2640
1982	1540	440	630	260	(300)	2570
1983	1660	490	860	310	(300)	3020

1. For the purpose of this project, the amount of waste delivered from adjacent Palm Beach County is estimated to be approximately 300 TPD, and it is deleted from Broward County waste totals.
2. Based upon available waste volume records and an assumed density of 300 pounds per cubic yard.

As indicated on the preceding page, the County's waste stream has been categorized as either garbage or trash. The waste classified as garbage consists of all wastes collected in packer-type vehicles. All garbage wastes are projected to be processable at a resource recovery facility. The tabulated garbage data is based upon actual weigh scale records from 1981 through 1983.

Discussions with officials from adjacent Palm Beach County indicate that a portion of their waste is disposed of at the Central Disposal landfill. For the purpose of this analysis the amount of waste delivered from adjacent Palm Beach County has been estimated to be approximately 300 tons per day (tpd). Since this waste cannot be controlled by Broward County, it is deleted from the waste disposal quantities required for the Project.

The other listed waste category, trash, consists of wastes collected in roll-off containers, pick-up trucks or other open non-packer vehicles. This waste category includes yard wastes, construction and demolition debris, packaging materials, discarded tires and miscellaneous wastes collected from commercial establishments. Only a fraction of trash is considered to be processable.

3.3.4 Seasonal Variations

The actual waste generation rates in Broward are subject to seasonal variations. The following table notes the variation in solid waste generation on a monthly basis. The tabulated figures are based upon 1981 weigh scale data and volume estimates at the Broward County sanitary landfill.

3.3.5 Waste Composition and Type

An estimate of the average composition of the processable portion of the Broward County waste stream is provided in the following table. This table represents a compilation of sam-

pling data obtained from the Central Disposal landfill in Pompano Beach; the County landfill in Davie; Hillsborough County: Daytona Beach; and a range for the State of Florida as published by the Florida Department of Environmental Regulation.

MONTHLY VARIATION OF SOLID WASTE

<u>Month</u>	<u>Percent of Average¹ Month</u>	
	<u>Garbage</u>	<u>Trash</u>
January	81	90
February	86	103
March	108	109
April	104	103
May	102	94
June	111	110
July	110	105
August	98	103
September	110	103
October	96	102
November	94	88
December	100	88

1. Based upon weigh scale data.
2. Based upon volume estimates.

Based on a weighing and sampling programs conducted at the Central Disposal landfill, during September 1983 and the County landfill in Davie, during April 1983, the following data was compiled on garbage and trash:

GARBAGE AND TRASH DISTRIBUTION (As Received Basis)

<u>Fraction</u>	<u>Percent By Weight</u>	
	<u>Of Total</u>	
	<u>Solid Waste Delivered</u>	
	<u>CDL</u>	<u>Davie</u>
Garbage	60	55
Trash	40	45
Processable trash as received	20	17
Processable trash requiring size reduction	4	7
Non-processable trash	16	21

PHYSICAL COMPOSITION - GARBAGE AND PROCESSABLE TRASH FRACTIONS
(As Received Basis)

<u>Component</u>	<u>Percent by Weight</u>					
	<u>Garbage</u>		<u>Trash</u>		<u>Combined</u>	
	<u>CDL</u>	<u>Davie</u>	<u>CDL</u>	<u>Davie</u>	<u>CDL</u>	<u>Davie</u>
Paper, Cardboard	39	47	9	11	27	36
Plastics	8	9	10	3	5	7
Rubber, Tires	-	-	-	9	-	3
Textiles, Rags, Carpeting and Mattresses	3	2	1	1	2	2
Food Wastes	9	9	-	-	5	6
Garden Wastes, Stumps, Leaves and Brush	21	17	45	36	24	22
Wood	2	3	28	35	8	13
Glass	12	7	-	-	7	5
Metals	6	6	-	-	5	4
Rock, Brick	-	-	-	-	15	-
Other	-	-	7	5	2	2
	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>	<u>100</u>

Based on examination of all information compiled, a range of proximate and ultimate analyses is provided in Tables 3.3.1 and 3.3.2. Based on the results of the laboratory analyses, a conservative BTU waste content range has been established at 4500 to 5000 BTU per pound of processable solid waste.

3.3.6 Daily Variations

During each week, there traditionally have been large variations in the quantities of solid waste collected on a given day. For example, more waste is generally collected on Mondays and Tuesdays than is collected on Wednesdays and Saturdays.

The Contractor will be responsible for accepting solid waste at the facility in accordance with normal collection and delivery practices of the County and the contract communities.

Similarly, during each day, more solid waste can be expected to be delivered at certain times than at other times.

TABLE 3.3.1

COMPARISON OF PROXIMATE ANALYSES
GARBAGE FRACTION

	Central Landfill September 1983 (1)						Broward County Landfill at Davie April 1983 (2)						Central Landfill August/September 1982 (3)					
	As Received			Dry Basis			As Received			Dry Basis			As Received			Dry Basis		
	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
% Moisture	20.66	40.46	30.70	0	0	0	19.27	27.98	23.82	0	0	0	37.70	52.21	45.04	0	0	0
% Volatile	41.79	55.58	47.55	60.28	75.36	68.69	51.41	62.03	57.77	71.38	82.39	75.83	NR	NR	NR	48.20	66.50	57.65
% Ash	7.60	25.08	15.21	11.20	34.62	21.97	7.34	19.60	14.35	9.75	24.31	18.82	NR	NR	NR	13.60	36.00	21.73
% Fixed Carbon	2.25	10.13	6.55	3.47	14.53	9.53	0.82	6.90	4.05	1.06	9.05	5.35	NR	NR	NR	15.80	20.40	18.13

Notes:

- NR - Not Reported
 (1) - Based on twelve (12) samples
 (2) - Based on eleven (11) samples
 (3) - Based on four (4) samples

TABLE 3.3.2

COMPARISON OF ULTIMATE ANALYSES
GARBAGE FRACTION

	Central Landfill September 1983 (1)						Broward County Landfill at Davie April 1983 (2)						Central Landfill August/September 1982 (3)					
	As Received			Dry Basis			As Received			Dry Basis			As Received			Dry Basis		
	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
% Carbon	26.85	36.60	30.91	41.67	47.44	44.58	24.15	35.90	30.60	31.69	44.80	40.17	NR	NR	NR	36.5	49.50	43.43
% Hydrogen	6.81	8.64	7.68	5.37	7.03	6.14	5.48	7.74	6.80	3.55	6.61	5.53	NR	NR	NR	4.5	5.90	5.1
% Nitrogen	0.31	0.49	0.39	0.43	0.68	0.56	0.25	0.40	0.31	0.31	0.52	0.41	NR	NR	NR	0.26	0.66	0.45
% Sulfur	0.10	0.17	0.13	0.16	0.22	0.18	0.05	0.12	0.09	0.06	0.16	0.12	NR	NR	NR	0.17	1.47	0.81
% Oxygen	34.89	55.79	45.54	14.39	34.25	26.35	40.93	59.40	47.71	27.50	49.08	34.76	NR	NR	NR	20.60	30.6	25.77
% Chlorine	0.11	0.19	0.15	0.17	0.26	0.21	0.10	0.17	0.14	0.12	0.23	0.19	NR	NR	NR	0.40	0.47	0.4
% Fluorine	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.00	0.005	0.003

Notes:

NR - Not Reported

(1) - Based on twelve (12) samples

(2) - Based on eleven (11) samples

(3) - Based on four (4) samples

Again, the Contractor will be responsible for accepting the County's waste at the facilities in accordance with the normal collection and delivery practices of the County and the Contract Communities. The County has no duty to levelize deliveries during the day.

3.3.7 Population Projections

Total 1981 population for the County was 1,052,020, as reported by the League of Cities, Broward County and the Broward County Office of Planning. The University of Florida has projected an annual population growth rate of approximately 2 percent resulting in a total Broward County population of 1,268,000 by 1989.

Table 3.3.7.1 presents a range (low, medium and high) of projected population growth from 1985 through 2010, based upon the projections developed by the University of Florida at Gainesville. These projections provide an indication of the type of growth that can be expected in Broward County during the operation of the project.

3.3.8 Facility Sizing

As previously discussed, the County is in the process of negotiating an Interlocal Agreement (ILA) with the Broward County League of Cities. Based upon these negotiations the County has determined that it will provide a put-or-pay commitment of 1,700 tpd for the Project.

Based upon a system availability factor of 0.85 to account for scheduled and unscheduled downtime and to accommodate peak seasonal variations, the minimum Nameplate Capacity required in 1989 at the southern resource recovery facility will be 2,000 tpd. Recognizing that vendor facilities come in different unit sizes and that optimum configurations may dictate different capacities at each of the two resource recovery facilities, the County is somewhat

TABLE 3.3.7.1

BROWARD COUNTY POPULATION PROJECTIONS¹

	<u>Low</u>	<u>Medium</u>	<u>High</u>
1985	1,103,000	1,149,000	1,194,900
1986	1,121,000	1,177,700	1,234,000
1987	1,139,300	1,207,200	1,274,500
1988	1,158,000	1,237,400	1,316,300
1989	1,177,000	1,268,300	1,359,400
1990	1,196,100	1,300,000	1,404,000
1991	1,211,200	1,328,200	1,445,000
1992	1,226,500	1,357,100	1,487,100
1993	1,242,000	1,386,500	1,530,500
1994	1,257,800	1,416,600	1,575,100
1995	1,273,700	1,447,400	1,621,100
1996	1,286,100	1,475,200	1,663,800
1997	1,298,700	1,503,500	1,707,700
1998	1,311,300	1,532,300	1,752,700
1999	1,324,100	1,561,700	1,799,000
2000	1,337,000	1,591,700	1,846,400
2001	1,342,700	1,614,600	1,885,400
2002	1,348,400	1,637,800	1,925,300
2003	1,354,200	1,661,300	1,966,000
2004	1,360,000	1,685,200	2,007,500
2005	1,365,800	1,709,400	2,050,000
2006	1,371,600	1,734,000	2,093,300
2007	1,377,500	1,758,900	2,137,600
2008	1,383,400	1,784,200	2,182,700
2009	1,389,300	1,809,800	2,228,900
2010	1,395,200	1,835,800	2,276,000

1. Based on University of Florida (Gainesville) projected population data for years 1985, 1990, 1995, 2000, and 2010.

flexible with regard to facility size configurations. Based upon the facility capacities proposed by the prequalified vendors, this certification application has been based on a maximum initial installed capacity of 2,352 tpd and a projected ultimate capacity of approximately 3,300.

3.3.9 Residue and Unprocessable Waste Disposal

The facility will include a residue/unprocessable waste landfill for the disposal of residue generated by the Project and unprocessable waste that cannot be incinerated at the resource recovery facility. This landfill will conform to all applicable laws and regulations. At no time will processable waste be disposed of at this landfill, except to the extent that it is contained in the normal unprocessable waste stream. The residue will be transported to the residue/unprocessable waste landfills in compliance with all applicable codes, rules, and laws regulating such material and its transportation.

At the Route 441 site, initial cellular development will begin in the southwestern quarter of cell 1, as shown on Figure 2.1.3, Proposed Landfill Design. Cellular development shall include the installation of a non-pervious liner system (double liner), leachate collection system (porous material and leachate collection piping), contingency collection system, berms, swales, stormwater piping, and sufficient temporary stormwater retention to satisfy SFWMD requirements. A detailed discussion on landfill design is provided in Section 5.3, Impacts on Water Supplies.

The County will monitor the delivery of waste to the Project to ensure that Processable and Unprocessable Wastes are directed to the proper disposal areas.

Hazardous wastes shall not be accepted at the facility. Any hazardous wastes inadvertently accepted at the Resource Recovery Facility or at the Residue/Unprocessable Waste landfill shall be properly stored and disposed of off-site.

The residue generated by the Project must meet the specification of not more than 0.3 percent putrescible matter and 4.0 percent combustible matter (dry weight).

3.4 Air Emissions and Controls

3.4.1 Air Emission Types and Sources

The proposed project consists of a resource recovery facility which will have initial and maximum (or ultimate) installed capacities of 2,352 and 3,300 tpd, respectively. The data presented in this report are based on preliminary or conceptual design of the proposed facility. The design will be subject to certain refinements following selection of a full-service vendor. However, the conceptual design is based on conservative or worst-case assumptions from a potential air quality impact viewpoint, particularly in minimizing the exit gas flow rate. The assumptions used in estimating the exit gas flow rate for modeling purposes were conservative because:

1. A lower percent of carbon (29 percent) was used in the calculations rather than higher percentages obtained from ultimate analysis tests, and
2. Only 60 percent excess air was considered (excess air for normal operation is between 80 and 120 percent).

The solid waste charging rate and location of the proposed facility are presented in Table 3.4.1.1. The stack and operating parameters for the projected initial and maximum capacities (i.e., 115 percent of nameplate) of the facility considered in the air quality modeling are presented in Table 3.4.1.2. The proposed stack height for the facility will be 195 feet above grade. This stack height represents the maximum height that can be used to ensure compliance with applicable Federal Aviation Administration (FAA) regulations.

TABLE 3.4.1.1

SOLID WASTE CHARGING RATE AND LOCATION OF THE PROPOSED FACILITY

Parameter	Value
<u>Solid Waste Charging Rate</u>	
Nameplate Capacity--Initial	2,352 TPD (98.0 tph)
Maximum	3,300 TPD (137.5 tph)
Projected Capacity--Initial	2,705 TPD (112.7 tph)
Maximum	3,795 TPD (158.1 tph)
<u>Heat Input Rate*</u>	
Nameplate Capacity--Initial	882.0 x 10 ⁶ Btu/hr
Maximum	1,237.5 x 10 ⁶ Btu/hr
Projected Capacity--Initial	1,014.3 x 10 ⁶ Btu/hr
Maximum	1,422.9 x 10 ⁶ Btu/hr
<u>Location</u>	
Latitude, Longitude	26.07°, 802.0°
UTM Zone	17
UTM East, North Coordinate	579.6, 2,883.3 km

*Based on average heating value of solid waste of 4,500 Btu/lb.

Source: Malcolm Pirnie, Inc., 1985.

TABLE 3.4.1.2

STACK AND OPERATING PARAMETERS FOR THE PROJECTED CAPACITIES*
OF THE PROPOSED FACILITY CONSIDERED IN THE AIR QUALITY MODELING

Parameter	Value
<u>Solid Waste Charging Rate</u>	
Initial	2,705 TPD
Maximum	3,795 TPD
<u>Heat Input Rate</u>	
Initial	$1,014.3 \times 10^6$ Btu/hr
Maximum	$1,422.9 \times 10^6$ Btu/hr
Stack Height	195 ft (59.4 m)
Stack Diameter	16.5 ft (5.03 m)
<u>Exit Gas Temperature</u>	
Initial	450°F (505°K)
Maximum	450°F (505°K)
<u>Exit Gas Flow Rate</u>	
Initial	691,493 acfm
	355,558 cscfm†
Maximum	970,134 acfm
	498,832 dscfm†
<u>Exit Gas Velocity</u>	
Initial (used in model)	42.6 ft/s (14.1 m/s)
Maximum (used in model)	65.0 ft/s (19.8 m/s)

*Based on 115 percent of nameplate capacity.

†AT 10-percent CO₂

Note: acfm = actual cubic feet per minute.

dscfm = dry standard cubic feet per minute.

Source: Malcolm Pirnie, Inc., 1985.

The emission factors for the regulated pollutants that will be emitted from the proposed facility are presented in Table 3.4.1.3. For most of the regulated pollutants, the emission factors are based on estimates derived for resource recovery facilities similar in size to the proposed facilities. The emission factors are given as a function of the heat content and amount of solid waste burned. These emissions factors were obtained from Malcolm Pirnie, Inc. and are based on a review of the literature, such as EPA AP-42 emission factors and A.D. Little reports, or manufacturer's design specification. The maximum hourly and annual average emission rates for the facility are presented in Table 3.4.1.4, and are 115 percent of nameplate capacity.

3.4.2 Air Emission Controls

The State of Florida has received administrative and technical review authority for the federal PSD program. In addition, Florida has passed PSD regulations and BACT requirements similar to EPA. DER defines BACT as follows (CH. 17-2.100(22), FAC):

An emission limitation, including a visible emissions standard, based on the maximum degree of reduction of each pollutant emitted which the Department, on a case by case basis, taking into account energy, environmental and economic impacts, and other costs, determines is achievable through application of production processes and available methods, systems, and techniques (including fuel cleaning or treatment or innovative fuel combustion techniques) for control of each such pollutant... Each BACT determination shall include applicable test methods or shall provide for determining compliance with the standard(s) by means which achieve equivalent results.

The source applicability analysis for the proposed facilities (see Appendix 10.1.5) identified the following emitted air pollutants as requiring a BACT review under federal and state PSD regulations:

- Particulate Matter (PM)
- Sulfur Dioxide (SO₂)
- Nitrogen Oxides (NO_x)

TABLE 3.4.1.3

POLLUTANT EMISSION FACTORS FOR PROPOSED FACILITY

Pollutant	Emission Factor	
	lb/10 ⁶ Btu	lb/ton*
Particulate Matter	0.074	0.67
Sulfur Dioxide	0.55	4.91
Nitrogen Dioxide	0.56	5.0
Carbon Monoxide	0.089	0.80
Volatile Organic Compounds	0.013	0.12
Lead	0.03 0.003	0.27 0.27
Fluorides	0.025	0.23
Sulfuric Acid Mist	0.0028 / 0.047	0.025 0.42
Hydrogen Sulfide	NA	NA
Total Reduced Sulfur	NA	NA
Reduced Sulfur Compounds	NA	NA
Asbestos	NA	NA
Beryllium	9.3 x 10 ⁻⁷	8.4 x 10 ⁻⁶
Mercury	0.00026 0.00006	0.0023 0.0053
Vinyl Chloride	NA	NA
Benzene	NA	NA
Radionuclides	NA	NA
Inorganic Arsenic	0.000031	0.00028

NA = Not Applicable.

*Based on average heating value of solid waste of 4,500 Btu/lb.

Source: Malcolm Pirnie, Inc., 1985.

TABLE 3.4.1.4

MAXIMUM HOURLY AND ANNUAL AVERAGE EMISSION RATES
FOR THE PROPOSED FACILITY

Pollutant	Initial Capacity = 2,705 TPD*		Maximum Capacity = 3,795 TPD*		PSD Significant Emission Rate (TPY)
	lb/hr	TPY	lb/hr	TPY	
Particulate Matter	75.1	328.8	105.3	461.3	25
Sulfur Dioxide	557.9	2,443.6	782.7	3,428.3	40
Nitrogen Dioxide	568.1	2,488.1	796.9	3,490.6	40
Carbon Monoxide	90.3	395.4	126.7	554.8	100
Volatile Organic Compounds	13.2	57.8	18.5	81.0	40
Lead	30.4 30.4	133.3 133.3	42.7 42.7	187.0 187.0	0.6
Fluorides	25.4	111.1	35.6	155.8	3
Sulfuric Acid Mist	47.3 2.8	206.5 12.3	67.1 4.0	290.4 17.3	7
Beryllium	0.00094	0.0041	0.0013	0.0058	0.0004
Mercury	0.26	1.4	0.36	1.6	0.1
Arsenic	0.032	0.14	0.044	0.19	0

*These capacities are 115 percent of nameplate capacities which are 2,352 TPD (initial) and 3,300 TPD (maximum).

Source: Malcolm Pirnie, Inc., 1985.

Carbon Monoxide (CO)

Lead (Pb)

Fluorides (F^-)

Beryllium (Be)

Mercury (Hg)

Arsenic (As)

Sulfuric Acid Mist

3.4.2.1 Particulate Matter

Particular matter (PM) generated by the combustion of solid waste will be minimized through combustion controls and boiler design. PM exiting the boilers in the exhaust gases will be controlled by use of electrostatic precipitators (ESPs). The combustion boiler design will be of the mass-burn stoker-fired type and capable of firing as-received solid waste on a continuous-feed basis without auxiliary fuel firing. This boiler design requirement will serve to minimize the generation of ash and, therefore, PM in the furnace.

The exhaust gases of each boiler will pass through an ESP prior to discharge to the atmosphere through a common stack with an individual flue for each boiler. Design details for the ESP are not known at this time. Design details will be supplied to DER as they become available for regulatory review. However, the following minimum criteria will have to be met by the selected manufacturer. Each ESP will be capable of reducing the exhaust gas PM concentration to 0.03 gr/dscf, corrected to 12-percent CO_2 , or 0.1 lb/mbtus whichever is less over the range of boiler operating conditions. Opacity of the emissions will not exceed 20 percent. A further discussion of the ESP design can be found in Section 3.4.4

An ESP with an outlet grain loading of 0.03 gr/dscf is considered to represent BACT for the proposed facility, based on economic, energy, environmental, and plant operating considerations. NSPS for new incinerators charging more than 50 TPD of solid waste are applicable to this proposed project

(40 CFR 60, Subpart E). The New Source Performance Standard (NSPS) emission standard limits PM emissions to 0.08 gr/dscf, corrected to 12-percent CO₂. The proposed ESP emission rate is well below this allowable level.

The boilers will be used to generate steam which will drive turbine electrical generators. The boilers will not be subject to the provisions of Subpart D or D(a) of 40 CFR 60, which are the NSPS for fossil-fuel-fired steam generators and electric utility steam generating units, respectively, because solid waste is not a fossil fuel.

State of Florida PM emission-limiting standards require new incinerators with a charging rate of greater than 50 TPD to meet 0.08 gr/dscf, corrected to 50-percent excess air. This standard is similar to the federal NSPS, and the proposed facility will emit PM at a significantly lower rate. State of Florida emission regulations also require an opacity limit of 20 percent, which the proposed facilities will not exceed. The eventual vendor will provide opacity meters to insure compliance (see Appendix 10.11).

Based on USEPA emission factors for municipal incinerators (USEPA, 1983), uncontrolled PM emissions are estimated at 30 pounds per ton (lb/ton) of solid waste fired. USEPA's review of NSPS for incinerators (USEPA, 1979) cites uncontrolled PM emissions in the range of 10 to 70 lb/ton. However, it is noted that these values are for municipal incinerators and may not be applicable to resource recovery units. Nevertheless, if an average value of 30 lb/ton is assumed, the proposed facility, at 115 percent of maximum nameplate capacity (i.e., 3,795 TPD = 115 percent of 3,300 TPD), would generate 4,744 lb/hr of PM. The ESP would then have a PM removal efficiency of at least 97 percent. The proposed ESP maximum PM emission rate will result in a maximum PM emission rate of 105.3 pounds per hour (lb/hr). Assuming an average solid waste heating value of 4,500 Btu/lb, the facility would emit 0.074 lb/10⁶ Btu of PM. This emission

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rate is even less than EPA's proposed revision to NSPS for large steam generating units which would limit PM emissions to $0.1 \text{ lb}/10^6 \text{ Btu}$.

3.4.2.2 Sulfur Dioxide

The control technology for Sulfur Dioxide (SO_2) of firing low-sulfur fuel in the mass-burn resource recovery facility is proposed as BACT. The proposed BACT emission limit of $4.9 \text{ lb SO}_2/\text{ton}$ of solid waste fired is equivalent to 782.7 lb/hr or $0.55 \text{ lb}/10^6 \text{ Btu}$ heat input. By comparison, NSPS for fossil-fuel-fired boilers and electric utility steam generators firing solid fuel (40 CFR 60, [Subparts D and D(a)]) would allow up to $1.2 \text{ lb SO}_2/10^6 \text{ Btu}$. No SO_2 emission-limiting standard currently exists or are proposed for incinerators or solid waste fired boilers.

3.4.2.3 Nitrogen Oxides and Carbon Monoxide

The proposed BACT for Nitrogen Oxides (NO_x) and Carbon Monoxide (CO) emissions is boiler design and good combustion practices. The proposed BACT emission limits are 5.0 lb/ton of solid waste fired for NO_x (as NO_2), and 0.8 lb/ton for CO. These emission factors are equivalent to 796.9 lb/hr or $0.56 \text{ lb}/10^6 \text{ Btu}$ for NO_x (as NO_2) and 126.7 lb/hr or $0.089 \text{ lb}/10^6 \text{ Btu}$ for CO.

By comparison, NSPS for fossil-fuel-fired boilers [40 CFR 60, Subparts D and D(a)] limit NO_x (as NO_2) emissions to between 0.5 and $0.7 \text{ lb}/10^6 \text{ Btu}$ for solid fuel. No NO_x or CO emission-limiting standard currently exist or are proposed for incinerators or solid waste fired boilers.

Factors that influence NO_x emissions from solid waste boilers consist of boiler design, excess air, and peak combustion temperatures. NO_x emissions are derived from either the fuel-bound nitrogen being reduced and subsequently oxidized, or thermal oxidation of nitrogen in the combustion air. The latter source of NO_x is much greater than the former source. The primary factors affecting combustion air NO_x is

the amount of oxygen in the combustion zone (i.e., related to excess air) and the peak combustion temperature.

CO is produced when carbon-containing fuel is burned in an oxygen-deficient atmosphere, resulting in the carbon atoms being oxidized partially to CO instead of totally to CO₂. An oxygen-deficient atmosphere may result from deficient amounts of combustion air or incomplete air/fuel mixing. High excess air, proper primary and secondary air distribution, and proper air/fuel mixing all tend to minimize unburned carbon and CO emissions.

3.4.2.4 Other Pollutants

Other pollutants emitted from the proposed source requiring BACT review are lead, fluorides, beryllium, mercury, sulfuric acid mist, and inorganic arsenic. These are all trace elements contained in solid waste in very minor quantities. The proposed BACT for lead, beryllium, and inorganic arsenic is the ESP for the control of PM emissions. These pollutants are emitted in the solid phase; therefore, control of PM emissions will also control these pollutants. The BACT emission limits are the emission rates presented in Table 3.4-4 for each pollutant.

Fluorides, sulfuric acid mist, and mercury are emitted in small quantities primarily in the gaseous phase and are not susceptible to collection by ESP. No additional control technology is proposed for these pollutants since such controls would be costly, unproven and would not provide significant environmental benefits.

3.4.2.5 Test Methods to Demonstrate Compliance

Compliance with NSPS for PM will be demonstrated by source emission tests conducted in accordance with the Federal Reference Methods specified in 40 CFR 60, Appendix A. Reference Method 1 will be used in sampling point determination for sample traverses. Reference Method 5 will be used in determination of PM emissions, grain loading, and moisture content.

3.4.3 Best Available Control Technology

Federal and state PSD/BACT regulations and guidelines require that an analysis of alternative control technologies to be conducted (USEPA, 1980; USEPA, 1978). The only alternatives that need be addressed are those "which have greater control capabilities than the system proposed as BACT and which have been used or proposed for the same or similar operations" (USEPA, 1978). If no better control technology than the proposed technology exists, no further analysis is necessary. Other equipment with similar control potential need not be evaluated.

The BACT analysis must support that the identified alternative control techniques would cause unreasonably adverse energy, environmental, or economic impacts. The following sections present the alternatives analysis required under BACT review and justify selection of the proposed control equipment described in Section 3.4.2.

3.4.3.1 Particulate Matter

In March 1979, USEPA conducted a survey of all existing and proposed incinerators in the United States (USEPA, 1979). The study identified three types of control devices as potentially applicable to incinerators: ESPs, fabric filters, and venturi scrubbers. Test results for PM were compiled for 14 municipal incinerators where the federal reference method (Method 5) was known to be used for testing. Solid waste charging rates varied from 30 to 600 TPD. Of these installations, only one used a fabric filter for PM control, while nine used ESPs and four utilized venturi scrubbers. Test results were as follows (corrected to 12-percent CO₂):

Fabric Filter:	0.024 gr/dscf
ESP:	0.018 to 0.060 gr/dscf, average of 0.041 gr/dscf
Venturi scrubber:	0.046 to 0.416 gr/dscf, average of 0.14 gr/dscf

These data indicate that fabric filter technology for incinerators is not well proven. Operational problems with filter bags were noted with the test results. However, the 0.024 gr/dscf emission rate was the second lowest of all test results; one ESP test was lower, with an emission rate of 0.018 gr/dscf.

ESPs are by far the most prevalent type of control and provide much better emission reduction than do venturi scrubbers. The venturi scrubber test results not only indicate much higher average emissions than the ESP, but scrubber deterioration due to wearing of scrubber parts has been noted on several installations. In addition, high scrubber pressure drops are required to meet the 0.08 gr/dscf NSPS, resulting in a significant energy penalty. Those venturi scrubbers meeting NSPS operated with pressure drops of 15 inches of water (in. H₂O) or greater, whereas an ESP typically operates at 1 to 2 in. H₂O.

Test data from eight additional municipal incinerator installations where the test method was not specified were also presented. Solid waste charging rates varied from 120 to 360 TPD, and ESPs were used at all of these installations. The PM emissions ranged from 0.013 to 0.108 gr/dscf and averaged 0.059 gr/dscf (excluding two facilities where test results were reported in gr/acf).

In March 1982, EPA issued a background information document for non-fossil-fuel-fired industrial boilers (USEPA, 1982b). The study included a survey of solid waste boilers as well as refuse-derived fuel (RDF). This study stated:

No successful scrubber applications to solid waste or RDF boilers exist: the fine particulate in these boiler exhausts can be removed only by very high-energy scrubbers which must be constructed of expensive corrosion resistant materials. The only solid waste boiler that used a wet scrubber replaced the scrubber with an electrostatic precipitator.

Few full-scale baghouses have been applied to nonfossil fuel fired boilers... no baghouse installations exist on bagasse, solid waste or

RDF boilers. However, one baghouse operates successfully on an solid waste incinerator. The principal drawback to fabric filtration, as perceived by potential users, is a fire danger arising from the collection of a combustible carbonaceous fly ash.

Electrostatic precipitators are currently used on boilers fired with wood, solid waste or refuse derived fuel.

The data from the USEPA study show that ESP is highly proven for municipal incinerator applications and is capable of achieving PM emission levels well below NSPS and State of Florida emission standards. In addition, this technology has low energy requirements (i.e., pressure drop of 1 to 2 in. H_2O) and no liquid waste disposal problem. On the other hand, a high pressure drop is required across a venturi scrubber to achieve levels as low as the proposed emission rate of 0.03 gr/dscf. This requirement would increase maintenance costs because of the severe wear on the venturi and increase energy costs significantly. The fabric filter is relatively unproven on municipal incinerators; although fabric filters potentially could achieve PM levels below 0.03 gr/dscf, they have experienced maintenance and operational problems which must be overcome before they are deemed reliable. For these reasons, venturi scrubbers and fabric filters were not considered further as viable control technologies.

Test data presented in the USEPA non-fossil-fuel boiler study consisted of ESP data only for solid waste fire boilers. PM emissions ranged from 0.2 to 0.05 lb/10⁶ Btu at average specific collection areas (SCA) of 140 to 570 (ft²/1,000 acfm, respectively. Data for the most efficient control device for PM emissions from solid waste boilers were also presented (obviously for an ESP, since no other test data were available). These data were for ESPs with SCAs of 240 ft²/1,000 acfm or more, and emissions averaged less than 0.1 lb/10⁶ Btu in each of the four cases presented. Emissions in lb/10⁶ Btu were shown to decrease as the SCA increased, the lowest test case yielding about 0.05 lb/10⁶ Btu with an SCA of 573

ft²/1,000 acfm. The proposed facilities will achieve a PM emission level of approximately 0.074 lb/10⁶ Btu.

The environmental impact of the selected control technology is considered to be minimal. The predicted maximum 24-hour average PM impact due solely to the proposed facility will be less than 10 percent of the de minimis air quality impact level (i.e., for monitoring exemption), less than 20 percent of the significant impact level (i.e., for modeling exemption), less than 3 percent of the PSD Class II increment, and less than 1 percent of Florida AAQS. Predicted annual average PM impacts due to the facility are 8 percent of the significant impact level (for modeling exemption), less than 1 percent of the PSD Class II increment, and less than 1 percent of Florida AAQS. These minimal environmental impacts do not justify a lower BACT emission level.

3.4.3.2 Sulfur Dioxide

Sulfur is contained in solid waste in very small quantities, typically about 0.12 percent on an as-fired basis. For the proposed facility, the resulting SO₂ emissions are 4.9 lb/ton or 0.55 lb/10⁶ Btu heat input. Precombustion and postcombustion SO₂ control technologies have been developed for boilers firing fossil fuels. However, SO₂ control technologies have not been applied to boilers burning non-fossil fuels, such as solid waste, due to the low SO₂ emissions.

Precombustion control technologies consist of: (1) using naturally occurring low-sulfur fuels, and (2) physically or chemically cleaning the fuel. The solid waste fired in the proposed facility falls into this first category, with a sulfur content of 0.12 percent (i.e., 0.30 lb/10⁶ Btu). By comparison, low-sulfur coal typically contains 0.5-percent sulfur (i.e., about 0.8 lb/10⁶ Btu), and No. 2 distillate oil typically is as low as 0.35-percent sulfur by weight (i.e., about 0.4 lb/10⁶ Btu).

No method of physically or chemically cleaning solid waste to lower its sulfur content is known to have been developed. The low sulfur content of solid waste has not required such a process to be developed. Therefore, precombustion sulfur removal from solid waste is deemed technologically unfeasible.

Postcombustion SO₂ removal techniques for boilers consist of the implementation of flue gas desulfurization (FGD) technology. Several different FGD systems have been developed, primarily for use on high-sulfur-fuel-fired boilers. These consist of sodium scrubbing, dual-alkali scrubbing, lime and limestone scrubbing, and dry scrubbing. These systems use calcium- or sodium-based scrubbing solutions which react with SO₂ to form sulfite and sulfate salts.

The major drawbacks to all of these systems are:

1. They produce large amounts of solid and/or liquid wastes, which must be disposed of properly. Disposal may cause other environmental effects (i.e., groundwater contamination).
2. Energy requirements to operate the FGD system are high. Typical FGD installations on electric utility boilers use 10 percent or more of the energy output of the boiler.
3. FGD systems have not been applied to incinerators where SO₂ concentrations are low and highly variable due to the variable nature of solid waste.
4. FGD systems are costly to install and operate and require considerable maintenance; due to operational problems, they are rarely available 100 percent of the time, unless costly redundancy is built into the plant.
5. FGD systems typically use large amounts of water for the scrubbing solution.

Costs of applying an FGD system to a resource recovery/incinerator facility were estimated by Environmental Research and Technology, Inc. (1981) as part of the PSD permit

application for Westchester County (New York) Resource Recovery Facility. This facility is capable of firing 1,890 TPD of solid waste, which is approximately the size of the proposed Broward County facilities. Five different FGD system types were evaluated.

SO₂ removal efficiency to each system was assumed to be 70 percent. Capital costs of an FGD system were found to range from \$7 to \$9 million (1983 dollars). Annual costs, including fixed capital charges and operating and maintenance costs, ranged from \$0.94 to \$1.34 per 10⁶ Btu for the first year of operation. These annual costs equate to \$4.6 to \$6.5 million, based on a 90-percent availability factor.

There are no energy penalties associated with the control technology proposed for the Broward County projects. The associated environmental impacts are minimal. The predicted maximum 24-hour SO₂ impacts due to the proposed facility are 45 percent of the de minimis impact level (i.e., for monitoring exemption) and 118 percent of the significant impact levels (i.e., for modeling exemption). Predicted impacts for all averaging times are less than 7 percent of all PSD Class II increments and Florida AAQS. The minimal SO₂ emissions and environmental impacts do not justify a lower BACT emission limit.

Considering the low SO₂ emissions from the proposed facility and the severe economic penalties, potential additional environmental impacts due to solid/liquid waste disposal, additional water and energy requirements, and unproven ability on solid waste fired boilers, implementation of an FGD system on the proposed BCRR facility is considered economically and environmentally unacceptable. None of the SO₂ removal alternatives is considered superior to that of firing low-sulfur solid waste fuel in the boiler.

3.4.3.3 Nitrogen Oxides and Carbon Monoxide

The proposed BACT control techniques for NO_x and CO emissions from the proposed facility are: (1) limit peak combustion temperature to 1,800°F, (2) proper solid waste firing in the boiler, and (3) high excess air operation. These control techniques are considered the only currently available methods of control for these pollutants.

The proposed BACT emission limits for NO_x result in maximum annual average predicted impacts of less than 5 percent of the de minimis impact level (i.e., for monitoring exemption), 60 percent of the significant impact level (i.e., for modeling exemption), and 0.6 percent of Florida AAQS. The proposed CO emission limit results in maximum predicted impact level, or Florida AAQS.

Further reduction in emissions could be achieved through add-on flue gas cleaning equipment, but such equipment or processes have not been demonstrated in practice on incinerators (USEPA, 1979). Flue gas cleaning methods for application to industrial/utility boilers with high NO_x emissions are currently in the developmental stage only. Therefore, add-on NO_x/CO controls are not considered technically feasible for this application. In addition, the very small air quality impacts due to NO_x and CO emissions from the proposed facility do not justify further reduction in emissions.

3.4.3.4 Other Pollutants

As discussed in Section 3.4.2.4, ESP's used to control PM emissions will also control emissions of lead, beryllium, and inorganic arsenic. Alternative PM control technology is discussed in Section 3.4.3.1. For the reasons stated therein, ESP's are considered to be the best choice of PM control technology for the proposed source and, therefore, BACT for control of lead, beryllium, and arsenic. The maximum predicted

air quality impacts for these pollutants are well below all applicable air quality standards and de minimis impact levels. The minimal environmental impacts of these pollutants do not justify additional controls or reduced emission levels.

Additional control technology (i.e., add-on equipment) could be used to further reduce emissions of fluorides, sulfuric acid mist, and mercury, which are emitted primarily in the gaseous phase. For example, a wet scrubber could be used, which has been demonstrated to remove more than 99 percent of the fluorides at phosphate rock plants. However, due to the low emission rates for these pollutants and the economic and energy penalties associated with add-on control equipment, additional add-on equipment is not justified. The maximum predicted air quality impacts for these pollutants are well below all applicable air quality standards and de minimis impact levels.

Recently, concerns have been expressed about potential emissions of chlorinated dibenzodioxins and related compounds from solid waste resource recovery facilities. However, it is believed that such emissions, if present, will be at such low concentrations that no appreciable impact on the surrounding environment will result. Considering the temperature at which combustion of the solid waste will occur and other furnace characteristics, the potential for release of measurable quantities of these compounds would appear to be low. Appendices 10.16 and 10.17 of this application provide more detailed information on this issue. Given the low probability of occurrence of these compounds in the emissions in other than negligible amounts, the imposition of additional specific control devices on the proposed facility does not appear justifiable. As a result, none are herein proposed.

3.4.4 Design Data for Control Equipment

The following information is based on the design data provided by a specific vendor. Again, this information is

provided on a preliminary basis and does not represent preference to any one vendor's design. Table 3.4.4.1 presents the efficiency and effectiveness of the electrostatic precipitator(s) proposed for the control of air emissions at the southern resource recovery facility.

3.4.5 Design Philosophy

As previously mentioned on Section 3.4.3.1, Particulate Matter, USEPA data suggests that the electrostatic precipitator is highly proven for municipal incinerator application and is capable of achieving PM emission levels well below NSPS and State of Florida emission standards. Figure 3.4.5.1 presents the conceptual simplified mass balance.

3.5 Plant Water Use

A quantitative preliminary water balance diagram for average and peak water use is provided in Figure 3.5.1. Presented in this figure are estimated quantities of water flows to and from the various plant water systems including the heat dissipation system, sanitary wastewater system potable water systems, and process water system. The source of all plant intake water is from the County water supply.

The plant water balance is designed to take advantage of operating procedures which will direct wastewater to the ash quench system and reduce neutralization chemical costs. The remaining plant process discharges will be disposed of at the Hollywood Wastewater Treatment Plant (HWWTP).

3.5.1 Heat Dissipation System

3.5.1.1 System Design

At the facility, the steam turbine condenser will be designed to meet maximum boiler American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE) output without any steam being extracted for process, for the

TABLE 3.4.4.1

ENVIRONMENTAL DATA

Air Pollution Control Equipment (Electrostatic Precipitator)1. Particulate

- a) The particulate size data from different facilities exhibit different characteristics. The size of the particulate matter entering and leaving the air pollution control equipment cannot be readily quantified due to changes in operation, design parameters, waste quality, and boiler configuration.

A review of data from incinerators equipped with ESP's indicate particle size distribution as follows:

	<u>Uncontrolled</u>	<u>Controlled</u>
Mass Mean Diameter	15 micron	10 micron
Percent less than 10 micron	42%	50%
Percent less than 2 micron	21%	24%

- b) Inlet Loading: 10 grams/m³ (sootblowing conditions).
 c) Particulate density in terms of specific gravity: 38 lb/ft³
 d) Resistivity: Ranges 10⁹ to 10¹⁰ ohm-centimeters.

Southern RRF
 (784 tons refuse/day
 per boiler)

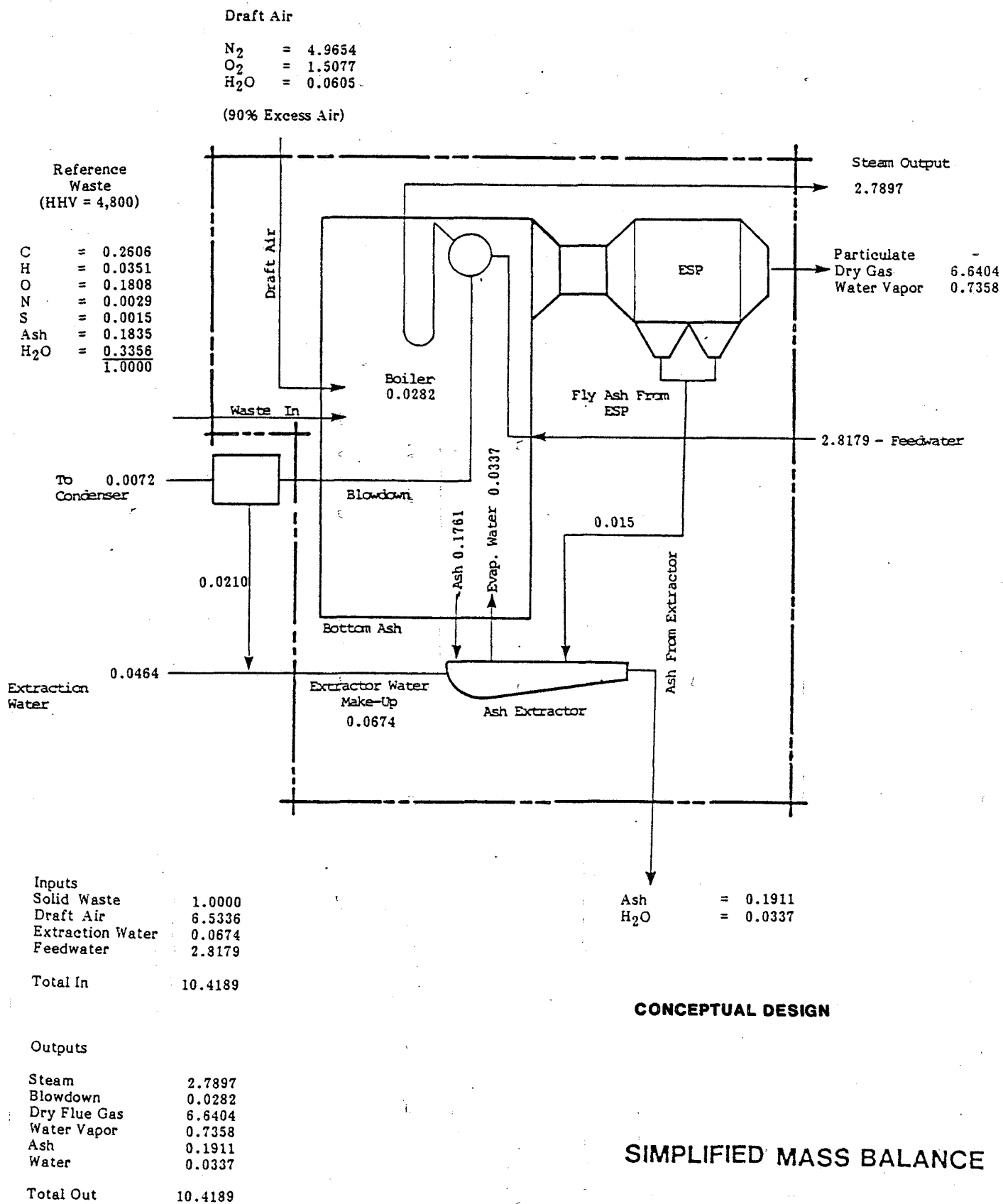
2. Gas Flow

- a) Volume Flow Rate: 99.0 meters³/second
 b) Velocity: 0.85 meters/second
 c) Temperature (per section): 288 °C.
 d) Pressure: -0.2 psi
 e) Viscosity: 0.026 cP

TABLE 3.4.4.1 (continued)

ENVIRONMENTAL DATA

		<u>Southern RRF</u> (784 tons refuse/day)
3.	<u>ESP Design</u>	
a)	Electrical Length per Plate	<u>2.8</u> meters
b)	Wire to Plate Spacing:	<u>150</u> millimeters
c)	Wire to Wire Spacing:	<u>300</u> millimeters
d)	Wire Diameter:	<u>2.5</u> millimeters
e)	Wires per Section	<u>3,430</u> meters
f)	Wire Length per Section:	<u>10.5</u> meters
g)	Plate Area per Section:	<u>638</u> meter ²
h)	Number of Electrical Sections:	<u>3</u>
i)	Duct Width:	<u>10.5</u> meters
4.	<u>Electrical Design</u>	
a)	Applied Voltage each Section:	<u>55,000</u> volts
b)	Total Current in Electrical Section:	<u>1,000</u> mA
c)	Roughness of Wire	<u>-</u> roughness factor



hottest day in the year, as per the Weather Bureau, for the Broward County area.

The vendor will provide cooling systems sized to condense the exhaust steam for the turbine assuming all boilers are in operation. Reducers and coolers of steam pressure will be installed so that the facility can also bypass the turbine and condense the total output of all boilers under maximum steam generation. Sustained venting of steam will be avoided. The condensing system shall be valved and piped to increase operation and maintenance flexibility.

The cooling system proposed to be utilized at the facility is an air cooled condenser. It will be designed for an exhaust steam pressure of between 3 and 4 inches of mercury absolute. The air cooled system will require approximately 50 gallons per minute of makeup water average. The location of the air cooled condenser is shown on Figure 2.1.2, Civil Site Plan. The condenser will be approximately 40 feet in height.

3.5.1.2 Source of Cooling Water

Water requirements for cooling water can be provided by County. County has an existing 12-inch diameter water main, which runs east-west along Griffin Road south of the project site. An 8-inch line extends north from that main to a point adjacent to the resource recovery facility site. Water quality data for the County water plant that would provide service to the southern site is provided in Table 3.5.1.1. Preliminary information from the County indicates that approximately 100 gpm of water from the County water system may be available to this site.

3.5.1.3 Dilution System

Since all cooling water intake will be from the County Utility, no dilution of intake water will occur. Discharge water, limited to boiler blowdown, will be disposed of directly to a sanitary sewer with no dilution required (see

TABLE 3.5.1.1

1982 AVERAGE ANNUAL WATER QUALITY VALUES FOR
THE BROWARD COUNTY SYSTEM 3-A PLANT

<u>Analytical Results</u>	<u>Raw Water</u>	<u>Finished Water</u>
Water pH at the Plant	7.25 units	8.75 units
Water pH at the Field	-	8.50 units
Water Color at the Plant	63 CU	12.0 CU
Water Color at the Field	-	12.8 CU
Water Odor No. Dilutions	3 DIL	-
Water Turbidity	-	0.41 BTU
Water Free Carbon Dioxide	21 mg/l	0 mg/l
Calcium Hardness as CaCO_3	209 mg/l	63 mg/l
Magnesium Hardness as CaCO_3	18 mg/l	14 mg/l
Total Hardness as CaCO_3	227 mg/l	77 mg/l
Total Mo. Alk. as Ca CO_3	198 mg/l	26 mg/l
Non Carbonate Hardness as CaCO_3	29 mg/l	51 mg/l
Calcium as Ca^{+2}	4.4 mg/l	3.4 mg/l
Iron as Fe^{+2}	1.67 mg/l	0.03 mg/l
Sodium as Na^{+1}	23.2 mg/l	23.8 mg/l
Bicarbonate as HCO_3^{-1}	242 mg/l	31.7 mg/l
Chloride as Cl^{-1}	35 mg/l	52.4 mg/l
Sulfate as SO_3^{+2}	17.0 mg/l	18.0 mg/l
Fluoride as F^{-1}	0.19 mg/l	0.88 mg/l
Total Dissolved Solids	408 mg/l	173 mg/l
Total Res. Chlorine	-	2.9 mg/l
Total Free Chlorine	-	2.5 mg/l
Total Comb Chlorine	-	0.4 mg/l
Saturation Index	+0.00	+0.14 mg/l

Figure 3.5.1). All wastewater discharges will meet the City of Hollywood pretreatment criteria as well as BCEQCB and Broward County Utilities Division standards.

3.5.1.4 Blowdown, Screened Organisms, and Trash Disposal

Because facility process water will be provided by a direct hookup with a water utility force main, screened organisms and trash associated with intake screens do not present a problem.

Boiler and cooling tower blowdown will be sent to a process neutralization sump. The pH of the blowdown may be near 10.5 to 11.5. However, its low volume and low buffering capability will bring the pH to within the typical 6 to 9 pH discharge limits when mixed with other discharge wastes. Mixing with other discharges will also reduce the temperature to approximately 90°F. Excess water that cannot be utilized for ash quench will be disposed of at the HWWTP (see Figure 3.5.1).

3.5.1.5 Injection Wells

Injection wells are not included in the overall design of the facility.

3.5.2 Domestic/Sanitary Wastewater

The sanitary sewers from the Truck Scale Building, the Administration Building and the Refuse Building will be collected and will flow to an existing sanitary sewer, with no pretreatment. Flow rates will be approximately 3,000 gallons per day.

3.5.3 Potable Water Systems

All facility water requirements will be supplied by the Broward County Utilities Division. As described in Subsection 3.5.1.2, Source of Cooling Water, no treatment is anticipated for non-process water applications (i.e., sanitary uses). Intake volume for non-process water is approximately 3,000 gallons per day.

3.5.4 Process Water Systems

As described above, all facility intake water will be provided from the County's potable water supply. Peak process water intake quantities will be approximately 100 gallons per minute. This includes water required for boiler and air cooled condenser makeup (blowdown and evaporative losses). Treatment of intake water will be limited to the following:

o Boiler Water Treatment	
- Iron dispersant	<u>14,100</u> lbs/year*
- Phosphate	<u>1,100</u> lbs/year
- Hydrazine	<u>1,800</u> lbs/year
- Neutralizing/ Filming Amines	<u>1,800</u> lbs/year
o Demineralizer	
- H_2SO_4 (93% H_2SO_4)	<u>48,600</u> lbs/year
- $NaOH$ (50% $NaOH$)	<u>85,500</u> lbs/year

*Approximate quantities.

Process wastewater will be neutralized and either used as ash quench makeup water or discharged to the HWWTP.

A second source of process wastewater is leachate generated in the residue/unporcessable waste landfill. To assess the potential volume of leachate generated at the landfill, various stages of landfill development were analyzed. The results of this water balance analysis indicate that during the May-October "wet" season, leachate production ranges from 0.5 to 8.3 million gallons per month, depending on the operation phase. All leachate will be disposed of at the HWWTP. For a more complete discussion on leachate production, see Section 5.3.4, Leachate and Runoff.

3.6 Chemical and Biocide Waste

The resource recovery facility intake water is provided from the County potable water supply by the Broward County Utilities Division. The system water losses (deaerator stripping steam, boiler and condenser blowdown, miscellaneous

system losses) will be made up with demineralized water. A strong acid/ strong base demineralizer system will provide the quality of feedwater necessary for the boilers. The make-up water is fully treated and pumped to a storage tank. This tank then supplies the make-up water necessary to the boilers.

The ion exchange system will be preceded by carbon bed absorption filters so as to effectively reduce organic contaminants and chlorine residual which would otherwise attack the ion exchange resins. The ion exchange system is a dual train system with separate anion and cation beds. The sulfuric acid and sodium hydroxide regenerant feeds will be adjusted to meet the bed ion exchange capacity requirements and to self neutralize when the regenerant feed and slow rinse cycles are combined in the waste neutralization tank. The neutralized process wastewater along with boiler blowdown water will then be pumped to the ash quench trough where it is evaporated or carried with the ash. Excess wastewater is discharged to the local sanitary sewer (as illustrated on Figure 3.5.1). Landfill leachate as collected will be pumped to a local sanitary sewer force main for ultimate disposal. No on-site treatment of leachate will occur.

The exact flow diagram of the chemical waste system will be developed by a yet to be selected vendor. There are no discharges from chemical processing, water treatment or leachate that may enter the local environment as the result of plant operations.

3.7 Solid and Hazardous Waste

Anticipated solid waste generation from the facility will be in the form of ash residue. As indicated in previous sections, disposal of ash residue will be at a double lined landfill located on the same site as the resource recovery plant. Details describing the design of the landfill are contained in Section 5. Possibilities for chemical fixation,

the design parameters for leachate and stormwater runoff control are also contained in Section 5.

Although these waste streams will be disposed of in the most efficient and environmentally secure manner, there still exists the possibility for recycling some of the waste products. For example, water used for the facility's operations will be cooled and recycled through the facility for other operational users such as ash quenching. Ash residue has been used on an intermittent basis in other cities and countries as an aggregate base for road construction. Although consideration has been given to this type of reuse, additional research concerning its environmental impacts is required.

3.7.1 Solid Waste (Ash Residue)

Sources of Solid Waste

Solid waste in the form of ash residue is generated at three points in the proposed resource recovery facility. In each case, waste is conveyed from its point of generation to an ash quench tank for the purpose of cooling the ash, facilitating its handling, preventing fugitive dust emissions and serving as a seal to prevent air from leaking into the grate area through the ash discharge chute.

It is anticipated that ash will be generated at approximately 25 cubic yards per hour with three boilers operating at their initial installed capacity. The three points at which ash residue waste is generated and collected are as follows:

- o Bottom-Ash - Burnout is achieved as waste is tumbled along the rollers or grates which comprise the stoker system. The residue passes over the final roller or grate and falls off into the residue extractor trough below. A siftings hopper under the stoker system will catch siftings that fall through the grate bars. The siftings will then be gravity-discharged onto a vibrating conveyor which transfers the siftings to the ash quench tank.

- o Boiler Fly Ash - A substantial amount of entrained particulate material (fly ash) carried by the combustion gas leaving the grate enclosure is removed in the boiler. The boiler is equipped with hoppers and valves for removing the accumulated fly ash while the boiler is in operation. Material collected in these hoppers is transferred by screw conveyors to the residue extractor trough.
- o Electrostatic Precipitator Fly Ash - Fly ash remaining in the flue gas as it leaves the boilers is removed in electrostatic precipitators. This reduces its particulate concentration to the level required by environmental regulations. The fly ash is collected in hoppers at the bottom of the precipitator and is conveyed to the ash quench tank.

3.7.1.1 Handling System for Ash Residue

Bottom ash, siftings, and collected fly ash will be quenched. Dual hydraulic, ram-type, ash extractors will push the ash up an inclined chute to a discharge opening.

From this opening the ash will enter a bifurcated chute that will direct the ash to either of two 100 percent capacity conveyors. These will be vibrating conveyors which will smooth out the slugs of ash that are removed from the quench tank by the ash extractor, permitting a level burden to be conveyed to the residue bunker.

All of the ash-handling equipment will be enclosed in a separate ash gallery to facilitate maintenance and control of vagrant dust, vapors, and noise emissions.

The conveyor will discharge the ash into the residue storage bunker. The residue storage area will provide enough storage capacity for all residue generated at the design rate, for a minimum of three days at full operating capacity.

An overhead crane with a clamshell bucket or front end loader may be used to transfer the residue from the bunker to residue trucks.

Following are the anticipated technical specifications for components of the ash handling system (full technical specification of the proposed system appear in Appendix 10.11):

- o Quenching Tank/Basin/Trough

Number per Furnace/Boiler	2
Dimensions (LxW) ft.	6 ft-6 in. x 2 ft - 3 in.
Capacity (cu.ft.)	19.74

- o Conveyors

Bottom Ash: Type	Vibratory
Capacity (tons/hr)	7.0
Fly Ash: Type	Screw
Capacity (tons/hr)	2.0

- o Ash Bunker (Enclosed)

Dimensions (LxWxH) ft.	224 x 24 x 25
Capacity (tons)	4,000

- o Overhead Cranes for Ash Handling

Number	1
Capacity (tons)	5

3.7.1.2 Disposal of Ash Residue

Residue generated and collected at the resource recovery facility will be transferred by transfer truck to the residue/unprocessable waste landfill located adjacent to the facility.

The combined ash residue is required to meet the following criteria:

- o Putrescible content: <0.3% by dry weight.

- o Moisture content (excluding free liquid): 30% by weight.
- o Bulk density (lbs/cu.ft.) 1,000-2,000
- o Combustible content: <4.0% by dry weight.

3.7.2 Hazardous Waste

As previously mentioned, no hazardous materials will be accepted at the facility for disposal. The ash residue will be tested periodically to insure conformance with the Federal Resource Conservation and Recovery Act standards. Appendix 10.12, Summary Update of Research Projects with Incinerator Bottom Ash Residue illustrates the non-hazardous nature of ash residue as well as its suitability for landfilling.

3.8 On-Site Drainage System

3.8.1 General

The project site is located east and downstream of the South Florida Water Management District C-11 Canal drainage basin.

On-site drainage for the project will be provided by separate systems for the resource recovery facility and the landfill. A discussion of the conceptual plan for each system follows. The design calculations which were used to base the conceptual design are provided in Appendix 10.13.

3.8.2 Water Quality Design Criteria

South Florida Water Management District (SFWMD) water quality guidelines for dry retention areas require a dry retention volume equal to 50 percent of the runoff from the 3-year, 1-hour storm (precipitation = 2.8 inches). This required retention storage will be provided typically in dry retention swales, dry retention ponds and/or underground exfiltration systems. Excess runoff, beyond that which is retained immediately on site will be conveyed, typically via

culverts, to detention ponds which are sized to supply sufficient storage volume to meet the quality criteria. Water stored by detention in the ponds will be released by controlled gravity discharge to the wetlands area and C-11 canal in accordance with SFWMD discharge criteria. Recovery to elevation 2.0 feet NGVD will be by filter berms.

3.8.3 Peak Discharge Criteria

The project is located downstream from SFWMD Pump Station S-13 and outside (i.e., downstream) of the C-11 drainage basin. To meet SFWMD design discharge criteria, post development peak discharges from the site will be limited to pre-development levels for the 25-year 72 hour design storm.

3.8.4 Seasonal Water Table Elevations/Control Elevation

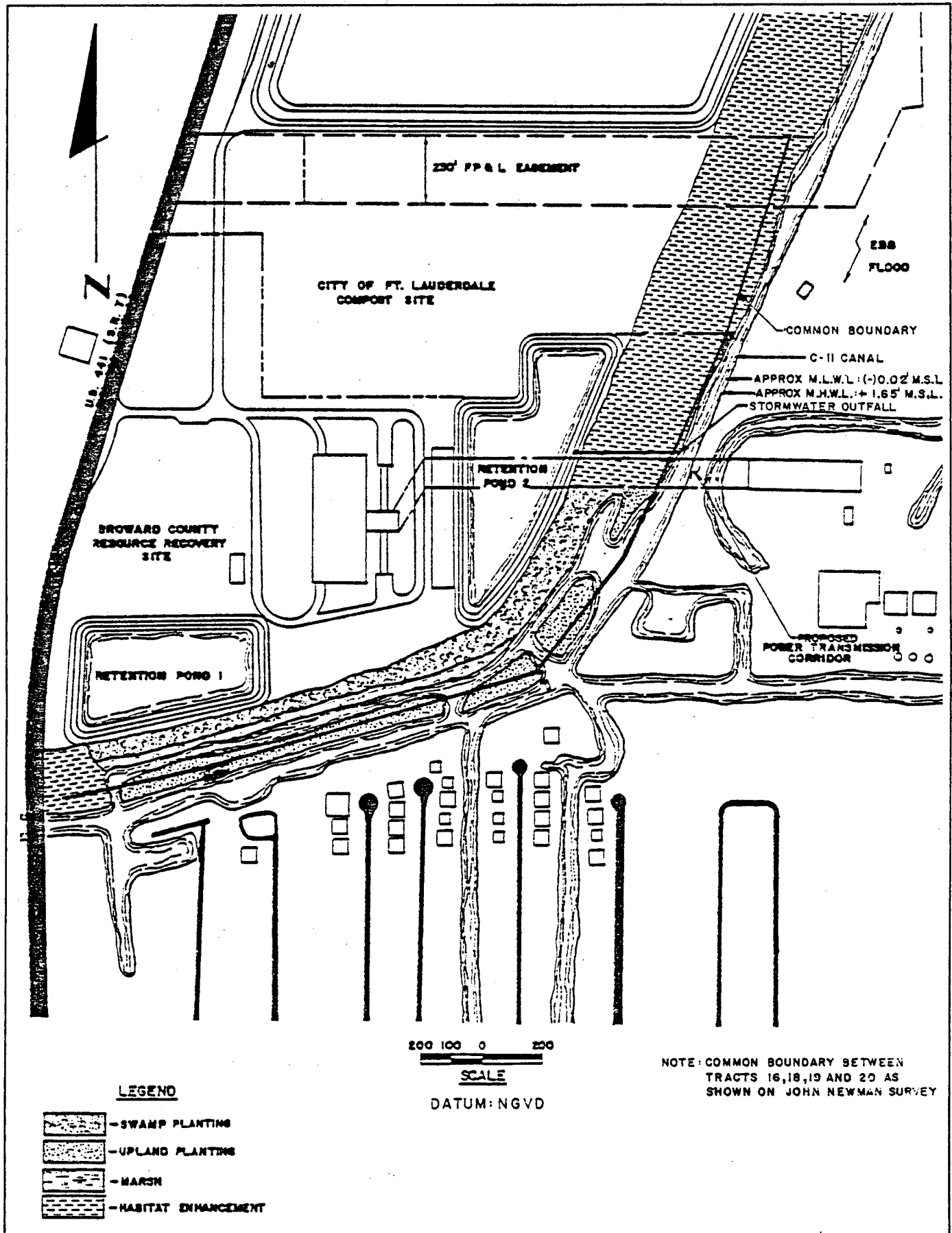
Water levels in the C-11 canal adjacent to the property, and downstream of SFWMD Pump Station S-13, are basically tidal in origin and typically range on an annual basis between - 1.64 ft., National Geodetic Vertical Datum (NGVD) (flood tide) and elevation -0.02 ft., NGVD (ebb tide). Stages within the canal are at times affected by gate operation and pumping at S-13, and are regulated to provide flood control in upstream reaches as well as to maintain adequate groundwater levels to discourage saltwater migration. Groundwater levels in the area fluctuate during the various seasons in conjunction with precipitation patterns and the operation of Pump Station S-13.

A control elevation of 2.0 ft., NGVD has been assumed for the project in accordance with existing conditions and with the recommendations of the Broward County Water Management Division.

3.8.5 Resource Recovery Facility

The required stormwater retention will typically be provided by on-site dry retention swales and/or dry retention

FIGURE 3.8.5.1



BROWARD COUNTY

SITE PLAN

SOUTHERN RESOURCE RECOVERY FACILITY

ponds. Disposal of retained water in these areas will be accomplished via percolation and evaporation processes. Excess runoff, beyond that which is retained in the retention areas will be conveyed to two ponds (pond 1 and pond 2). These ponds, which are approximately 3.4 and 4.3 acres in area, will be constructed at the southern and eastern portions of the RRF site (Figure 3.8.5.1). Detained water in the ponds will be released by controlled gravity discharge, via a weir/culvert structure to the C-11 canal in accordance with SFWMD discharge criteria. The ponds will be hydraulically connected.

The major outfall structure for the site is located at Pond 2. It consists of a weir overflow structure (invert el. 2.3 ft. NGVD with a pipe, sluice gate and a baffle for water quality and discharge control. An approximately 36-inch in diameter Reinforced Concrete Piping (RCP) connects the structure to the C-11 canal, which is the final discharge point for project drainage. Specifically, post development peak discharges from the resource recovery facility site, for the 25 year-72 hour design storm, will not exceed predevelopment levels. Peak discharge to the C-11 canal will be approximately 23 cubic feet per second (cfs) which is the estimated predevelopment discharge. Discharge velocities will be limited to below 4 feet per second, for erosion control purposes. The weir outfall control structure will be furnished with a baffle for oil, grease and sediment control. The invert of the weir will be set at elevation 2.3 feet NGVD. This elevation provides sufficient retention for water quality control. Elevation 2.0 feet NGVD is the established control elevation for the site. Water level in the ponds will rise to elevation 4.8 ft NGVD during the 25 year-72 hour storm. Ponds will be constructed with a minimum 0.5 foot freeboard.

Berms will be constructed to contain water during dredging and filling. Sediment traps and screens will be strate-

gically placed to trap runoff. All permanent berms constructed for the development will be grassed to prevent erosion.

3.8.6 Residue/Unprocessable Waste Landfill

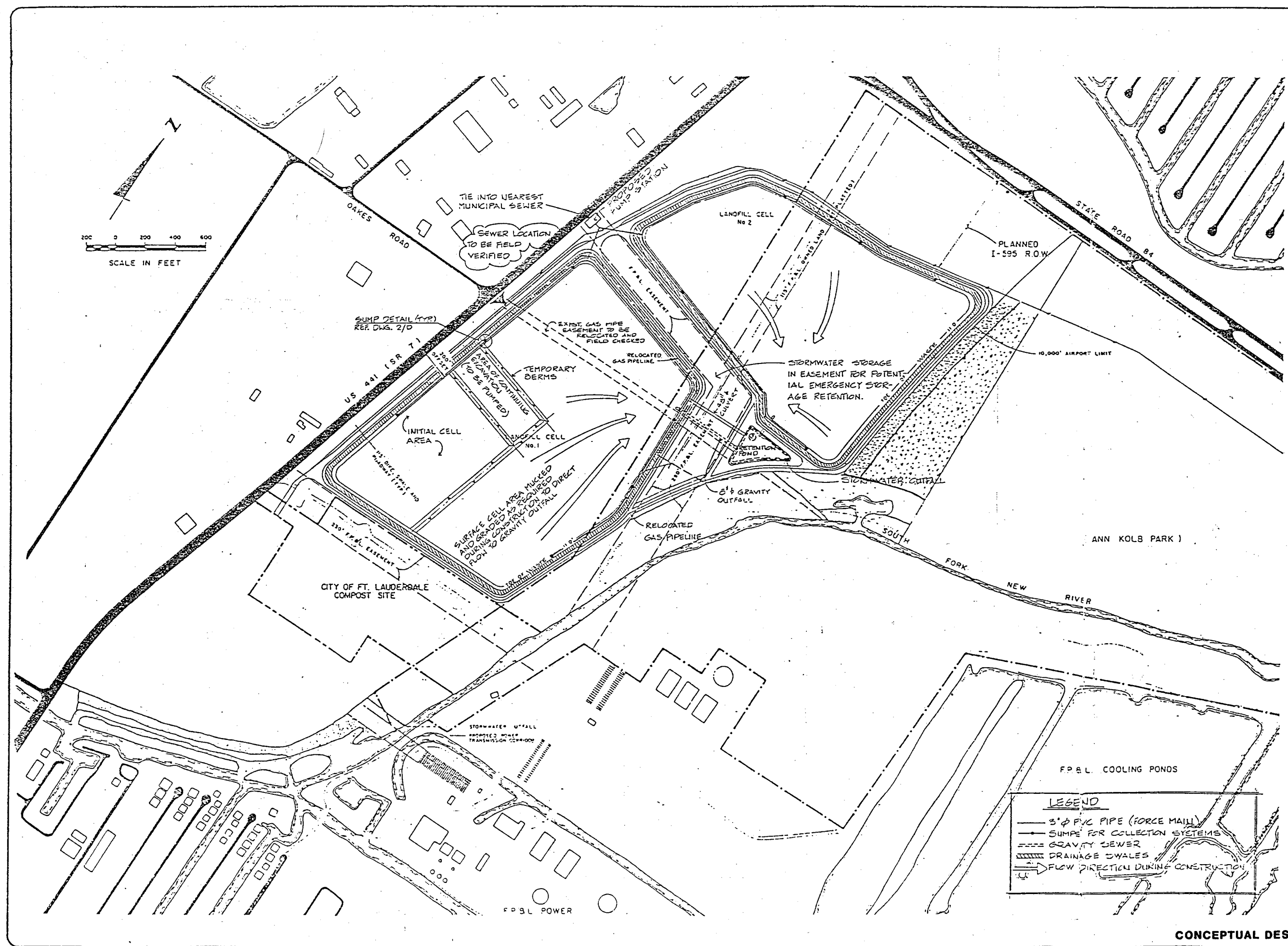
The surface water management system for the landfill portion of the project will be designed to accommodate current and future site utilization. A phased development and operational plan is envisioned in order to address such issues as the routing and treatment of runoff from active portions of a landfill cell and concerns regarding the quality and appropriate control methods for the disposal of surface runoff during rainfall periods.

3.8.6.1 Preclosure Operation

Preclosure operations will be conducted to provide the required protection for water resources. The major preclosure operations are described below:

- o Before material is deposited within a given landfill cell:
 - The landfill cell will be surrounded by a perimeter access road which will serve as a dike to prevent on-site runoff from impacting off-site areas and will also protect the fill from storm surge flooding.
 - The landfill cell will be surrounded by a grassed perimeter swale system.
 - The landfill cell will have an impermeable bottom liner and underdrain system to capture any leachate generated within the landfill.
- o Typically active areas within the landfill cell will be temporarily bermed in order that stormwater runoff that does not come in contact with landfill materials (thus being uncontaminated) will be directed to a gravity outfall to the retention pond (Figure 3.8.6.1). Stormwater runoff that comes in contact with landfill waste materials will be treated as leachate and collected in the landfill cell underdrain system and conveyed along with the

FIGURE 3.8.6.1



REV.	DESCRIPTION	DATE	BY



DOWNING-FERRIS INDUSTRIES
ENGINEERING SERVICES
14701 SAINT MARY'S STREET, P.O. BOX 3151, HOUSTON, TEXAS 77001 • (713) 870-8100

2011 DRAINAGE CONTROL

PROPOSED LANDFILL DESIGN
SOUTHERN RESOURCE RECOVERY FACILITY
BROWARD COUNTY, FLORIDA

DATE: 10-20-01
DESIGNED BY: J. M. JONES
CHECKED BY: J. M. JONES
APPROVED BY: J. M. JONES
PROJECT NUMBER: 01

CONCEPTUAL DESIGN

landfill leachates to a common collection sump for ultimate disposal at the Hollywood Waste Water Treatment Plant. This collection and disposal system will be separate from the stormwater management facilities. A more detailed description of landfill operations is provided in Section 5.3.

- o The Route 441 landfill site will ultimately consist of two landfill cells. Each cell will be surrounded by a perimeter access road which will serve as a dike in order to insure all surface runoff is contained on site and to protect the fill from flooding.

A grassed perimeter swale will be located between the toe of each landfill cell and the cell's perimeter access road. During periods of rainfall, uncontaminated stormwater will run off covered portions of the landfill and be captured in the perimeter swale system. Runoff from the landfill which is captured in the perimeter swale systems will typically drain via culverts beneath the access road ultimately to a stormwater pond from where final disposal can take place. The ultimate method of stormwater runoff disposal will vary as the landfill site is developed, as indicated in Sections 4 and 5 below.

- o The development plan for the landfill site will initially involve ash and non-processable waste disposal in landfill cell 1, which is expected to occur over a period of 14 years, (i.e. 1988 to 2002). During this entire 14 year period, the area set aside for landfill cell 2 will be utilized as a temporary retention area for runoff from landfill cell 1. This will be accomplished by connecting the perimeter swale around landfill cell 1 to the cell 2 retention area by culverts passing under the perimeter road. Thus, during rainfall periods stormwater run-off from capped and interior portions of the landfill cell will first be captured in its perimeter swale system and then flow by gravity through the culverts to the retention area. The retention area will be connected by pipes to a pond near the southeast corner of landfill cell 2 and to the diked FPL easement for potential emergency storage retention. The easement will be connected hydraulically via an equal-

izer structure to the retention pond. Runoff will typically flow from the perimeter swale to the retention area to the stormwater pond where final disposal will be to the C-11 canal (see Figure 3.8.6.1 for details). Water levels will rise to elevation 5.9 feet NGVD during the 25 year-72 hour storm. Recovery to control elevation 2.0 NGVD will be by filter berm bleeddown an controlled gravity discharge to the wetland areas bordering the C-11 canal.

- o Peak discharges to the C-11 canal will be limited to predevelopment or natural levels for the 25 year-72 hour design storm, in accordance with SFWMD discharge criteria. The analysis provided in Appendix 10.13 has determined that for the design storm, peak discharges from the stormwater pond to the C-11 canal will be limited to approximately 104 cubic feet per second (cfs). By approximately the year 2002, landfill cell 1 will be completely filled and inactive and will have been closed in accordance with federal, state and local regulatory agency requirements. This includes final capping with two feet of earth and seeding to create an established vegetative cover. At this time, (year 2002) the remaining landfill cell 2, will become the site for active landfilling.

During the continued development of the landfill site, a major objective of the stormwater management system will be to utilize remaining available land for stormwater retention purposes. Thus, during the landfilling of cell 2, unused portions of the cell 2 site will be set aside for uncontaminated stormwater retention purposes. Runoff from landfill cell 2 and the developed portions of landfill cell 2 will be directed via culverts to these areas. Culverts will connect these areas to the stormwater pond for ultimate disposal. As available on-site stormwater storage is depleted due to the continued filling of cell 2.

Peak discharges to the C-11 canal will be limited to predevelopment or natural levels for the 25 year - 72 hour design storm, in accordance with SFWMD discharge criteria. The analysis provided in Appendix 10.13 has determined that for the design storm, peak dis-

charges from the stormwater pond to the C-11 canal will be limited to approximately 104 cubic feet per second (cfs).

3.8.6.2 Post Closure Operation

Final closure of landfill cell includes several operations to ensure long-term protection of surrounding waters:

- o At final closure each landfill cell (i.e. 1 and 2) will have been closed in accordance with federal, state and local regulatory agency requirements. This includes capping with two feet of earth and seeding.
- o SFWMD water quality and quantity criteria will be satisfied by the retention of an initial portion of the landfill runoff within the FP&L easement area and stormwater pond with ultimate disposal via controlled gravity discharge to the C-11 canal.

Runoff will be directed from the cell 1 and 2 perimeter swales to the retention areas in the pond and FP&L easement. Water quality criteria will be met by retaining 50 percent of the 3 year-1 hour storm. This will require approximately 14.2 acre-feet of storage above elevation 2.0 feet NGVD. A discharge weir elevation set at 3.7 feet NGVD provides this desired retention. Recovery to elevation 2.0 feet NGVD will be accomplished with filter berms.

Peak discharges during the 25 year-72 hour storm will be attenuated so as not to exceed 104 cfs; the estimated predevelopment set discharge. Water levels in the retention pond and easement will rise to elevation 8.6 feet NGVD during the 25 year storm. Peak flows from larger storm events will be discharged through an emergency outflow control structure. This structure will have sufficient capacity to hold retention pond water levels at elevation 10.0 feet NGVD for peak discharges from the 100 year-72 hour storm event.

3.9 Materials Handling

3.9.1 Facility

No heavy equipment such as large cranes, plant components such as boilers, or other voluminous materials will be transported to the site, unloaded, stored, or moved around the site during normal operation or maintenance of the facility. All equipment will be positioned inside the facility's buildings, and all maintenance will be carried out within the building except for routine painting, electrical work, and minor maintenance. The room where the steam turbogenerator is housed will have an overhead crane for maintenance of the turbogenerator. The solid waste and residue will be hauled in trucks. Section 5.9 describes and analyzes the impact of the truck traffic.

3.9.2 Landfill

A list of the heavy equipment that would be used in the normal operation of the landfill and ash handling is presented in Table 3.9.2.1. This equipment will be transported to the site over existing roads. On the site both permanent and temporary roads will be constructed so vehicles can carry refuse from the main service road to the working face of the landfill road construction and will be on a continuous basis as filling progresses to ensure efficient waste flow to the active landfill cell. Temporary roads will be constructed with on-site fill material wherever possible, well drained and constructed so that grades will not exceed 6 percent. All roads will be continually maintained to control dust and to allow free traffic flow at all times.

An equipment maintenance building will be constructed near the entrance of the landfill where equipment will be stored when not in use and for routine maintenance. Appropriate pollution control measures will be taken at the maintenance building.

TABLE 3.9.2.1

EQUIPMENT LIST

<u>Landfill</u>	<u>Ash Handling</u>
2 Caterpillar D8L Dozers	1 Caterpillar 980 F.E.L.
1 Caterpillar D5 Dozer	1 Caterpillar 966 F.E.L.
1 Gradall	3 Dump Trucks
1 Road Grader	1 Street Sweeper
1 Tractor	
1 Grease Truck	
1 4 x 4 vehicle	
1 Water Truck	

AREA	SPECIES	DENSITY
Everglades Tree Island (continued)	Pond Apple <u>Annona glabra</u> Pigeon Plum <u>Coccoloba diversifolia</u> Red Bay <u>Persea borbonia</u> Dahoon <u>Ilex cassine</u>	Equal mixture, random spacing, 1 tree/ 300 square feet. " " "

EVERGLADES RESTORATION AREA

**EFFECTS OF SITE PREPARATION, AND PLANT AND ASSOCIATED
FACILITIES CONSTRUCTION**

SECTION 4

SECTION 4

ENVIRONMENTAL EFFECTS OF SITE PREPARATION AND PLANT AND ASSOCIATED FACILITIES CONSTRUCTION

Introduction to Construction Phases and Activities

It is anticipated that the construction period for the Southern Broward County Resource Recovery Facility will be approximately 36 months. Initially, there will be a seven-month period for preparation of final process, civil, and structural design and the design and purchase of major equipment. This would be followed by an intensive 24 month construction phase. After construction, there will be approximately five months of personnel training, equipment testing, plant start-up shakedown. The exact schedule will be determined by the selected vendor.

The principal construction phases for the Resource Recovery Facility will include site preparation (site clearing and preparation, grading, excavation, pile driving and backfilling), facility construction (foundations, building and process equipment erection, electrical and mechanical systems installation, instrumentation), and finalization (road construction and paving, equipment start-up and testing, final grading, landscaping and cleanup). Possibly the completion of the final construction activities will extend into the shakedown period.

The principal construction phase for landfill development will be divided into three phases. Phase I will include site preparation (site survey, drainage swales, stormwater area, pump station and maintenance yard), installation of monitor wells, facilities construction (office, maintenance building, entrance, fencing and landscaping) and preparation of the initial disposal area (construction of three sump pumps, a contingency collection system and a leachate collection

system). Phase II will be the construction of the remainder of Cell 1. Phase II will follow the same construction procedure as that of Phase I to prepare the cell area. Phase III is the construction of Cell 2. The overall construction sequence is the same as that of Cell 1.

Figure 4.1 is a graphic representation of the expected progression of field construction activities. This figure indicates the activities that will be involved in the construction of the resource recovery facility and the estimated time required for completion of each activity. The environmental effects of the construction activities are presented in the following sections.

4.1 Land Impact

4.1.1 General Construction Impacts

4.1.1.1 Land Disturbance

The amount of land which will be disrupted by construction is approximately 200 acres. Fifty acres for the resource recovery facility and 150 acres for the landfill cells. The existing terrain will be disturbed by the following activities.

1. Initial Site Preparation and Clearing

The site will be cleared, grubbed, and graded to provide proper drainage. Topsoil will be stripped from all areas to be cut and filled as indicated on Figures 4.1.1 & 4.1.2 and will be stockpiled in designated areas of the site. Borrow will be obtained from off-site as necessary.

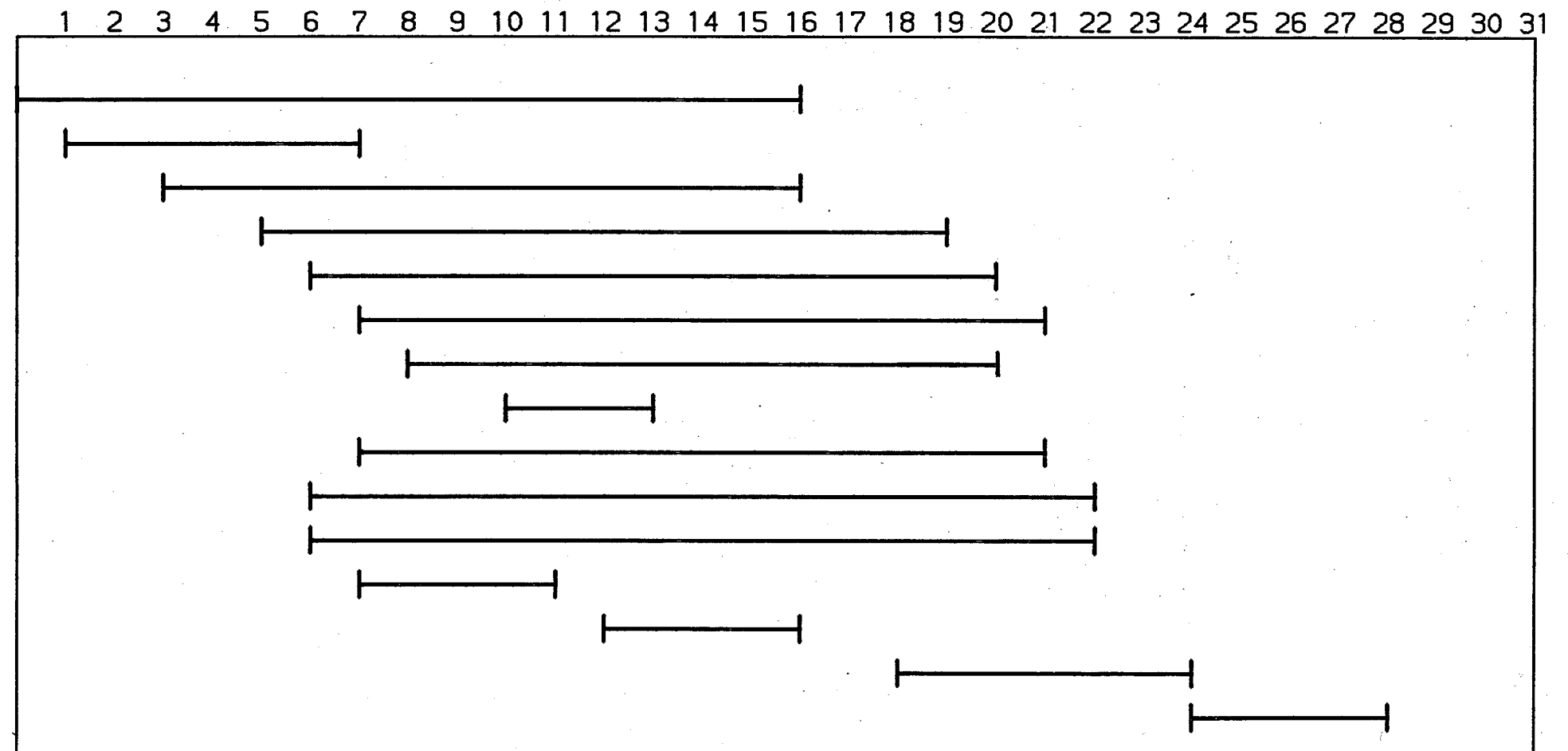
2. On-Site Excavation and Filling

Excavation will be required for the two landfill cells, three retention ponds, the area for the switchyard, building areas, refuse bunker, cooling tower and all roads up to the limit of the backfill. Excavated soil that is unsuitable for fill material will be stockpiled for use as landfill cover or wasted in designated areas on the site. The stockpile and waste areas will be graded to drain properly. The facility and landfill sites will be

CONSTRUCTION ACTIVITIES

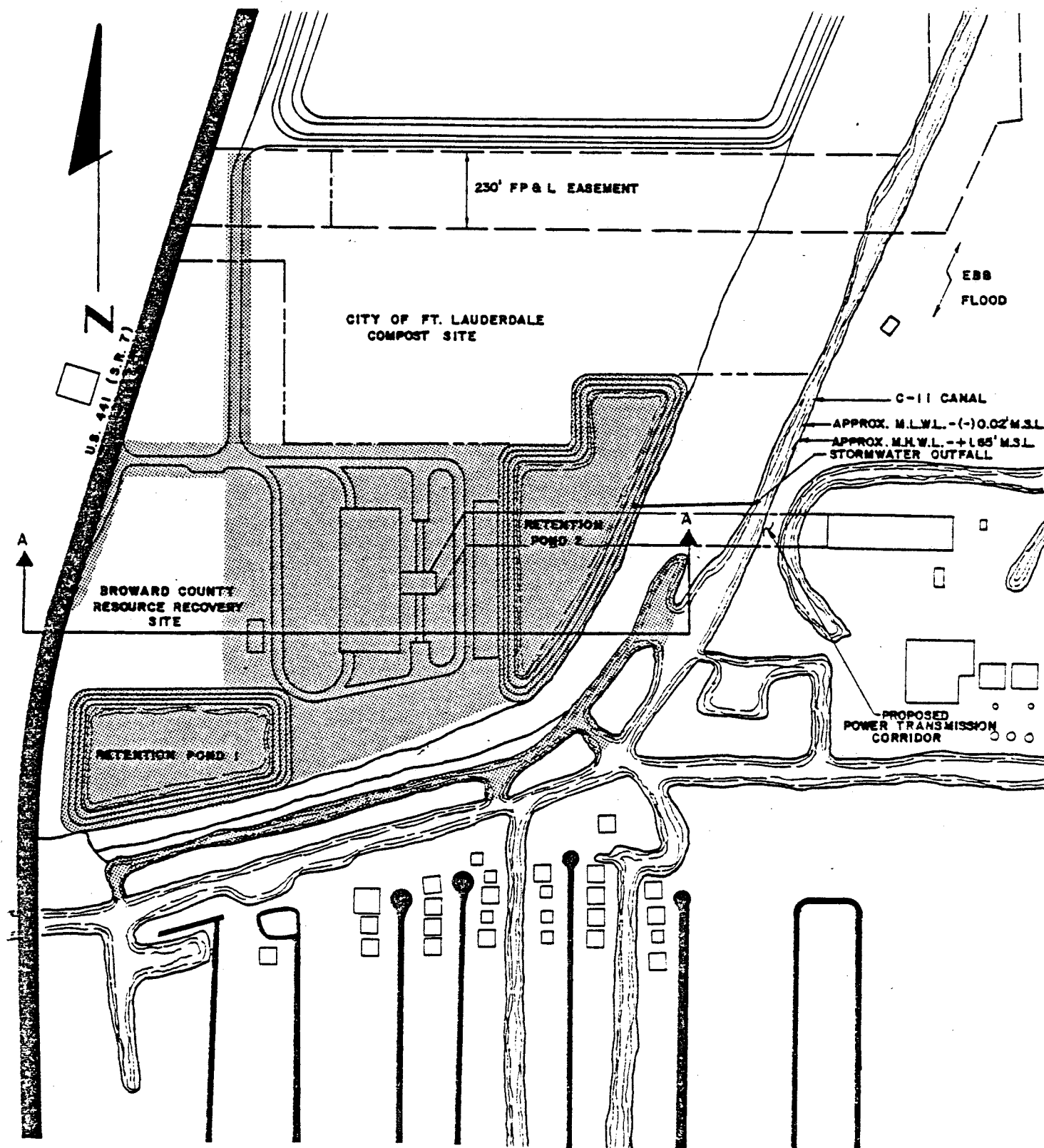
MONTHS

- SITE PREP., ROADS & UNDERGROUND FIRE SYSTEM
- PILING & FOUNDATIONS
- ERECT STRUCTURAL STEEL
- ERECT BOILER NO. 1
- ERECT BOILER NO. 2
- ERECT BOILER NO. 3
- INSTALL GRATES
- INSTALL CRANES
- INSTAL MATERIAL HANDLING & AIR QUALITY EQU.
- INSTALL PIPING & INSTRUMENTATION
- INSTALL ELECTRICAL
- ERECT CONDENSER
- TURBINE - GENERATOR
- TEST & CHECK-OUT
- SHAKE DOWN & PERFORMANCE TESTING



BROWARD COUNTY
RESOURCE RECOVERY PROJECT
ESTIMATED FIELD/CONSTRUCTION SCHEDULE

FIGURE 4.1.1



LEGEND

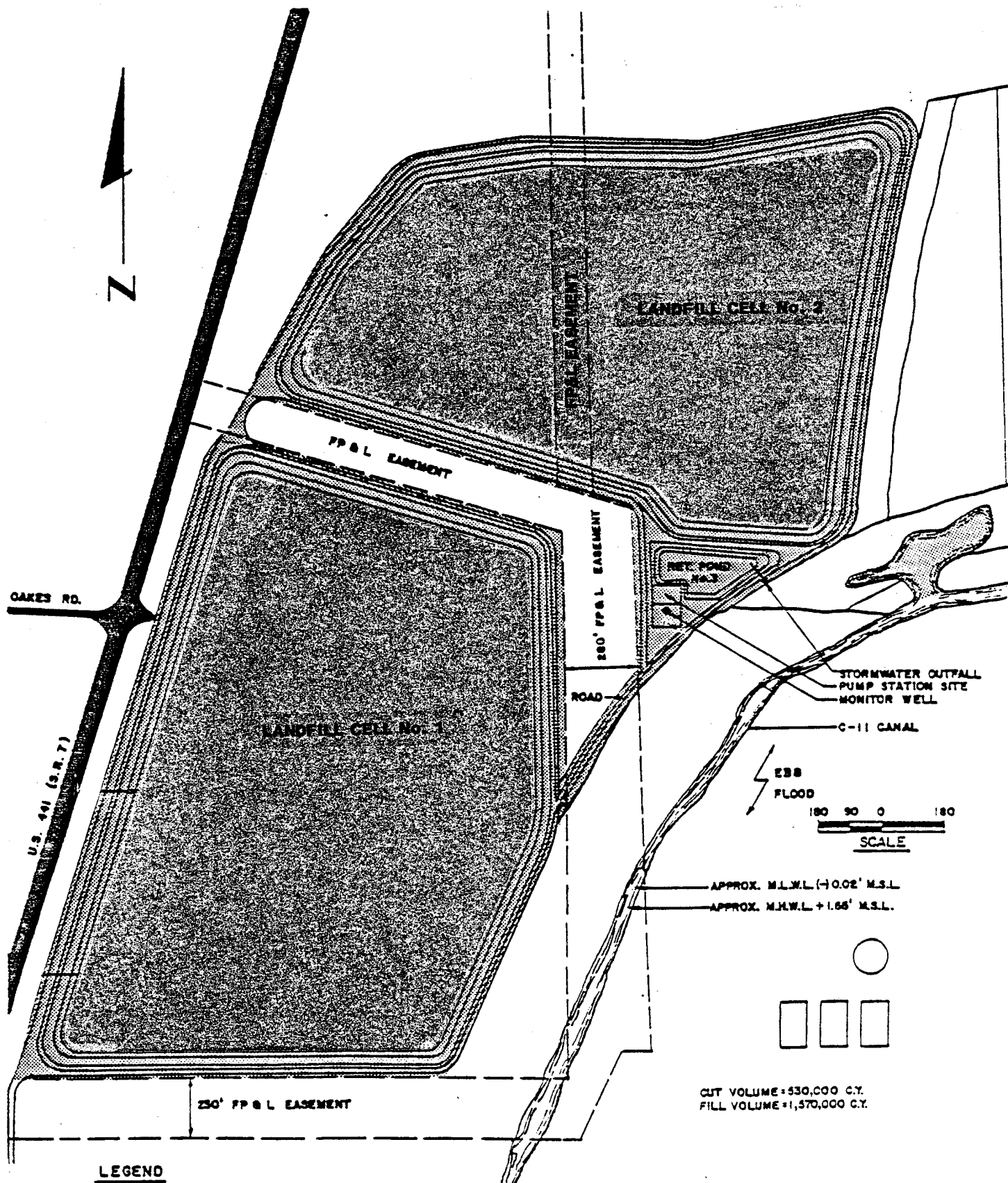
- CUT AND/OR FILL AREAS

200 100 0 200
SCALE

CUT VOLUME=260,000 C.Y.
FILL VOLUME=260,000 C.Y.

SECTION A-A REFER TO FIGURE 3.2.1.1

**BROWARD COUNTY
CUT AND FILL AREAS
SOUTHERN RESOURCE RECOVERY FACILITY**



BROWARD COUNTY
CUT AND FILL AREAS
SOUTHERN RESIDUE/UNPROCESSABLE
WASTE LANDFILL

filled to a minimum of +7.0 feet MSL during development. The fill area will be constructed of approved earth or friable materials free of organic substances, spongy soil, or other objectionable material that would prevent satisfactory compaction. All fill will be compacted in accordance with applicable specifications.

3. Fill Placement for Tipping Floor

Coincident with the excavation activities will be the placement of backfill required for the elevation of the tipping floor and its associated access ramps.

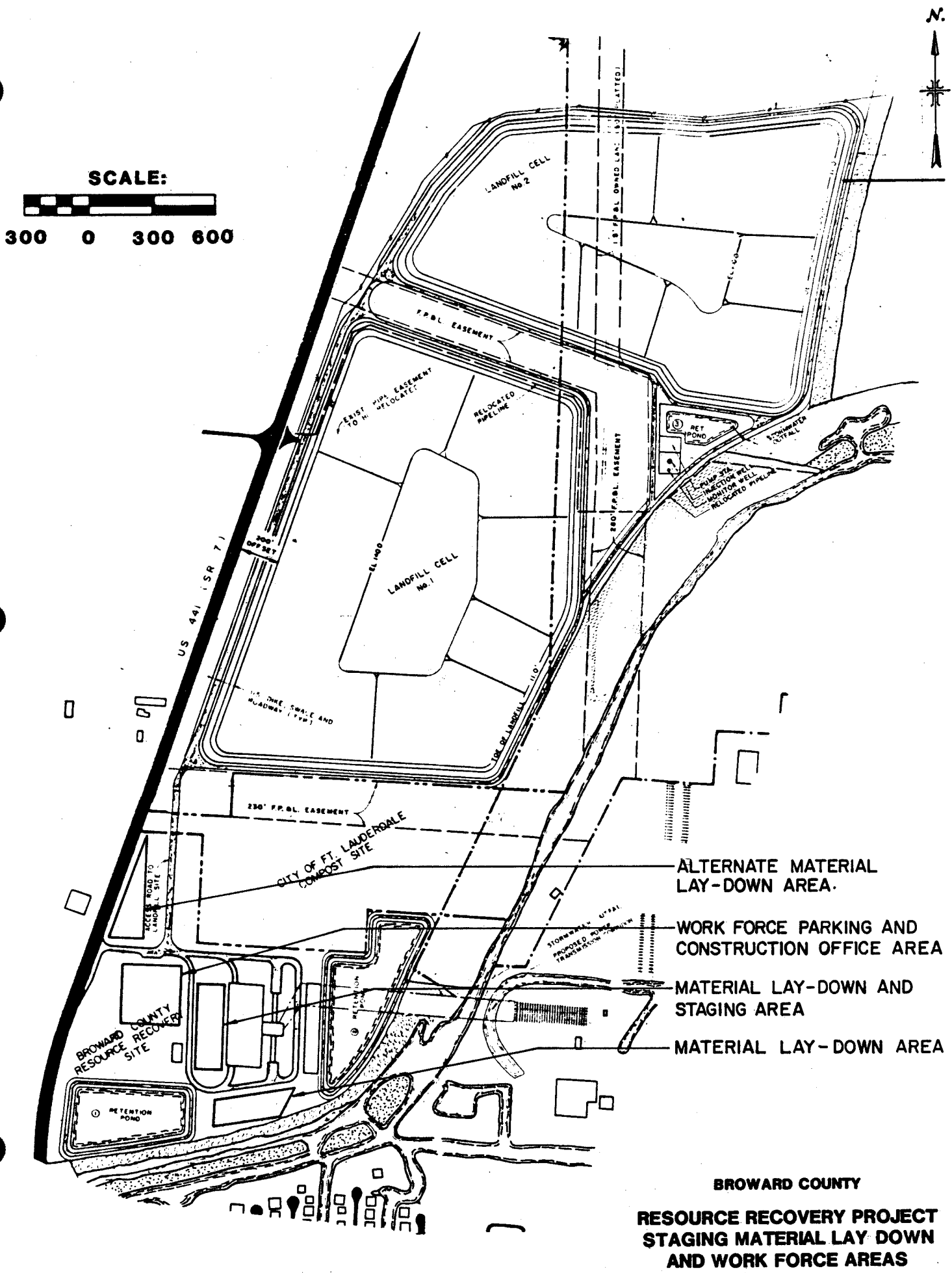
The site is comprised of basically a flat terrain and therefore, minimal erosion during construction is anticipated. The erosion that will occur can be controlled by various methods. They include the use of netting, sodding or mulch seeding, as well as leaving exposed areas bare for as little time as possible during construction.

4.1.1.2 Staging, Material, Lay-Down, and Work Force Parking Areas

The staging, materials lay-down, storage, and parking areas must be directed to areas where there are minimal construction activities. Areas west and south of the resource recovery facility will be utilized as materials lay-down areas due to their closeness to the facility and site entrance. These locations will minimize the level of traffic near the center of construction and reduce the handling distances for construction materials. A construction office and general work force parking area will be located adjacent to the site entrance. Locating the parking area near the site entrance will minimize traffic interference. Figure 4.1.3 indicates the construction support areas in relation to the construction areas.

4.1.1.3 Impact on Solid Waste Generation and Disposal

A variety of solid waste materials will be generated periodically throughout each of the construction phases of the



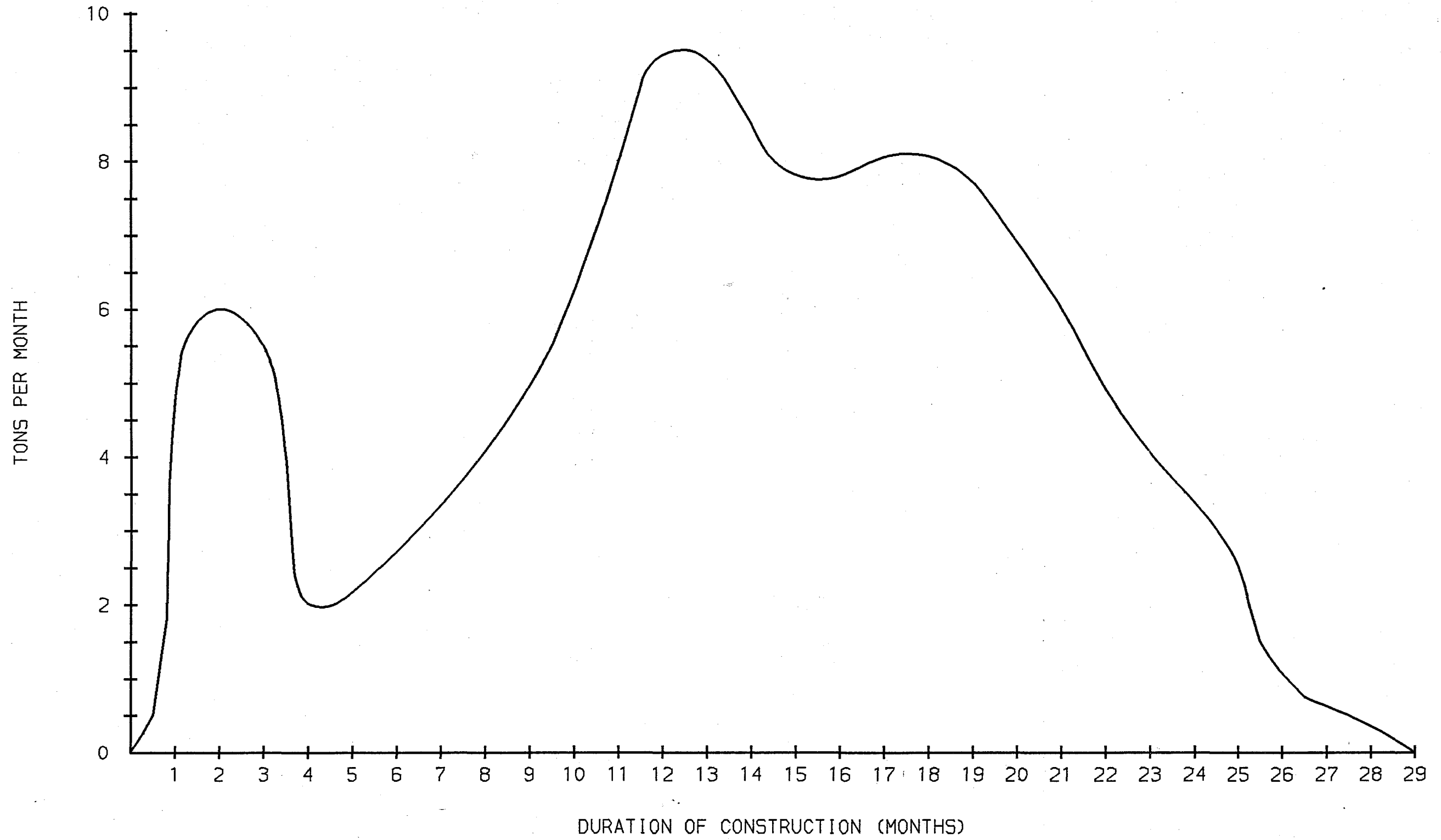
BROWARD COUNTY
RESOURCE RECOVERY PROJECT
STAGING MATERIAL LAY DOWN
AND WORK FORCE AREAS

resource recovery facility. These wastes will include vegetation, trees, concrete, metal, paper, trash and oils and fluids required for equipment operations. They will be disposed of off-site.

The initial clearing of the facility and landfill sites will produce vegetative matter and wood and concrete debris. These types of wastes will be generated by the removal of vegetative ground cover, approximately 100 trees and demolition of two structures located on the southern portion of the site. All the debris will be hauled to the County Landfill for disposal.

As a result of equipment maintenance and various construction activities, waste oils and solvents will be generated on-site. The rate of generation for waste oil will be approximately two to three drums (55 gallon barrel) every three months. Waste solvent on the other hand will be generated mostly during certain phases of equipment installation, e.g., piping and electrical systems where solvent generation could be two to three times that of oil. The waste oil and solvents will be stored in 55 gallon drums, contained in a bermed area, covered with a weather-proof canvas and properly labeled. Properly licensed contractors will transport and dispose of these wastes every two to three months as required under the Resource Conservation and Recovery Act manifest system.

A total of approximately 250 tons of solid wastes will be generated over the duration of construction. The pattern of waste generation follows the type and level of activities occurring on-site (Figure 4.1.4). During site preparation and clearing there will be an initial peak, which will then be followed by a waste generation drop and then by an increase which coincides with the actual construction and installation activities.



BROWARD COUNTY
 RESOURCE RECOVERY PROJECT
 ESTIMATED SOLID WASTE GENERATED
 DURING CONSTRUCTION

4.1.2 Roads

On-site access roads will be the only roads constructed for this project. Access to and from the site will be from U.S. Route 441 (State Road 7) and therefore, no new public roads will be needed for this project. Improvement to Route 441 will be made by the Florida Department of Transportation.

4.1.3 Flood Zones

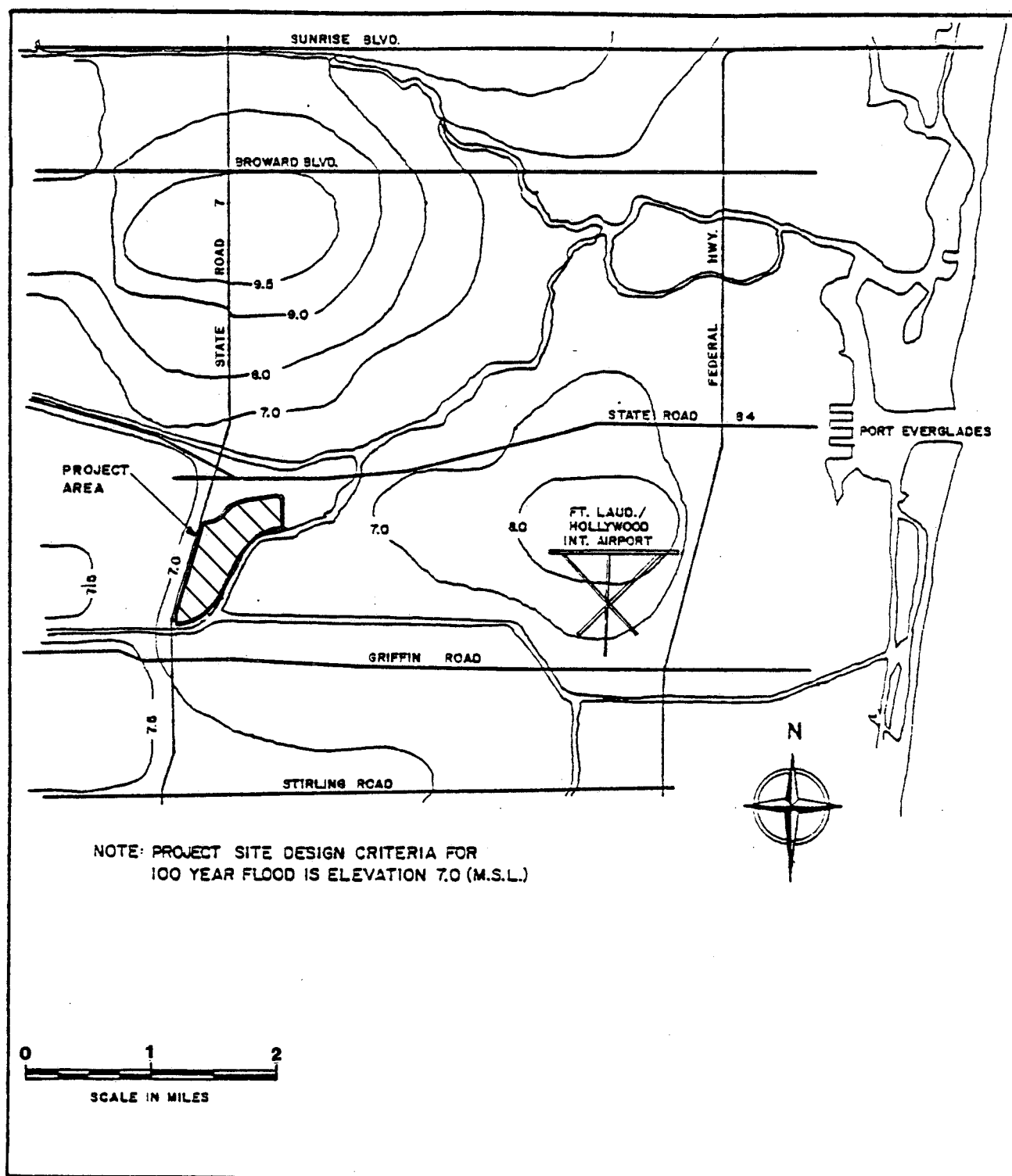
Fill material and piles will be utilized to ensure that none of the structures planned as part of this project or material placed in the landfill cells will be within the 100-year flood zone. Consequently, this section does not apply to this project. For information on the limits of the 100-year flood zone in the vicinity of the site refer to Figure 4.1.3.1.

4.1.4 Topography and Soils

The construction of three retention ponds and two landfill cells will alter the topography of the site. The three retention ponds will cover approximately 8.7 acres and be dredged down to -10 feet MSL, and the two landfill cells will cover approximately 147.6 acres and be filled to +7 feet MSL. Figure 4.1.3 shows the area of these basins.

Roads and buildings will cover more and more of the site as construction progresses. Approximately 336,750 square feet of impervious surfaces will cover the site by the end of construction. Buildings will cover approximately 124,000 square feet and roads and parking lots will cover approximately 212,750 square feet. 7.7

Due to these impervious surfaces the drainage features and percolation rates of the site will change. As summarized in Section 3.8, the addition of impervious surfaces to over 20 percent of the site area will result in an 80 percent increase in the rate of peak runoff. The total runoff volume will not be substantially affected by the increase in impervious sur-



Source: Board of County Commissioners Broward County, Florida

**BROWARD COUNTY
100 YEAR FLOOD
ELEVATION MAP**

The subsurface conditions will be affected by the construction of the refuse bunker. The dimensions of the bunker will be 200 feet long, 50 feet wide and 23 feet deep. When the bunker is constructed, it will have to be excavated down to about twenty-six to twenty-seven feet. Sheet piling will be used to shore up excavated areas, and load bearing piling will be installed underneath the areas of the main structure having the heaviest loads.

During construction berms will be constructed to contain water during dredging and filling. Sediment traps and screens will be strategically placed to trap runoff. All permanent berms constructed for the development will be grassed to prevent erosion. No discharge of sediment laden water will be made to South Fork New River Canal during construction.

The changes in the site's drainage features or the planned construction activities will not result in the formation of any sink holes or result in any subsidence. Settlement will occur due to the increased load on soils by the planned backfilling, but it should be minor.

The use of piles to support heavy equipment will improve the bearing capacity of the site. The site's subsurface conditions should have no long-term problems due to the construction.

Aesthetically the construction activities will have some temporary negative impacts on nearby residences, but the visual impacts should be limited to the southern part because this is the only area near the site that is residential. Most of the landfill area construction will occur at or below grade, resulting in very limited visibility from nearby roadways and residential areas. However, backfilling activities to bring existing grade up to +7 feet MSL for the landfill and +27 feet MSL for the planned tipping floor will result in activities occurring above existing ground levels. A minor visual impact will result from the backfilling operation and resulting mounds.

4.2 Impact on Surface Bodies and Uses

4.2.1 Impact Assessment

The major activities described in the Instruction Guide will not be associated with this project. None of the construction activities are planned to occur in or near surface water bodies. However, there is one project activity which could affect nearby surface waters and that is the discharge of storm water runoff during construction.

The different construction activities, e.g., clearing of lands, excavation and backfilling, will result in an increase in site runoff during storms. This increased runoff will have more erosion potential because surface vegetation will be disturbed or removed and steeper slopes will be created causing runoff to become sediment-laden. But, detention basins will be constructed at the beginning of the initial construction phase and they will hold the storm water prior to discharge. The design detailed in Appendix 10.13 ensures that all active portions of the site are drained into basins and those basins' depths and spillway heights are sufficient to ensure attenuation of peak discharge and retention of the first 1.4 inches of runoff. The basins have been designed to limit the volume and rate of discharge so that they do not exceed the values determined for the pre-developed site.

4.2.2 Measuring and Monitoring Programs

Section 2.3.4.1 describes the water sampling program conducted for this project. The baseline conditions were established and used to evaluate the potential impacts during construction.

The construction impacts will be minimized by the use of mitigation measures for the control of surface runoff and erosion and the construction of retention basins at the beginning of construction. These methods will effectively eliminate any adverse impacts to surface waters during construction.

4.3 Groundwater Impacts

The chemical quality of the local groundwaters will not be significantly affected by site preparation. The construction of the facility and the landfill will have no significant impact on groundwater levels either on site or off site. Ground water elevation on site is +1.0 feet NGVD, and the outfall structure to be constructed will be placed at +2 feet NGVD as per recommendation of Broward County Water Management Division. The outfall elevation will maintain existing ground water elevation in the area.

Site dewatering will not be necessary prior to construction of the refuse bunker, dredging out the detention ponds, or mucking out the landfill cells. The construction of the refuse bunker will use the slurry trench method and tremie concrete. Dredging out of the detention ponds and mucking out of the landfill cells will be accomplished by the use of a dragline. These methods will avoid impacts to the groundwater levels.

4.4 Ecological Impacts

4.4.1 Impact Assessment

Almost the entire site will be modified from its existing state. This will be the result of actual facility and landfill construction, site grading for drainage, preparation of retention basins, landfill cells and final site landscaping. The ecological features of the site will be modified as a result of construction, but the site has been previously disturbed for agricultural and marine industry purposes. The proposed mitigation plan (Appendix 10.7) will provide the floral species a more diverse and more productive habitat than currently exists, and any fauna displaced by construction can move to adequate habitat adjacent to the site without serious detriment. The construction activities will have a very minor overall effect on both on and off-site local ecosystems.

In addition, the mitigation plan (Appendix 10.7), previously approved by the U.S. Army Corp of Engineers and Florida Department of Environmental Regulation, and the landscaping will improve the ecological productivity of this site.

4.4.2 Measuring and Monitoring Programs

No monitoring programs are required based upon the data presented in Section 2.3.6 and conclusions presented in Section 4.4.1.

4.5 Air Impact

4.5.1 Fugitive Dust and Mobile Source Emissions

Short-term and local air quality impacts are caused by land clearing, site preparation and emissions from construction equipment. These air quality impacts will vary during each phase of construction, with the greatest impact for fugitive dust occurring during the site preparation phase when approximately 108 acres (Table 4.5.1) of the facility and landfill sites will be exposed, and the greatest emission impacts from mobile sources occurring during the construction phase (Table 4.5.2) when the amount of equipment on-site is the greatest.

4.5.2 Mitigation Measures

For the impacts described in the preceding section a number of mitigation measures are available to minimize the impacts. If the following practices are carried out, particulate emissions can be reduced significantly.

- o Particulate matter from unpaved roads:

- Routine watering of the roadway would provide at least a 50% reduction in emissions

TABLE 4.5.1

CONSTRUCTION ACTIVITIES IMPACTING FUGITIVE DUST

Construction Phase	Anticipated Areas to be Exposed Simultaneously	Estimated Area of Land Cleared (Acres)
SITE PREPARATION	First Landfill Cell	80.9
	Three Retention Ponds	8.6
	Access Roadway Stripped to Subgrade	7.2
	Backfill Embankment	7.1
	Miscellaneous (Staging Area, Employee Parking, Materials, Lay Down Area, etc.)	4.3
FACILITY CONSTRUCTION	Access Roadway Stripped to Subgrade	7.2
	Backfill Embankment	7.1
	Miscellaneous (Staging Area, Employee Parking, Materials, Lay Down Area, etc.)	4.3
FINALIZATION	Estimated Area to be Exposed at One Time Due to Landscaping and Final Grading	11.0
	Miscellaneous (Staging Area, Employee Parking, etc.)	4.3

TABLE 4.5.2
CONSTRUCTION ACTIVITIES IMPACTING NOISE AND EMISSIONS
FROM CONSTRUCTION EQUIPMENT

Construction Phase	Activities Occurring Simultaneously	Anticipated Operating On Site	Relative Location of Equipment On Site
SITE PREPARATION	Sheet Pile Driving for Refuse Bunker	1 Pile Driver 1 Front End Loader	Localized
	Refuse Bunker Excavation	2 Backhoes 7 Trucks	
	Landfill Cells Excavation	4 Backhoes 12 Trucks	
	Placement & Compaction of Fill for Tipping Floor	2 Dozers 3 Trucks	Spaced 500 Ft. Along Access Road
FACILITY CONSTRUCTION	Concrete Placement	1 Pump 2 Saws 3 Vibrators 3 Trucks	Localized Spaced 500 Ft. Along Access Road
	Structural Steel Erection	2 Cranes 2 Dericks 4 Pneumatic Tools 2 Welders 1 Compressor	Localized Within A 200' Radius
	Major Equipment Installation	2 Cranes 1 Fork Lift 2 Generators 8 Pneumatic Tools 2 Compressors 3 Welders	
	Scale Installation	1 Crane 2 Pneumatic Tools 1 Compressor 1 Welder & 1 Generator	Localized
FINALIZATION	Paving of Access Road	1 Paver 2 Trucks	Mobile Along Paved Roadway
	Landscaping and Final	1 Dozer 1 Grader	Transit Over Entire Site

- Penetrating chemicals sprayed on the surface can also provide a 50 percent reduction in emissions. However, chemical spraying would cost more than watering.
- Paving the roads would provide up to an 85 percent reduction in emissions. This can be done by either soil compaction and adding base coarse material or by soil stabilization with an asphalt cap.
- o Particulate emissions across open and active construction areas:
 - Watering of the site would reduce emissions by 50 percent.
- o Particulate emissions from completed cut and fill areas:
 - Planting vegetation as soon as possible can reduce emissions between 65 and 85 percent.
 - Applying chemical binders also can reduce emissions between 65 and 85 percent.

4.6 Impact on Human Populations

4.6.1 Sensitive Receptors

In Section 2.2, Socio-Political Environment, land use and demographic features were discussed in detail. The area around the site is used mostly for industry and some farming. These land uses are not considered sensitive receptors for this report. The nearest sensitive receptor is the residential area south of the New River Canal. This area would be impacted temporarily most by traffic, noise and fugitive dust during the construction of the facility. There are no hospitals, churches or schools in the vicinity of the site.

4.6.2 Work Force

The estimated total peak construction work force will be approximately 500 personnel. The initial phase of construction (site clearing, access roads, excavation of retention ponds and filling of the landfill cell) will require a work

force of approximately 100 personnel for the first 6 months. From the ninth month to the twenty-second month the work force should increase to about 500 and average from 340 to 380 personnel. The estimated work force requirements are presented in Figure 4.6.2.1. The work will mainly take place on an eight hour per day shift, five days a week but some night time and weekend work can be expected.

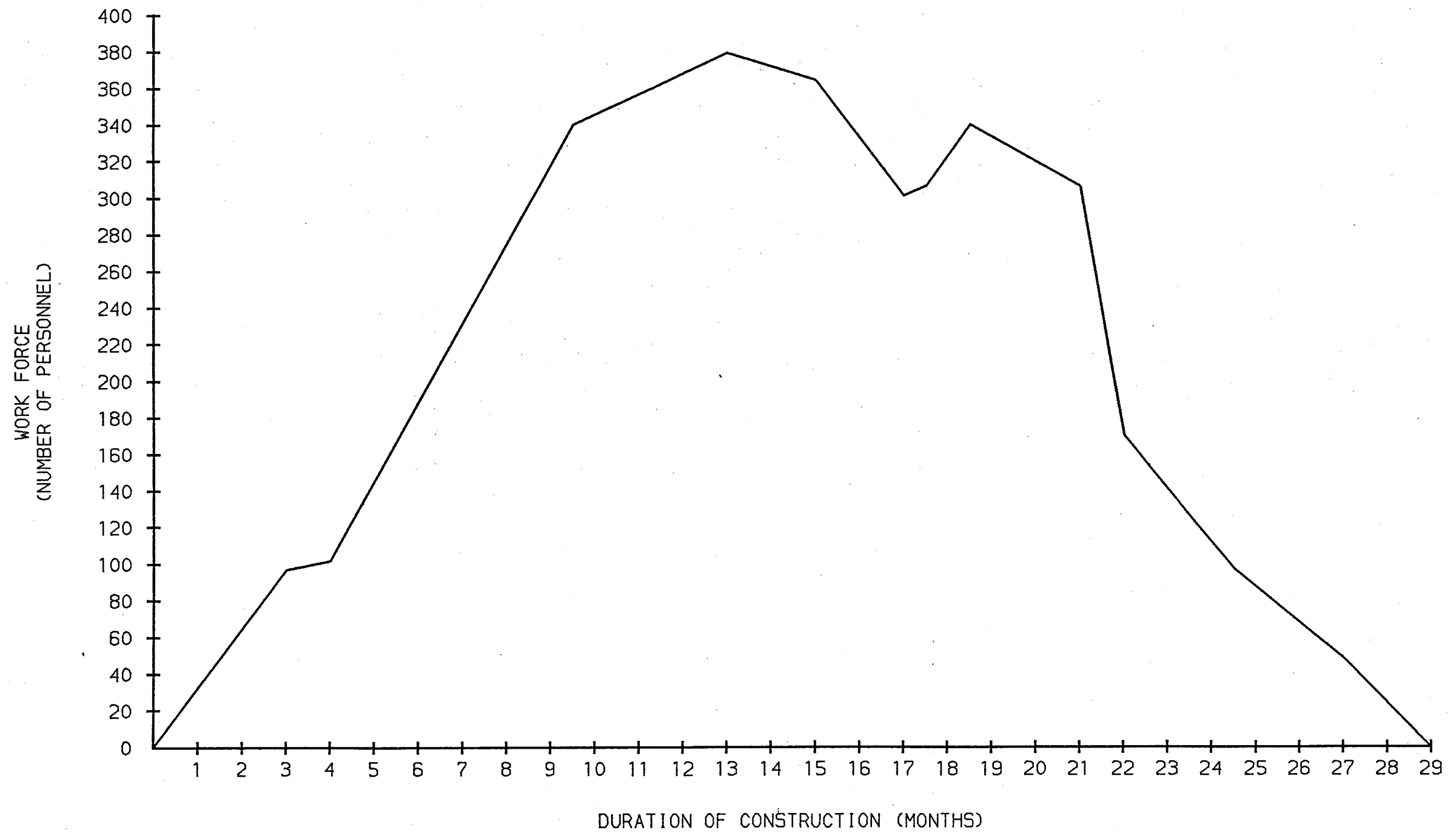
The County's local economy and labor market will benefit from the project. Proposals submitted by potential vendors include provisions for hiring local construction labor and contractors. Preliminary commitments with the local labor force have been established through a National Industrial Construction Agreement. No major relocation of construction workers and families is anticipated. Therefore, no impact on available housing, schools or other community support assets is expected.

It is anticipated that local construction and equipment suppliers will realize both direct and indirect benefits from both the construction and operation of the resource recovery facility.

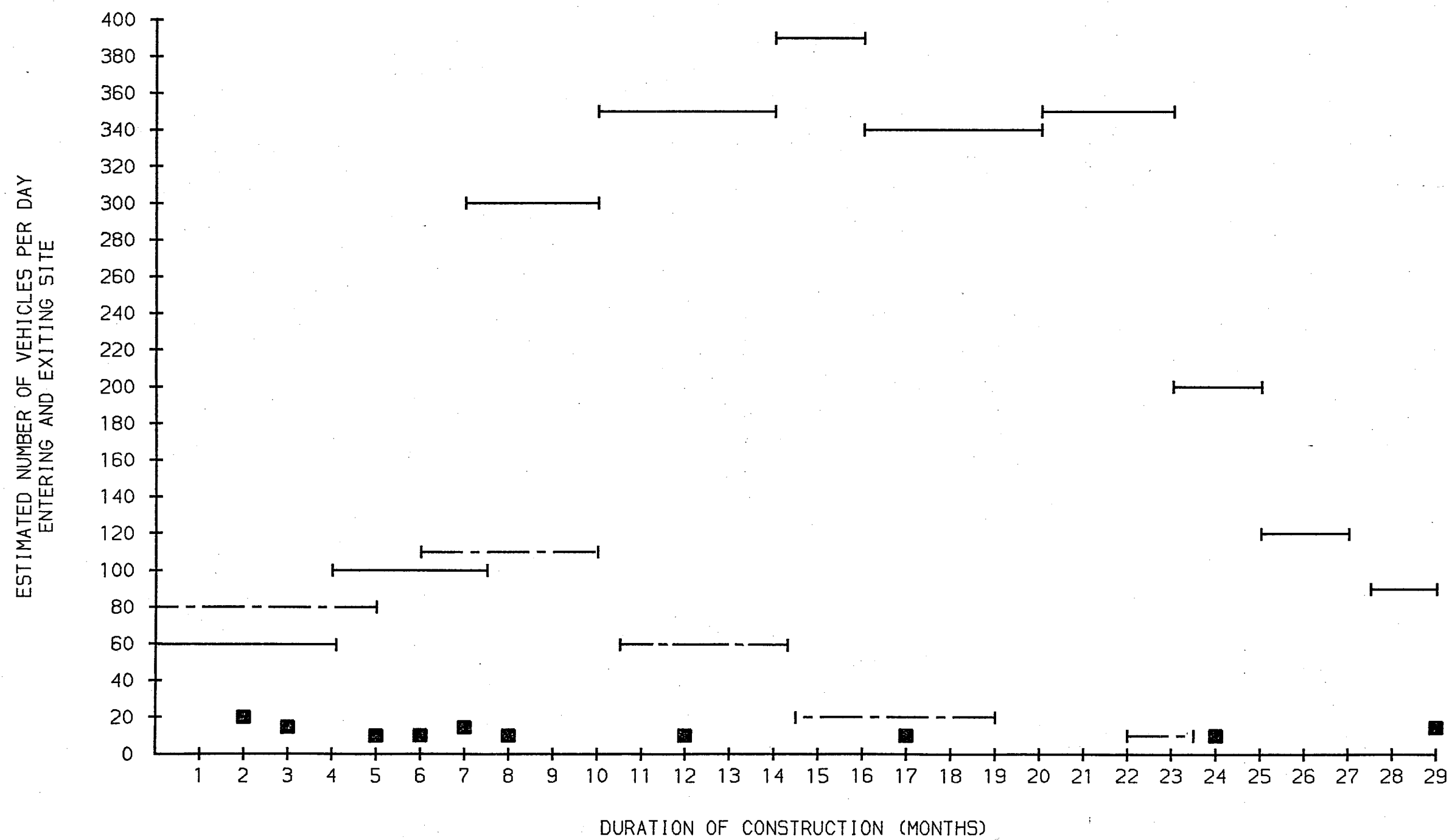
4.6.3 Traffic Associated with Construction

Traffic due to construction will enter and exit the site by way of Route 441. This traffic will consist of the daily work force, delivery of construction equipment and delivery of construction materials (Figure 4.6.3.1).

The general work force traffic will average about 80 vehicles per day for the first eight months, and then average about 350 vehicles per day for the next sixteen months. After the twenty-fourth month, the general work force traffic will fall off as construction is completed. The greatest impact of this traffic will occur at the start of the work day at 7:00 A.M. and at the end of the work day at 4:00 P.M.



BROWARD COUNTY
RESOURCE RECOVERY PROJECT
ESTIMATED WORK FORCE REQUIREMENTS
DURING CONSTRUCTION



LEGEND: TRAFFIC CATEGORIES

WORK FORCE

CONSTRUCTION EQUIPMENT

CONSTRUCTION MATERIALS

BROWARD COUNTY

RESOURCE RECOVERY PROJECT

TRAFFIC ASSOCIATED WITH PLANT CONSTRUCTION

The traffic caused by the delivery and removal of construction equipment will be spread out over the duration of construction. Most of the equipment will be delivered at the start of site preparation, but other pieces will be delivered as needed. The impacts of this traffic will be of short duration of a few hours at a time.

The traffic caused by the delivery of construction material will average about 100 vehicles per day for the first ten months and then drop off to about sixty vehicles per day for the next nine months. The impacts of this traffic will be spread over the work day.

The maximum traffic during construction for all three categories will be approximately 400 vehicles per day. This will reduce the available capacity of Route 441 in the early morning and late afternoon but will not result in any unacceptable roadway capacity problems. A more detailed analysis on traffic is presented in Section 5.9.

4.6.4 Noise

Noise emissions from the proposed facility will not significantly impact the surrounding community and will meet standards of working condition comfort for on-site personnel. During the design phase, noise abatement features will be incorporated into the design. During the construction phase, temporary intrusive noise emissions will be controlled by the use of noise-attenuating devices (e.g. mufflers) or equipment, and by ensuring compliance with vehicle noise regulations. Major noise-producing construction activities will be confined to normal working hours.

4.7 Impact on Landmarks and Sensitive Areas

The project is located in a portion of the Local Area of Particular Concern (LAPC) and a proposed urban wilderness area. the site adjacent to the New River. The area was so

designated because it is part of the last vestige of natural vegetation along South Fork New River. The 300-wide strip adjacent to the river will be preserved and enhanced by the mitigation plan (Appendix 10.1.4). In fact the mitigation plan includes extension of the preservation and enhancement area along the entire waterfront and not just that part designated as urban wilderness.

4.8 Impact on Archaeological and Historic Sites

As stated in Section 2.2.6, The State of Florida, Division of Archives, History and Records Management stated that there are no known or potential historic or archaeological resources at the site. Therefore, there will be no construction impacts on archaeological or historic sites.

4.9 Special Features

This section describes and discusses all special features associated with site preparation and plant and associated facilities construction that may have an influence on the environment and ecological systems of the plant site and adjacent areas.

During construction there will be generated certain quantities of solid and liquid waste. This waste may take the form of earth spoils, discarded packaging materials, refuse produced by construction workers, sanitary wastes, or waste oils. To maintain the aesthetic and ecological integrity of the site and surrounding areas proper handling and disposal of these wastes on-site will occur.

4.10 Benefits From Construction

Section 7, Economic and Social Effects of Plant Construction and Operation provides an analysis of social and economic benefits arising from plant construction. Specifically, these benefits include:

- o Adequate Disposal
- o Economic Viability
- o Environmental Security
- o Energy Production
- o Local Economy Stimulators, and
- o Social Enhancement.

4.11 Variances

No variances from standards or guidelines are anticipated for this project.

EFFECTS OF PLANT OPERATION

SECTION 5
EFFECTS OF PLANT OPERATION

5.1 Effects of the Operation of the Heat Dissipation System

The design of the heat dissipation system, as discussed in Section 3.5, is based upon the utilization of an air cooled condenser. Condensate from the turbine-generator will be collected, processed and returned to the deaerator. Steam pressure reducing valves and desuperheaters will be installed so that the facility can bypass the turbine (when out of service for maintenance) and condense the total output of all boilers under maximum steam generation. The condensing system will incorporate a flexible design to enhance operation and maintenance reliability. In addition, the systems will be designed to avoid sustained periods of steam release (from pressure relief valves) and thus mitigate any potential negative effects from its operation. As such, effects from limited steam venting, considered unavoidable, will only be temporary and later ameliorated.

5.1.1 Temperature Effect on Receiving Body of Water

This section is not applicable to the project since there will be no heated effluent discharged from the resource recovery facility into any body of water. Any discharge will be directed into the head works of the Hollywood Wastewater Treatment Plant. The amount of discharge is considered to be minimal since the facility is designed to recirculate wastewater for use in ash quenching.

5.1.2 Effects on Aquatic Life

This section is not applicable to the project since there will be no process effluent discharged from the resource recovery facility into any body of water.

5.1.3 Biological Effects of Modified Circulation

The resource recovery facility will use potable water supplied by either Broward County or the City of Fort Lauderdale. The Broward County water supply can be made available to the facility via an 8-inch diameter water line adjacent to the site and a 6-inch diameter force main located just south of the site. The City of Fort Lauderdale water supply could be made available by tapping their water main extension located adjacent to the site. Discharges from the resource recovery facility will flow to existing sanitary sewer lines located directly adjacent to the site. As such, no water body will be directly affected by the resource recovery facility water demand or discharge. Figure 5.1.3.1, provides details of the utility locations adjacent to the Route 441 Project site. Stormwater runoff is discussed in Section 5.

5.1.4 Effects of Offstream Cooling

This section, as described, is not applicable to the project since the air cooled system proposed will not have a measurable impact on the local environment.

5.1.5 Measurement Program

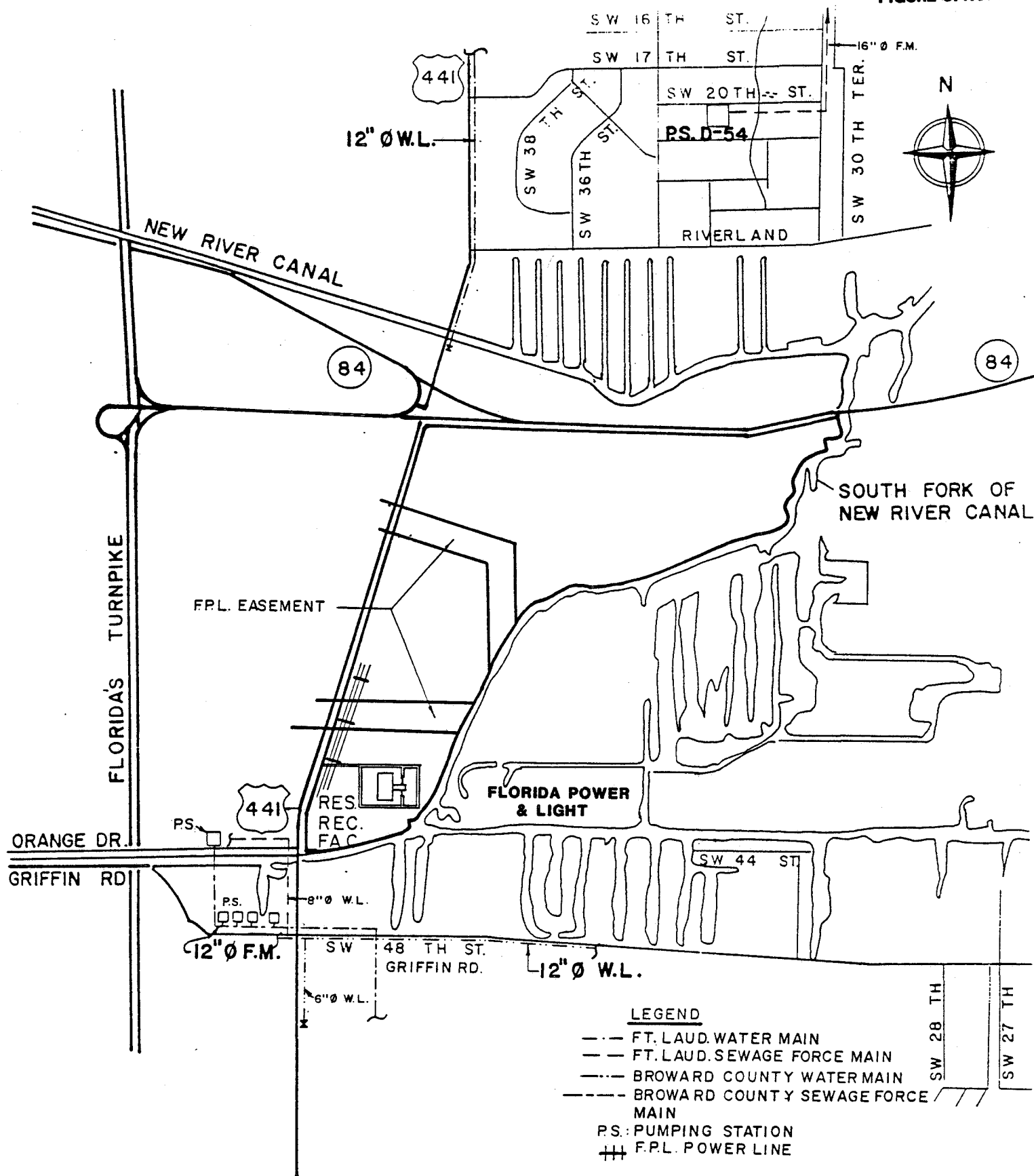
Programs and methods for measuring the physical and chemical parameters of waters which will be affected during operation of the facility are not applicable to the project because no water body will be directly affected by the operation of the facility.

5.2 Effects of Chemical and Biocide Discharges

5.2.1 Industrial Wastewater Discharge

There will be no off-site industrial discharges to surface waters or to groundwater from the operation of the resource recovery facility and associated ash residue/unprocessable waste landfill. Effluent from all site facilities

FIGURE 5.1.3.1



1000 0 1000 2000
SCALE IN FEET

BROWARD COUNTY
RESOURCE RECOVERY

UTILITY LOCATIONS
ADJACENT TO THE
ROUTE 441 SITE

will go directly to the Hollywood Wastewater Treatment Plant (HWWTP). This method of ultimate disposal will meet all applicable state and federal discharge regulations and water quality standards for industrial wastewater including chemical and biocide wastes, and oil and grease.

5.2.2 Cooling Tower Blowdown

The resource recovery facility will dispose of its air cooled condenser and boiler blowdown along with its other process water wastes at the HWWTP. As a result, there will be no effect of chemicals in the blowdown wastewater on the environment.

5.2.3 Measurement Programs

Waste process water flow quantities to the city sewer will be monitored by a sewer meter to be installed on the site.

5.3 Impacts on Water Supplies

Due to the sensitive nature of the hydrologic environment of this portion of Broward County, the conceptual design for construction and operation of the resource recovery facility and ash residue/unprocessable waste landfill has been developed in order to have a minimal impact, both quantitative and qualitative, on groundwater or surface water supplies.

The two major sources of potential impact on water supplies from the facility and associated landfill are from on-site surface water runoff and landfill generated leachate. Section 3.8, On-Site Drainage System, describes how uncontaminated stormwater runoff (runoff which does not come in contact with landfill materials) will be collected, retained and treated in order to conform with state and local regulations.

Presented below is the conceptual landfill design which describes the development and operation of the landfill. The goal of the conceptual design is to provide maximum ground-

water protection, good surface water flow controls, and efficient and effective site operations, all in accordance with federal state and local regulations.

Conceptual Landfill Design

The following description of the construction and operation of the residue/unprocessable waste landfill appeared in American Ref-Fuel's proposal dated November 16, 1984. Preliminary discussions with the County indicate that this is the type of landfill design, i.e., utilizing a double synthetic membrane liner with a leachate collection and leak detection systems, desired as part of this facility's construction. It should be noted that this concept is referenced in order to provide a description of the preliminary development of the landfill design and associated facilities; it in no way represents a preference toward vendor selection. Detailed design may ultimately utilize various methods and materials in order to arrive at the same goal.

General

The proposed design was developed to meet Florida Department of Environmental Regulation (DER) regulations and adhere to sound engineering principles. The highlights of the design criteria are as follows:

- o 200-ft. buffer zone.
- o Lowest waste elevation is above the 100-year flood elevation of 7.0 ft.
- o Contaminated surface runoff and leachate are collected and pumped to a sanitary sewer.
- o Maximized site life by filling to elevation 140.00, on 3 horizontal:1 vertical side slopes.
- o Double liner, leachate collection system, and contingency leachate collection system to provide maximum environmental protection.

- o Final cap design utilizing locally available materials that will impede rainfall percolating into the waste to reduce leachate generation.

Figures 5.3.1 through 5.3.7, provide an illustrative example of the landfill plan and details. The discussion on landfill design presented below supercedes the information provided in the design drawings.

Leachate Control

The layout and slope of the primary liner, leachate collection and removal system has been designed to minimize the travel distance of fluid through the perforated pipe network, thereby decreasing the amount of structural fill required and reducing the possibility of clogging. Six sumps will be installed in each cell to collect the leachate. The sump pump discharges will be connected by a 3-in. diameter force main system which has sufficient capacity for the selected 30 gpm pumps. The leachate will flow to the existing pump station and then to the Hollywood Wastewater Treatment Plant (HWWTP).

A contingency collection system has been added underneath the leachate collection system. This additional system will be able to detect and collect leakages in the leachate collection system. The contingency system design consists of a 40 ml HDPE liner, sloped "geonet" to collect and transport leachate to the 6-in. diameter collection pipes, and 8-in. diameter PVC pipe to carry the leachate from the collection pipes to separate sumps located adjacent to the leachate collection sumps. A "geonet" is a manmade drainage blanket (substituting for sand or gravel) consisting of transverse strands of polyethylene fibers. The "geonet" is relatively thin, about 1/3-inch. thick, but a 22-ft. width of the material can transport as much fluid as a 4-in. diameter pipe flowing full.

[illegible]

DATE	12-31-84
FACILITY #	61107
LOCATION #	JHLSAY
APPROVED BY	
PROJECT NUMBER	

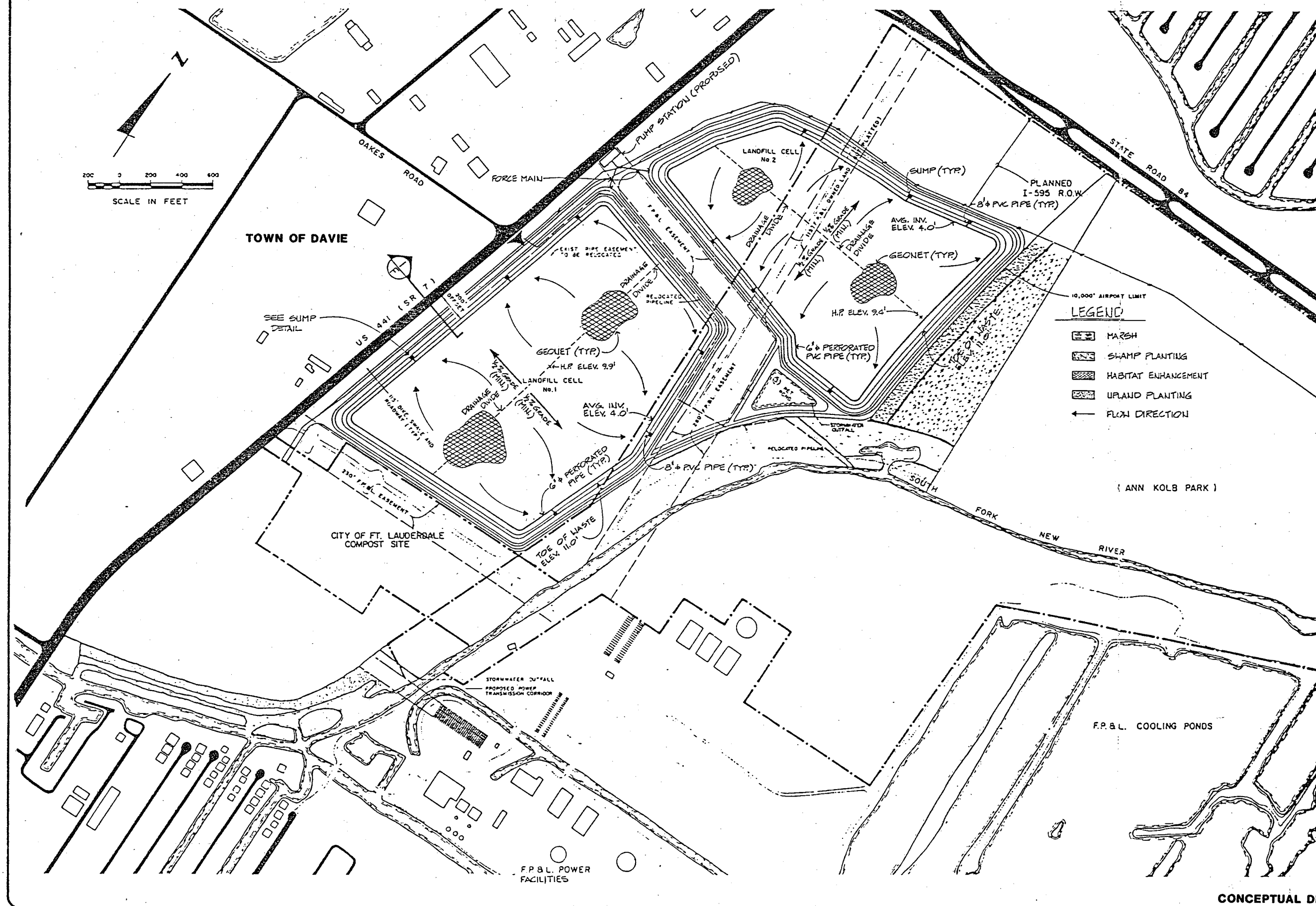
TITLE LEACHATE COLLECTION SYSTEM	PROJECT NAME & LOCATION PROPOSED LANDFILL DESIGN SOUTHERN RESOURCE RECOVERY FACILITY BROWARD COUNTY, FLORIDA
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DRAWING NUMBER **A** OF



A

FIGURE 5.3.2

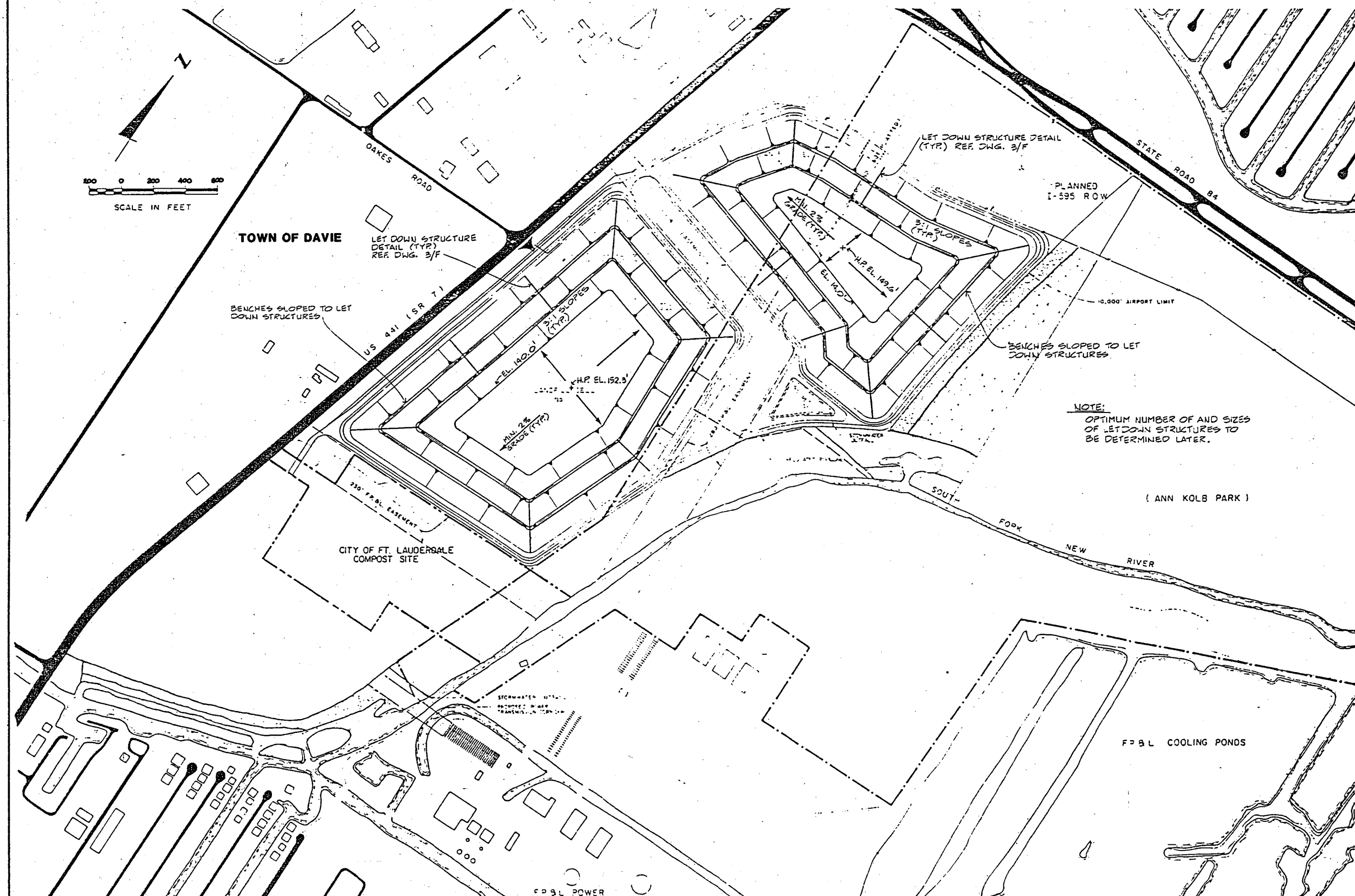
[illegible]

 UNOWNING-FENNIS INDUSTRIES

ENGINEERING SERVICES
14701 SAINT MARY'S STREET • P.O. BOX 3151 • HOUSTON, TEXAS 77001 • (713) 870-8100

CONTINGENCY COLLECTION SYSTEM	SHEET 17 OF 200
	DATE 12-30-84
	DESIGNED BY G. HAY
	ISSUED BY J.H. GAY
	APPROVED BY
	PROJECT NUMBER
PROPOSED LANDFILL DESIGN SOUTHERN RESOURCE RECOVERY FACILITY BROWARD COUNTY, FLORIDA	

FIGURE 5.3.4



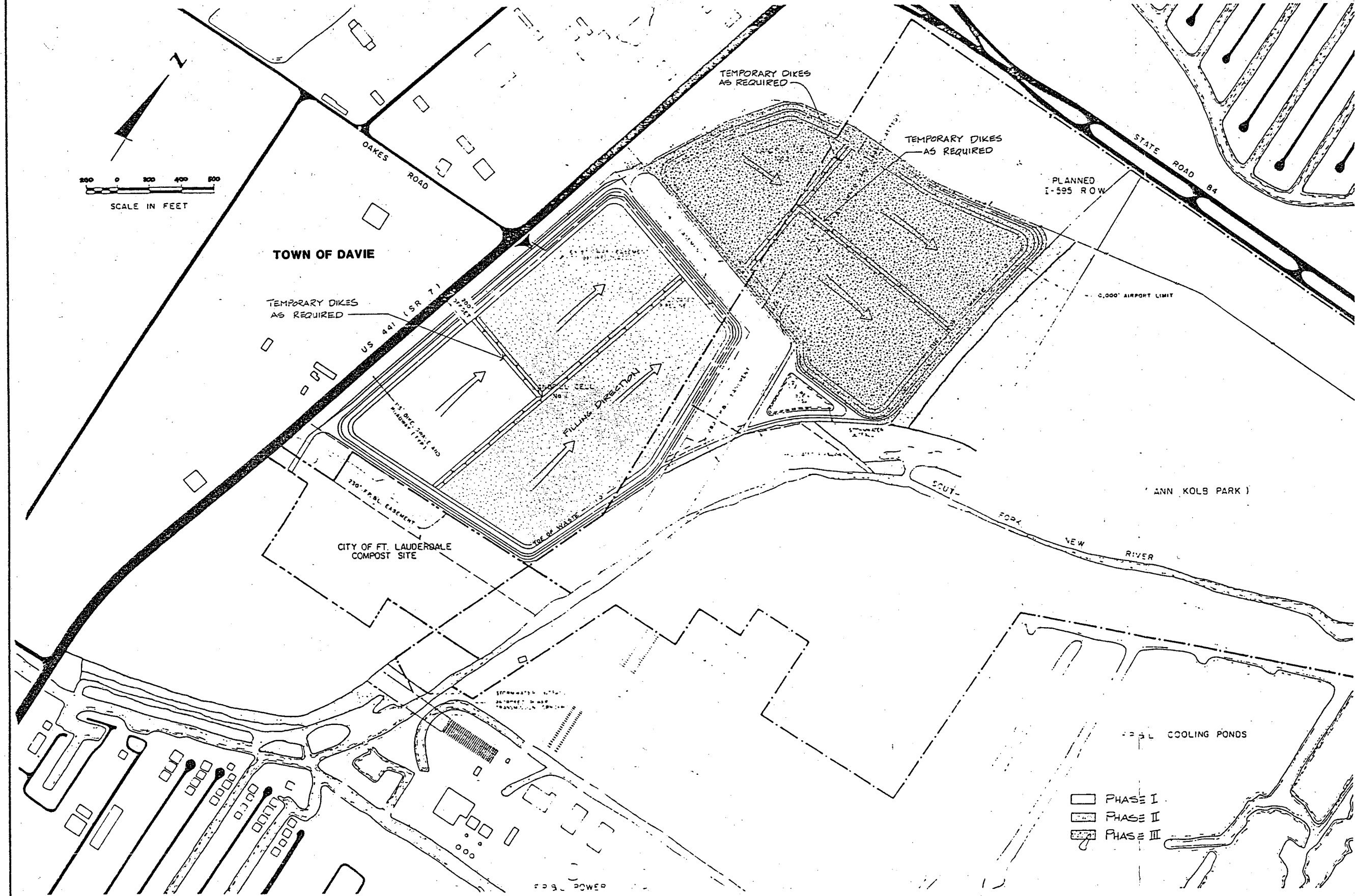
REV	DESCRIPTION	DATE	BY



BROWNING-FERRIS INDUSTRIES
ENGINEERING SERVICES
14701 SAINT MARY'S STREET, P.O. BOX 3131, HOUSTON, TEXAS 77001-1731 B/D - BUD

SCALE: 1" = 900'	DATE: 11-1-84	DESIGNED BY: G. HOY	ENGINEER BY: J.H. GAY	APPROVED BY: [Signature]	PROJECT NUMBER: [Blank]
FINAL GRADE					
PROPOSED LANDFILL DESIGN					
SOUTHERN RESOURCE RECOVERY FACILITY					
BROWARD COUNTY, FLORIDA					
DRAWING NUMBER: D					

FIGURE 5.3.5



CONCEPTUAL DESIGN

REV	DATE	DESCRIPTION

ENGINEERING SERVICES
 BROWNING-FENNIS INDUSTRIES
 11001 N. W. 11th Ave., Suite 100, Fort Lauderdale, FL 33309

PROJECT NO.	15-300
DATE	10/20/84
DESIGNED BY	SAUL
CHECKED BY	JANIS
APPROVED BY	JANIS
DATE	10/20/84

PROPOSED LANDFILL DESIGN
 SOUTHERN RESOURCE RECOVERY FACILITY
 BROWARD COUNTY, FLORIDA

TOP SOIL
 SOIL/BENTONITE MIXTURE
 LET DOWN STRUCTURE
 WASTE
 SEE DETAIL 4
 80 MIL. HDPE KEYED IN
 SELECT FILL
 SOIL BUFFER
 MATERIAL EXTRUSION SEALS
 ELEV. 7.0'
 INV. EL. 6.17'
 0.5% MIN. GRADE
 TO SUMP
 8" DIA. PIPE
 TO SUMP
 0.5% MIN. GRADE
 6" DIA. PERFORATED PIPE
 PEA GRAVEL
 SELECT SAND FILL
 SELECT FILL
 GEONET
 40 ML HDPE
 80 ML HDPE
 GEOTEXTILE
 0.5% MIN. GRADE
 NOTE: DISCHARGE PIPES OFFSET IN PLAN VIEW

2' x HALF-ROUND ALUMINUM CULVERT, CUT IN HALF LENGTHWISE

4'-0"

1'-0"

2'-0" MIN.

1'-0"

CEMENT STABILIZED SAND

ANCHOR SUPPORTS

TOP SOIL

SOIL/BENTONITE MIXTURE

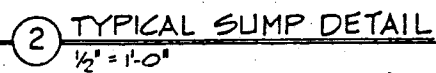
③ LET DOWN STRUCTURE DETAIL

A cross-sectional diagram of a landfill liner system. At the top, a layer of **WASTE** is shown with diagonal hatching. Below the waste is a layer of **SELECT SAND FILL**, indicated by a stippled pattern. A **GEOTEXTILE FOR GRAVEL/SAND SEPARATION** is shown as a dashed line between the sand fill and the gravel. Below this is a layer of **PEA GRAVEL**, also stippled. A **4" OR 6" PERFORATE PIPE** is shown as a circle within the gravel layer. The pipe has a **2" MIN.** diameter and is surrounded by a **6" MIN.** thickness of gravel. Below the gravel is another **GEOTEXTILE TO PROTECT HDPE**, shown as a dashed line. At the bottom is a layer of **80 MIL HDPE** (High Density Polyethylene), shown as a solid line. The diagram includes various labels with arrows pointing to the corresponding components.

④ TYPICAL SECTION @ MANIFOLD

CONCEPTUAL DESIGN

TITLE <u>SECTIONS & DETAILS</u> PROJECT NAME & LOCATION <u>PROPOSED LANDFILL DESIGN</u> <u>SOUTHERN RESOURCE RECOVERY FACILITY</u> <u>BROWARD COUNTY, FLORIDA</u>	SCALE	NOTED
	DATE	11-1-84
	ENGINEER	G. HOY
	CHECKED BY	J.M. JG.
	PROJECT NUMBER	



DRAWING NUMBER	TITLES		SCALE	NOTED
	<u>PLANS, SECTIONS & DETAILS</u>			
PROJECT NAME & LOCATION	<u>PROPOSED LANDFILL DESIGN</u> <u>SOUTHERN RESOURCE RECOVERY FACILITY</u> <u>BROWARD COUNTY, FLORIDA</u>		DATE	11-1-84
ENGINEER	<u>G. HOY</u>		ENGINEER	G. HOY
DRAWN BY	<u>J.H. GAY</u>		DRAWN BY	J.H. GAY
APPROVED BY			APPROVED BY	
PROJECT NUMBER			PROJECT NUMBER	

The additional collection system is necessary to provide a method of collecting and detecting any leachate from potential leaks. The combination collection and contingency collection system offers a high degree of groundwater protection to the Biscayne Aquifer underlying the site.

Final Slopes

The final outside slopes will be at 3 horizontal:1 vertical and have 24-in. thick final cover. The top of the landfill will have a 2 percent to 4 percent slope to provide adequate runoff.

Three, 15-ft wide benches (one every 43 vertical feet) will decrease surface flow velocities on the 3 horizontal:1 vertical slopes to reduce erosion potential. The benches will be sloped 'inward' and toward let-down structures such that flow is directed to the drainage swales at the base of the slope.

Final Cap

The type of final cap material proposed is a soil/bentonite mixture topped with 6 additional inches of soil with a vegetative cover. Ordinarily, clay is used for a final cap. However, the unavailability of this material indicates that 18 inches of a soil/bentonite mix is the best alternative to achieve a 10^{-7} permeability. Six inches of topsoil with vegetative cover will be placed over the soil/bentonite material. This design should provide a final cap that: (a) meets Florida DER criteria, (b) remains stable, (c) supports vegetation to minimize erosion, and (d) reduces infiltration into the landfill.

Stormwater Retention Area

A stormwater retention pond has been sized as large as possible to maximize retention time and capacity. The pond is

fed uncontaminated surface runoff by two sources: cell construction area runoff (via 8-in. diameter gravity outfalls) and final slope area runoff (via let-down structures and drainage swales). The pond serves only as a retention area for uncontaminated water before being discharged through the stormwater outfall into the river. Unlined portions of both cells may also be utilized as retention areas.

As Cell 2 nears completion it may be necessary to utilize the FP&L easement as an emergency retention area.

A more detailed description of site drainage provision is provided in Section 3.8, On-Site Drainage System.

Staging

A three-phase landfill operating plan has been developed to minimize site visibility, optimize construction, and minimize the amount of surface runoff that is routed for treatment during construction.

Filling the west side of each cell first will create a "visual block" for the remainder of the cell as construction progresses. The proposed filling direction also optimizes haul routes and construction sequences.

Temporary dikes and grading during construction will be used to direct surface flow through 8-in. diameter outfalls to the retention area.

Phase I - Initial Construction

Construction Sequence

- o Site Survey - A site survey will be conducted to determine site boundaries, buffer zones, and control points.
- o Clearing - The initial clearing area includes the entrance roads; Cell 1 and Cell 2 berms; swales and roads, stormwater retention area, pump station and office areas; and the initial disposal area.
- o Mucking Out - An estimated 4.5 ft. of unsuitable material will be removed and stockpiled. The cell construction area will be graded toward the Cell 1 gravity outfall which routes

runoff to the retention pond. Cell 2 will be cleared and used as a retention area.

- o Backfilling and Construction - Phase I areas will be backfilled to design grades. The areas include roadways, drainage swales, stormwater area, pump station, and maintenance yard. Disturbed areas in which filling is the final stage of construction will be revegetated. Dust and silt control devices will be installed as required.
- o Monitor Wells - Monitor wells will be installed around the site to monitor upgradient and downgradient ground water.

Preparation of Initial Disposal Area

- o Construction of three sump sets (leachate and contingency) on the western side of the cell, and their connecting 3-in. diameter force mains. The eastern side of the cell will be used to collect uncontaminated runoff.
- o Placement and grading of a minimum of 1 ft. of select fill on the floor and side slopes of the initial cell area.
- o Construction of contingency collection system which includes installation:
 - 40 mil High Density Polyethylene (HDPE) liner
 - 6-in. diameter perforated collection pipes
 - 8-in. diameter discharge pipe to carry flow from the system to the sumps
 - "Geonet" to facilitate leachate flow
 - "Geotextile" (a synthetic porous reinforcing fabric) to protect the "geonet"
 - Select sand and/or gravel fill to protect the 40 mil HDPE and serve as an additional drainage blanket.
- o Construction of leachate collection system which includes installation of:

- 80 mil HDPE liner and protective "geomembrane"
 - 4-in. diameter and 6-inch. diameter perforated PVC manifold system
 - Select sand and/or gravel fill drainage blanket
- o Placement of 1-ft soil buffer on side slopes.
 - o Preparation of roads for waste handling vehicles.

Filling Waste

The initial cell area will have about 753,000 cy of available capacity. An approximate life of about 1½ years is projected using available waste generation data.

While the initial cell area is being filled, water which contacts waste is routed to the sumps and thence to the sewer. Temporary dikes will separate the excavation area from the remainder of the cell. All other surface flow from the open cell area is routed through the gravity outfall to the detention pond. (Specific operation procedures are discussed later.)

Phase II - Construction

Construction Sequence

Phase II is the construction of the remainder of Cell 1. Phase II will follow the same construction procedure as that of Phase I to prepare the cell area.

Filling Waste

As Cell 1 nears capacity, construction and preparation will begin on Cell 2. The unlined area of Cell 2 could be used as a stormwater retention area as the Cell 1 retention area decreases. The total projected available capacity of Cell 1, including Phase I volume, is about 6,500,000 cy, or about 12 to 13 years of life.

The waste will be filled from south to north. Surface flow will be directed through the 8-in. diameter gravity outfall from Cell 2 to the retention pond.

Phase III - Construction

Construction Sequence

Phase III is the construction of the remainder of Cell 2. The construction sequence is the same as that of Cell 1. The total projected available capacity of Cell 2 is about 4,300,000 cy, or about 7 to 8 years life. The total estimated life of the entire landfill site, including Cells 1 and 2, is about 20 years.

Cover

Daily Cover

At least 6 inches of suitable cover will be placed over the waste at the end of each day. Ash residue or a mixture of ash residue and soil will be used for daily cover.

Intermediate Cover

Intermediate cover will be applied to all landfill surfaces and slopes which will not receive additional refuse for two months or more. This cover will be placed to a minimum compacted thickness of one foot (including daily cover). When landfilling operations begin again in areas with intermediate cover, the cover will be stripped from the surface and stockpiled. When each operating area is brought to intermediate grade and intermediate cover is applied, the surface will be graded with a minimum 2 percent slope and maintained to prevent the formation of standing water. These areas will also be seeded to prevent erosion.

Final Cover

As soon as practical after an area reaches final grade, the final cover will be applied and the area revegetated. In this way, the volume of leachate produced at the landfill will be minimized.

5.3.1 Surface Water

There are no proposed surface water withdrawals or discharges associated with the operations of the resource recovery facility and ash residue/unprocessable waste landfill. All plant water intake will be via City or County Utility Division water mains while all facility discharges,

i.e. sanitary sewage, and surplus boiler and cooling tower blowdown, will be to the HWWTP.

Stormwater runoff will be controlled in accordance with SFWMD requirements as described in Section 3.8, On-Site Drainage.

Potential impact from surface runoff of leachate will be prevented by utilizing temporary berms to separate contaminated stormwater runoff (i.e. stormwater which comes in contact with landfilled materials) from uncontaminated stormwater runoff. Contaminated stormwater will be treated as leachate, contained by the impermeable liner and collected by the leachate underdrain system. A detailed description is provided in Section 5.3, Impacts on Water Supplies.

5.3.2 Groundwater

The only plant pollutant capable of having a potential impact on groundwater supplies at the project site will be the leachate generated at the residue/unprocessable waste landfill. Thus, in the landfill design major importance has been placed on the protection of the groundwater aquifer so as to virtually eliminate the possibility of adverse impact.

The geology at the site, as described in Section 2.3 is rather typical of the entire Broward County area. Consequently, there is a lack of sizable quantities of suitable clays from which recompacted or remolded clay liners can be constructed. Therefore, flexible membrane liners (FML) were chosen to provide containment of the landfill leachate and promote flow to the leachate collection and removal system(s).

There has been a sufficient amount of laboratory and field performance data made available by the EPA (see Appendix 10.14 for references cited) and by synthetic liner manufacturers and installers on which to base the following conclusions:

- o The use of synthetic membrane liners as a means to prevent groundwater contamination by leachate from waste impoundment facilities is a highly developed and proven technology.

- o There are many varieties of synthetic liner materials available, each characterized by specific physical and chemical properties. For a given landfill environment there usually exist several varieties of synthetic liner materials which exhibit excellent physical and chemical compatibility.
- o There are many waste impoundment facilities in the United States which for the past 10 to 15 years have utilized synthetic membrane liner materials to protect groundwater resources. These facilities include municipal solid waste landfills, hazardous waste landfills and lagoons, as well as ash residue landfills associated with coal fired power plants.
- o The EPA, under the most recent RCRA guidelines for the disposal of hazardous waste, views synthetic liner materials as the only low permeability membranes which will effectively prevent groundwater contamination. If synthetic liner materials can successfully be utilized to contain highly acidic, basic or corrosive liquids in a lagoonal environment, for example, then these same materials exposed to municipal solid waste leachate should exhibit superior performance.
- o Proper design considerations (subgrade preparation and liner selection), quality control during construction (seaming and liner soil cover), and consistent facility operation practices (fire control and prevention of the dumping of incompatible wastes) are all important variables in successful liner performance.

Appendix 10.14 is a report prepared by Malcolm Pirnie, Inc. for Broward County describing the current technology associated with synthetic membrane liners.

The FML selected for the site is High Density Polyethylene (HDPE). Experience at various waste disposal sites (see Appendix 10.14 for examples) has shown HDPE to be one of the most physically durable and chemically resistant products currently available on the market. In addition, this material provides a very positive seaming technique that uses extrusion of the parent material along with heat, mechanical agitation, and/or pressure. Solvent bonding techniques, commonly used

with other types of FML, can sometimes dissolve or degrade through chemical reaction with certain quality leachates thereby breaching the containment system.

Because the potential exists that the HDPE may be damaged in some way, a second HDPE liner has been designed for placement beneath the primary liner with a contingency collection system between the two liners. Without the second liner any breach in the primary would allow leachate to escape into the surrounding ground water. With the second liner protected by a 1-ft. thick drainage layer, the containment properties of the design can be maintained. The contingency collection system between the two liners can be (a) sampled periodically to detect potential problems and (b) pumped as a fluid collection and removal system to maintain environmental integrity.

A detailed description of conceptual landfill design is provided in Section 5.3, Impacts on Water Supplies.

As detailed in Subsection 5.3.5, Measurement Programs, a comprehensive ground water monitoring and sampling program will be initiated at the landfill site at least one year prior to beginning commercial operation. If contamination is detected the source of the leak will be determined and the liner will be repaired.

The leachate generated at the landfill would be expected to have an insignificant impact on water quality even if it did come in contact with the ground water reservoir. A detailed discussion of the matter is discussed in Subsection 5.3.4, Leachate and Runoff.

5.3.3 Drinking Water

The Biscayne Aquifer provides the sole source potable water supply for Broward County. The facility, landfill and appurtenances will not incorporate either direct withdrawal from or discharge to the Biscayne Aquifer as part of the design. All intake water, either for sanitary or boiler

requirements, will be provided from City or County Utility Division water mains.

All discharges, from sanitary systems, boiler cooling tower blowdown, leachate, will be to an existing sanitary sewer line for ultimate disposal at the HWWTP.

Landfill design and drainage control considerations as described previously are such that there will be no expected impacts on the Biscayne Aquifer.

5.3.4 Leachate and Runoff

5.3.4.1 General

The proposed development is expected to have an insignificant impact on water quality. The materials to be landfilled (inert residue and unprocessable materials) will be essentially non-putrescible and non-combustible. The available data indicates that, typically, leachate generated at this type of landfill does not contain the pollutants usually associated with a processable waste landfill. Specifically, between 1977 and 1981, the environmental impact and potential utilization of incinerator residue was evaluated at the Suburban Experiment Station of the University of Massachusetts in cooperation with several Massachusetts environmental departments and the RESCO Saugus Incineration Facility. A summary report of this research effort is attached as Appendix 10.12.

The report describes the several studies designed to assess the direct and indirect interaction of incinerator residues with the natural environment. The three studies include wetland/incinerator residue interactions, extensive leaching studies of incinerator residue with natural rain, and horticultural studies in soil mixes containing incinerator residue.

The data indicate that land application of this heterogeneous material has had no discernible impact upon the quality of groundwater, the growth and diversity of the soil

algal community, or the growth and diversity of the terrestrial higher plant community. Further, there has been no significant increase in heavy metal content of soils adjacent to large deposits of residue under field conditions.

Extensive leaching studies with natural rain revealed no significant losses of heavy metals from the residue in spite of a mean rainfall pH of 4.0. The residue had a high buffering capacity which persisted undiminished for over 3 years; during which time about 360,000 ml (60 inches) of pH 4.0 rainfall passed through the residue.

The testing indicated that under field conditions, the bare residue was readily colonized by native plant species, without the aid of any nutritional amendments. Three years after land application of the residue, the majority of the higher plants growing on the residue appeared vigorous and normal. As a result, the incinerator residue appears to be an excellent medium for growth of turf and horticulturally valuable plant materials such as bedding and pot plants like chrysanthemums, poinsettias, geraniums, and bulb plants. Mixtures containing RESCO residue, peat, and soil perform as well as commercial soil mixes and several soil-less potting media. Incinerator residue also is expected to perform well as a subsoil for building golf courses and as fill for grading highway slopes and median strips. After two years' contact with soil and cropping with a variety of plants, the residue takes on the character of a loose, granular soil-like material which drains well, is easy to work, and is quite resistant to erosion from wind or water. There is no difficulty growing a grass cover crop in the greenhouse or in the field on the residue surface.

The studies also show that incinerator bottom/fly ash mix is highly buffered; that the buffering capacity is massive and persistent; that heavy metals are chemically bound in the residue matrix, and that the residue can raise the pH of

leaching acid rainwater from 4.0 - 7.8 without a concomitant release of heavy metals into the leachate. The data presented in this report suggest that incinerator residue (bottom/fly ash) might be used as a landfill intermediate and final cover and may improve landfill management by buffering acid rain percolating through the landfill, thereby reducing the leaching of heavy metals from the residue as well as from other metal-containing materials which might be present in the landfill.

Despite the evidence documenting the acceptable quality of residue leachate, the County is taking the additional precautions of providing an extensive liner and leachate collection systems, together with a stormwater control system that will minimize leachate and stormwater intermixing with surface and ground waters. The following sections summarize the stormwater and leachate control systems.

5.3.4.2 Leachate Production

The major source of leachate production is rainfall. This is the result of both natural phenomena and landfill operation procedures. As rainfall comes into contact with the surface of the landfill, a portion is diverted as runoff while the remaining volume penetrates the ash residue/unprocessable solid waste. Information has been provided by the DER on the landfiling and environmental acceptability of ash residue and is presented in Appendix 10.15. The extent of surface runoff is dependent upon many variables including surface vegetation, the magnitude and duration of the rainfall event, the character of the landfill surface at that time, and surface slopes. It should be noted that runoff which comes in contact with active landfill areas, i.e. areas without final cover, will be treated as leachate. Until the surface is raised to final elevation and capped, a relatively large volume of rainfall will infiltrate portions of the landfill. Upon final closure, infiltration will be minimized and stormwater runoff will remain uncontaminated.

To assess the potential volume of leachate generated at the residue/unprocessable waste landfill, various stages of landfill development were analyzed. The results of this water balance analysis indicate that during the May-October "wet" season, leachate production ranges from 0.5 to 8.3 million gallons/month, depending on the operation in progress.

5.3.4.3 Leachate Control

The landfill main cell will be developed in a series of subcells; each subcell will be temporarily bermed so that rainfall falling on the active side of the berm will be collected as leachate while rainfall falling on the inactive side of the berm will be collected as uncontaminated runoff (Figure 5.3.3). This substantially reduces the volume of leachate requiring treatment.

Before active landfilling begins in a landfill subcell a leachate collection system will be placed in the subgrade. The system consists of two layers of impermeable liner material (HDPE provides a permeability of 1×10^{-12} cm/sec), each with a collection system consisting of a series of pipes or filter fabric embedded in a porous subgrade and sloped so as to transport collected leachate via gravity to peripheral sumps. From the sumps the leachate is pumped to ultimate disposal at the HWWTP. The top liner and collection system is designed to transport all leachate generated at the landfill while the bottom system is provided to contain and transport leachate which may leak through the top system.

As major sections of the residue landfill are brought to final grade, portions of the final cap will be applied. The final cap serves the function of (a) covering and securing deposited wastes, (b) supporting an aesthetically pleasing stand of vegetation, and (c) impeding infiltration of rainwater into the waste to reduce leachate quantities to be handled.

Section 5.3, Impacts on Water Supplies, provides a more detailed description of the technology utilized to control leachate and runoff.

5.3.5 Measurement Programs

The recommended permanent long-term ground water monitoring network includes three upgradient well clusters (five wells per cluster) and several downgradient monitoring well clusters. In addition, the landfill contingency collection system will be pumped and monitored for leachate leak detection.

The proposed long-term ground water sampling program will involve quarterly sampling for a wide variety of inorganic and heavy metal constituents, as well as, a quality assurance/quality control program. The proposed long-term ground water sampling program will be updated as needed as changes in governmental regulation become applicable.

5.3.5.1 Recommended Permanent Long-Term Ground Water Monitoring Network

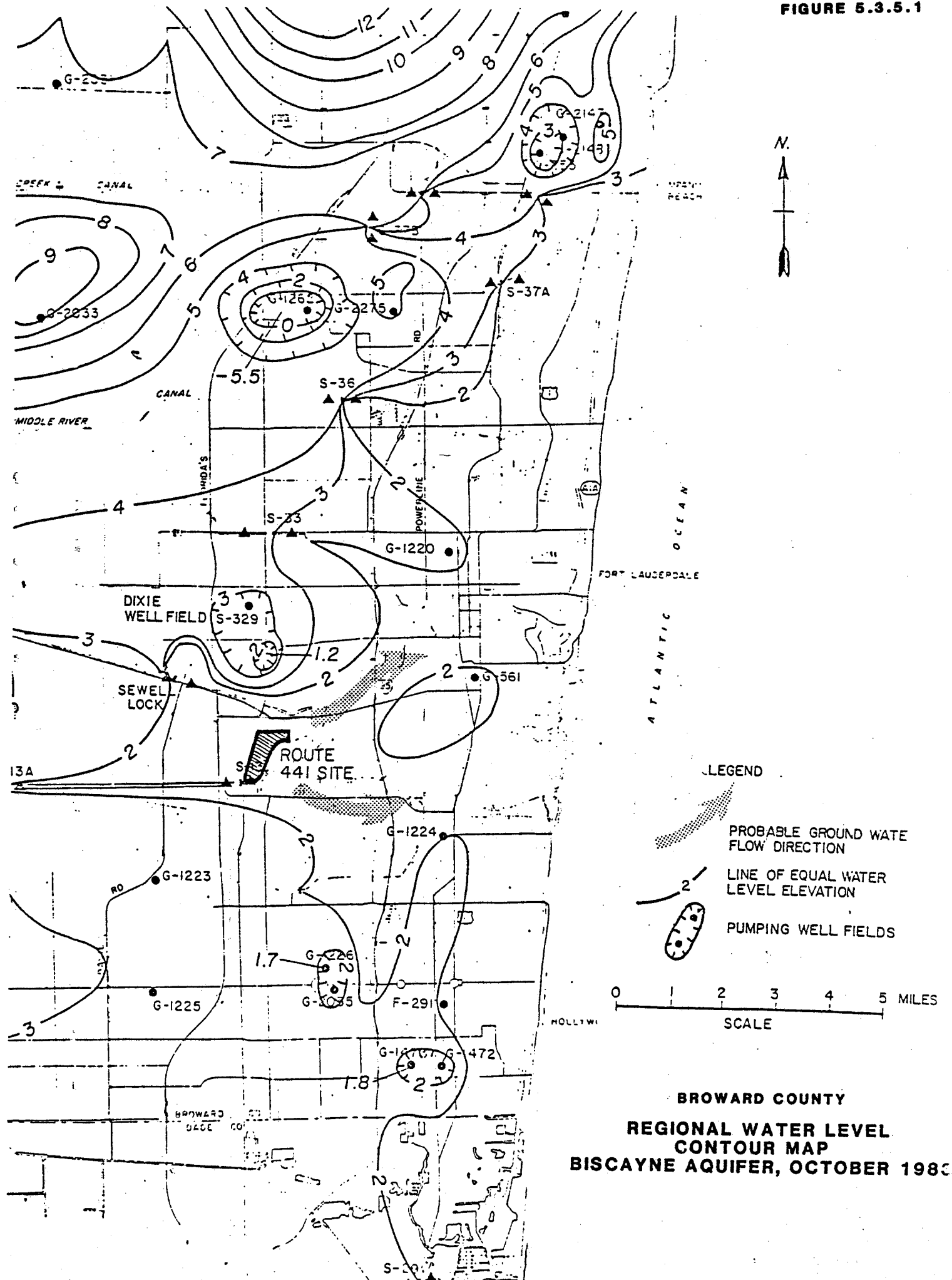
The basic factors which were taken into consideration in the development of a long-term monitoring system included:

- o Ground water flow conditions (shallow and deep).
- o Ground water quality conditions (principally location of fresh/brackish water interface).
- o Ground water use and the locations of major pumping centers (Section 2).
- o Landfill design - specifically use of a synthetic liners and use of a leachate detection system. There will also be at least a ± 5 -foot separation from the water table).

The principal direction of ground water flow in the shallow regimen is to the east (see Figure 2.3.2.4 in Section 2.3.2, Subsurface Hydrology) and shallow flow ultimately discharges to the South New River Canal. Ground water flow conditions at depth become somewhat more complicated primarily due to large withdrawals north and west of the site.

Prior to extensive development of the Biscayne Aquifer, the principal direction of ground water flow was south-south-east. However, as shown on Figure 5.3.5.1, the extensive

FIGURE 5.3.5.1



development of this aquifer has altered natural flow conditions at places. The most recent water table contour map (Figure 5.3.5.1; USGS, 1983) and earlier contour maps indicate that ground water flow, in close proximity to the site, is in a general easterly direction. Moreover, while major pumping centers to the north and west have caused a cone of depression, the cone does not extend to the Route 441 Site.

Given the current understanding of both shallow and deep ground water flow conditions, it appears reasonable that downgradient monitoring take place along the eastern boundary of the site. However, given that increased pumpage might take place at nearby well fields north and west of the site, we would also recommend the placement of as many as three deep well clusters to monitor for possible future ground water movement to these well fields.

We have developed the elements of a monitoring system which are summarized below. It is important that the long-term monitoring effort at the site also address and monitor ground water flow conditions in order to assess possible changes in flow direction.

Shallow Network

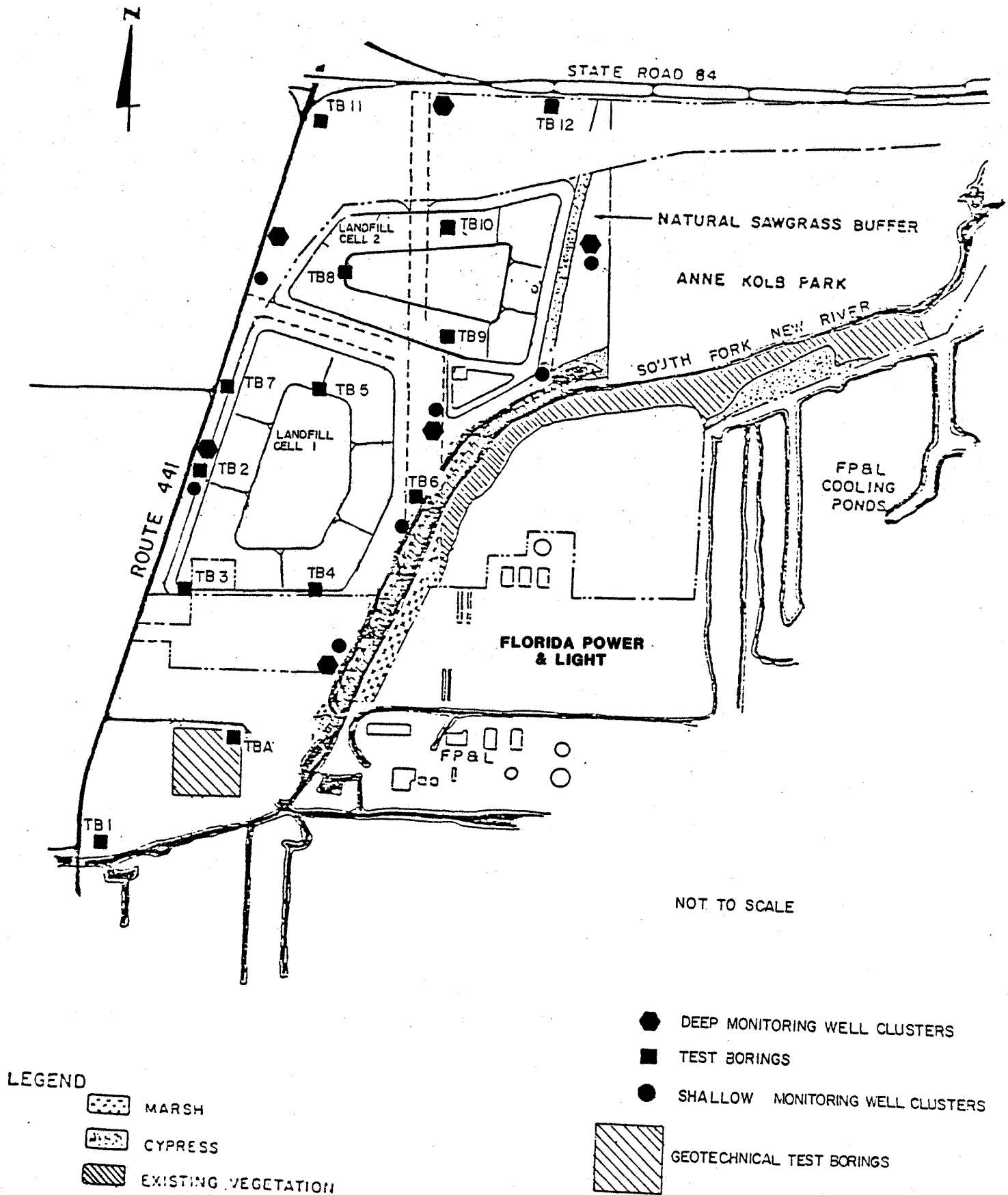
- Upgradient: Use existing clusters (Figure 5.3.5.2).
- Downgradient: Install five shallow clusters downgradient of the landfill cells as shown on Figure 5.3.5.2. The wells should be screened from 15 to 25 feet and from 40 to 50 feet.

Principal objective will be to assess downgradient ground water quality conditions prior to discharge to South New River Canal.

Medium/Deep Network

- Due to uncertainty with respect to future pumpage at well fields to the north and west of the site, it would seem reasonable to establish a medium and deep monitoring network between the landfill site and major pumping centers, as well as medium and deep downgradient monitoring well clusters.

FIGURE 5.3.5.2



NOT TO SCALE

RECOMMENDED LOCATIONS FOR
PERMANENT MONITORING WELLS

Proposed clusters would include:

- Two clusters to the north between the site and Dixie Well Field.
- One cluster to the west between the site and Ferncrest Well Field.
- Three clusters to the east, downgradient of the landfill cells.

The proposed clusters would be comprised of 5 wells completed at depths of 25, 50, 75, 100 and 150 feet.

Leak Detection

As described in Section 5.3, Impacts on Water Supplies, the landfill is designed with a contingency collection system between the two liners. This collection system is supplied with a separate sump which will be sampled periodically to detect potential problems and pumped to maintain environmental integrity. P

5.3.5.2 Proposed Long-Term Ground Water Sampling Program

Ground water sampling will begin on a quarterly basis upon completion of the deep monitoring well system. It is anticipated this will be at least one year prior to the beginning of commercial operation of the Resource Recovery Plant. Ground water sampling will be completed in accordance with procedures outlined in:

- o Procedures Manual for Ground Water Monitoring at Solid Waste Disposal Facilities, EPA/530, SW-611, August 1977.
- o National Handbook of Recommended Methods for Water-Data Acquisition, USGS, 1977-1983.
- o Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WPCF, 1975.

Depending on well diameter, depth, and recharge rates, we propose the use of either hand bailers or sampling pumps to evacuate water from the wells. We recommend the removal of

three to five well casing volumes from each well prior to sample collection.

At the end of the well evacuation procedure, temperature, pH and specific conductance should be measured and recorded. Field notes should be kept of water levels during and after the evacuation procedure, and also of pumping or bailing rates.

Ground water samples should be collected with dedicated PVC bailers. Samples should be sent to the laboratory, with appropriate labeling and chain-of-custody forms, at the end of each day.

We propose that the samples be analyzed for the constituents specified in Table 5.3.5.1. The proposed constituents (Table 5.3.5.1) include indicators of leachate generation from municipal landfills as well as common incinerator ash constituents. In addition, an annual pesticide scan will be included in the program.

A Quality Control (QC) program for laboratory services will be required to ensure confidence in the reported results. A QC program may also provide information pertaining to factors in the sampling procedures that may adversely bias the "true" definition of a specific chemical parameter.

We recommended that the Quality Control program be conducted on two levels, as follows:

- o The contracted laboratory should be required to perform a QC program as described in the U.S. EPA Handbook for Analytical Quality Control in Water and Wastewater Laboratories (EPA 600/2-79-019). The QC plan calls upon the laboratory to perform "duplicate" and "self-spiked" analyses of water samples over the course of the sampling program. The frequency of the duplicates and spikes are 1 from every 10 and 20 water samples collected from the field, respectively.
- o Duplicate and spiked samples, collected according to a similar schedule as described above, should be prepared by the sampling crew. These samples should never be identified as such, and thereby, serve as "unannounced spot checks" on laboratory performance.

TABLE 5.3.5.1

SAMPLING PARAMETERS

<u>Constituent</u>	<u>Detection Limit</u>
TOC	1 mg/l
COD	5 mg/l
pH	-
Specific Conductance	-
Nitrate-N	0.1 mg/l
Sulfate	5 mg/l
Chloride	5 mg/l
Sodium	1 mg/l
Potassium	1 mg/l
Magnesium	0.04 mg/l
Calcium	1 mg/l
Ammonium-N	0.1 mg/l
Bicarbonate	1 mg/l
Alkalinity	1 mg/l
Iron	0.05 mg/l
Manganese	0.05 mg/l

<u>Priority Pollutant Metals</u>	<u>Detection Limit</u>
Antimony	0.2 mg/l
Arsenic	0.01 mg/l
Beryllium	0.01 mg/l
Cadmium	0.01 mg/l
Chromium (total)	0.05 mg/l
Copper	0.05 mg/l
Cyanide	0.01 mg/l
Lead	0.01 mg/l
Mercury	0.01 mg/l
Nickel	0.05 mg/l
Selenium	0.01 mg/l
Silver	0.01 mg/l
Thallium	0.1 mg/l
Zinc	0.005 mg/l

Duplicate samples will consist of filling up two different sets of containers for water at a single sampling location. Spikes should be prepared with USEPA samples at a contractual laboratory in Florida.

5.3.5.3 Proposed Long-Term Surface Water Monitoring Program

The proposed surface water monitoring program will comply with water quality standards during the operation of the facility.

All stormwater run-off generated up to the 25 year - 72 hour design storm is to be captured on-site, temporarily stored and then slowly released via a filter berm bleeddown system into the adjacent marsh areas. Excess run-off is discharged via the outfall structure into the adjacent marsh area.

No data has been generated to confirm the water quality of the stormwater run-off expected from the proposed residue/unprocessable landfill. All rainfall falling on the working face of the landfill will be collected and handled separately as leachate. Temporary dikes and drainage works will divert uncontaminated run-off from entering the working landfill face. The finished sides and exterior of the landfill will be constructed of two (2) feet of soil and then grassed. Potential contaminants are as follows:

- o Nutrients - used to fertilize the grassed slopes and swales.
- o Sediments - washed off the side slopes.

Nutrient levels in the run-off will be monitored. If excess levels are reported then Broward County would take steps to insure that the fertilizer application rates are lowered or the type of fertilizer chemical change. A retention pond is provided ahead of the outfall structure which will reduce velocities and allow soil particles, etc. an

opportunity to settle out. When the stormwater run-off passes through the outfall structure, it is once again slowed down in the energy dispersion pond and then allowed to flow overland through the marsh prior to discharging into the river.

An extension surface water quality monitoring program, similar to that described in Section 2.3.4.2, Measurement Programs, will be undertaken in the C-11 Canal during the first 10 years of operation. With 10 years of water quality data available, a reevaluation of the proposed stormwater disposal system may be required. Pretreatment of runoff before disposal may be necessary.

5.4 Solid/Hazardous Waste Disposal Impacts

The impact of solid and hazardous waste disposal related to the project is expected to be minimal.

5.4.1 Solid Waste

As previously discussed in Section 3.7, Solid and Hazardous Waste, solid waste in the form of residue from the resource recovery facility will be handled in a safe, controlled manner from the point of generation to the point of disposal at the adjacent landfill. Details regarding protection of ground and surface waters at and adjacent to the landfill are presented in Section 4.2, Impact on Surface Water Bodies and Uses, Section 4.3, Groundwater Impacts, and Section 5.3, Impacts on Water Supplies. The latter section includes a description of the method by which the landfill will be operated on a daily basis, including measures for the prevention of erosion, leachate collection and treatment, and the minimization of visual impact. Details regarding the long-term management of the landfill, including final grading and landscaping, vertical elevation, and finished contour elevation are also presented in Section 5.3.

5.4.2 Hazardous Waste

As described in Section 3.7.2, Hazardous Waste, it is expected that little, if any hazardous waste will enter or accepted at the facility. Any residue which is deemed to be hazardous will be stored, transported and disposed of off-site in accordance with all applicable hazardous waste regulations.

5.5 Sanitary and Other Waste Discharges

All sanitary and other waste discharges (i.e., boiler blowdown and process water waste) will be disposed of at the HWWTP. Therefore, there will be no expected effects of these discharges on off-site water supplies.

5.6 Air Quality Impacts

5.6.1 Impact Assessment

Predicted maximum impact concentrations for the proposed facility at initial projected operation, using screening and refined modeling receptor grids, are presented in Tables 5.6.1.1 and 5.6.1.2, respectively, and at maximum projected operation in Tables 5.6.1.3 and 5.6.1.4, respectively. These results are based on the plant charging 2,352 tpd or 98.0 tons per hour of solid waste at initial projected operation and 3,795 tpd or 158.1 tons per hour of solid waste at maximum projected operation. Figures 5.6.1.1 and 5.6.1.2 present impact concentration for criteria pollutants (these for which Federal Ambient Air Quality Standards have been established) graphically by comparing the maximum short-term impact levels with monitored background value and the applicable standards.

In general, maximum pollutant concentrations increased slightly for the plant at maximum projected operation compared to initial operation and for the refined receptor grid compared to the screening grid. For most of the pollutants, the predicted maximum concentrations are below the Prevention of Significant Deterioration (PSD) significant impact levels and

TABLE 5.6.1.1

PREDICTED MAXIMUM CONCENTRATIONS FOR THE PROPOSED BCRR FACILITY AT INITIAL PROJECTED OPERATION (115 PERCENT OF NAMEPLATE CAPACITY) USING SCREENING MODELING METHODS

Pollutant	Averaging Time	Maximum Concentration* ($\mu\text{g}/\text{m}^3$)	Receptor Location†		Period		
			Direction (°)	Distance (km)	Year	Julian Day	Ending
SO ₂	3-hour	23.8	300	2.7	1971	126	12
	24-hour	5.4	310	2.3	1972	112	24
	Annual	0.6	280	4.3	1970	-	-
			300	3.1	1972,1974	-	-
TSP	24-hour	0.74	310	2.3	1972	112	24
	Annual	0.08	280	4.3	1970	-	-
			300	3.1	1972,1974	-	-
NO ₂	Annual	0.62	280	4.3	1970	-	-
			300	3.1	1972,1974	-	-
CO	1-hour	9.7	10	1.1	1970	187	11
	8-hour	2.4	310	2.3	1972	111	16
Pb	24-hour (Quarterly)	0.30 (0.03)**	310	2.3	1972	112	24
			(300)	(3.5)	(1972)	(-)	(-)
			(300)	(3.9)	(1974)	(-)	(-)
F	24-hour	0.25	310	2.3	1972	112	24
Be	24-hour	0.0000091	310	2.3	1972	112	24
Hg	24-hour	0.0026	310	2.3	1972	112	24

*Highest, second-highest concentrations for short-term period; highest concentration for annual period. Values in parenthesis represent results associated with revised de minimis monitoring levels. See Section 2.2 for details.

†With respect to proposed facility.

**Annual average.

Source: ESE, 1985.

TABLE 5.6.1.2

PREDICTED MAXIMUM CONCENTRATIONS FOR THE PROPOSED BCRR FACILITY AT INITIAL PROJECTED
OPERATION (115 PERCENT OF NAMEPLATE CAPACITY) USING REFINED MODELING METHODS

Pollutant	Averaging Time	Maximum* Concentra- tion ₃ (ug/m ³)	Receptor Location†		Period			Significant Impact Level ₃ (ug/m ³)	De Minimis Monitoring Level ₃ (ug/m ³)
			Direction (°)	Distance (km)	Year	Julian Day	Hour Ending		
SO ₂	3-hour	23.8	300	2.7	1971	126	12	25	NA
	24-hour	5.5	312	2.4	1973	112	24	5	13
	Annual	0.6	280	4.3	1970	-	1	1	NA
			300	3.1	1972,74	-	-	-	-
TSP	24-hour	0.75	312	2.4	1972	112	24	5	10
			270	-	1973	107	24	-	-
	Annual	0.08	280	4.3	1970	-	-	1	NA
			300	3.1	1972,74	-	-	-	-
			-	3.1	1972,74	-	-	-	-
NO ₂	Annual	0.6	280	4.3	1970	-	-	1	14
			300	3.1	1972,74	-	-	-	-
CO	1-hour	10.4	8	1.0	1970	187	11	2,000	NA
	8-hour	2.7	312	2.3	1972	111	16	500	575
Pb	24-hour (Quarterly)	0.30 (0.03)**	312	2.4	1972	112	24	NA	0.1
			(280)	(4.3)	(1970)	-	-	(NA)	(0.1)
			(300)	(3.1)	(1972,74)	-	-	-	-
F ⁻	24-hour	0.25	312	2.4	1972	112	24	NA	0.25
Be	24-hour	0.000093	312	2.4	1972	112	24	NA	0.0005 (0.001)
Hg	24-hour	0.0026	312	2.4	1972	112	24	NA	0.25

NA = Not Applicable.

*Highest, second-highest concentration for short-term period; highest concentration for annual period. Values in parantheses represent results associated with revised de minimis monitoring levels. See Section 2.2 for details.

†With respect to proposed facility.

**Annual average.

Source: ESE, 1985.

TABLE 5.6.1.3

PREDICTED MAXIMUM CONCENTRATIONS FOR THE PROPOSED BCRR FACILITY AT MAXIMUM PROJECTED OPERATION (115 PERCENT OF NAMEPLATE CAPACITY) USING SCREENING MODELING METHODS

Pollutant	Averaging Time	Maximum Concentration* (ug/m ³)	Receptor Location†		Period		
			Direction (°)	Distance (km)	Year	Julian Day	Ending
SO ₂	3-hour	27.5	10	1.1	1970	187	12
	24-hour	5.8	310	2.7	1972	111	24
	Annual	0.6	300	3.5	1972	-	-
			300	3.9	1974	-	-
TSP	24-hour	0.79	310	2.7	1972	111	24
	Annual	0.08	300	3.5	1972	-	-
			300	3.9	1974	-	-
NO ₂	Annual	0.6	300	3.5	1972	-	-
			300	3.9	1974	-	-
CO	1-hour	13.5	10	1.1	1970	187	11
	8-hour	2.6	310	2.7	1972	183	16
Pb	24-hour (Quarterly)	0.32 (0.03)**	310	2.7	1972	111	24
			(300)	(3.5)	(1972)	(-)	(-)
			(300)	(3.9)	(1974)	(-)	(-)
F	24-hour	0.27	310	2.7	1972	111	24
Be	24-hour	0.0000098	310	2.7	1972	112	24
Hg	24-hour	0.0028	310	2.7	1972	112	24

*Highest, second-highest concentrations for short-term period; highest concentration for annual period. Values in parenthesis represent results associated with revised de minimis monitoring levels. See Section 2.2 for details.

†With respect to proposed facility.

**Annual average.

Source: ESE, 1985.

TABLE 5.6.1.4

PREDICTED MAXIMUM CONCENTRATIONS FOR THE PROPOSED BCRR FACILITY AT MAXIMUM PROJECTED
OPERATION (115 PERCENT OF NAMEPLATE CAPACITY) USING REFINED MODELING METHODS

Pollutant	Averaging Time	Maximum* Concentra- tion ₃ (ug/m ³)	Receptor Location†		Year	Period		Significant Impact Level ₃ (ug/m ³)	De Minimis Monitoring Level ₃ (ug/m ³)
			Direction (°)	Distance (km)		Julian Day	Hour Ending		
SO ₂	3-hour	29.1	8	1.0	1970	187	12	25	NA
	24-hour	5.9	312	2.8	1972	112	24	5	13
	Annual	0.6	300	3.5	1972	-	1	NA	-
TSP	24-hour	0.81	312	2.8	1972	112	24	5	10
	Annual	0.08	300	3.5	1972	-	-	1	NA
			300	3.9	1974	-	-	-	-
NO ₂	Annual	0.6	300	3.5	1972	-	-	-	-
			300	3.9	1974	-	-	-	-
CO	1-hour	14.3	8	1.0	1970	187	11	2,000	NA
	8-hour	2.6	308	2.7	1972	183	16	500	575
Pb	24-hour (Quarterly)	0.32 (0.03)**	312	2.8	1972	112	54	NA	0.1
			(300)	(3.5)	1972	-	-	(NA)	(0.1)
			(300)	(3.9)	1974	-	-		
F ⁻	24-hour	0.27	312	2.8	1972	112	24	NA	0.25
Be	24-hour	0.000010	312	2.8	1972	112	24	NA	0.0005 (0.001)
Hg	24-hour	0.0028	312	2.8	1972	112	24	NA	0.25

NA = Not Applicable.

*Highest, second-highest concentration for short-term period; highest concentration for annual period. Values in parantheses represent results associated with revised de minimis monitoring levels. See Section 2.2 for details.

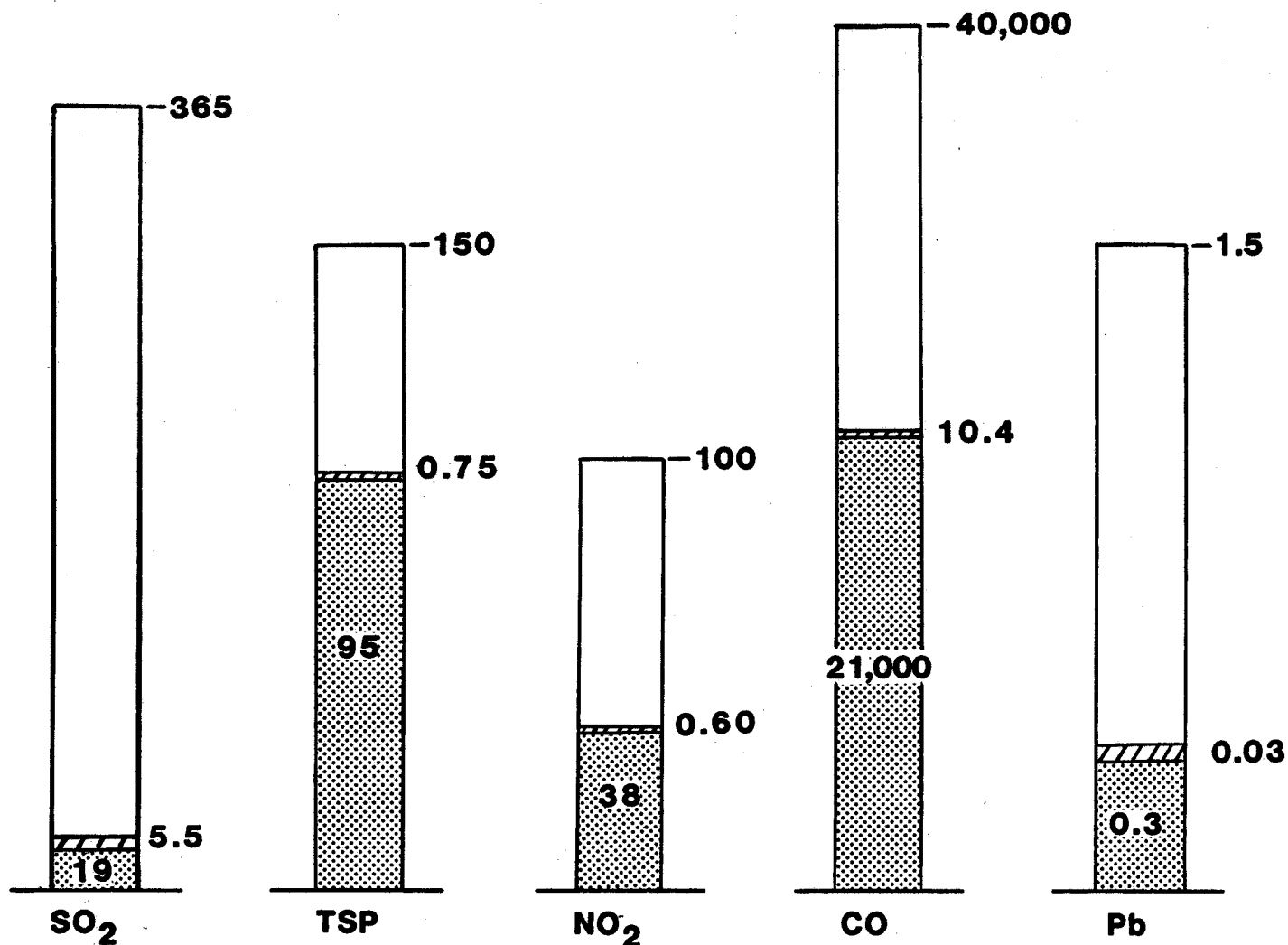
†With respect to proposed facility.

**Annual average.

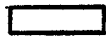
Source: ESE, 1985.

**COMPARISON OF FACILITY AIR QUALITY IMPACTS
WITH SHORT-TERM AAQS* AVERAGING PERIODS
INITIAL PROJECTED CAPACITY**

(Concentrations in $\mu\text{g}/\text{m}^3$ **)



LEGEND

-  Background Ambient Air Concentration
-  Maximum Allowable Ambient Concentration
-  Maximum Facility Impact

SO₂ - Sulfur Dioxide (SO₂) concentrations given for 24-hour averaging time.

TSP - Particulate Suspended Matter (TSP) concentrations given for 24-hour averaging time.

NO₂ - Nitrogen Dioxide (NO₂) concentrations given for annual averaging time.

CO - Carbon Monoxide (CO) concentrations given for 1-hour averaging time.

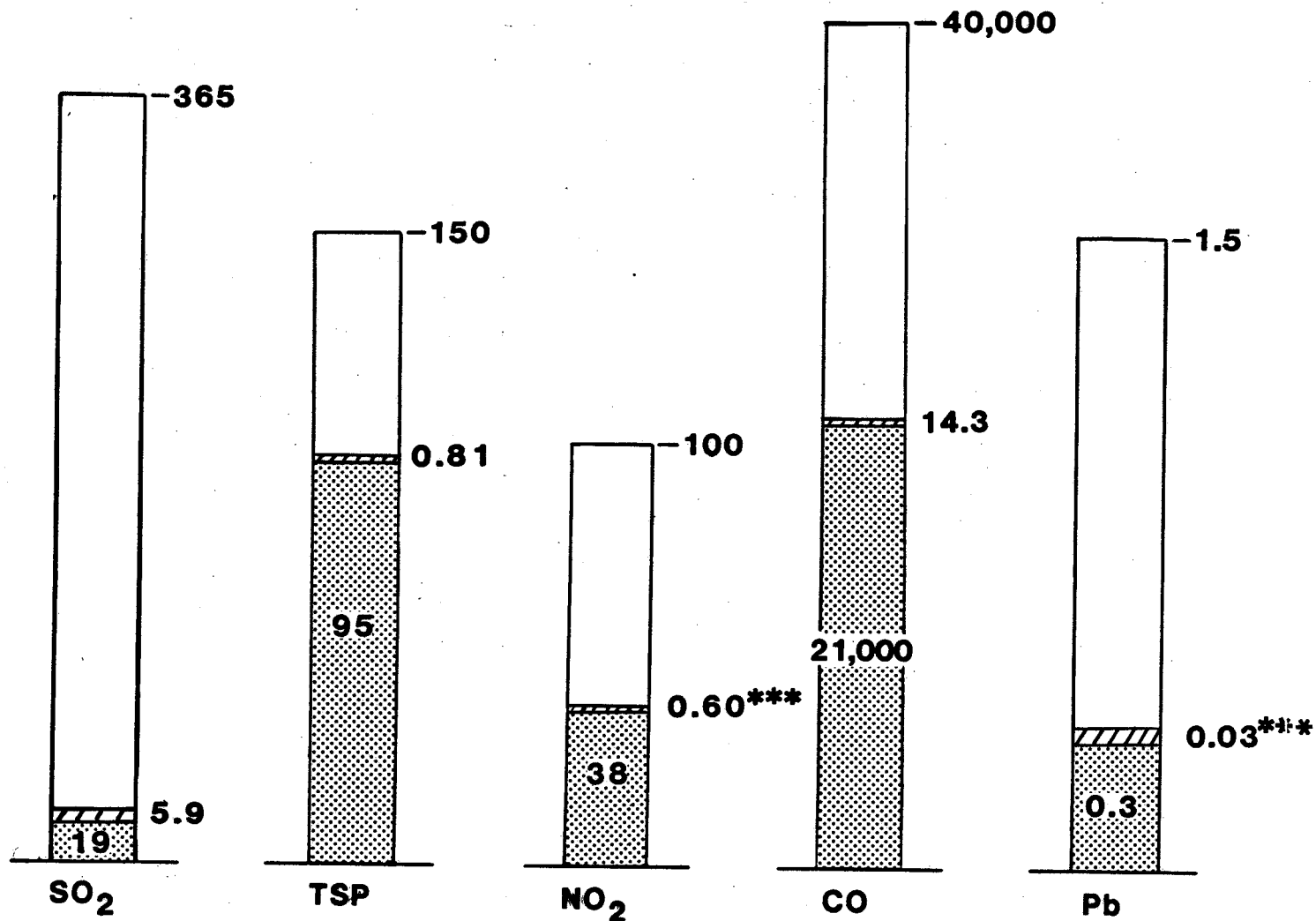
Pb - Lead (Pb) concentrations given for quarterly averaging time.

* - AAQS - Ambient Air Quality Standard

** - $\mu\text{g}/\text{m}^3$ - micrograms per cubic meter

**COMPARISON OF FACILITY AIR QUALITY IMPACTS
WITH SHORT-TERM AAQS* AVERAGING PERIODS
MAXIMUM PROJECTED CAPACITY**

(Concentrations in $\mu\text{g}/\text{m}^3$ **)



LEGEND

-  Background Ambient Air Concentration
-  Maximum Allowable Ambient Concentration
-  Maximum Facility Impact

SO₂ - Sulfur Dioxide (SO₂) concentrations given for 24-hour averaging time.

TSP - Particulate Suspended Matter (TSP) concentrations given for 24-hour averaging time.

NO₂ - Nitrogen Dioxide (NO₂) concentrations given for annual averaging time.

CO - Carbon Monoxide (CO) concentrations given for 1-hour averaging time.

Pb - Lead (Pb) concentrations given for quarterly averaging time.

* - AAQS - Ambient Air Quality Standard

** - $\mu\text{g}/\text{m}^3$ - micrograms per cubic meter

*** Actual concentrations are negligibly higher (rounded to the nearest hundredth)

de minimis monitoring levels. As a result, the proposed plant emissions do not produce a significant impact for Particulate Matter (PM), Nitrogen Dioxide (NO₂), or Carbon Monoxide (CO) concentrations, and, therefore, do not require additional modeling analyses. For Sulfur Dioxide (SO₂), the maximum predicted 3- and 24-hour concentrations for the plant operations are greater than the significant impact levels. However, even under maximum projected operation, the maximum concentrations are predicted to be only 16 and 18 percent above the 3- and 24-hour significant impact levels, respectively. For the other regulated pollutants for which significant impact levels have not been established, the predicted maximum concentrations are well below the de minimis monitoring levels established for these pollutants. Based on these results and the existing low measured pollutant concentrations in Broward County, the proposed emissions from the proposed plant are expected to comply with the national and Florida AAQS and PSD Class II increments. Appendix 10.16 is a report prepared by Fred C. Hart Associates, Inc. Report to New York City Department of Sanitation on projected emissions from similar resource recovery facilities. Additionally, testimony by Gary Smith, EPA on behalf of William Ruck Lehaus (then Director, EPA) indicating the environmental acceptability of emissions from resource recovery incinerators is contained in Appendix 10.17.

The proposed emissions from the proposed facility produce predicted maximum concentrations that are less than PSD significant impact levels and de minimis monitoring levels in the PSD Class I area in the Everglades National Park (Tables 5.6.1.5 and 5.6.1.6). These results are consistent with the predicted maximum concentrations within the near vicinity of the proposed facility. Thus, the emissions for proposed facility are expected to comply with national and Florida Ambient Air Quality Standards (AAQS) and PSD Class I increments in the Everglades National Park.

TABLE 5.6.1.5

PREDICTED MAXIMUM CONCENTRATIONS AT THE PSD CLASS I AREA DUE TO THE PROPOSED BCRR FACILITY AT INITIAL
PROJECTED LOAD (115 PERCENT OF NAMEPLATE CAPACITY)

Pollutant	Averaging Time	Maximum Concentration* (ug/m ³)	Receptor Location UIM Coordinates (km)		Period		Significant Impact Level (ug/m ³)	Monitoring Level ³ (ug/m ³)
			x	y	Year	Julian Day	Hour Ending	
SO ₂	3-hour	4.0	520.75	2849.4	1973	18	3	25
	24-hour	0.8	522.75	2849.4	1973	17	24	5
	Annual	0.1	-	0	1971-74	-	-	1
TSP	24-hour	0.10	522.75	2849.4	1973	17	24	5
	Annual	0.01	-	-	1971-74	-	-	1
NO ₂	Annual	0.1	-	-	1971-74	-	-	1
CO	1-hour	1.4	532.75	2847.4	1971	216	20	2,000
	8-hour	0.31	522.75	2849.4	1971	204	24	500
Pb	24-hour (Quarterly)	0.042 (0.0)†	522.75	2849.4	1973	17	24	NA
F ⁻	24-hour	0.035	522.75	2849.4	1973	17	24	NA
Be	24-hour	0.0000013	522.75	2849.4	1973	17	24	NA
Hg	24-hour	0.00036	522.75	2849.4	1973	17	24	NA

NA = Not applicable.

*Highest, second-highest concentration for short-term period, highest concentration for annual period. Values in parentheses represent results associated with revised de minimis monitoring levels. See Section 2.2 for details.

†Annual average.

Source: ESE, 1985.

TABLE 5.6.1.6

PREDICTED MAXIMUM CONCENTRATIONS AT THE PSD CLASS I AREA DUE TO THE PROPOSED BCRR FACILITY AT MAXIMUM
PROJECTED LOAD (115 PERCENT OF NAMEPLATE CAPACITY)

Pollutant	Averaging Time	Maximum Concentration* (ug/m ³)	Receptor Location UIM Coordinates (km)		Period			Significant Impact Level (ug/m ³)	Monitoring Level (ug/m ³)
			x	y	Year	Julian Day	Hour Ending		
SO ₂	3-hour	4.8	520.75	2849.4	1973	194	21	25	NA
	24-hour	1.0	522.75	2849.4	1973	60	24	5	13
	Annual	0.1	-	0	1971-74	-	-	1	NA
TSP	24-hour	0.13	522.75	2849.4	1973	60		5	10
	Annual	0.01	-	-	1971-74	-	-	1	NA
NO ₂	Annual	0.1	-	-	1971-74	-	-	1	14
CO	1-hour	1.7	532.75	2847.4	1971	216	20	2,000	NA
	8-hour	0.38	522.75	2849.4	1971	204	24	500	575
Pb	24-hour (Quarterly)	0.054 (0.0)†	522.75	2849.4	1974	60	24	NA	0.1 (0.1)
F ⁻	24-hour	0.045	522.75	2849.4	1974	60	24	NA	0.25
Be	24-hour	0.0000016	522.75	2849.4	1974	60	24	NA	0.0005 (0.001)
Hg	24-hour	0.00045	522.75	2849.4	1974	60	24	NA	0.25

NA = Not applicable.

*Highest, second-highest concentration for short-term period, highest concentration for annual period. Values in parentheses represent results associated with revised de minimis monitoring levels. See Section 2.2 for details.

†Annual average.

Source: ESE, 1985.

Because the maximum predicted concentrations for pollutants emitted above the PSD significant emissions levels are below the AAQS and threshold limits the cause injury to vegetation and soils (see Appendix 10.1.5), the impacts due to each facility are not expected to have a significant impact on vegetation and soils in the PSD Class I and II areas. Also, the emission are highly unlikely to cause adverse visibility impairment in the Everglades National Park.

5.7 Noise

Noise baseline data and conditions are discussed in Section 2.3.8. Noise monitoring sites are illustrated in Figure 2.3.8.1 in Section 2.3.8 as well. In addition, baseline sound levels are shown in the same section (see Table 2.3.8.1).

From the analysis presented in Appendix 10.10, the projected noise levels at sensitive boundaries range from 55-65 dB(a). It is projected that any noises generated on-site will be attenuated adequately to ensure compliance with the applicable County regulations. This is based on an analysis of noise attenuation from the point of origin to all property lines around the perimeter of the site. As such, noise impacts with respect to various zoning classification criteria are projected to be in compliance with zoning standards. Table 5.7.1 is a summary of the projected noise levels recorded at the property lines as compared to the standards set forth in the Broward County Code of Regulations, Chapter 27-7. Table 5.7.2 is a list of common noise levels.

Appropriate mitigation measures for reducing expected noise levels are included in the design of the project. Mitigation measures presently being considered include:

- o On the west side of the site, there will be a 200 foot setback east of Route 441. The setback will be enriched with extensive landscaping which will include high trees and other flora.

TABLE 5.7.1

PROJECTED NOISE IMPACTS (dB(A))

Noise Source	Noise Level 50' from Source	Distance to Closest Property Line	Zoning Classification Impacted	Noise Attenuation ¹	Noise Level at Property Line ²	Noise Standard ³
Trucks at Landfill	80	300', west	industrial	15	65	70
Trucks at Facility	80	300-400', south	industrial, agricultural	15	65	70(+10)
Evaporative Cooling Tower	-	300-400', south	residential	-	approx. 55 dB	55(+10) ⁴

1. Attenuation is by distance (see Section 3.4) for trucks. For cooling tower, attenuation is by distance and a noise attenuating barrier.
2. Noise level at source - noise attenuation.
3. Sound Level Limit (+ allowable increment), from Chapter 27-7 of the Broward County Code of Regulations (see Section 4.2).
4. Standards require that levels measured at residential areas cannot exceed 55 dB(A) for more than 50% of any measurement period. It is predicted that trucks noises above 55 dB(A) will not occur for more than 50% of any measurement period. Further, regulations state that a sound level limit of 65 dB(A) may not be exceeded during the hours of 7 a.m. to 10 p.m.
5. Figures extrapolated from Pinellas County facility data. Noise reading at Pinellas County, 200 feet from the noise source, was 65 dB(A). Attenuation is expected to be achieved by distance and by noise attenuating barriers and surrounding structures.

TABLE 5.7.2

COMMON OUTDOOR LEVELS	INDOOR LEVELS	NOISE LEVEL (dBA)	RESPONSE	CONVERSATION RELATIONSHIPS
Carrier Deck, Jet Operations		140		
		135		
		130	Limit Amplified Speech	
		125		
Jet Takeoff, 200 Ft.	Discotheque	120	Maximum Vocal Effort	
Auto Horn, 3 Ft.		115		
	Rock Band	110		
	Riveting Machine	105		Shouting in Ear
Jet Flyover, 1000 Ft.		100	Very Annoying	
Jet Takeoff, 2000 Ft.		95	Hearing Damage	
Gas Lawn Mower, 3 Ft.	N.Y.C. Subway	90		Shouting, 2 Ft.
Pneumatic Drill, 50 Ft.		85		
Diesel Truck, 50 Ft.	Food Blender, 3 Ft.	80	8 Hours - Annoying	
		75		Very Loud Conversation, 2 Ft.
Noisy Urban Daytime	Garbage Disposal, 3 Ft.	70		Loud Conversation, 2 Ft.
Freight Train, 50 Ft.	Shouting, 3 Ft.	65		
Gas Lawn Mower, 100 Ft.	Vacuum Cleaner, 10 Ft.	60	Telephone Use Difficult	Loud Conversation, 4 Ft.
Freeway Traffic, 50 Ft.		55		
Commercial Area	Normal Speech, 3 Ft.	50	Intrusive	
	Air Conditioner, 20 Ft.	45		Normal Conversation, 12 Ft.
	Large Business Office	40		
Quiet Urban Daytime	Dishwasher, Next Room	35	Quiet	
Light Auto Traffic, 100 Ft.		30		
		25		
Quiet Urban Nighttime	Small Theatre (Background)	20		
Quiet Suburban Nighttime	Library	15		
	Bedroom at Night	10	Very Quiet	
Quiet Rural Nighttime	Concert Hall (Background)	5		
		0	Just Audible	
			Threshold of Hearing	

- o On site noise generated from plant processing operations will be either largely contained within the structure or shielded from residential properties.
- o The air cooled condenser will be surrounded by a noise-attenuating wall/barrier. In addition, noise resulting from its operation will be shielded by locating it on the east side of the facility. The facility will then act as a sound barrier between the tower and residential areas located to the west.

The operation of the proposed facility will increase day time truck traffic levels along roadways in the vicinity of the site. Truck traffic to and from the facility will occur an estimated twelve hours per day from approximately 7:00 AM to 7:00 PM.

The average hourly track volume expected to be added to the access roads from the proposed project is 25 vehicle trips for the initial maximum installed capacity of 2,352 tons per day and 35 vehicle trips for the ultimate capacity of approximately 3,300 tons per day. These figures represent less than a one percent increase above existing traffic patterns and therefore, would not have a significant impact on ambient noise levels during the period when trucks would be entering and existing the facility. Trucks operating on a public right-of-way are exempted from noise control provisions (Section 4.2, Appendix 10.10).

5.8 Changes In Non-Aquatic Species Populations

5.8.1 Impacts

Long-term impacts to non-aquatic species populations resulting from plant operations are anticipated to be insignificant. There would be no anticipated changes in diversity, relative abundance, species composition, distribution, domi-

nance, or gradient distribution of important non-aquatic species.

5.8.2 Monitoring

No long-term monitoring programs are proposed because significant impacts to non-aquatic species populations are not expected.

5.9 Other Plant Operation Effects

There are no significant environmental effects resulting from plant operations that have not been discussed in Section 5.1 through 5.8.

Estimates of the truck traffic that will be required to transport waste to the facility, including trips from the facility after trucks have unloaded their waste, were utilized to project traffic impacts on the local access roads. Table 5.9.1 presents the results of these estimates. Vehicle trips expected on each of the impacted roadways and the percentage increase these additional trips represent is presented. As the figures on Table 5.9.1 indicate, any increase in average daily traffic volumes will have an insignificant impact on existing traffic conditions. In addition, since both the resource recovery facility and the unprocessable ash/residue landfill will be located on the same site, there will be no need to haul ash residue over public roads, thus eliminating traffic and environmental impacts associated with the hauling of ash residue.

5.10 Archaeological Sites

The State of Florida, Division of Archives, History and Records Management stated that a review of the Florida Master Site File indicates that no archaeological or historic sites are recorded for the project area. From their review they concluded that the proposed project will have no effect on any

TABLE 5.9.1

BROWARD COUNTY RESOURCE RECOVERY FACILITY
ROUTE 441 SITE

PROJECTED TRAFFIC IMPACTS

	<u>Segment Number</u>	<u>Average Daily Traffic</u>	<u>Approximate Additional Vehicle Trips</u>	<u>Percent Increase</u>
Rt. 441 (south to Rt. 84)	562 (84 to Riverland)	35,930	36	0.1
	561 Riverland to SW 18th)	34,227	34	0.1
	560 (SW 18th to Davie)	35,524	24	0.1
Rt. 441 (north to Rt. 84)	626 (84 to Oaks)	29,596	100	0.3
	627 (Oaks to Orange)	30,059	168	0.6
	628 (Orange to Griffin)	26,174	131	0.5
Rt. 84 (east to Rt. 441)	593	37,480	7	<0.1
	592	44,399	7	<0.1
Rt. 84 (west to Rt. 441)	594	41,200	58	0.1
	595	44,920	50	0.1
Florida Turnpike Exit (east to Rt. 441)	629	11,678	7	0.1
	630	13,534	7	0.1

sites listed or eligible for listing, in the National Register of Historic Places (see Appendix 10.18).

5.11 Resources Committed

Some of the resources committed to the project will be consumed and converted and hence, be unavailable for future use once the project is complete.

Resources and materials used in the construction phase of the project would be committed to the project. Building materials would be consumed and thus irretrievably used in the facility's construction. Lumber and concrete would be committed, as well as:

- o glass products
- o ceramics
- o paint
- o metals
- o insulation
- o electrical equipment, and
- o piping

In addition, human labor and energy utilized in the construction of the facility would be irretrievable. However, all of the above is typical of the commitment of resources necessary to bring to fruition a major capital project such as the south Broward County resource recovery project.

Some significant financial commitments already have been made to the project. Approximately \$29 million has already been spent on acquisition of the site and another \$5 million has been spent on other development activities. In addition, approximately \$521 million in Industrial Revenue Bonds have been sold to finance the southern Route 441 and northern Copans Road resource recovery projects. The southern Route 441 facility will serve approximately 60 percent of Broward County residents. Again, the commitment of finances, like labor and materials, is typical for a major project of this nature.

The mass-burning combustion process will chemically alter many of the compounds contained in the waste stream in a positive way (i.e., raw garbage is turned into a relatively inert ash residue). Materials thus consumed in the combustion process are converted to energy a large portion of which is recovered. This is considered a positive result of the combustion process since the materials burned will generate electricity. Otherwise, these same materials would have to be buried consuming landfill capacity. In contrast, the mass-burning of a projected ultimate capacity of approximately 3,300 tons per day at the facility could result in the conversion of up to one million tons of municipal solid waste per year into energy equivalent to one million barrels of crude oil.

5.12 Variances

As described, at this time no known variances from applicable standards will be required as part of the state certification program for the proposed resource recovery facility.

TRANSMISSION LINES AND OTHER LINEAR FACILITIES

SECTION 6

TRANSMISSION LINES AND OTHER LINEAR FACILITIES

Based upon discussions with Florida Power and Light, Company (FP&L) officials and their preliminary investigation of electrical interconnection requirements, there does not appear to be a need for new transmission line corridors or any other long narrow siting corridors (e.g., rail lines, influent or effluent pipelines, etc.) which leave the main site area. The site is directly adjacent to the FP&L complex; however, the two sites are separated by the South Fork New River which runs along their entire length. Therefore, transmission lines will not cross any land that is not the property of the County or FP&L. The method for transmission line crossing of the South Fork New River will be designed such that it will have no adverse impact on existing use of the river nor will it affect current water conditions.

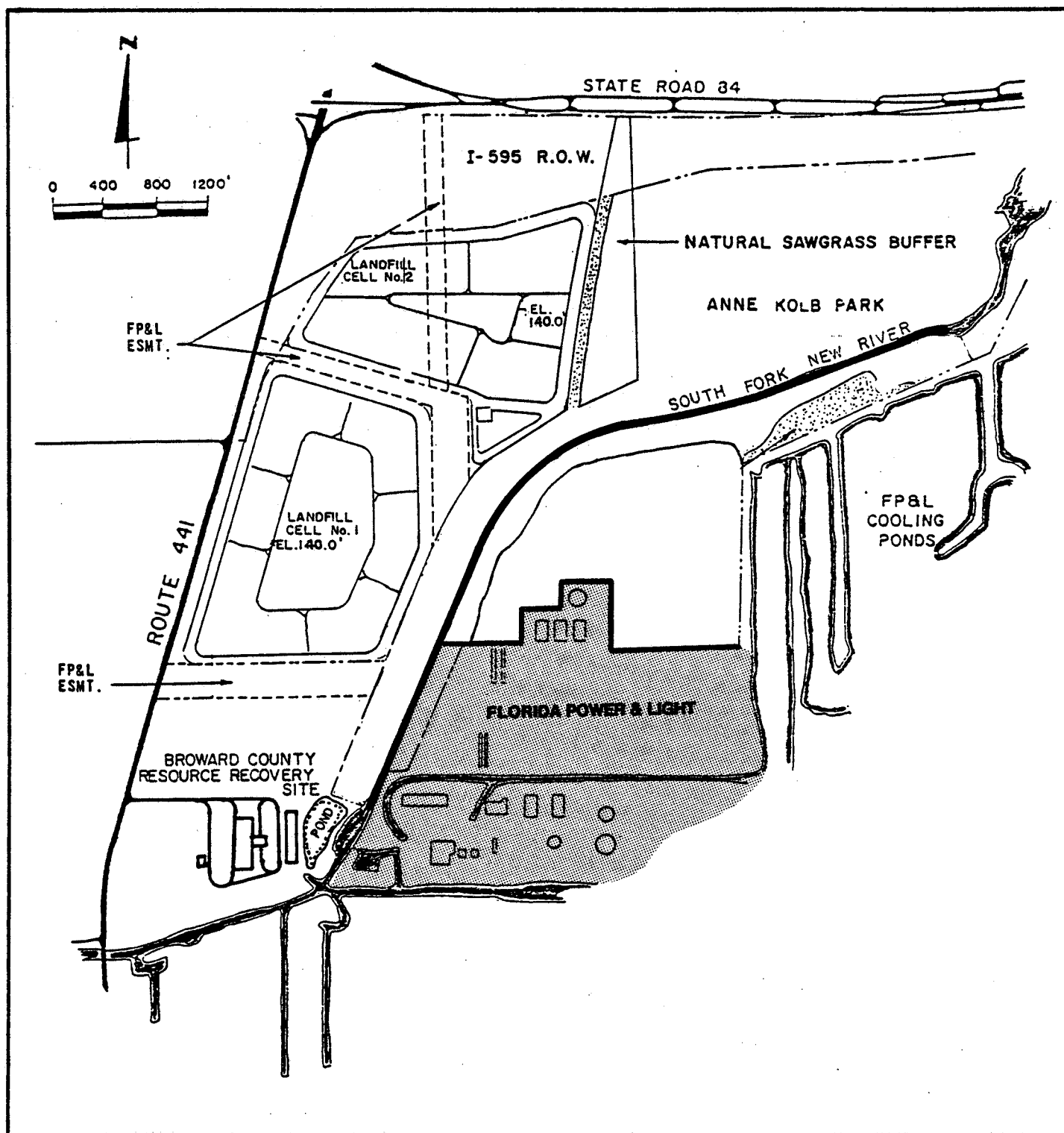
Figure 6.1.1 illustrates the general location of the electrical utility (FP&L) with respect to the site. Access to these transmission lines from the facility to FP&L will be readily available.

Since the transmission lines will not be located outside of the project site area, information pertaining to transmission lines and other linear facility impacts are consistent with the information pertaining to the site. The information requested in the permit application guidelines and identified as Sections 6.1.1 through 6.1.10, as well as 6.2 has been provided in Section 2 through Section 5.

6.1 Electrical Power

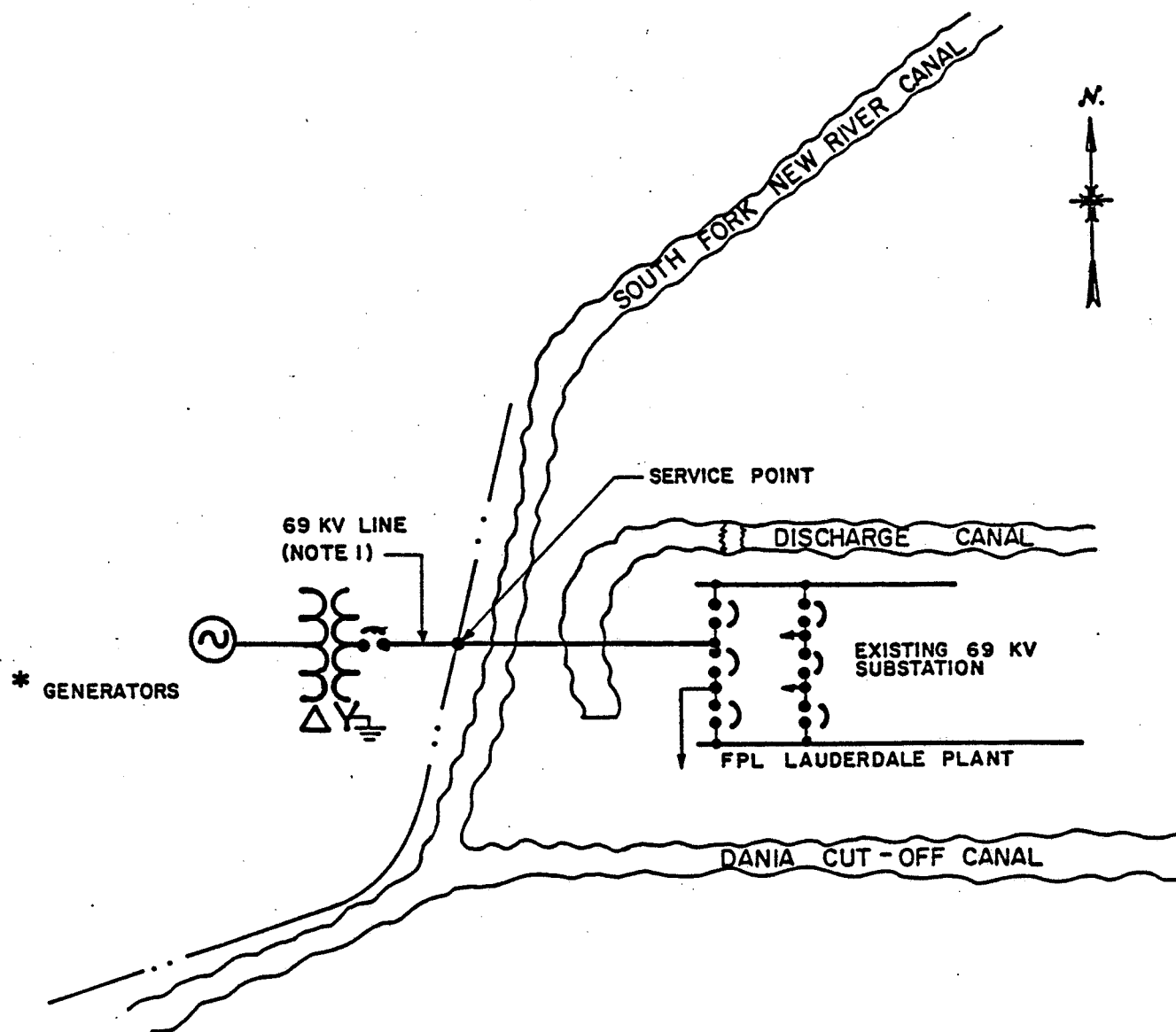
Florida Power & Light will bring transmission power to the facility substation. The electrical interconnections proposed by FP&L are shown in Figure 6.1.2. FP&L indicates that a 69 KV transmission line will be extended westward

FIGURE 6.1.1



**BROWARD COUNTY
RESOURCE RECOVERY
SITE AND UTILITY LOCATIONS**

FIGURE 6.1.2



* GROSS OUTPUT MAY BE SUPPLIED BY TWO GENERATORS

NOTE 1

PROVIDE FOR FUTURE CONVERSION FROM 69 TO 138 KV

BROWARD COUNTY
 RESOURCE RECOVERY
 ELECTRICAL INTERCONNECTION SCHEMATIC
 ROUTE 441 SITE

across the South Fork New River Canal from FP&L's Fort Lauderdale Power Plant Substation to the facility substation. The routing of this line will require coordination in the development of the resource recovery plant. The facilities at the site will be designed to accommodate future conversion of the 69 KV service voltage to 138 KV.

The design and installation of all electrical interconnections, meters, plant distribution systems and protection equipment will be in accordance with the requirements and standards imposed by FP&L. FP&L will tie-in to the electrical substation to be located within the facility site.

The mode of electrical energy distribution shall include the following:

- o The turbo-generator and associated power generation equipment will have its own bus which will be at the same voltage level as the generator. Synchronizing and protective relays will be provided on each generator breaker.
- o Interconnect transformers will each be sized for the full output of the plant.
- o Complete indoor relay and control switchboards will be provided for each facility's electric systems.

The distribution systems will have 4.16 KV and 400 volt systems with switchgear and related accessories housed in the processing section of the facilities.

The electrical output of the turbine-generator set will operate within the interconnection system established by FP&L. The turbine-generator set will be capable of operating in the full condensing mode, at maximum steam flow, even on the hottest day of the year, and still provide an efficient and adequate quantity of electrical energy.

6.2 Projected Interconnection Costs

Florida Power and Light has developed an interconnection cost estimate, including modifications to offsite substations

and transmission lines, for the site. This estimate is \$300,000 which does not include the cost of the transformer, circuit breaker or protective equipment installed at the site.

In addition, payment to FP&L will be required for interconnection and protection costs associated with the facility electrical interconnections, and for the following additional costs:

- o Monthly telephone company charge for FP&L dispatcher communication channel, which has been estimated by FP&L at \$175 per month.
- o Maintenance and operation fee to FP&L for interconnections facilities.
- o Metering costs.
- o Suitable arrangements for termination of FP&L lines. The service points may be adjusted if desirable to provide suitable line terminations.
- o Costs of all fees and permits, if applicable, will also be paid.

The above costs, in current dollars, should be regarded as a budget estimate. Since the Project will pay on the basis of actual cost including appropriate overheads, rather than estimated cost, the estimates may change when specific designs become available.

ECONOMIC AND SOCIAL EFFECTS OF PLANT CONSTRUCTION AND OPERATION

SECTION 7

ECONOMIC AND SOCIAL EFFECTS OF PLANT CONSTRUCTION AND OPERATION

The majority of benefits resulting from the construction and operation of the resource recovery facility are more qualitative than quantitative. Comparison with measurable costs is difficult to assess. This section, however, illustrates that the measurable costs associated with the proposed facility development should have a minimal impact on the facility users, and the associated benefits far outweigh any additional costs.

For many areas, such as Broward County, an environmentally sound waste-to-energy facility can provide the best long-term solution to a solid waste disposal problem. A properly sited resource recovery facility using proven technology becomes a valuable asset to the community.

The resource recovery project will:

- o Provide an environmentally sound and economically viable means for the disposal of solid waste over the long-term (20 or more years),
- o Decrease the potential threat to groundwater and land use as the need for disposal of raw garbage in landfills is eliminated,
- o Recover energy for sale thereby establishing a revenue stream that will offset the cost of disposal,
- o Reduce the need to consume natural energy sources such as gas, oil and coal, and
- o Stabilize or reduce future disposal cost escalation.

The following discussion addresses the socio-economic benefits and the costs associated with the proposed project.

7.1 Socio-Economic Benefits

7.1.1 State and Local Government Tax Revenues

The Broward County Office of Budget and Management Policy has estimated that between \$1.85 and \$2.17 million in local tax revenues will be generated by the South Broward County Resource Recovery Project, Inc. based on Fiscal Year 1985 millage rates from the 1984 tax roll. Taxing authorities benefitting from this Project include Broward County, the Unincorporated Municipal Service District, Broward County School Board, South Florida Water Management District, South Broward Hospital District, South Broward Park District and Fire Assessment.

State sales tax will be paid on equipment and materials not associated with pollution control for the Project.

7.1.2 Creation of Temporary and Permanent New Jobs

In addition to providing the County with an economical and environmentally responsive long-term solid waste disposal system which removes the major technical, operating, and business risks from the County at the lowest net cost, the County's local economy and labor market will also benefit from the project. Proposals submitted by potential vendors include provisions for hiring local construction labor and businesses including use of minority subcontractors in accordance with the County's Disadvantaged Business Enterprise Affirmative Action Program.

It is anticipated that local construction and equipment suppliers will realize both direct and indirect benefits from the construction and operation of the resource recovery facility. More than 500 construction workers will be employed on the facility at the peak of activity.

The facility itself, once operational, will become an integral part of the local economy and community as a whole. An operational work force in excess of 125 people will be

required to run the facility. It is estimated that a payroll of over \$4 million will offer the County economic stimulus. About 25 percent of available income (\$1 million) will boost retail sales. An estimated additional \$1.5 million in personal income will be realized by local residents and over 100 non-manufacturing jobs will be a direct result from project implementation. On the aggregate a total of \$5 million in estimated annual economic benefits to the economy of Broward County will be realized as a direct result of this facility.

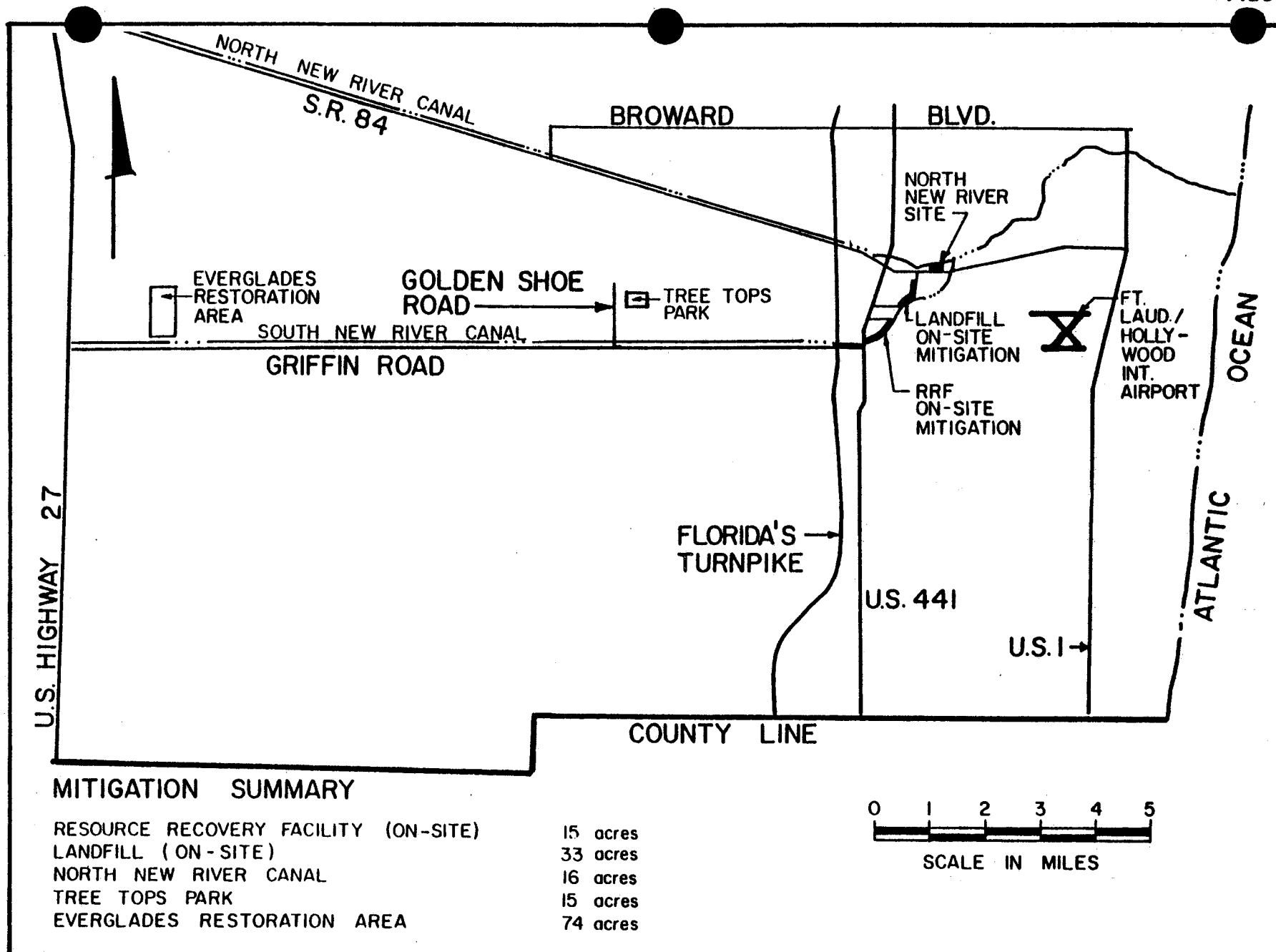
7.1.3 Recreation and Wetland Habitat Enhancement Benefits

Development of the South Broward County Resource Recovery Project site will require that approximately 148 acres of wetland area be removed and filled. To compensate for the wetland losses, a mitigation plan involving 153 acres has been developed by the County as an integral part of the development (Appendix 10.1.4). The plan has been approved by biologists from the U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, Florida Game and Freshwater Fish Commission, Florida Department of Environmental Regulation, South Florida Water Management District and the Broward County Office of Planning.

Mitigation for the project (Figure 7.1.3.1) comprises the following parcels:

- o 15 acres on site at the Resource Recovery Facility
- o 33 acres on site at the Residue/Unprocessable Waste Landfill
- o 16 acres adjacent to North Fork New River
- o 15 acres at Tree Tops Park and
- o 74 acres in the Everglades Restoration Area

Land acquisition costs for mitigation are summarized as follows:



**MITIGATION AREA
VICINITY MAP**

LAND COSTS FOR PROJECT MITIGATION

<u>Area</u>	<u>Acres</u>	<u>Costs/Acre</u>
On Site	48	\$ 100,000+
North New River	16	75,000
Tree Tops Park	15	None-Already in County Ownership
Everglades Restoration Area	74	<u>12,000</u>
Approximate Land Acquisition Cost		\$6,888,000+

Land acquired for mitigation will be preserved in perpetuity for the citizens of Broward County through covenants and deed restrictions on the land which will bind the County, its successors and assigns and require that the land be maintained according to the requirements imposed by the regulatory agencies (See Appendix 10.1.4).

Mitigation work on the project site would be completed prior to the commencement of any landfill operation on the property or prior to the issuance of the Certificate of Occupancy for the resource recovery facility, whichever shall occur first.

The benefits realized as a result of the improved mitigation plan include the following:

- o One-to-one replacement of wetlands lost;
- o Wetlands of greater overall value per unit area than those lost to development;
- o Compliance with regulatory agency requirements;
- o Consistency with the County's Parks and Recreation Division Master Plan; and
- o Provides beneficial environmental, social and recreational values to the people, wildlife and water resources of Broward County.

A more detailed discussion of the South Broward County Resource Recovery Project Mitigation Plan has been provided in Section 3 and Appendix 10.7.

7.1.4 Local Road Improvements

Construction of the South Broward County Resource Recovery Facility will occur at approximately the same time construction is undertaken for Interstate 595 (I-595). The County has been coordinating land acquisition and road improvement activities with the Florida Department of Transportation (FDOT). For example, the County will be dedicating 50 feet of right-of-way along the east side of U.S. Route 441 to FDOT as a part of I-595 related construction. In exchange, FDOT will provide the County with a southbound left turn lane, a median opening and north bound acceleration and deceleration lane on U.S. Route 441 at the entrance to the resource recovery facility. These improvements are subject to approval by Broward County Traffic Engineering and Engineering Divisions.

7.1.5 Environmental Benefits

The primary benefit associated with the development of a resource recovery facility in Broward County is the efficiency and effectiveness of the process itself, and its ability to provide an environmentally secure method of solid waste disposal.

The facility proposed for southern Broward County will have an initial maximum installed nameplate capacity to process approximately 860,000 tons per year of solid waste. However, it is estimated that approximately 730,000 tons per year of solid waste will actually be processed in efficient, proven waterwall boilers. The facility is designed so that increases in waste generation can be accommodated by facility expansion up to a projected ultimate capacity of 1,200,000 tons per year.

Although the majority of solid waste delivered will be processed at the facility, some unprocessable (by-pass) waste will still need to be landfilled. In addition, the combustion process will produce an ash residue that will require land-

filling. The ash residue will represent approximately 10 percent of the processable waste's original volume and represents an environmentally secure waste product for disposal. The proposed resource recovery facility for Broward County will include an ash residue/unprocessable waste landfill adjacent to the waste-to-energy facility.

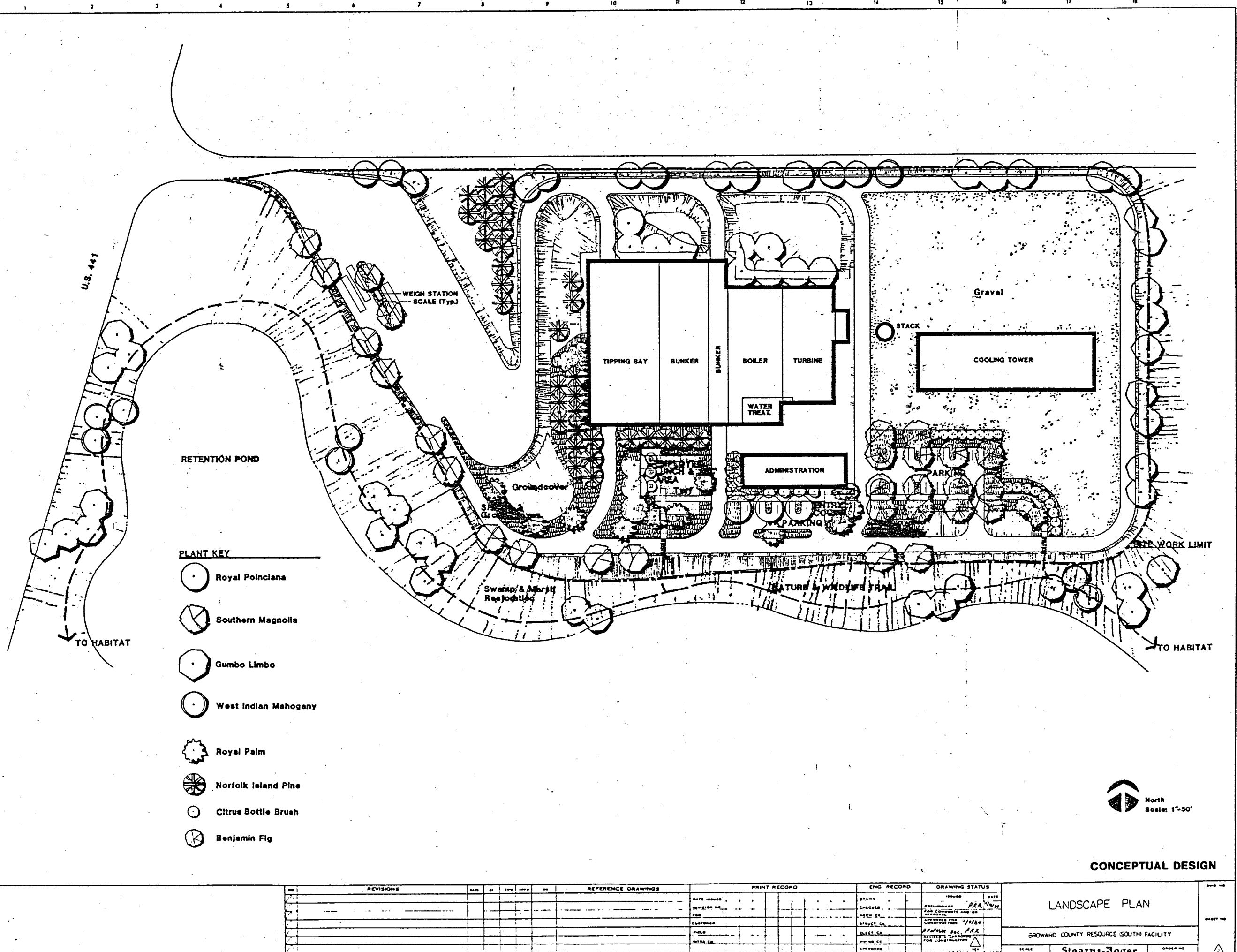
Through a public awareness program, many County residents have already come to realize the pressing environmental problems of solid waste disposal in the County. Information pertaining to all facets of the completion of this project will be invaluable to other municipalities considering resource recovery.

The facility structure itself will be aesthetically pleasing to the surrounding environment utilizing landscaping to enhance land use. Figure 7.1.5 presents the proposed landscape plan for the site. Ingress and egress roads will be sculptured to provide a panoramic view of the facility and accompanying structures.

Project Environmental Information and Impact Assessment Reports

Information on the environment and ecology at the South Broward County Resource Recovery Project site is contained in several reports.

Section 5 - 182 (i) of the Broward County Land Development Code (Ordinance 81-16) requires the Broward County Office of Planning to prepare an environmental impact report on environmentally sensitive lands. Since the Project partially encompasses land designated by the County as a Local Area of Particular Concern and, a proposed urban wilderness area an environmental impact report was prepared for the Project in January 1984 as a part of the rezoning process.



- PLANT KEY**
- Royal Poinciana
 - Southern Magnolia
 - Gumbo Limbo
 - West Indian Mahogany
 - Royal Palm
 - Norfolk Island Pine
 - Citrus Bottle Brush
 - Benjamin Fig

North
Scale: 1"=50'

CONCEPTUAL DESIGN

REVISIONS					REFERENCE DRAWINGS					PRINT RECORD					ENG RECORD					DRAWING STATUS				
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To assist the Office of Planning in evaluating the impact of the Project on the site two other reports were prepared:

- o Land Use and Environmental Overview of the Route 441 Site - Broward County Resource Recovery, February, 1983, Data and Information for the Route 441 Site -- Broward County Resource Recovery -- Summary Report and Appendices A and B, July 1983.

Groundwater and Surface Water Protection

Another benefit resulting from the construction and operation of the resource recovery facility will be the reduced potential for damage to both groundwater and surface water. Unprocessed solid waste that is disposed of at a landfill has the potential to contaminate water resources through the leaching of metals and organic compounds. Solid waste processed in a mass-burn resource recovery facility, as mentioned, produces an ash residue that is basically inert. This residue is required by specifications to consist of less than 4.0 percent combustible material and 0.3 percent putrescible material. Appendix 10.12, "Summary Update of Research Projects with Incinerator Bottom Ash Residue" illustrates the environmental acceptability of typical ash residue from mass-burn facilities.

Hydrogeological Field Investigation Program

A hydrogeological field investigation program has been prepared and approved for the Project in accordance with the Florida Department of Environmental Regulation (FDER) Chapter 17-7 -- Resource Recovery and Management; Part I requirements (See Appendix 10.8). This program provides subsurface information at this site. The principal elements of the field investigation are:

- o Installation of soil borings to assess shallow subsurface geologic and hydrogeologic conditions and depths to ground water.
- o Installation of monitoring well clusters to provide permanent ground water quality sampling points.

- o Inventory of active wells within one mile of the sites.
- o Water level measurements to assess ground water flow conditions.
- o Sampling of monitoring wells to determine water quality conditions prior to landfilling.

The principal study outputs are as follows:

- o Definition of shallow subsurface geologic conditions.
- o Definition of depth to ground water, seasonal fluctuations, and thickness of unsaturated zone.
- o Assessment of horizontal and vertical ground water flow conditions.
- o Definition of pre-landfilling water quality conditions.
- o Assessment (from existing reports) of regional ground water flow and quality conditions.

(For a more detailed discussion of this program, see Section 2.3).

Management Plan for Ann Kolb Park

Prior to landfill development, an impact assessment must be prepared by the Broward County Resource Recovery Office to address the potential hydrological impacts of the development of the landfill in Ann Kolb Park in accordance with Broward County Ordinance Nos. 84-6 and 84-7. Data and information utilized in this application will be used to conduct this assessment. In the event potentially significant impacts are identified, a management plan must be developed to offer recommendations and mitigative actions to insure the integrity of the Park.

Plant Species Survey

As a part of the development of the Mitigation Plan, a special plant species survey of the project site was conducted (see Appendix 10.1.4). The survey enabled a plan to be developed which would minimize the impact of the project to the more significant vegetation in the mitigation area. Landscaping will be done around existing. Large clumps of native trees such as those found the northeastern and southwestern end of the mitigation area will be preserved. As appropriate, these areas will be enhanced by removal of discarded construction materials, selective removal of exotic species (per Broward County Ordinance 33 $\frac{1}{2}$), and planting of native species (See Appendix 10.7). A monitoring report must be submitted to semi-annually to the Office of Planning for a period of three years after planting, indicating the survival rates of the planted material.

7.1.6 Creation of a Source of Heated Discharge

The Project will not create a source of heated discharge.

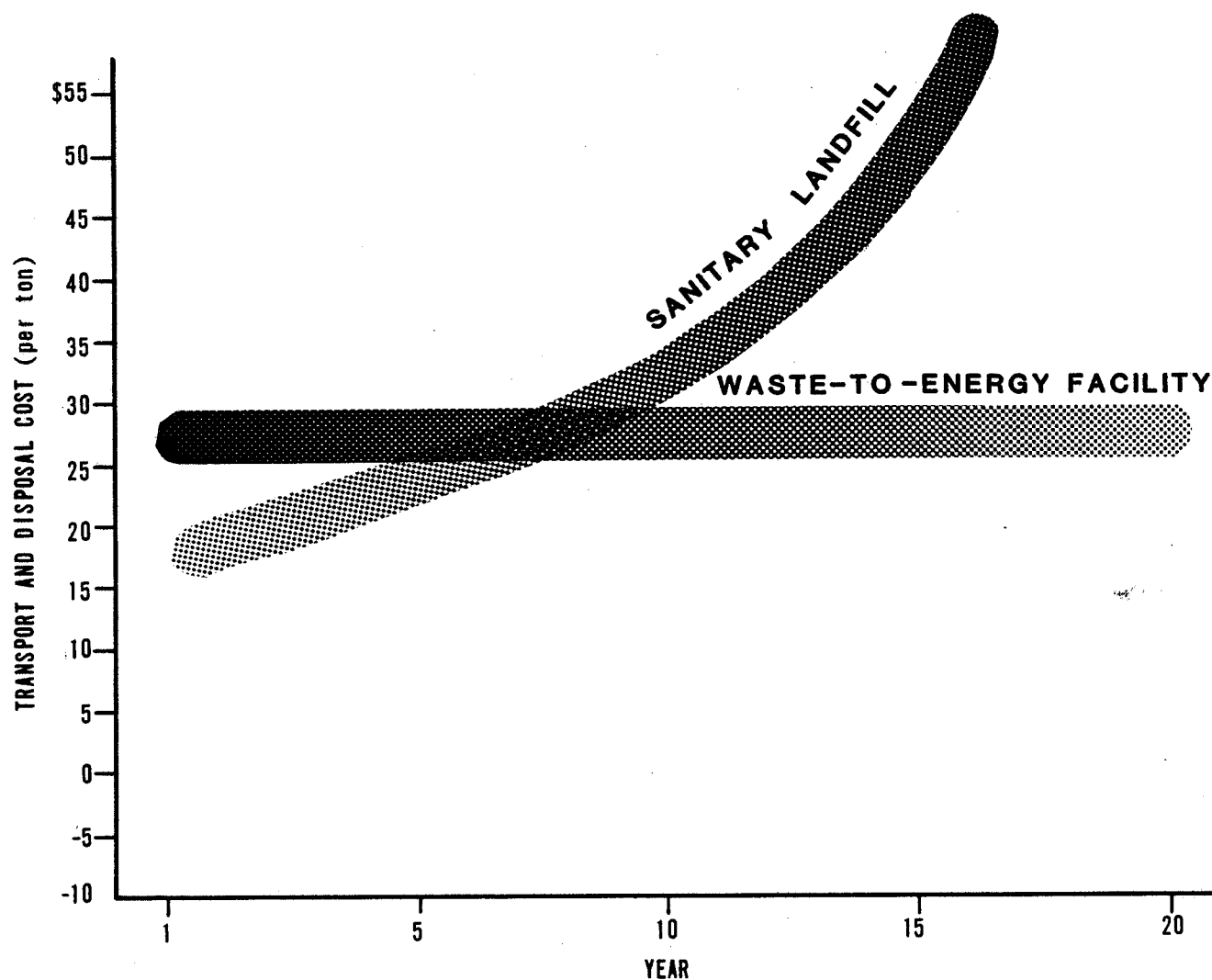
7.1.7 Visitor Accommodations

The Vendor for the South Broward County Resource Recovery Facility will provide for on-site public education programs for individuals and groups visiting the facility.

In addition, controlled visitor viewing locations, in various process areas of the facility, will be provided. These viewing spaces will not be directly exposed to operating equipment to assure the safety of the public. Elevators will be provided to facilitate visitor access and movement to all levels of the facility.

7.1.8 Economic Benefits

Figure 7.1.8.1 illustrates typical costs of solid waste disposal for both a sanitary landfill and waste-to-energy



* The curves shown on this figure represent current waste disposal cost trends. They may vary by community depending on current landfill life and disposal costs, waste-to-energy facility cost and energy rates.

**BROWARD COUNTY, FLORIDA
RESOURCE RECOVERY PROJECT
ESTIMATED SOLID
WASTE DISPOSAL COST**

facility over a twenty year period. As shown, landfill costs generally increase at a faster rate and eventually surpass the costs associated with resource recovery development. There are a myriad of reasons for the continuous increase in land disposal costs:

- o Higher land and real estate escalation costs.
- o Higher transportation costs to and from landfills located further and further away from urban centers.
- o Higher permitting and operating costs, including daily cover, landfill liners, leachate and methane collection systems, and the need for a sinking fund accrual account for post-closure maintenance and monitoring.

Alternatively, a waste-to-energy project can result in a stabilized or decreased net cost for waste disposal over the life of the project. The reasons for this are:

- o Capital costs are fixed for the facility's life.
- o Only operating and maintenance expenses are subject to inflation.
- o Expected rising energy rates will offset increasing operating and maintenance costs.

Resource recovery (waste-to-energy), although often more expensive than landfilling, usually becomes less expensive over the life of the project.

7.1.9 Energy Benefits

A significant benefit that will be realized once the facility becomes operational, is the generation of electric power. Approximately 328 million kilowatt hours (kwh) of electricity will be generated initially per year. It is likely that the electrical output will be significantly higher since the 328 million kwh estimate is based on a minimum guaranteed tonnage of 730,000 tons per year and a conservative electrical generation rate of 450 kwh per ton.

MALCOLM
PIRNIE

27,333 kwh

There is approximately a one-to-one fuel value relationship between garbage and crude oil (i.e., one ton of garbage equals approximately one barrel of crude oil). Thus, at a minimum, 730,000 barrels of crude oil per year or 14.6 million barrels of crude oil over the life of the project will be conserved. Assuming a conservative inflation rate (4 percent over the life of the project) the net present worth of the annuity relative to the conservation of 14.6 million barrels of imported crude oil is approximately \$287 million.

Although revenue generated from the sale of electricity will be the property of the vendor (owner and operator of the facility), users of the facility will share the revenue benefits in the following manner:

- o Projected revenues will be included in the vendor's tip fee calculation thereby establishing a disposal cost that is consistent with long-term County projections.
- o The users will benefit from power sharing if rates for purchase of electricity escalate at a more rapid rate than inflation, thereby further reducing disposal costs.

7.2 Socio-Economic Costs

There will be both direct and indirect costs associated with the construction of the resource recovery facility. The costs will be borne by the users of the facility over the twenty year life of the project. This section discusses both the direct and indirect cost streams resulting from the construction and operation of the proposed facility.

The County is presently in the process of selecting a full-service vendor for the construction and 20 year operation (plus addition of 5 year County and 10 year contractor option periods) of the resource recovery facility and associated residue/unprocessable waste landfill. The full-service vendor will be the owner operator of the facility. The County will be prime customer or "anchor tenant" of the Project. Under

this approach, the County expects the vendor to take on the substantial risks of construction, operation and marketing of solid waste disposal and energy output of the facilities as well as residue/unprocessable waste landfilling responsibilities. Ownership of the Project for federal income tax benefits will reside with the vendor. The County also expects the vendor to pass through a substantial portion of the federal tax benefits available to the vendor, in the form of an up-front equity contribution during the construction period, which will serve to reduce the amount of bonds required to be issued and lower the net tipping fee. In turn, the County will: (i) guarantee on a put-or-pay basis specified quantities of processable waste; (ii) provide sites for the two resource recovery facilities and associated residue/unprocessable waste landfills; and (iii) give the vendor latitude in profitably operating the Project.

Based on proposals submitted by the two vendors competing to construct, own and operate the South Broward County Resource Recovery Project, the following presents a synopsis of the total estimated costs required for development of the project.

Cost

The major cost components associated with the Project include: resource recovery facility construction, landfill construction, other related development costs, and site acquisition costs. The total costs are reduced by a factor equaling the vendor's contribution (equity) to the project. Competing vendors will be required to take a minimum 20 percent equity position on the total construction costs for the resource recovery facility and adjacent landfill. The County estimates that the total cost to purchase the site and make it available for resource recovery and landfill construction will be approximately \$32,810,000. Thus to purchase

and develop the site for construction the County will invest approximately \$132,000 per acre. The County zoning classification for this site is Planned Unit Development for Special Complexes which is compatible with the construction of the proposed resource recovery facility and landfill.

To service the debt over the twenty year life of the project, including the cost of annual principal and interest, capitalized interest and debt service reserve fund, an assumed debt service factor of .175 has been used by the vendors. Utilizing the preceding assumptions together with the cost proposals submitted by the potential vendors, a range of estimated capital costs were developed for the proposed Project and are presented in Table 7.2.1. These costs are subject to change during the final negotiation with the selected vendor, however, they represent the best available estimates at the present time:

TABLE 7.2.1

CAPITAL COST

<u>Cost Component</u>	<u>Range (\$ in million)</u>
Resource Recovery Facility Construction	175-220
Landfill Construction	12-15
Contractor's Contribution	(45)-(60)
Total Construction	142-175
Other Development (fixed)	4
Site Acquisition (fixed)	\$32.8
Contingency Fund	7-9
Total Project	187-220
Annual Debt Service	35-40

In addition to the preceding capital costs, estimates have been made for the operations and maintenance costs of both the resource recovery facility and attendant unprocessable ash residue landfill and for the annual revenues anticipated from the facility. The following Table 7.2.2 presents projected annual operating costs and revenues (including interest income) for the proposed resource recovery facility and establishes a range for the net tipping fee.

The total capital and annual operating costs for the project are provided in order that a comparison can be made between present and future landfilling costs and the proposed resource recovery project.

At the present time, the cost to dispose of a ton of garbage is \$22. The upper estimate of the tip fee for disposing of a ton of garbage at the resource recovery facility in 1985 dollars is projected to be approximately \$29. Therefore, the cost differential between the resource recovery

TABLE 7.2.2

ANNUAL OPERATING COSTS AND REVENUES
(including interest income)

<u>Cost Component</u>	<u>Range (\$ in million)</u>
Annual Debt Service	30-40
Operations and Maintenance of Resource Recovery Facility and Landfill	8-10
Total Annual Cost	40-50
<u>Revenues</u>	
Electrical Power Sales	14-18
Interest Income	3-5
Non-County Tipping Fee	1-2
Proposers Adjustment	1-5
<u>Net Tipping Fee</u>	25-35

facility compared to existing landfilling is approximately \$7 per ton. As previously discussed this cost differential is expected to decrease as landfill costs increase. No additional cost to dispose of garbage in the initial year of resource recovery operation is therefore, expected.

Given the expectation of no additional cost or marginal increase in cost per household to support this project which will provide an environmentally secure alternative to the landfilling of processable solid waste, the applicant believes the benefits described in the preceding subsections clearly outweigh the costs associated with the resource recovery facility.

To acquire and develop a new landfill site, which would be required if the County does not go ahead with this project, would cost more than \$7 per ton over its available life. Therefore, in real dollars, no additional cost to dispose of garbage in the initial year of resource recovery operation is expected.

7.2.1 Temporary External Costs

Temporary external costs and benefits have been previously discussed in this section. The following potential temporary costs and impacts have been considered through the course of the project.

Shortages of housing	None
Inflationary rentals or prices	None
Congestion of local streets and highways	Minor
Noise	Construction
Temporary aesthetic disturbance	Minor
Overloading of water supply and sewage treatment facilities	None
Crowding of local schools	None

Crowding of hospitals	None
Crowding of other public facilities	None
Overtaxing of community service	None
Disruption of lives or local community caused by acquisition	relocation of businesses only; no residential relocation involved; businesses (2) re- ceiving compensation and relocation assistance

7.2.2 Long-Term External Costs

Long-term external costs and benefits have been previously discussed throughout this report. Specifically, the extensive mitigation plan (Appendix 10.7) was developed to offset any projected long-term external costs.

SITE AND DESIGN ALTERNATIVES

SECTION 8

SECTION 8
SITE AND DESIGN ALTERNATIVES

8.1 Alternative Sites

To identify the most appropriate site for development of the South Broward County Resource Recovery Project and associated Ash Residue/ Unprocessable Landfill, Broward County has undertaken a comprehensive site selection process which was initiated in 1981 and completed in 1983.

Initially, the site evaluation process for the Broward County resource recovery program involved the identification of one site for the construction of a resource recovery facility and a second site for the development of a new sanitary landfill.

In 1981, the former Broward County Solid Waste Division identified five prospective landfill sites and three prospective resource recovery facility sites for detailed evaluation. The criteria used to select these sites included:

- o general location
- o jurisdiction (unincorporated vs. incorporated areas)
- o size
- o existing zoning
- o land use plan designation
- o existing land use

The potential sites that were identified were:

LANDFILL

- Broward Correctional Institute (BCI) - This site represents between 480 and 710 acres surrounding the State of Florida Women's Correctional Institute located between Stirling Road and Sheriden Street near U.S. 27 in West Broward.
- Chapel Trail - This site consists of approximately 1830 acres located northeast of the intersection of Hollywood Boulevard and U.S. Route 27.

- Sportatorium - This site consists of approximately 440 acres located north of Hollywood Boulevard. The Sportatorium and the Miami/Hollywood Speedway are located on this site.
- Davie - This site is comprised of approximately 420 acres located adjacent to the existing Broward County Sanitary Landfill at the northwest intersection of Orange Drive and Shotgun Road.
- Markham Park - This 150 acre site is located in the eastern portion of the park, north of State Route 84 and west of Southwest 148th Avenue.

RESOURCE RECOVERY

- Fort Lauderdale Incinerator - This site is located on N.W. 31st Ave. in the City of Fort Lauderdale. It contains a City incinerator that is no longer in operation, and is currently used to park Department of Public Works sanitation vehicles.
- Route 441 - This site is located at the southeast intersection of U.S. Route 441 and State Route 84.
- Port Everglades - While a specific site had not been identified by the County, a tract bounded on the east by the Intracoastal Waterway and along the west and south by a discharge basin was reviewed.

An investigation of available information and on-site inspections was performed by Malcolm Pirnie, Inc. for each of the identified sites to assess:

- o Adequacy of site to contain the project
- o Proximity of site location to energy market(s)
- o Existing solid waste collection and transportation practices
- o Ability of the immediately adjacent transportation network to accommodate added collection vehicular traffic and associated loading
- o Conditions of existing roads to withstand vehicular loads
- o Identification of environmental and social constraints and existing land-use ordinances

- o Number of permits/approvals required for project development and the probability of obtaining the required approvals

The results of this evaluation were presented in a Malcolm Pirnie Site Evaluation report dated February 1982. These results indicated that the Route 441 site was the most promising of the potential resource recovery sites identified by the County. This was based upon the proximity of this site to the solid waste centroids, the adequacy of the access roadway system, the amount of acreage available for site development and the relative probability of receiving the required regulatory permits.

This recommendation was also based upon a consideration of potential environmental impacts. With the proposed mitigation, use of the Route 441 site for resource recovery facility development was found to be compatible with existing and proposed development in this area. The other sites under consideration involved more significant impacts on adjacent residential areas or sensitive habitats. In addition, considerations of ambient air and water quality indicated that use of the Route 441 site for a resource recovery facility would be acceptable based upon the contemplated facility design criteria.

In early 1982, more detailed investigations were performed on the Route 441 site. These investigations were summarized in a Malcolm Pirnie letter report dated April 22, 1982. The results indicated that the proposed designation of environmentally sensitive urban wilderness areas in the vicinity of the Route 441 site would not be encroached upon by the proposed resource recovery facility development, and that the site was not within the corporate limits of Hacienda Village, a formerly neighboring municipality.

To verify the results of these initial studies, supplemental investigations were undertaken by the Broward County

Office of Planning, which involved the identification of major undeveloped areas in the County through a review of current aerial photographs. This resulted in the identification of 97 locations. These sites were then evaluated based upon the following criteria:

- o Developed Area: Parcels that were clearly developed or being developed, based on evidence from observation, street maps and aerial photographs, were eliminated because it was assumed the cost of purchasing such areas would be prohibitive and would be strongly opposed by landowners and residents.
- o Location: Parcels within the unincorporated area of the County were considered because it was assumed that the necessary land use plan amendments and zone changes could not be obtained in a municipality.
- o Size: Parcels of approximately 300 acres within a section were the minimum considered. Smaller parcels were considered if their combination with parcels in adjacent sections would achieve the 300 acre threshold. The 300 acre minimum was used because it was assumed that smaller parcels would reduce the effective lifespan of a landfill operation.
- o Development of Regional Impact: Active and approved D.R.I.s were excluded from consideration because it was assumed that acquisition costs would be prohibitive.
- o Waterbodies: Parcels that included large waterbodies, such as abandoned rock pits, were eliminated, based on the assumption that filling the waterbodies would be impractical.

Sixteen possible sites (see Figure 3.1.2.1., Section 3.1.2, Site Selection) met the above criteria and were subjected to further evaluation by the Broward County Office of Planning, using the following criteria:

- o Surrounding Existing Land Use: The type of land use and its density were considered for compatibility and possible neighborhood opposition.
- o Surrounding Proposed Land Use: The land use type and density of any proposed projects or plats in progress were identified for compatibility.

- o Existing Land Use on Site: The site land use type was examined for compatibility with and adaptability to a possible operation.
- o Proposed Land Use on Site: Proposed uses were examined for compatibility and for present commitment.
- o Access: Roads adjacent to, leading to, or cutting through the site, as well as proposed roadway corridors, were examined for compatibility, adequacy and possible neighborhood opposition.
- o Environmental Sensitivity: Local Areas of Particular Concern (LAPC) and proposed Urban Wilderness Areas, both on and adjacent to the site, were identified to determine environmental compatibility.
- o Ownership Pattern: The number of landowners, and the size of their parcels on the site were examined to find sites with approximately three owners or less.
- o Jurisdiction by Other Agencies: Where it was known that agencies outside Broward County would have additional review or permitting powers (e.g., the FAA or the Army Corps of Engineers), they were noted.

Of the sixteen sites considered 9 were eliminated for reasons including LAPC status, size, parkland status and presence of development on-site. The 7 remaining sites were then further evaluated on the same level of detail as the sites previously investigated by Malcolm Pirnie, Inc.

Malcolm Pirnie supplemented the County evaluation of these seven sites by investigating several specific aspects of each site in addition to those evaluated by County staff.

Based upon the results of this study, it was concluded that only the Copans Road site should be considered for further evaluation along with the Route 441 site. This site was eventually selected for development of the North Broward County Resource Recovery Project.

The Broward County Commission on October 12, 1982, decided not to rely on landfill as a primary long-term disposal solution, but required a reevaluation of the following three top ranked southern sites:

Malcolm Pirnie evaluated the above sites in a report titled Site Evaluation Solid Waste Management Program, Southern Full Service Resource Recovery Facility on the basis of the following criteria:

- o Adequacy of the site to contain the southern resource recovery facility and an associated residue/unprocessable waste landfill for the duration of the 20 year planning period.
- o A comparative estimate of site acquisition costs and preparation costs required to develop the site to 100 year flood elevations.
- o The site's proximity to energy markets and the technical feasibility of electrical interconnection at each site.
- o A comparative estimate of waste transport costs to each of the sites.
- o The impact at each site of the additional truck traffic associated with the proposed development.
- o Compatibility with the existing land use on and adjacent to each site.
- o Potential air and water quality impacts of the proposed development at each site.
- o An assessment of the number of regulatory permits/approvals required at each site and the probability of obtaining such permits/approvals.

Table 8.1.1 summarizes the ranking of these sites. As illustrated, the Route 441 site was top ranked and recommended for development of the southern resource recovery facility and associated residue/unprocessable waste landfill. This recommendation was based upon the advantages inherent in its centralized location (potential waste transport savings of \$100

million), the industrial nature of the site and surrounding area the availability of electrical interconnection with the adjacent Florida Power and Light Company generating station, and the adequacy of the site access roads.

Subsequent developments concerning the second ranked Davie site indicated that as a result of legal complications, the site was unacceptable for development as a resource recovery facility. These legal complications involve the uncertainty of the jurisdictional location of the Davie site. The Town of Davie, in opposition to the potential siting of the resource recovery project, alleged that the site had been annexed within the Town of Davie boundaries. Development at this site would therefore require the rezoning approval of the Town of Davie. The County concluded that the time required to complete the legal process would delay the project beyond the exhaustion of the County's current waste disposal capabilities. A legal opinion provided by the County Office of General Counsel concerning this situation is attached as Appendix 10.2. The third site, Broward Correctional Institute site, has been selected as a contingency landfill site.

8.2 Proposed Site Design Alternatives

As a full service vendor has not been chosen for the proposed project, site design alternatives are dependent upon requirements presented in the Request for Proposals (RFP) and design alternatives presented in the vendor proposals. Two vendors, Signal RESCO and American Ref-Fuel, have submitted proposals for the southern site. Presented below is a description of how each vendor proposes to provide the following facility systems while conforming to the RFP.

8.2.1 Cooling System

The cooling method utilized at the facility will be air cooling (air cooled condenser).

TABLE 8.1.1

RANKING OF SOUTHERN SITES

	<u>Route 441</u>	<u>Davie</u>	<u>BCI</u>
Overall Ranking	1	2	3
Available Acreage	295	380	630
Site Adequacy	Adequate	More than Adequate	More than Adequate
Estimated Annual Site Acquisition and Preparation Costs (\$1000)	2,150	800	970
Annual Waste Transport Costs (\$1000)	2,340	4,590	6,310
Project Traffic Impact (\$1000)	60	30	30
Potential Environmental Impacts*			
Air Quality	1	1	1
Water and Soil Resources	1	1	3
Vegetation and Wildlife Habitat	1	1	1
Adjacent Land Use	2	2	2
Regulatory Permits			
Number Required	15	12	14
Approval Probability	Good	Poor	Moderate

*These ratings are based upon the assumption that the proposed mitigating measures for development of the southern resource recovery facility and residue/unprocessable waste landfill are implemented. Ratings range from 1 to 3, with 1 indicating the least and 3 indicating the most potential for negative impact.

Signal RESCO, in addition to providing an air cooled condenser to condense turbine exhaust steam, is also proposing to utilize a small package evaporative cooling tower to provide cooling for miscellaneous streams such as air compressors, sample coolers, etc. Additional water losses due to evaporation and blowdown will amount to approximately 25 gallons per minute.

8.2.2 Biological Fouling Control

If a small package evaporative cooling tower is used to supplement the air cooled condenser, then cooling tower biocides will have to be added at the cooling tower in the following appropriate quantities:

Inhibitor	2,600 lbs/year
Dispersant	1,300 lbs/year

8.2.3 Intake System

All intake water will be provided by County water supply; no other intake system is proposed.

8.2.4 Discharge System

All wastewater generated at the facility will be disposed of at the Hollywood Wastewater Treatment Plant. No other discharge system is proposed.

8.2.5 Chemical Waste Treatment

As described in Section 3.5, Plant Water Use, plant chemical waste treatment will be limited to pH neutralization of waste process water. The wastewater will be of acceptable quality to be disposed of at the Hollywood Wastewater Treatment Plant. As no other disposal method is proposed, other methods of chemical waste treatment have not been developed.

8.2.6 Sanitary Waste System

All sanitary wastewaters will be discharged to sanitary sewers for ultimate disposal at the Hollywood Wastewater Treatment Plant; no alternative disposal system is proposed.

8.2.7 Solid Waste Disposal System

8.2.7.1 Ash Wastes

The ash residue resulting from the incineration of solid waste has been used in parts of the United States and Europe as an aggregate for concrete, as well as a subbase material for roadway construction. This technology is still in the experimental stages. At present this type of application is not used in Florida. However, the possibility exists that after extensive study, the use of ash residue from incinerated solid waste as a construction material will prove to be environmentally benign. Ash residue used in this way would not only increase the life of the landfill associated with the resource recovery facility, but its sale would add revenue to the project.

8.2.7.2 Other Solid Wastes

The potential exists that unprocessables (i.e., white goods and construction debris) and recovered metals and glass can be recycled. However, this potential is dependent on a future market for such materials. At present, there are no plans for the recovering of these materials since the markets for their reuse are not sufficient to justify the additional costs associated with their recovery.

8.2.8 Multiple Uses

The facility as designed will process solid waste only. The technology utilized is specific to this application.

8.2.9 Other Systems

The facility has been designed to include state-of-the-art technology in order to provide maximum environmental protection.

COORDINATION

SECTION 9 COORDINATION

Implementation of the resource recovery project has required input from numerous federal, state, regional, county and local government agencies. Information concerning the project and its subelements has been obtained through correspondence, meetings and other forms of direct communication. Table 9.1 is a compilation of individuals, their respective association to the project, the date of contact, and the subject matter discussed. Table 9.2 is a list of additional individuals who have provided information throughout the development of this project.

TABLE 9.1

COORDINATION DURING LAND USE PLAN AMENDMENT
REZONING AND PREPARATION OF POWER PLANT SITE CERTIFICATION APPLICATION

<u>Federal</u>			
<u>Agency</u>	<u>Contact</u>	<u>Date</u>	<u>Subject</u>
Department of Army (Jacksonville District) Corps of Engineers Regulatory Division, Permits Branch	Raymond Vachon Deputy Commander	July 13, 1984	Letter: re Permit application 83B-3304 and 83B-3305
		July 19, 1984	Letter: re Permit applications 83B-3304 and 83B-3305
		July 11, 1984	Letter: re Modification request of Army permit 82R-1590
		August 4, 1983	Letter: re Application for activities in waters of the State of Florida Southern Broward Resource Recovery Facility
	Michael Slayton Chief, Regulatory Section	June 21, 1984	Letter: re Section 10 of of Rivers and Harbor's Act
	John Adams Chief, Regulatory Division	March 28, 1984	Letter: re Applications 83B-3304 and 83B-3305
		Nov. 9, 1983	Letter: re The Davie Site for potential location of Southern Broward Resource Recovery Facility
		Nov. 1, 1983	Letter: re Broward County Resource Recovery Project
		October 5, 1983	Letter: re Broward County Resource Recovery Facility
	Bertil Heimer Chief, Permits Branch	Feb. 16, 1984	Letter: re Placing fill in wetlands area

TABLE 9.1 (continued)

COORDINATION DURING LAND USE PLAN AMENDMENT
REZONING AND PREPARATION OF POWER PLANT SITE CERTIFICATION APPLICATION

Federal (continued)

<u>Agency</u>	<u>Contact</u>	<u>Date</u>	<u>Subject</u>
Corps of Engineers Regulatory Division, Permits Branch	Bertil Heimer (cont'd)	Nov. 8, 1983	Dredge and Fill Permit Application for Southern Broward
Environmental Protection Agency Region IV	Charles R. Jeter Regional Administrator	March 26, 1984	Letter: re: Broward County Southern Resource Recovery Landfill
Department of Interior			
Fish and Wildlife Service	Joseph Carroll, Jr. Field Supervisor	Nov. 23, 1984	Letter: re Manatee & Crocodile
	David Wesley Field Supervisor Endangered Species Field Station	Sept. 21, 1984	Letter: re Biological Assessment for Section 7 of the Endangered Species Act of 1973
House of Representatives	Daniel Mica Congressman	March 12, 1984	Letter: re Permit Application with EPA and Army Corp of Engineers
Department of Transportation			
Federal Aviation Administration	James Sheppard Manager	Feb. 6, 1984	Letter: re FAA Forms 7460-1 dated 12-5-83 Resource Recovery Projects
		December 8, 1983	Letter: re Notice of Proposed Construction
	Steve Nelson Airport Planning and Specialist	January 6, 1983	Letter: re Future site of resource recovery plant in Southern Broward
		April 5, 1983	Telephone Call: re FAA approval of Route 441 site

TABLE 9.1 (continued)

COORDINATION DURING LAND USE PLAN AMENDMENT
REZONING AND PREPARATION OF POWER PLANT SITE CERTIFICATION APPLICATION

<u>Agency</u>	<u>Contact</u>	<u>Date</u>	<u>Subject</u>
Federal Aviation Administration	Carl Stokoe Airspace Specialist	June 24, 1984	Letter: re Proposed resource recovery facility in Broward County
Florida Department of Environmental Regulation			
Solid Waste Permitting	John Guidry Supervisor Solid Waste Permitting, Chairman Technical Advisory Committee Injection Well Program	Jan. 24, 1985	Letter: re Application No. SC06-86059 and Application SC06-86060
		August 23, 1984	Memorandum: re TAC concept approval meeting to be scheduled in early Sept. 1984 on the two injection well projects associated with the Broward County Resource Recovery Program
		June 8, 1984	Letter: re William Grassi's Letter
		May 11, 1984	Letter: re Pre-application to construct a future Class 5 injection well system for the Southern Broward Resource Recovery Facility
		April 20, 1984	Letter of Transmittal: Application fees for following DER Solid Waste facility permits
		March 14, 1984	Letter: re Cell Number 14 Construction Permit Application, Broward County Sanitary Landfill

TABLE 9.1 (continued)

COORDINATION DURING LAND USE PLAN AMENDMENT
REZONING AND PREPARATION OF POWER PLANT SITE CERTIFICATION APPLICATION

State (continued)

<u>Agency</u>	<u>Contact</u>	<u>Date</u>	<u>Subject</u>
Solid Waste Permitting	John Guidry (cont'd)	Dec. 22, 1984	Letter: re Broward County Resource Recovery Project Solid Waste Management Facility Applications
		Nov. 16, 1983	Letter: re Draft copies of proposed construction
		Oct. 23, 1983	Resource Recovery Program for Broward County
Standard Permitting Section	Beverly Birkitt Environmental Supervisor	Sept. 24, 1984	Letter: re Broward County Resource Recovery Facility & Unprocessable waste landfills. File Nos. 060781739 & 060781749
		Sept. 14, 1984	Letter: re Notice of proposed Agency Action and Intent to issue
		Aug. 31, 1984	Letter: re Notice of final agency action
		July 19, 1984	Letter: re File Nos. 060781739 & 060781749
	Dan Garlick Environmental Specialist	July 9, 1984	Letter and Memorandum: re DER Dredge and Fill Permit for the Route 441 Site
		June 14, 1984	Letter: re Response to your completeness summary
		June 28, 1984	Letter: re Application File numbers 060781739, 060781749, and 060746599

TABLE 9.1 (continued)

COORDINATION DURING LAND USE PLAN AMENDMENT
REZONING AND PREPARATION OF POWER PLANT SITE CERTIFICATION APPLICATION

State (continued)

<u>Agency</u>	<u>Contact</u>	<u>Date</u>	<u>Subject</u>
Standard Permitting Section	Dan Garlick (cont'd)	April 23, 1984	Letter: re Amendment to be response to the completeness summary. File Nos. 060781749 & 060781739
		May 3, 1984	Letter: re Application File No. 060781739 Southern Resource Recovery Facility
		Dec. 15, 1983	Letter: re Southern Resource Recovery Facility next to the New River in Broward County
		Dec. 8, 1983	Letter: re Application File Number 06781749
		Oct. 7, 1983	Letter: re Preliminary Review - Drafts of Joint Applications for act- ivities in the waters of the State of Florida
	George Baragona	May 14, 1984	Letter: re Southern Broward Residue/Un- processable Waste Land- fill Permit Application File Number 06078749
	Jeremy Craft	Nov. 16, 1983	Letter: re Amendment to the Dredge and Fill Permit Application for Broward County
		Nov. 4, 1983	Letter: re Dredge and Fill Permit Application for Southern Broward Resource Recovery Facility

TABLE 9.1 (continued)

COORDINATION DURING LAND USE PLAN AMENDMENT
REZONING AND PREPARATION OF POWER PLANT SITE CERTIFICATION APPLICATION

State (continued)

<u>Agency</u>	<u>Contact</u>	<u>Date</u>	<u>Subject</u>
Standard Permitting Section	Jeremy Craft (cont'd)	November 1983	Letter: re Dredge and Fill Permit Application for Southern Broward Residue/Unprocessible Waste Landfill
Florida Department of Natural Resources	James MacFarland Director of Statelands	Jan. 16, 1984	Letter: re File Number 06-78173-9E Applicant: Broward County; also File Number 06-78174-9E Applicant: Southern Broward Residue/Unpro- cessable Waste Landfill
Florida Department of Land & Water Manage- ment	Paul Darst	May 19, 1983	Telephone Call: re The forwarding of FP&L 10 Year Site Plans
Florida Department of Veteran and Community Affairs			
Division of Local Resource Management, Bureau of Land and Water Management	Blaine Oliver Associate Planner	Nov. 10, 1983	Letter: re Blid- 1184-003 Broward County Resource Recovery Project
		Aug. 23, 1983	Letter: re Blid- 1184-003 Broward County Resource Recovery Project

TABLE 9.1 (continued)

COORDINATION DURING LAND USE PLAN AMENDMENT
REZONING AND PREPARATION OF POWER PLANT SITE CERTIFICATION APPLICATION

State (continued)

<u>Agency</u>	<u>Contact</u>	<u>Date</u>	<u>Subject</u>
Division of Local Resource Management, Bureau of Land and Water Management	Blaine Oliver (cont'd)	July 27, 1983	Letter: re Application for activities in waters of the State of Florida Southern Broward Resource Recovery Facility
Florida Public Service Commission	Joseph Cresse	July 21, 1983	Letter: re Broward County's proposed re- source recovery program
Intergovernmental Affairs	Eugene Suter Director	March 20, 1983	Memorandum: Proposed Legislation regarding Utility Funding for Resource Recovery Facilities

Regional

South Florida Water
Management District

Resource Control Department	William Helferich Water Management Engineer	Jan. 23, 1984	Letter: re Application 11293-D Broward County Southern Resource Recovery Facility
		Jan. 24, 1984	Letter: re Application No. 11153-A, Application No. 11293-B, and Appli- cation No. 11293-D
		June 19, 1984	Letter: re Application No. 11153-A, Application No. 11293-B, Application No. 11293-D asking for a 60 day extension
		April 13, 1984	Letter: re Application No. 11153-A, Application No. 11293-B, Application No. 11293-D withdraw for 30 days

TABLE 9.1 (continued)

COORDINATION DURING LAND USE PLAN AMENDMENT
REZONING AND PREPARATION OF POWER PLANT SITE CERTIFICATION APPLICATION

Regional (continued)

<u>Agency</u>	<u>Contact</u>	<u>Date</u>	<u>Subject</u>
Resource Control Department	William Helferich (cont;d)	June 13, 1984	Letter: re about Applications 11293-D and 12193-B are on hold
		Feb. 6, 1984	Memorandum: re Application 11293-D and 12193-B
		Dec. 28, 1983	Letter: re Application No. 11293-D Broward County Southern Resource Recovery Facility
	Charles Pemble Director Water Management Division	June 25, 1984	Letter: re File No. 060746599, Broward County File No. 060781739 File No. 060781749 Broward County
		Aug. 3, 1984	Letter: re File Nos. 060781739 & 060781749
	Leslie Wedderburn Deputy Director	Feb. 7, 1984	Letter: re Application No. 11293-D and Application No. 12193-B
	Richard Rogers Director	Dec. 15, 1983	Letter: re Surface Water Management Permit Application for Southern Broward
		Nov. 23, 1983	Letter: Containing surface water management permit application for southern Broward resource Recovery Facility
South Florida Water Management District	John Malloy	Feb. 22, 1983	Letter: re Broward County Solid Waste Facility Siting

TABLE 9.1 (continued)

COORDINATION DURING LAND USE PLAN AMENDMENT
REZONING AND PREPARATION OF POWER PLANT SITE CERTIFICATION APPLICATION

Regional (continued)

<u>Agency</u>	<u>Contact</u>	<u>Date</u>	<u>Subject</u>
South Florida Water Management District	Jeanne Hall	Feb. 8, 1983	Letter: re Broward County Resource Recovery Program
South Florida Planning Counsel	Rod Arroyo	Jan. 12, 1984	Letter: re Broward County Resource Recovery Project
<u>County</u>			
Economic Development Council	Steve Jernigan Executive Director	May 13, 1983	Telephone Call: re Presentation to his council
Public Works, Broward County	Dewey L. Bryant Director	May 11, 1983	Letter: re Discussion of Vendors
		April 18, 1983	Letter: re Reference Letter
Office of Planning	Diane Moore Environmental Coordinator	Nov. 16, 1983	Letter: re Request for additional information on the southern resource recovery landfill project (Route 441 Site)
		Nov. 17, 1983	Letter: re Request No. 2 for additional information on the Southern Resource Recovery Landfill Project at Route 441
		Dec. 15, 1983	Letter: re Water Management Work Permit
Water Management Division, Broward County	Roy Reynolds P.E.	Dec. 15, 1983	Letter: re Water Management Works Permit
Board of County Commissioners Pinellas County	W.W. Dasher Director, Public Works Operations	Oct. 20, 1983	Letter: re RCRA samples Pinellas County resource recovery facility

TABLE 9.1 (continued)

COORDINATION DURING LAND USE PLAN AMENDMENT
REZONING AND PREPARATION OF POWER PLANT SITE CERTIFICATION APPLICATION

County (continued)

<u>Agency</u>	<u>Contact</u>	<u>Date</u>	<u>Subject</u>
Board of County Commissioners Pinellas County	W.W. Dasher (cont'd)	Oct. 13, 1983	Letter: re Residue Ash Fill Leachate Quality
Environmental Quality Control Board, Broward County	William Stone Air Pollution Engineer	May 2, 1984	Letter: re Application for resource recovery in Southern Broward County
Broward County Environmental Quality Control Board	John Chase	Oct. 3, 1984	Memorandum: re Dredge & Fill Licenses
	Gary Carlson Chief, Air and Noise Pollution Section	April 4, 1984	Letter: re Broward County Resource Recovery Project Draft Noise Permit Application
Broward County League of Cities	Walter Falck Executive Director	Aug. 15, 1984	Resolution of the Broward County League of Cities authorizing and directing the development for the cities of Broward County
Broward County Resource Recovery Office	Carlton Miller Resource Recovery Coordination	Jan. 26, 1983	Letter: re Broward County Resource Recovery Plan
Broward County Parks and Recreation Division	Jim Clark	June 20, 1984	Memo: re Conversation with Phyllis Korab
	Floyd T. Johnson	July 13, 1984	Re: Waiver of 90 day time limit for Application SC06-86059 and SC06-96060
		Aug. 2, 1984	Letter: re Submitting additional information for the mitigation area

TABLE 9.1 (continued)

COORDINATION DURING LAND USE PLAN AMENDMENT
REZONING AND PREPARATION OF POWER PLANT SITE CERTIFICATION APPLICATION

Local (continued)

<u>Agency</u>	<u>Contact</u>	<u>Date</u>	<u>Subject</u>
City of Fort Lauderdale	Alan Roberts	April 1, 1983	Letter: re Broward County Full Service Resource Recovery Project
City of Boca Raton, Florida Department of Sanitation	Michael Strasser	Feb. 15, 1984	Telephone Call: re Palm Beach County solid waste being disposed in Broward County
City of Miramar	Frank Branca Mayor	July 8, 1983	Letter: re Discussion of preliminary proposal for resource recovery project
City of Tampa	Joseph D. Nardoch	Apr. 16, 1984	Letter: re Tour of the McKay Bay Refuse- to-Energy Facility

TABLE 9.2

ADDITIONAL PARTIES CONTACTED

<u>County</u>		
<u>Agency</u>	<u>Federal</u>	<u>Title</u>
Department of the Army (Jacksonville District)		
Corps of Engineer Miami Beach Area Office	Charles Schnepel	Inspector (Permits)
<u>State</u>		
Florida Department of Environmental Regulation		
Power Plant Siting Section	Hamilton Oven	Power Plant Siting Section Administration
Power Plant Siting Section	Karen Anthony	Transmission Line Siting Coordinator
Bureau of Air Quality Management	Edward Palagyi	Engineer
Bureau of Air Quality Management	Larry George	Environmental Administrator
Bureau of Air Quality Management	Clair Fancy	P.E.
Bureau of Air Quality Management	Edward Svec	Engineer
Bureau of Air Quality Management	Gary Early	Attorney (Tallahassee)
Bureau of Air Quality Management	Roy Duke	Regional Director
Bureau of Air Quality Management	Steve Fox	Permit Administrator (Tallahassee)
Bureau of Air Quality Management	Steven G. Conn	Permitting
Public Service Commission	Bonnie Davis Robert Trapp	General Counsel Engineer

TABLE 9.2 (continued)

ADDITIONAL PARTIES CONTACTED

<u>County</u>		
<u>Agency</u>	<u>Federal</u>	<u>Title</u>
Broward County:		
Environmental Quality Control Board, Broward County	Vic Howard	Pollution Control Officer
	James E. Elias	Biologist Manager, non Solid Waste Section, Broward County Utilities Division
	Fran Henderson	Water Quality Investigator
Broward County Aviation Division	James E. Benedict	P.E.
	Richard Mooney	Project Director of Airport Expansion
Office of Planning Broward County	Roy Groves	Director, Plan Implementation
	Kelly Carpenter, AICP	Formerly Director, Plans & Implementation Division
	Al Shamoun	Associate Planner
	Arla Bernstein	Associate Planner
	Don Kowell	Director, Office of Planning
Finance & Administrative Services Dept.	Thomas Elliott	Formerly Assistant Finance Director
Engineering Division	Henry P. Cook	Director
Planning Council	Susan K. Philp	Director, Comprehensive Planning
Utilities Division	Ed Goscicki	Director
Parks and Recreation Division	Larry Lietzke	Director

TABLE 9.2 (continued)

ADDITIONAL PARTIES CONTACTED

<u>Agency</u>	<u>County</u>	<u>Title</u>
Broward County: (cont'd)		
Aviation Division	James E. Benedict	P.E.
	Richard Niedenthal	Asst. Director Aviation Division
Project 80's Airport Expansion	Richard Mooney	P.E. Executive Director
Property Division	Frank Frey, Jr.	Director
General Counsel Office	Susan F. Delegal	County Counsel
	Annette Star Lustgarten	Assistance General Counsel
Finance and Administrative Services Department	Foster Muzca	Director
Offices of Budget and Mgmt.	John Canada	Director
Florida Department of Transportation:	William K. Fowler	District Engineer
	Timothy O'Brien	Deputy, Formerly District Right of Way Administrator
	Jerry Sasser	I-595 Utility Engineer
Florida Power & Light Company:	Douglas P. Macke	Administrator of Governmental Services
	Duane Bateman	Right-of-Way Representative
	Robert H. Stevens	Distribution Engineering Dept.
Municipalities:		
Dania	Richard Marant	Formerly City Manager
Davie	Irv Rosenbaum	Town Manager
	Bud Jenkins	Mayor

TABLE 9.2 (continued)

ADDITIONAL PARTIES CONTACTED

<u>Agency</u>	<u>County</u>	<u>Title</u>
Municipalities: (cont'd)		
Hollywood	James Chandler	City Manager
	Taylor P. Calhoun	Utilities Division Director
Ft. Lauderdale	Robert Cox	Commissioner
	Alan Roberts	Utilities Division Director
Miramar	Milan Knor	City Engineer
Broward League of Cities:	Walter Falck	Executive Director
South Florida Regional Planning Council	M. Barry Peterson	Executive Director
National Marine Fisheries Service	Gary Nelson	Fishery Biologist
Florida House of Representatives	Anne MacKenzie	Representative, 95th District
Florida State Senate	Tom McPherson	Senator, 30th District
United State House of Representatives	E. Clay Shaw Larry Smith	Congressman, 15th District Congressman, 16th District
United States Senate	Lawton Chiles	Senator
The Trust for Public Land	Joel Kuperberg	Vice President

APPENDICES

SECTION 10
APPENDICES

Appendices 10.1 through 10.18 are included as part of this submittal in two separate volumes. Volume II contains Appendices 10.1 through 10.8. Volume III contains Appendices 10.9 through 10.18.

SECTION 11

REFERENCES

SECTION 11

REFERENCES

- Broward County Office of Planning; "Update of Broward County Statistical Summary", 1984.
- Broward County Planning Council; "Broward County Land Use Plan". Adopted by Board of County Commissioners, 1977.
- Broward County Planning and Administrative Systems Division, "Unincorporated Area Land Use Plan". Adopted by Board of County Commissioners, 1979; Amended 1980.
- Broward County Planning and Administrative Systems Division; "The Housing Element of the Broward County Comprehensive Plan", 1979.
- Broward County Office of Planning; "Parks, Recreation and Open Space Element of the Broward County Comprehensive Plan", 1982.
- Broward County Office of Planning; "The Economic Element of Broward County Comprehensive Plan", 1983.
- Broward County Office of Planning; "Broward County Comprehensive Plan Utility Element", 1981.
- Broward County Office of Planning; "Broward County Statistical Summary" 1983.
- Broward County Office of Planning; "The Coastal Zone Protection/Conservation Element of the Broward County Comprehensive Plan", 1981.
- Broward County, "Coastal Zone Protection Conservation Element of the Broward County Comprehensive Plan", March 1981.
- Broward County; "Broward County Environmental Quality Control Board Annual Report", 1982/1983.
- Broward County; "Broward County Land Use Plan Board of County Commissioners", 1977.
- Broward County; "Unincorporated Area Land Use Plan, Board of County Commissioners". Adopted September 4, 1979,
- Cartographic Section of the Planning and Administrative Systems Division of Broward County; "Broward County Metropolitan Area Map Atlas", 1980.

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Law Engineering Testing Company; "Report of Geotechnical Investigation, Broward County North District Wastewater Treatment Solid Residuals Disposal Facility", 1980.

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Malcolm Pirnie, Inc.; "Application for Permit to Construct a Solid Waste Resource Recovery and Management Facility -- Southern Residue/Unprocessable Waste Landfill", submitted to the Florida Department of Environmental Regulation, April 1984.

Malcolm Pirnie, Inc.; "The Generic Overview of Solid Waste Management Alternatives", February 1982.

Malcolm Pirnie, Inc.; "Site Evaluation for Solid Waste Management Alternatives", February 1982.

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Malcolm Pirnie, Inc.; Engineering Report, "Evaluation of Contractor Qualifications", March 1983.

Malcolm Pirnie, Inc.; "Engineers Project Status Report", November 1984.

Malcolm Pirnie, Inc.; "Technical Evaluation of Vendor Proposals", February 1985.

Parker, Garald G., G.E. Ferguson, S.R. Love; "Water Resources of Southeastern Florida". Geological Survey Water-Supply Paper 1255, United States Government Printing Office, Washington, 1955.

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Sherwood, C.B., H.J. McCoy, C.F. Galliher; "Water Resources of Broward County, Florida". Report of Investigation Number 65, United States Geological Survey, Tallahassee, 1973.

U.S. Environmental Protection Agency; "Methods for Chemical Analysis of Water and Wastes", 1979.

Vorhis, R.C.; "Geology and Ground Water of the Fort Lauderdale Area, Florida". Florida Geological Survey Report Investigation 6, 1948.

Broward County,
Florida



SOUTH BROWARD COUNTY RESOURCE RECOVERY PROJECT, INC.
Solid Waste Energy Recovery -
Application for Power Plant Site Certification

**MALCOLM
PIRNIE**

Volume II -
Route 441
Appendices

South Broward County Resource Recovery Project, Inc.

Solid Waste Energy Recovery Facility

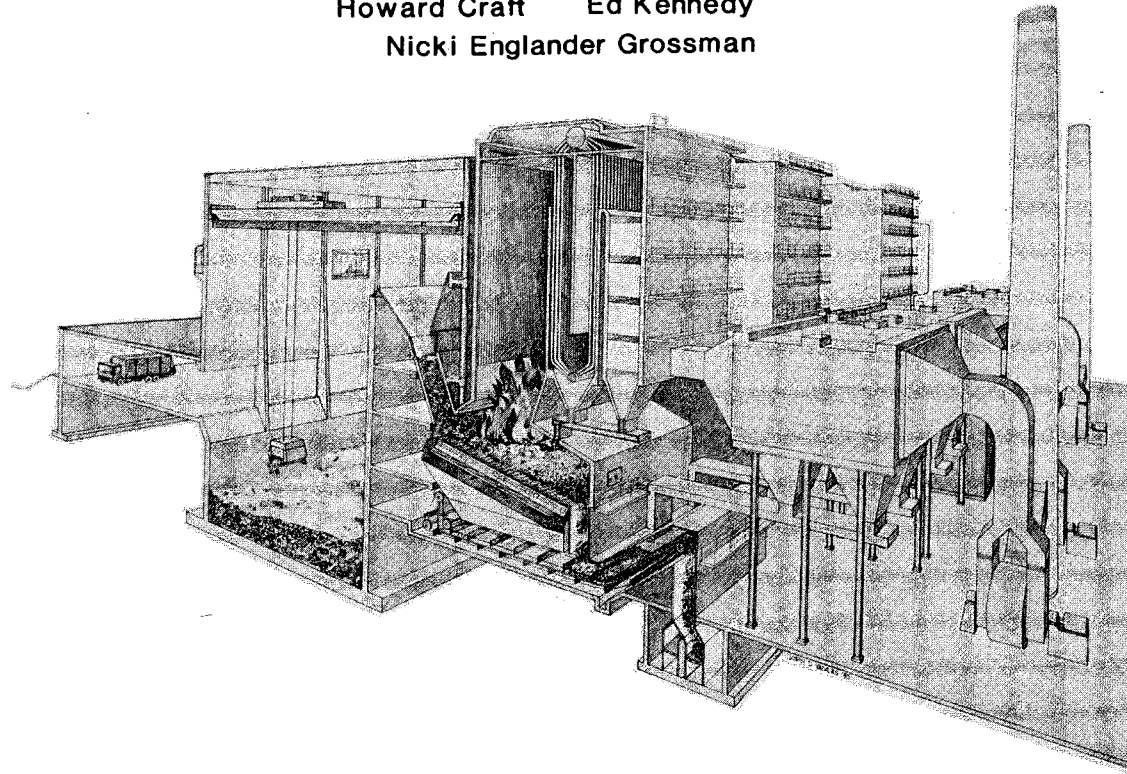
Application for

Power Plant Site Certification

Volume II - Route 441 - Appendices

Submitted By
The Broward County
Board of County Commissioners

Scott I. Cowan, Chairman
Gerald Thompson, Vice Chairman
Marcia Beach Howard Forman
Howard Craft Ed Kennedy
Nicki Englander Grossman



Floyd T. Johnson, County Administrator
Thomas M. Henderson, Director, Resource Recovery Office

March 1985

**MALCOLM
PIRNIE**



VOLUME II

LIST OF APPENDICES

- 10.1 FEDERAL PERMIT APPLICATIONS OR APPROVALS
 - 10.1.1 316 Demonstration
 - 10.1.2 NPDES Application/Permit
 - 10.1.3 Hazardous Waste Disposal/Permit
 - 10.1.4 Section 10 and 404 Application/Permit
 - 10.1.5 Prevention of Significant Deterioration
 - 10.1.6 Coastal Zone Management Certifications
- 10.2 ZONING DESCRIPTIONS/ZONING
- 10.3 LAND USE PLAN DESCRIPTIONS
- 10.4 EXISTING STATE PERMITS
- 10.5 MONITORING PROGRAMS
- 10.6 PETITION FILED WITH PUBLIC SERVICE
COMMISSION IN MARCH 1985
- 10.7 MITIGATION PLANS
- 10.8 GEOTECHNICAL REPORTS

FEDERAL PERMIT APPLICATIONS OR APPROVALS

APPENDIX 10.1

FEDERAL PERMIT APPLICATIONS OR APPROVALS

Appendices 10.1.1 through 10.1.6 present a compilation of federal permit applications submitted, approvals obtained, and general correspondence relating to their content.

316 DEMONSTRATION

APPENDIX 10.1.1

316 DEMONSTRATION

Demonstration pursuant to Section 316(a) and (b) of the
Clean Water Act are not applicable to the project.

NPDES APPLICATION/PERMIT

APPENDIX 10.1.2

APPENDIX 10.1.2

NPDES APPLICATION/PERMIT



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

MAR 28 1985

REF: 4WM-FP

Mr. Thomas M. Henderson
Project Director
Resource Recovery Office
Room 521
115 South Andrews Avenue
Fort Lauderdale, Florida 33301

RE: Stormwater Discharge
South Broward County Resource Recovery Project, Inc.

Dear Mr. Henderson:

Acknowledgement is made of receipt of your application dated March 13, 1985, for a National Pollutant Discharge Elimination System (NPDES) permit.

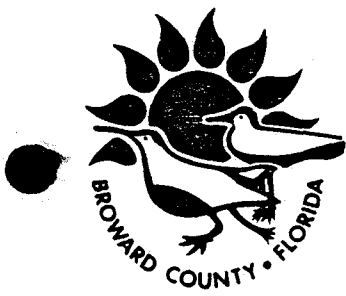
Your application is considered complete and has been assigned NPDES No. FL0060020. Please refer to this number in future correspondence concerning this application.

Your obligation to submit an application for your stormwater discharge(s) has been met and we will contact you when the permit issuance process begins. If you have questions or comments, please contact Roosevelt Childress at (404)881-2913.

Sincerely yours,

A handwritten signature in cursive script that reads "Gloria Love".

Gloria Love, Permits Clerk
South Area Permits Unit
Facilities Performance Branch
Water Management Division



Resource Recovery Office

Room 521, 115 South Andrews Avenue
Fort Lauderdale, Florida 33301
(305) 357-6458

March 15, 1985

U.S. Environmental Protection Agency
EPA Region IV
Water Management Division
345 Courtland Street
Atlanta, Georgia 30365

Attention: Mr. Michael Magee

Re: South Broward County Resource Recovery Project, Inc.
NPDES - Permit Application

Gentlemen:

Enclosed please find EPA Forms 3510-1 and 3510-2C which Broward County is submitting pursuant to the Clean Water Act under the National Pollutant Discharge Elimination System (NPDES) for the construction and operation of a Resource Recovery Facility in Broward County. The proposed facility will have an initial installed capacity of 2,352 tons per day with a projected estimated ultimate capacity of 3,300 tons per day of solid waste.

Uncontaminated stormwater will be the only discharge to surface waters during the construction and operation of this facility. This discharge will occur only during peak storms. The sanitary and process wastewater will be discharged to the existing Hollywood Wastewater Treatment Plant.

In accordance with the requirements of the Federal Consistency Evaluation Procedures (15 CFR 930.50), the permit application is accompanied by an "NPDES Florida Coastal Zone Management Certification". As specified in 15 CFR 930.58, 10 copies of EPA Forms 3510-1 and 3510-2C and the "NPDES Florida Coastal Zone Management Certification" have been sent under separate cover to the Federal Consistency Coordinator of the Florida State Planning and Development Clearinghouse.

BROWARD COUNTY BOARD OF COUNTY COMMISSIONERS

Marcia Beach Scott I. Cowan Howard Craft Howard Forman Nicki Englander Grossman Ed Kennedy Gerald Thompson
An Equal Opportunity Employer

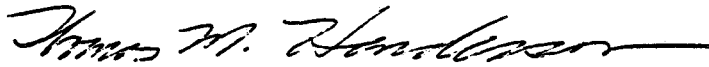
Mr. Michael Magee

-2-

March 15, 1985

Should you have any questions concerning the information presented in this submittal, please do not hesitate to contact us.

Sincerely,

A handwritten signature in cursive script, reading "Thomas M. Henderson".

Thomas Henderson
Project Director
Resource Recovery Office

TH/lfc

FORM 1 GENERAL		U.S. ENVIRONMENTAL PROTECTION AGENCY GENERAL INFORMATION Consolidated Permits Program (Read the "General Instructions" before starting.)		I. EPA I.D. NUMBER	
II. POLLUTANT CHARACTERISTICS		III. NAME OF FACILITY		IV. FACILITY CONTACT	
INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold-faced terms.		A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER		B. COUNTY NAME	
I. EPA I.D. NUMBER		B. CITY OR TOWN		C. CITY OR TOWN	
II. FACILITY NAME		C. STATE		D. ZIP CODE	
III. FACILITY MAILING ADDRESS		D. STATE		E. ZIP CODE	
IV. FACILITY LOCATION		E. ZIP CODE		F. COUNTY CODE (if known)	
PLEASE PLACE LABEL IN THIS SPACE		F. COUNTY CODE (if known)			
SPECIFIC QUESTIONS		SPECIFIC QUESTIONS			
A. Is this facility a publicly owned treatment works which results in a discharge to waters of the U.S.? (FORM 2A)		B. Does or will this facility (either existing or proposed) include a concentrated animal feeding operation or aquatic animal production facility which results in a discharge to waters of the U.S.? (FORM 2B)			
C. Is this a facility which currently results in discharges to waters of the U.S. other than those described in A or B above? (FORM 2C)		D. Is this a proposed facility (other than those described in A or B above) which will result in a discharge to waters of the U.S.? (FORM 2D)			
E. Does or will this facility treat, store, or dispose of hazardous wastes? (FORM 3)		F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)			
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)			
I. Is this facility a proposed stationary source which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		J. Is this facility a proposed stationary source which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)			
1 SKIP S O. B R O W A R D C O. R E S. R E C O V E R Y P R O J. I N C.		2 H E N D E R S O N T H O M A S P R O J. D I R.		3 0 5 3 5 7 6 4 5 6	
3 1 1 5 S A N D R E W S A V E R O O M 5 2 1		4 F T L A U D E R D A L E		F L 3 3 3 0 1	
5 4 4 0 0 S O U T H S T A T E R D 7		6 F T L A U D E R D A L E		F L 3 3 3 1 2 1 0	

CONTINUED FROM THE FRONT

VII. SIC CODES (4-digit, in order of priority)

A. FIRST				B. SECOND			
7	4	9	5	7			
(specify) Refuse Systems				(specify)			
C. THIRD				D. FOURTH			
7				7			
(specify)				(specify)			

VIII. OPERATOR INFORMATION

A. NAME												B. Is the name listed in Item VIII-A also the owner?	
S O. B R O W A R D C O. R E S. R E C O V E R Y P R O J. I N C.												☒ YES ☐ NO	
C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box; if "Other", specify.)													
F - FEDERAL				M - PUBLIC (other than federal or state)				M*				(specify)	
S - STATE				O - OTHER (specify)									
P - PRIVATE													
D. PHONE (area code & no.)													
3				05		3		57		6456			
E. STREET OR P.O. BOX													
115 S. A N D R E W S A V E R O O M 521													
F. CITY OR TOWN						G. STATE		H. ZIP CODE		IX. INDIAN LAND			
F T. L A U D E R D A L E						F L		33 3 01		Is the facility located on Indian lands?			
										☐ YES ☒ NO			

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water)												D. PSD (Air Emissions from Proposed Sources)											
9 N												9 P											
B. UIC (Underground Injection of Fluids)												E. OTHER (specify)											
9 U												(specify)											
C. RCRA (Hazardous Wastes)												E. OTHER (specify)											
9 R												(specify)											

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS (provide a brief description)

The proposed southern Resource Recovery Facility will receive and process initially approximately 2352 tpd of Municipal Solid Wastes and ultimately approximately 3300 tpd of MSW from Southern Broward County. Processible waste received at the RRF will be burned to reduce the original volume by approximately 90 percent and Energy will be recovered from the combustion process in the form of electricity.

XIII. CERTIFICATION (see instructions)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print)		B. SIGNATURE		C. DATE SIGNED	
Thomas Henderson Project Director		Thomas M. Henderson		3/13/85	

COMMENTS FOR OFFICIAL USE ONLY

C											
---	--	--	--	--	--	--	--	--	--	--	--

**FORM
26
NPDES**



U.S. ENVIRONMENTAL PROTECTION AGENCY
APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER
EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICULTURAL OPERATIONS
Consolidated Permits Program

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

[illegible]

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined (e.g., for certain mining activities), provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

[illegible]

OFFICIAL USE ONLY (effluent guidelines sub-categories)

CONTINUED FROM THE FRONT

C. Except for storm runoff, leaks, or spills, are any of the discharges described in Items II-A or B intermittent or seasonal?

☐ YES (complete the following table)

☒ NO (go to Section III)

1. OUTFALL NUMBER (list)	2. OPERATION(s) CONTRIBUTING FLOW (list)	3. FREQUENCY		4. FLOW						5. ELUTION (in days)
		a. DAYS PER WEEK (specify average)	b. MONTHS PER YEAR (specify average)	3. FLOW RATE (in mgd)		b. TOTAL VOLUME (specify with units)				
				1. LONG TERM AVERAGE	2. MAXIMUM DAILY	1. LONG TERM AVERAGE	2. MAXIMUM DAILY			

III. MAXIMUM PRODUCTION

A. Does an effluent guideline limitation promulgated by EPA under Section 304 of the Clean Water Act apply to your facility?

☐ YES (complete Item III-B)

☒ NO (to Section IV)

B. Are the limitations in the applicable effluent guideline expressed in terms of production (or other measure of operation)?

☐ YES (complete Item III-C)

☐ NO (go to Section IV)

C. If you answered "Yes" to Item III-B, list the quantity which represents an actual measurement of your maximum level of production, expressed in the terms and units used in the applicable effluent guideline, and indicate the affected outfalls.

I. MAXIMUM QUANTITY			2. AFFECTED OUTFALLS (list outfall numbers)
a. QUANTITY PER DAY	b. UNITS OF MEASURE	c. OPERATION, PRODUCT, MATERIAL, ETC. (specify)	

IV. IMPROVEMENTS

A. Are you now required by any Federal, State or local authority to meet any implementation schedule for the construction, upgrading or operation of waste-water treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes, but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.

☐ YES (complete the following table)

☒ NO (go to Item IV-B)

1. IDENTIFICATION OF CONDITION, AGREEMENT, ETC.	2. AFFECTED OUTFALLS		3. BRIEF DESCRIPTION OF PROJECT	4. FINAL COM- PLIANCE DATE	
	a. NO.	b. SOURCE OF DISCHARGE		a. RE- QUIRED	b. PRO- JECTED

B. OPTIONAL: You may attach additional sheets describing any additional water pollution control programs (or other environmental projects which may affect your discharges) you now have underway or which you plan. Indicate whether each program is now underway or planned, and indicate your actual or planned schedules for construction. ☐ MARK "X" IF DESCRIPTION OF ADDITIONAL CONTROL PROGRAMS IS ATTACHED

V. INTAKE AND EFFLUENT CHARACTERISTICS

NOTE: Tables V-A, V-B, and V-C are included on separate sheets numbered V-1 through V-9.

1. POLLUTANT	2. SOURCE	1. POLLUTANT	2. SOURCE

A. Is any pollutant listed in Item V-C a substance or a component of a substance which you do or expect that you will over the next 5 years use or manufacture as an intermediate or final product or byproduct?

☐ YES (list all such pollutants below)

☐ NO (go to Item VI-B)

☐ YES (complete Item VI-C below)

☐ **NO** (go to Section VII)

CONTINUE ON REVERSE

VII. BIOLOGICAL TOXICITY TESTING DATA

Do you have any knowledge or reason to believe that any biological test for acute or chronic toxicity has been made on any of your discharges or on a receiving water in relation to your discharge within the last 3 years?

☐ **YES** (Identify the test(s) and describe their purposes below)

☐ **NO** (go to Section VIII)

VIII. CONTRACT ANALYSIS INFORMATION

Were any of the analyses reported in Item V performed by a contract laboratory or consulting firm?

☐ **YES** (list the name, address, and telephone number of, and pollutants analyzed by, each such laboratory or firm below)

☐ **NO** (go to Section IX)

A. NAME	B. ADDRESS	C. TELEPHONE (area code & no.)	D. POLLUTANTS ANALYZED (list)

IX. CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print)

Thomas Henderson
Project Director

B. PHONE NO. (area code & no.)

305-357-6458

C. SIGNATURE

Thomas M. Henderson

D. DATE SIGNED

3/13/85

EPA I.D. NUMBER (copy from Item 1 of Form 1)

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (use the same format) instead of completing these pages. SEE INSTRUCTIONS.

Form Approved
OMB No. 2000-0059
Approval expires 3-31-84

V. INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C)

OUTFALL NO.
001

PART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT							3. UNITS (specify if blank)		4. INTAKE (optional)		
	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biochemical Oxygen Demand (BOD)												
b. Chemical Oxygen Demand (COD)												
c. Total Organic Carbon (TOC)												
d. Total Suspended Solids (TSS)												
e. Ammonia (as N)												
f. Flow	VALUE		VALUE		VALUE					VALUE		
g. Temperature (winter)	VALUE		VALUE		VALUE			°C		VALUE		
h. Temperature (summer)	VALUE		VALUE		VALUE			°C		VALUE		
i. pH	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM				STANDARD UNITS				

PART B - Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2-a for any pollutant, you must provide the results of at least one analysis for that pollutant. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. (if available)	2. MARK 'X'		3. EFFLUENT							4. UNITS		5. INTAKE (optional)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Bromide (24959-67-9)		X												
b. Chlorine, Total Residual		X												
c. Color		X												
d. Fecal Coliform		X												
e. Fluoride (16984-48-8)		X												
f. Nitrate-Nitrite (as N)		X												

ITEM V-B CONTINUED FROM FRONT

1. POLLUTANT AND CAS NO. (if available)	2. MARK 'X'		3. EFFLUENT						4. UNITS		5. INTAKE (optional)			
	a. BELIEVED PRE-SENT	b. BELIEVED AS-SENT	B. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG. VALUE (if available)		d. NO. OF ANALYSES	B. CONCENTRATION	b. MASS	B. LONG TERM AVERAGE VALUE		D. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic (as N)		X												
h. Oil and Grease		X												
i. Phosphorus (as P), Total (7723-14-0)		X												
j. Radioactivity														
(1) Alpha, Total		X												
(2) Beta, Total		X												
(3) Radium, Total		X												
(4) Radium 226, Total		X												
k. Sulfate (as SO ₄) (14808-79-8)		X												
l. Sulfide (as S)		X												
m. Sulfite (as SO ₃) (14265-45-3)		X												
n. Surfactants		X												
o. Aluminum, Total (7429-90-5)		X												
p. Barium, Total (7440-39-3)		X												
q. Boron, Total (7440-42-8)		X												
r. Cobalt, Total (7440-48-4)		X												
s. Iron, Total (7439-89-6)		X												
t. Magnesium, Total (7439-95-4)		X												
u. Molybdenum, Total (7439-98-7)		X												
v. Manganese, Total (7439-96-5)		X												
w. Tin, Total (7440-31-5)		X												
x. Titanium, Total (7440-32-6)		X												

EPA I.D. NUMBER (copy from Item 1 of Form 1)	OUTFALL NUMBER
	001

CONTINUED FROM PAGE 3 OF FORM 2-C

Form Approved
OMB No. 2000-0059
Approval expires 3-31-84

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (*secondary industries, non-process wastewater outfalls, and non-required GC/MS fractions*), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe to be absent. If you mark either columns 2-a or 2-b for any pollutant, you must provide the results of at least one analysis for that pollutant. Note that there are seven pages to this part; please review each carefully. Complete one table (*all seven pages*) for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT						d. NO. OF ANALYSES	4. UNITS		5. INTAKE (optional)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG. VALUE (if available)			a. CONCENTRATION	b. MASS	b. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)			X												
2M. Arsenic, Total (7440-38-2)			X												
3M. Beryllium, Total, 7440-41-7)			X												
4M. Cadmium, Total (7440-43-9)			X												
5M. Chromium, Total (7440-47-3)			X												
6M. Copper, Total (7550-50-8)			X												
7M. Lead, Total (7439-97-6)			X												
8M. Mercury, Total (7439-97-6)			X												
9M. Nickel, Total (7440-02-0)			X												
10M. Selenium, Total (7782-49-2)			X												
11M. Silver, Total (7440-22-4)			X												
12M. Thallium, Total (7440-28-0)			X												
13M. Zinc, Total (7440-66-6)			X												
14M. Cyanide, Total (57-12-5)			X												
15M. Phenols, Total			X												
DIOXIN															
2,3,7,8-Tetra-chlorodibenzo-P-Dioxin (1764-01-6)			X	DESCRIBE RESULTS											

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT						4. UNITS		5. INTAKE (optional)			
	ANALYST INITIALS (if available)	D. DE- LIVERED FUEL SENT	C. BE- LIEVED AD- SENT	A. MAXIMUM DAILY VALUE		B. MAXIMUM 30 DAY VALUE (if available)		C. LONG TERM AVG. VALUE (if available)		d. NO. OF ANAL- YSES	a. CONCENTRATION	b. MASS	B. LONG TERM AVERAGE VALUE		b. NO. OF ANAL- YSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)			X												
2V. Acrylonitrile (107-13-1)			X												
3V. Benzene (71-43-2)			X												
4V. Bis (Chloro- methyl) Ether (542-88-1)			X												
5V. Bromoform (75-25-2)			X												
6V. Carbon Tetrachloride (56-23-5)			X												
7V. Chlorobenzene (108-90-7)			X												
8V. Chlorodi- bromomethane (124-48-1)			X												
9V. Chloroethane (75-00-3)			X												
10V. 2-Chloro- ethylvinyl Ether (110-75-8)			X												
11V. Chloroform (67-66-3)			X												
12V. Dichloro- bromomethane (75-27-4)			X												
13V. Dichloro- difluoromethane (75-71-8)			X												
14V. 1,1-Dichloro- ethane (75-34-3)			X												
15V. 1,2-Dichloro- ethane (107-06-2)			X												
16V. 1,1-Dichloro- ethylene (75-35-4)			X												
17V. 1,2-Dichloro- propane (78-87-5)			X												
18V. 1,3-Dichloro- propylene (542-75-6)			X												
19V. Ethylbenzene (100-41-4)			X												
20V. Methyl Bromide (74-83-9)			X												
21V. Methyl Chloride (74-87-3)			X												

CONTINUED FROM PAGE V-4

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT						4. UNITS		5. INTAKE (optional)			
	a. TEST ING RE- QUIR- ED	b. BE- LIEVED PRE- SENT	c. BE- LIEVED AB- SENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG. VALUE (if available)		d. NO. OF ANAL- YSES	a. CONCENTRATION	b. MASS	b. LONG TERM AVERAGE VALUE		d. NO. OF ANAL- YSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS (continued)															
22V. Methylene Chloride (75-09-2)			X												
23V. 1,1,2,2-Tetrachloroethane (79-34-5)			X												
24V. Tetrachloroethylene (127-18-4)			X												
25V. Toluene (108-88-3)			X												
26V. 1,2-Trans-Dichloroethylene (156-60-5)			X												
27V. 1,1,1-Trichloroethane (71-55-6)			X												
28V. 1,1,2-Trichloroethane (79-00-5)			X												
29V. Trichloroethylene (79-01-6)			X												
30V. Trichlorofluoromethane (75-69-4)			X												
31V. Vinyl Chloride (75-01-4)			X												
GC/MS FRACTION – ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)			X												
2A. 2,4-Dichlorophenol (120-83-2)			X												
3A. 2,4-Dimethylphenol (105-67-9)			X												
4A. 4,6-Dinitro-O-Cresol (534-52-1)			X												
5A. 2,4-Dinitrophenol (51-28-5)			X												
6A. 2-Nitrophenol (88-75-5)			X												
7A. 4-Nitrophenol (100-02-7)			X												
8A. P-Chloro-M-Cresol (59-50-7)			X												
9A. Pentachlorophenol (87-86-5)			X												
10A. Phenol (108-95-2)			X												
11A. 2,4,6-Trichlorophenol (88-06-2)			X												

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT						4. UNITS		5. INTAKE (optional)			
	A. TEST ING RE- QUIR- ED	B. DE- LIVER- PRE- SENT	C. DE- LEVEL- AB- SENT	D. MAXIMUM DAILY VALUE		D. MAXIMUM 30 DAY VALUE (if available)		C. LONG TERM AVG. VALUE (if available)		D. NO. OF ANAL- YSES	B. CONCENTRATION	D. MASS	B. LONG TERM AVERAGE VALUE		D. NO. OF ANAL- YSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (83-32-9)			X												
2B. Acenaphthylene (208-96-8)			X												
3B. Anthracene (120-12-7)			X												
4B. Benzidine (92-87-5)			X												
5B. Benzo (a) Anthracene (56-55-3)			X												
6B. Benzo (a) Pyrene (50-32-8)			X												
7B. 3,4-Benzo- fluoranthene (205-99-2)			X												
8B. Benzo (ghi) Perylene (191-24-2)			X												
9B. Benzo (k) Fluoranthene (207-08-9)			X												
10B. Bis (2-Chloro- ethoxy) Methane (111-91-1)			X												
11B. Bis (2-Chloro- ethyl) Ether (111-44-4)			X												
12B. Bis (2-Chloro- isopropyl) Ether (39638-32-9)			X												
13B. Bis (2-Ethyl- hexyl) Phthalate (117-81-7)			X												
14B. 4-Bromo- phenyl Phenyl Ether (101-55-3)			X												
15B. Butyl Benzyl Phthalate (85-68-7)			X												
16B. 2-Chloro- naphthalene (91-58-7)			X												
17B. 4-Chloro- phenyl Phenyl Ether (7005-72-3)			X												
18B. Chrysene (218-01-9)			X												
19B. Dibenzo (a,h) Anthracene (53-70-3)			X												
20B. 1,2-Dichloro- benzene (95-50-1)			X												
21B. 1,3-Dichloro- benzene (541-73-1)			X												

CONTINUED FROM PAGE V-6

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT						4. UNITS		5. INTAKE (optional)			
	a. TEST INITIALS (if available)	b. DE- CL. VEC. PHL- SENT	c. DE- CL. VEC. PHL- SENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG. VALUE (if available)		d. NO. OF ANAL- YSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANAL- YSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B. 1,4-Dichlorobenzene (106-46-7)			X												
23B. 3,3'-Dichlorobenzidine (91-94-1)			X												
24B. Diethyl Phthalate (84-66-2)			X												
25B. Dimethyl Phthalate (131-11-3)			X												
26B. Di-N-Butyl Phthalate (84-74-2)			X												
27B. 2,4-Dinitrotoluene (121-14-2)			X												
28B. 2,6-Dinitrotoluene (606-20-2)			X												
29B. Di-N-Octyl Phthalate (117-84-0)			X												
30B. 1,2-Diphenylhydrazine (as Azobenzene) (122-66-7)			X												
31B. Fluoranthene (206-44-0)			X												
32B. Fluorene (86-73-7)			X												
33B. Hexachlorobenzene (118-71-1)			X												
34B. Hexachlorobutadiene (87-68-3)			X												
35B. Hexachlorocyclopentadiene (77-47-4)			X												
36B. Hexachloroethane (67-72-1)			X												
37B. Indeno (1,2,3-cd) Pyrene (193-39-5)			X												
38B. Isophorone (78-59-1)			X												
39B. Naphthalene (91-20-3)			X												
40B. Nitrobenzene (98-95-3)			X												
41B. N-Nitrosodimethylamine (62-75-9)			X												
42B. N-Nitrosodi-N-Propylamine (621-64-7)			X												

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT						4. UNITS		5. INTAKE (optional)			
	a. TEST ING RE- QUIR- ED	b. DE- LIVERED PRE- SENT	c. DE- LIVERED AS- SENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (If available)		d. NO. OF ANAL- YSES	a. CONCEN- TRATION	b. MASS	e. LONG TERM AVERAGE VALUE		b. NO. OF ANAL- YSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCEN- TRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS (continued)															
43B. N-Nitro- sodiphenylamine (86-30-6)			X												
44B. Phenanthrene (85-01-8)			X												
45B. Pyrene (129-00-0)			X												
46B. 1,2,4 - Tri- chlorobenzene (120-82-1)			X												
GC/MS FRACTION – PESTICIDES															
1P. Aldrin (309-00-2)			X												
2P. α -BHC (319-84-6)			X												
3P. β -BHC (319-85-7)			X												
4P. γ -BHC (58-89-9)			X												
5P. δ -BHC (319-86-8)			X												
6P. Chlordane (57-74-9)			X												
7P. 4,4'-DDT (50-29-3)			X												
8P. 4,4'-DDE (72-55-9)			X												
9P. 4,4'-DDD (72-54-8)			X												
10P. Dieldrin (60-57-1)			X												
11P. α -Endosulfan (115-29-7)			X												
12P. β -Endosulfan (115-29-7)			X												
13P. Endosulfan sulfate (1031-07-8)			X												
14P. Endrin (72-20-8)			X												
15P. Endrin aldehyde (7421-93-4)			X												
16P. Heptachlor (76-44-8)			X												

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT						4. UNITS		5. INTAKE (optional)			
	a. TEST ING RE- QUIR- ED	b. BE- LIEVED PRE- SENT	c. BE- LIEVED AB- SENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANAL- YSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANAL- YSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES (continued)															
17P. Heptachlor Epoxide (1024-57-3)			X												
18P. PCB-1242 (53469-21-9)			X												
19P. PCB-1254 (11097-69-1)			X												
20P. PCB-1221 (11104-28-2)			X												
21P. PCB-1232 (11141-16-5)			X												
22P. PCB-1248 (12672-29-6)			X												
23P. PCB-1260 (11096-82-5)			X												
24P. PCB-1016 (12674-11-2)			X												
25P. Toxaphene (8001-35-2)			X												

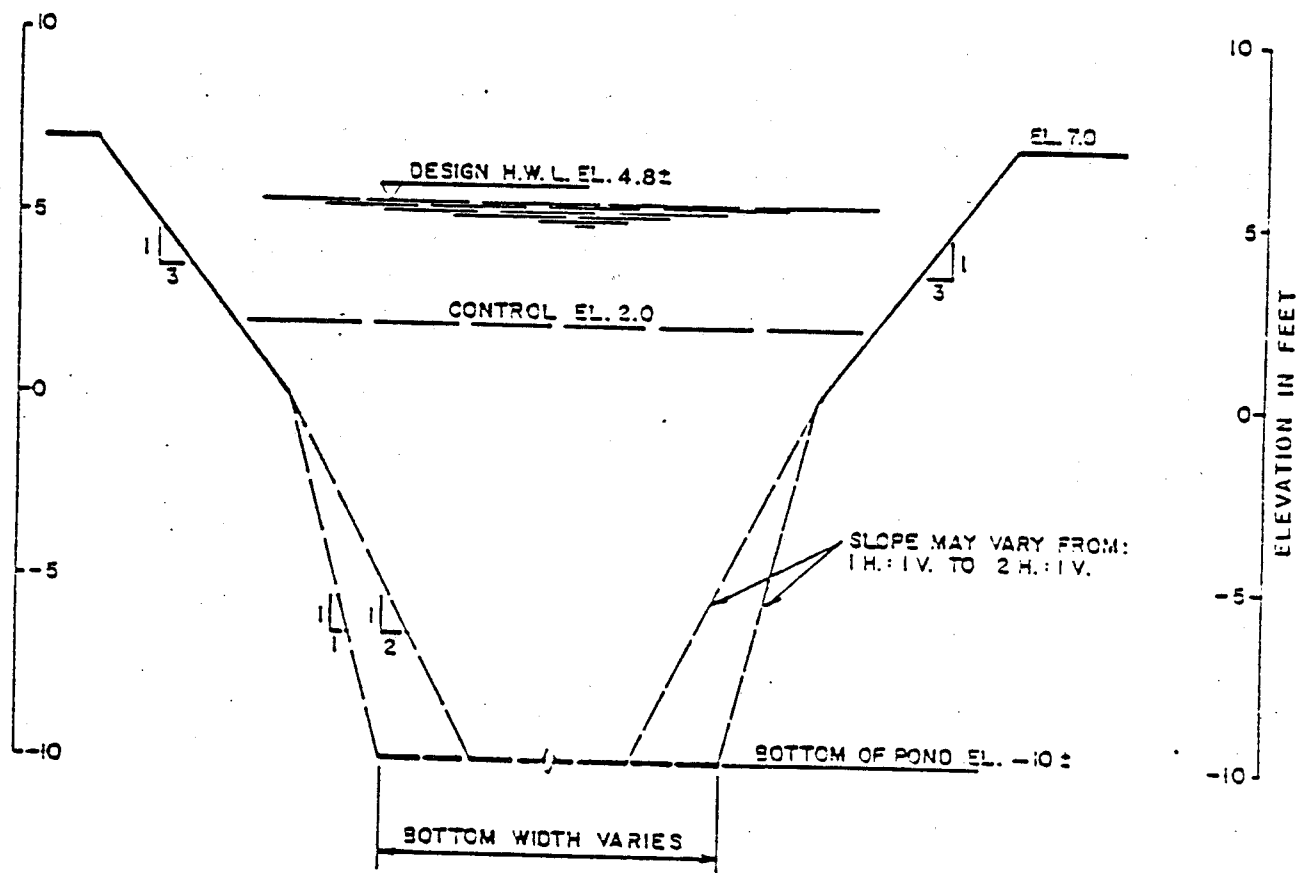
ATTACHMENT A

Resource Recovery Facility

The required stormwater retention will typically be provided by on-site dry retention swales and/or dry retention ponds. Disposal of retained water in these areas will be accomplished via percolation and evaporation processes. Excess runoff, beyond that which is retained in the retention areas will be conveyed to two ponds (pond 1 and pond 2). These ponds (See Figure 1 for typical cross section) which are approximately 3.4 and 4.3 acres in area, will be constructed at the southern and eastern portions of the RRF site (Figure 2). Detained water in the ponds will be released by controlled gravity discharge, via a weir/culvert structure to the C-11 canal in accordance with SFWMD discharge criteria. The ponds will be hydraulically connected with a single discharge at pond 2.

The major outfall structure for the site is located at Pond 2. It consists of a weir overflow structure (invert el. 2.0 ft. NGVD) with a pipe, sluice gate and a baffle for water quality and discharge control. An approximately 36-inch in diameter RCP connects the structure to the C-11 canal, which is the final discharge point for project drainage. Specifically, post development peak discharges from the resource recovery facility site, for the 25 year-72 hour design storm, will not exceed predevelopment levels. Peak discharge to the C-11 canal will be approximately 23 cubic feet per second (cfs) which is the estimated predevelopment discharge. Discharge velocities will be limited to below 4 feet per second, for erosion control purposes. The weir outfall control structure will be furnished with a baffle for oil, grease and sediment control. The invert of the weir will be set at elevation 2.3 feet NGVD. This elevation provides sufficient retention for water quality control. Elevation 2.0 feet NGVD is the established control elevation for the site. Water level in the ponds will rise to elevation 4.8 ft NGVD during the 25 year-72 hour storm. Ponds will be constructed with a 0.5 foot freeboard.

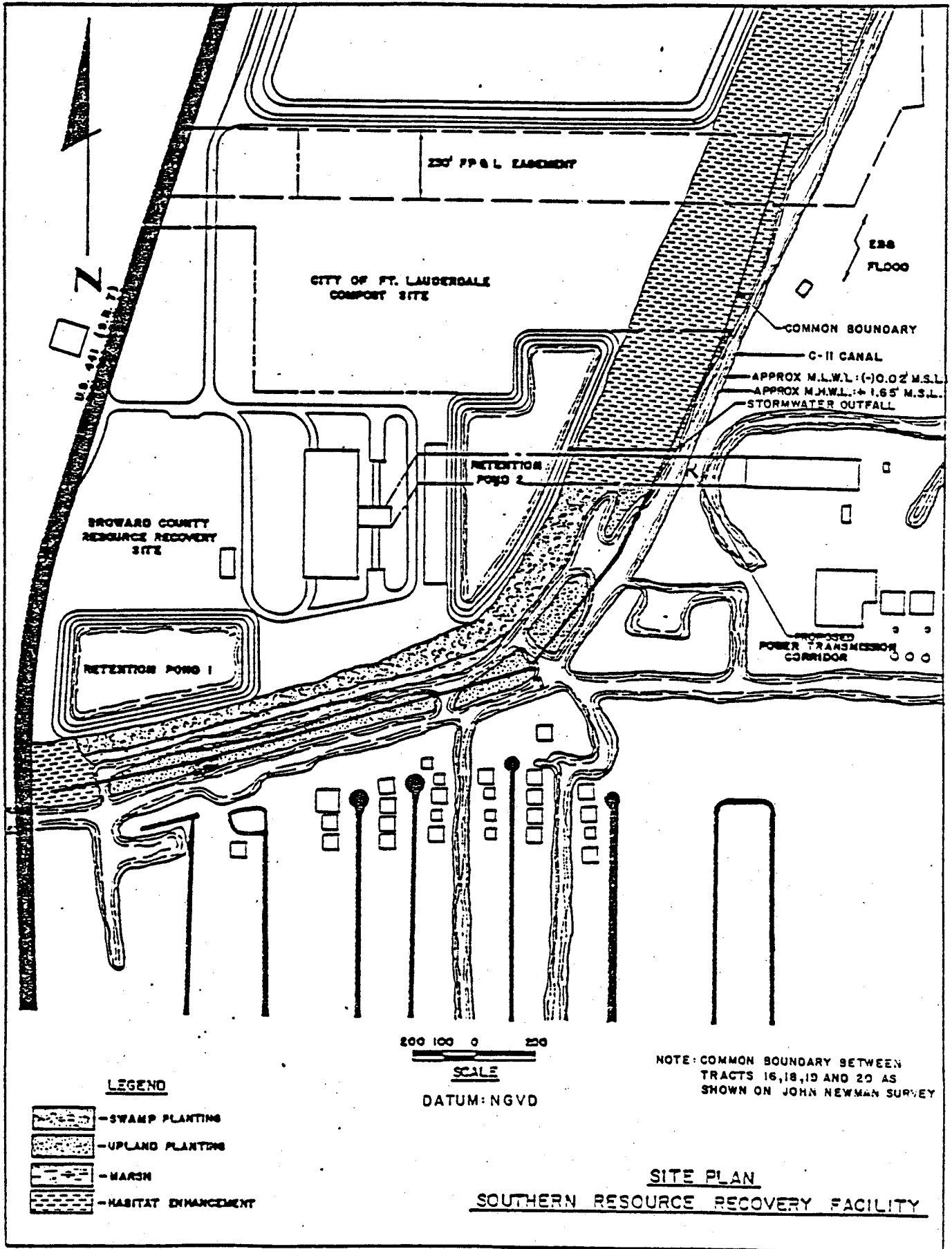
A berm will be constructed to contain water during dredging and filling. Sediment traps and screens will be strategically placed to trap runoff. All permanent berms constructed for the development will be grassed to prevent erosion.

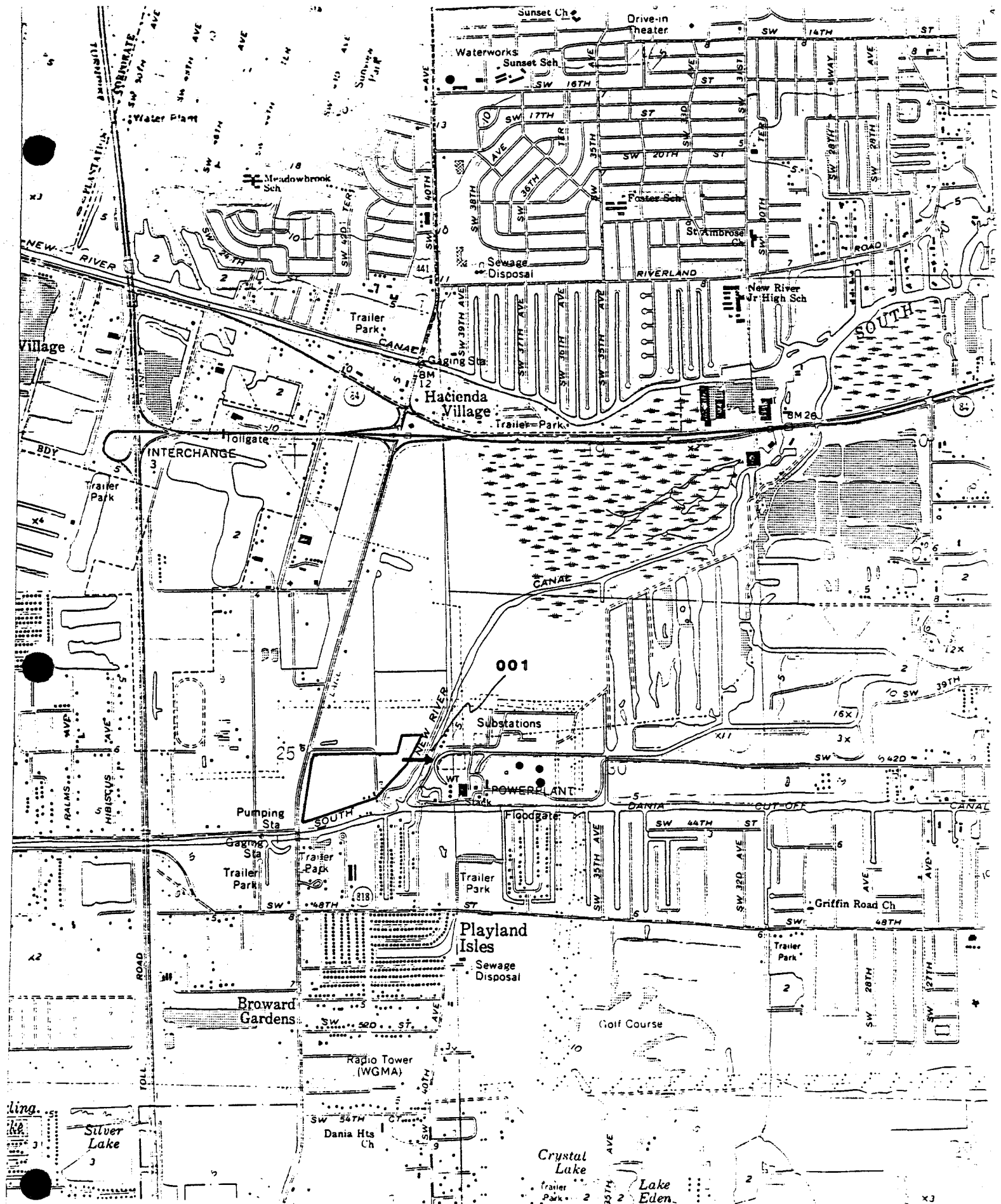


SCALES: HORIZ. 1" = 20'
VERT. 1" = 5'

DATUM:
FT, NGVD

SOUTHERN RESOURCE RECOVERY FACILITY
TYPICAL POND CROSS SECTION DETAIL

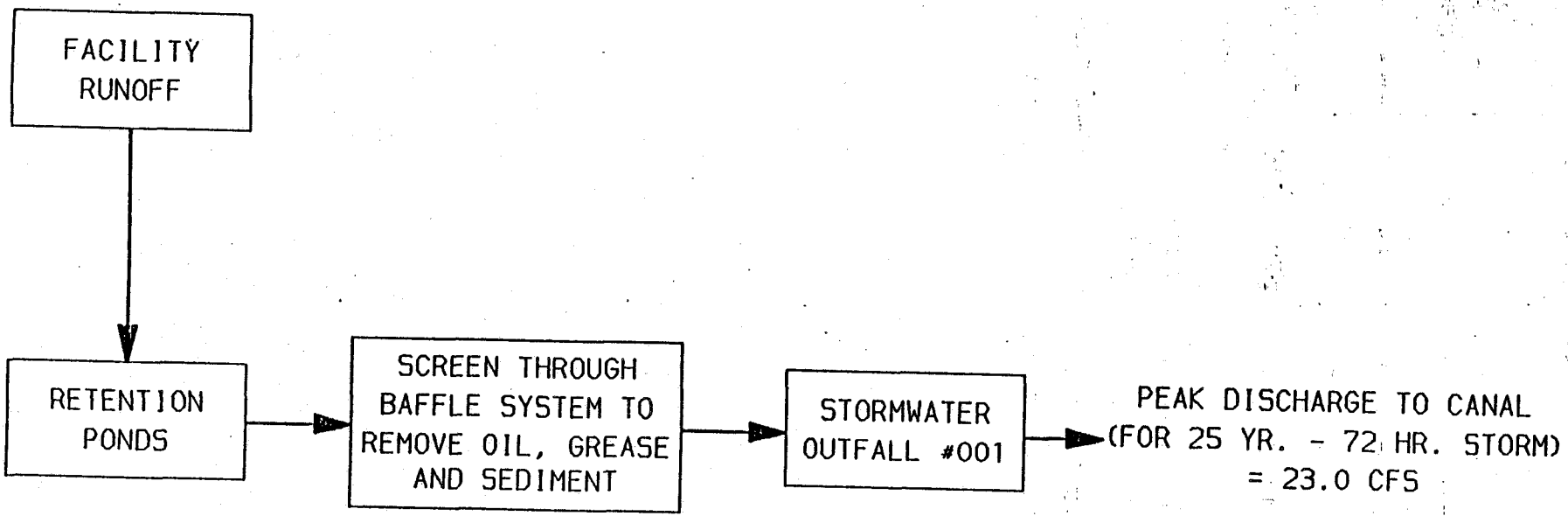




SCALE: 1: 24,000

SITE LOCATION PLAN

BROWARD COUNTY
RESOURCE RECOVERY
ROUTE 441 SITE



BROWARD COUNTY
SOUTHERN RESOURCE RECOVERY FACILITY
STORMWATER OUTFALL

ATTACHMENT B

COASTAL ZONE MANAGEMENT CERTIFICATIONS

ATTACHMENT B
COASTAL ZONE MANAGEMENT CERTIFICATIONS

As part of Florida's Coastal Management Program federal consistency procedures (15 CFR 930.50) all federal permits for which there are no corresponding state permits require certification of compliance with the State Coastal Management Program. For this project two such federal permits or approvals are necessary. These are the U.S. Department of Transportation, Federal Aviation Administration (FAA) approval for stack construction (FAR Part 77) and the USEPA NPDES permit for stormwater runoff (Section 404 of the Clean Water Act).

The Federal Consistency Evaluation Procedures require these permit applications to be accompanied by a consistency certification attachment which include:

- o A written and pictorial description of the project.
- o An assessment of probable impacts relevant to applicable FCMP statutes.
- o A signed statement by the applicant regarding consistency of the project with FCMP statutes.

In accordance with FCMP consistency evaluation procedures, the certification package and permit application must be sent to the appropriate federal agencies (FAA and Coordinator of the Florida State Planning and Development Clearinghouse, DER. Copies of the permit applications and certifications are included in this appendix.

DESCRIPTION OF THE PROJECT

The Broward County Resource Recovery Project has been selected as the best alternative for meeting Broward County's long-term solid waste disposal needs. This facility will:

- o dispose of garbage and trash in an environmentally sound manner;
- o reduce the need for siting and developing a raw garbage landfill;
- o recover energy by using solid waste as a fuel to produce electricity and;
- o create new opportunities for recreation and wetland habitat enhancement through extensive mitigation.

The proposed southern facility will be located on a 248 acre tract in unincorporated Broward County at the southeast quadrant of the intersection of U.S. Route 441 and State Road 84.

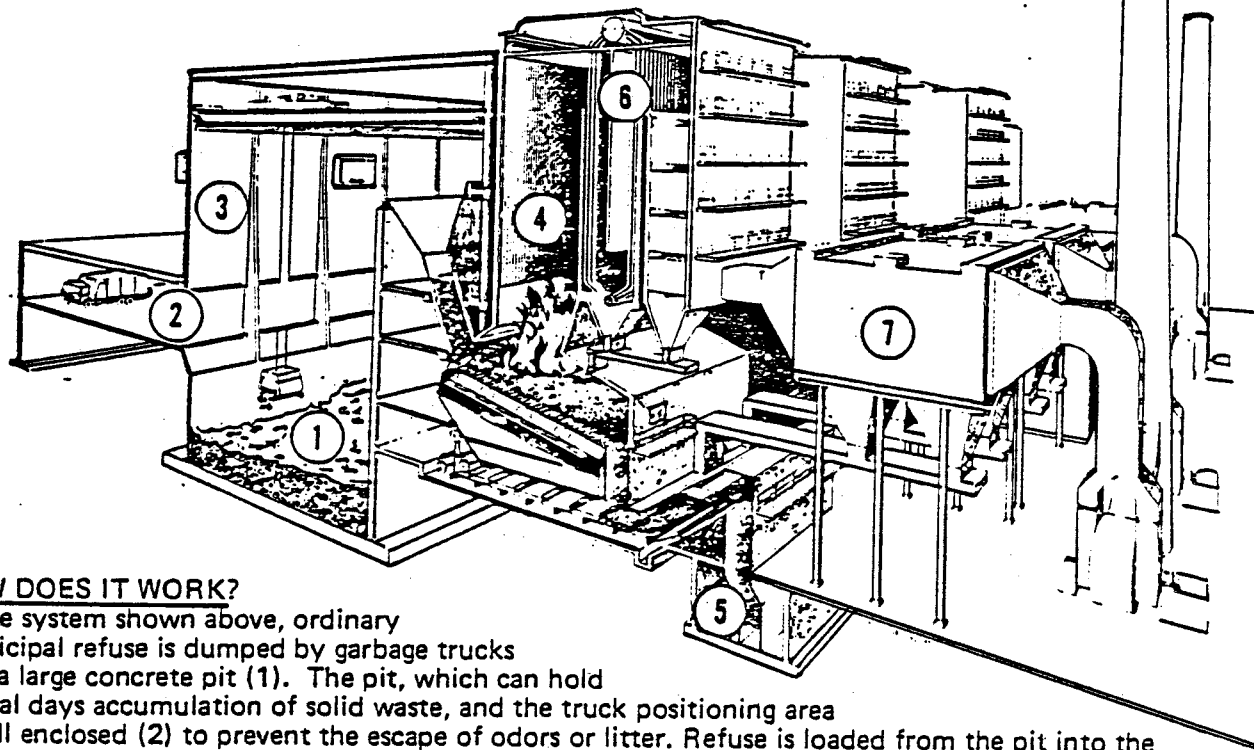
The facility is slated to have an initial installed capacity of 2,352 tons per day and an estimated projected ultimate capacity of approximately 3,300 tons per day. Since the proposed facility will utilize mass-burn technology, there will be no preprocessing of wastes at the facility prior to combustion. A schematic diagram describing the mass burn process of a typical resource recovery facility is presented in Figure 1. Solid waste will be delivered in collection trucks to the facility. It will be dumped directly into a bunker located entirely inside a building. All waste will be stored inside the building, therefore no waste will be visible from the outside. Two overhead cranes will mix the solid waste in the bunker and load the charging hoppers as required.

Waste will enter the furnace via a charging hopper and will progress through the combustion chamber by means of a stoker system that agitates the waste providing the proper air/fuel mixture to complete the combustion process. The

Questions & Answers

Broward County RESOURCE RECOVERY PROGRAM

WHAT IS RESOURCE RECOVERY? It is a solid waste disposal method producing inert residue while recovering useful energy and/or materials. The resource recovery process chosen by Broward County is called mass-fired waterwall incineration.



HOW DOES IT WORK?

In the system shown above, ordinary municipal refuse is dumped by garbage trucks into a large concrete pit (1). The pit, which can hold several days accumulation of solid waste, and the truck positioning area are all enclosed (2) to prevent the escape of odors or litter. Refuse is loaded from the pit into the furnace by a large overhead bridge crane (3). Oversized or unprocessable items (engine blocks, tree stumps, concrete rubble, etc.) which accidentally get into the pit can be removed at this point and either sent directly to the landfill, or put through a shredder for size reduction prior to being sent to landfill or sold.

In the furnace (4) the refuse is burned at high temperature and under controlled conditions of air and turbulence. The result is essentially complete destruction of organic material, (paper, plastic, wood, food wastes, etc.) leaving an ash residue (5) which contains the unburnable fraction (glass, metal, ceramics, etc.). This residue has a volume of five to ten percent of the original solid waste, thus lengthening the projected landfill lifetime by a factor of ten to twenty.

Hot gases from the combustion process pass up through the boiler portion (6) of the furnace where the heat is transferred to water-filled steel tubes. This heat is used to generate steam and ultimately electricity.

After passing through the boiler the hot gases pass through electrostatic precipitators (7) which act as giant filters removing the dust particles from the gas stream. The clean gases are then discharged at the stack.

HAS THIS METHOD OF RESOURCE RECOVERY BEEN SUCCESSFUL ELSEWHERE?

Yes. There are over 400 plants of this type in successful operation worldwide, some for as long as 30 years. There are about a dozen in the U. S., including Pinellas County, Florida; Saugus, Mass.; Hampton, Va.; Chicago, Ill.; Harrisburg, Pa.; and others. Several more are under construction.

WHAT ARE THE MAJOR ELEMENTS OF THE RESOURCE RECOVERY PROGRAM?

Broward County's resource recovery program consists of two major facilities. Serving the northern part of the County, a site north of Copans Road and west of Powerline Road will be developed to include a 1000 ton per day (tpd) resource recovery facility, and an 80 acre landfill for ash residue and unprocessable waste. A second facility, 1600 tpd in capacity, will serve the southern part of the County from a site at the intersection of SR 84 and Route 441. The southern facility will also include a landfill for ash residue and unprocessable wastes.

HOW WERE THESE SITES CHOSEN?

Broward County has been working on its resource recovery program for several years, and in that time more than 20 sites have been evaluated, for use as landfills, resource recovery facilities, or both. The site selection process included numerous reports, public meetings, and consultation with Federal, State, and local environmental officials. As a result of this process these two sites were chosen for the following reasons:

- (1) Adequate area is available to develop both the resource recovery facility and residue landfill at each site.
- (2) Each site is centrally located within the area of the County it is to serve, thus minimizing haul costs and traffic.
- (3) Each site is situated so that buffer areas and screening are available between the facilities and residential areas.
- (4) Each site is located and sized so that environmental impact will be manageable, and permits obtainable.

DO RESOURCE RECOVERY FACILITIES CAUSE ADVERSE HEALTH EFFECTS?

No. These facilities are tightly regulated by Federal, State, and local government and will be required to use the latest in state-of-the-art air pollution and other control equipment. Facilities of this type have been in successful operation around the world for over 30 years, many in densely populated urban areas, and no adverse health effects have been found.

WHAT IMPACT WILL THE RESOURCE RECOVERY PLANTS HAVE ON THE ENVIRONMENT?

Resource recovery facilities of the scale required in Broward County are major installations, and cannot be built and operated without some impact. Nevertheless, through proper siting, design, and operation, adverse environmental impacts can and will be reduced to negligible levels. Key issues are:

Air quality — The facilities will be equipped with the latest state-of-the-art air pollution control equipment. No visible smoke will be emitted from either facility, and high furnace temperatures will destroy all organic materials thereby preventing emission of odors.

Aesthetics — Each modern facility will be enclosed so that all garbage processing will take place indoors. This will prevent the attraction of scavenging animals (rodents, seagulls), and the escape of blowing refuse. Combustion air for the furnaces will be drawn from the tipping area, thereby preventing the escape of odors.

Traffic — Each resource recovery facility has been sited near major arterial routes to minimize local traffic impact. Analyses, using the County's TRIPS computer model, has demonstrated negligible traffic increases caused by the resource recovery facilities.

Ground Water — By replacing raw garbage landfills, the resource recovery program will, in fact, protect ground water in Broward County. The landfills which accompany each resource recovery facility will be for ash residue and unprocessable waste (construction debris and the like) only, and will include an impermeable liner and leachate collection system.

WHO IS GOING TO OWN AND OPERATE THESE FACILITIES?

These facilities will be leased from Broward County and operated by a private vendor. An extensive review of potential bidders is currently underway. The projects will be financed by thirty year bonds. Use of a private vendor will result in lower disposal charges thru available tax benefits.

For further information contact the Broward County Resource Recovery Office at 765-5844.

resulting ash will be deposited and quenched, and the heat from the furnace will be transferred through waterfilled steel tubes lining the furnace to produce steam. The steam will then be transmitted to turbine generators to produce electricity for sale to Florida Power and Light, Inc.

Each boiler will be equipped with an electrostatic precipitator (ESP) for particulate air emission control. An electrostatic precipitator is a pollution control device that removes small particles from exhaust gases. The gases pass through a strong electric field where the particles are charged and attracted to the opposite electrically charged collecting plates. The dust is then removed mechanically from these plates. The flue gas will be drawn through the ESPs by an induced draft fan located between the stack and the ESPs.

Bottom ash from the furnace and flyash from the precipitator will be mixed prior to removal from the facility. The combined ash will comprise 10 percent of the volume and 25 percent of the weight of the solid waste processed by the facility. The ash will be quenched with water to about 30 percent moisture prior to transport to the unprocessable waste landfill.

As noted above, while the proposed facility will have ultimate design capacity of approximately 3,300 tpd, its maximum initial installed capacity will be 2,352 tpd. Each boiler unit operates independently from the others. It will, therefore, be possible to routinely shut down units for periods of maintenance and inspection and still continuously operate the facility.

Assessment of Probable Project Impacts

As part of the Federal Consistency Evaluation Procedures, an assessment of the probable impacts of the project on the coastal zone were determined in relation to the Florida Coastal Management Program statutes.

Chapter 403, Environmental Control

The air and water pollution concerns will be addressed by obtaining the appropriate facility permits and using pollution control measures to abate impacts from facility construction and operations. Facility boilers will be equipped with electrostatic precipitators for particulate air emission control. Air construction and operating permits will be obtained through the Power Plant Siting Act process in accordance with requirements established in the Prevention of Significant Air Quality Deterioration (PSD) regulations and the regulation governing New Sources.

Stormwater retention basins will be used to collect runoff waters from the site. This discharge will comply with all DER requirements for protection of surface and groundwater.

Chapter 267, Archives, History and Records Management

The State of Florida Division of Archives, History and Records Management, has stated that there are no known or potential historical or archaeological resources at the site. Therefore, no significant cultural resources would be affected by the project.

Chapter 373 (Water Resources)

The South Florida Water Management District will review the project for water resources impacts. No consumptive use of water is anticipated therefore permits for such use do not apply. Monitoring wells will be installed to provide an early warning system of groundwater contamination and stormwater management practices will be employed to mitigate water resources impacts from runoff.

Power Plant Siting Act (PPSA)

An application is being filed with FDER under the power plant siting act. This application will present information discussing the conditions resulting from construction, and the anticipated impacts from facility operation in order to provide assurance that all applicable state, regional and local standards are met and that the project will be consistent with the FCMP.

Consistency Determination

The proposed project complies with Florida's Coastal Management Program and will be conducted in a manner consistent with that program.



Thomas M. Henderson
Project Director

HAZARDOUS WASTE DISPOSAL/PERMIT

APPENDIX 10.1.3

APPENDIX 10.1.3

HAZARDOUS WASTE DISPOSAL APPLICATIONS/PERMIT

There are no hazardous waste disposal applications/permits pursuant to the Resource Recovery and Conservation Act that are applicable to this project. No hazardous waste will be accepted, stored, or disposed of at the facility.

SECTION 10 AND 404 APPLICATION/PERMIT

APPENDIX 10.1.4

SECTION 10 AND 404 APPLICATIONS/PERMIT

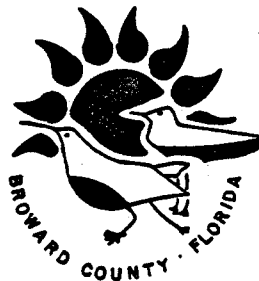
**FLORIDA DEPARTMENT OF ENVIRONMENTAL
REGULATION**

U.S. DEPARTMENT OF THE ARMY

**JOINT APPLICATION FOR ACTIVITIES IN
THE WATERS OF THE
STATE OF FLORIDA**

SOUTHERN RESOURCE RECOVERY FACILITY

BROWARD COUNTY, FLORIDA



NOVEMBER, 1983

**HAZEN AND SAWYER, P.C.
CZR, INCORPORATED
MALCOLM PIRNIE, INC.**

DREDGE AND FILL PERMIT APPLICATION

SOUTHERN RESOURCE RECOVERY FACILITY

BROWARD COUNTY, FLORIDA

NOVEMBER 1983

Hazen and Sawyer, P.C.
CZR, Incorporated
Malcolm Pirnie, Inc.

HAZEN AND SAWYER, P.C.

ENGINEERS



5950 WASHINGTON STREET • HOLLYWOOD, FLORIDA 33023 • (305) 987-0066
(305) 625-4101

November 4, 1983

Mr. Jeremy Craft
State of Florida
Department of Environmental Regulation
Twin Towers Building
2600 Blair Stone Road
Tallahassee, FL 32301

Dredge and Fill Permit Application for Southern Broward Resource
Recovery Facility, Broward County, Florida

Dear Mr. Craft:

On behalf of Broward County, we are submitting an application for activities in the waters of the State of Florida. The application is being made for dredge and fill of wetlands at the Southern Resource Recovery Facility located on US 441 in Broward County. The wetlands have been declared to be within the Department of Environmental Regulation (DER) and U.S. Army Corps of Engineers jurisdiction.

The resource recovery facility is part of Broward County's solid waste management plan. The facility will provide the necessary municipal solid waste management for the southern part of the County until year 2007. The facility will service the public in providing Broward County with an effective, reliable, and environmentally sound municipal solid waste management system.

Numerous sites through the county were evaluated during a lengthy site selection study. On the basis of location, cost, size, sociological impacts, environmental sensitivity, zoning/land use compatibility, transportation, and jurisdictional control, the US 441 site was selected as the best over-all location for the Southern Resource Recovery Facility. The site is located near the solid waste centroid for the southern part of the county, has adequate space for the facility and ancillary development, and is adjacent to an FP & L generating plant which is important for routing of electricity generated by the facility. The site location provides sufficient buffer space from residential areas.

The site contains 15.6 acres of wetlands based upon a U.S. Army Corps of Engineers evaluation. The hydrologic regime has been disturbed by previous development and drainage. Part of the site is currently being used as a marine construction yard and office for Powell Brothers, Incorporated.

Mr. Jeremy Craft

-2-

November 4, 1983

The remainder of the site is a wet pasture. Mitigation to compensate for wetlands lost during construction will be accomplished on-site. This mitigation (14.98 acres) will consist of clearing discarded construction materials, creating shallow open water, marsh, and swamp habitat, and planting of upland and wetland species in appropriate areas. The mitigation plan effectively provides equivalent compensation for wetlands lost to construction.

We are most anxious to proceed on this project since the County's existing landfill capacity is very limited and construction of the resource recovery facility requires a long lead time prior to operation. If you have any questions or need additional information, please contact our office.

Very truly yours,

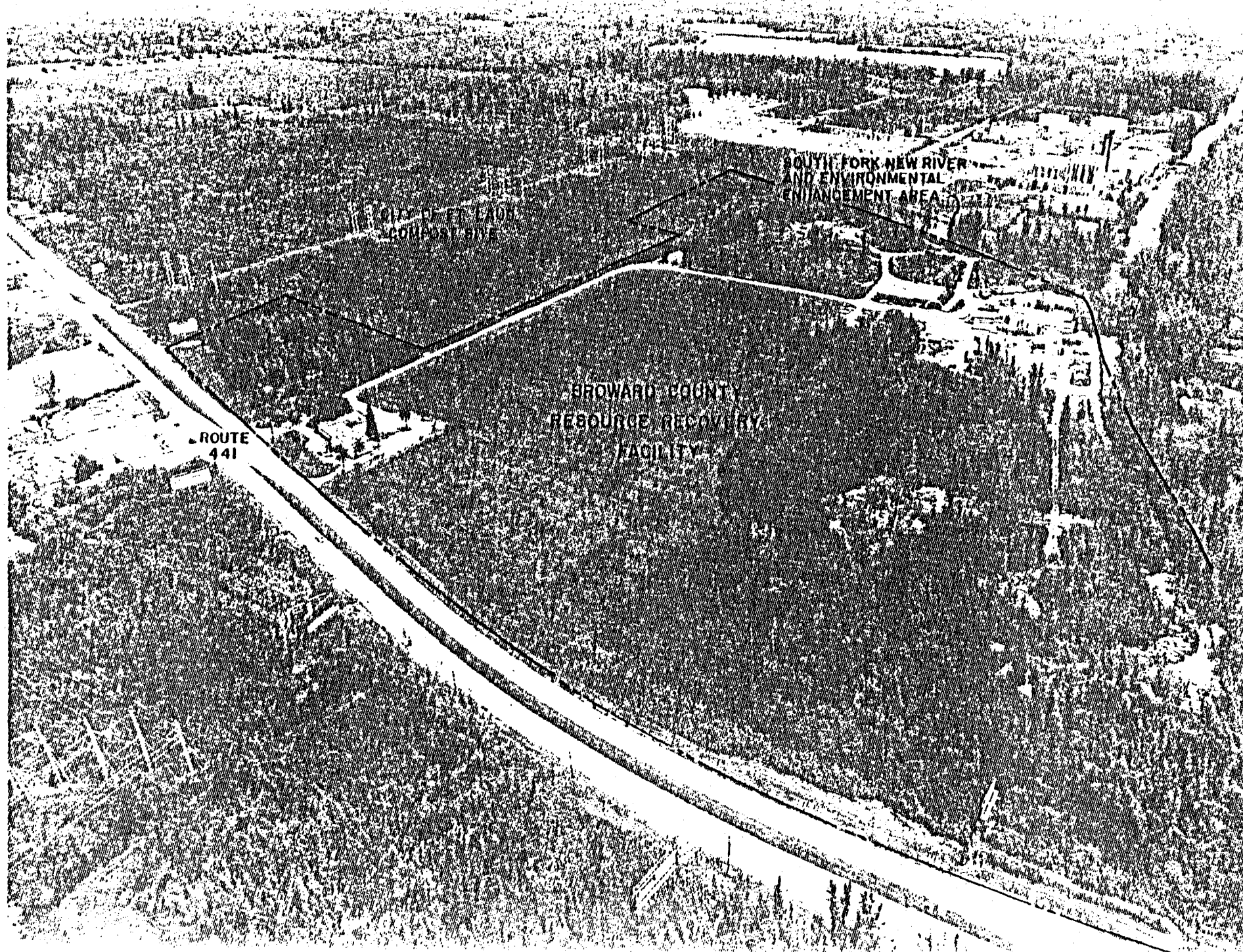
HAZEN AND SAWYER, P.C.

Peter E. Robinson, P.E.
Vice President

PER/md

Enclosure

cc: P.A. Korab
J. Hudgens
S. C. Schwarz

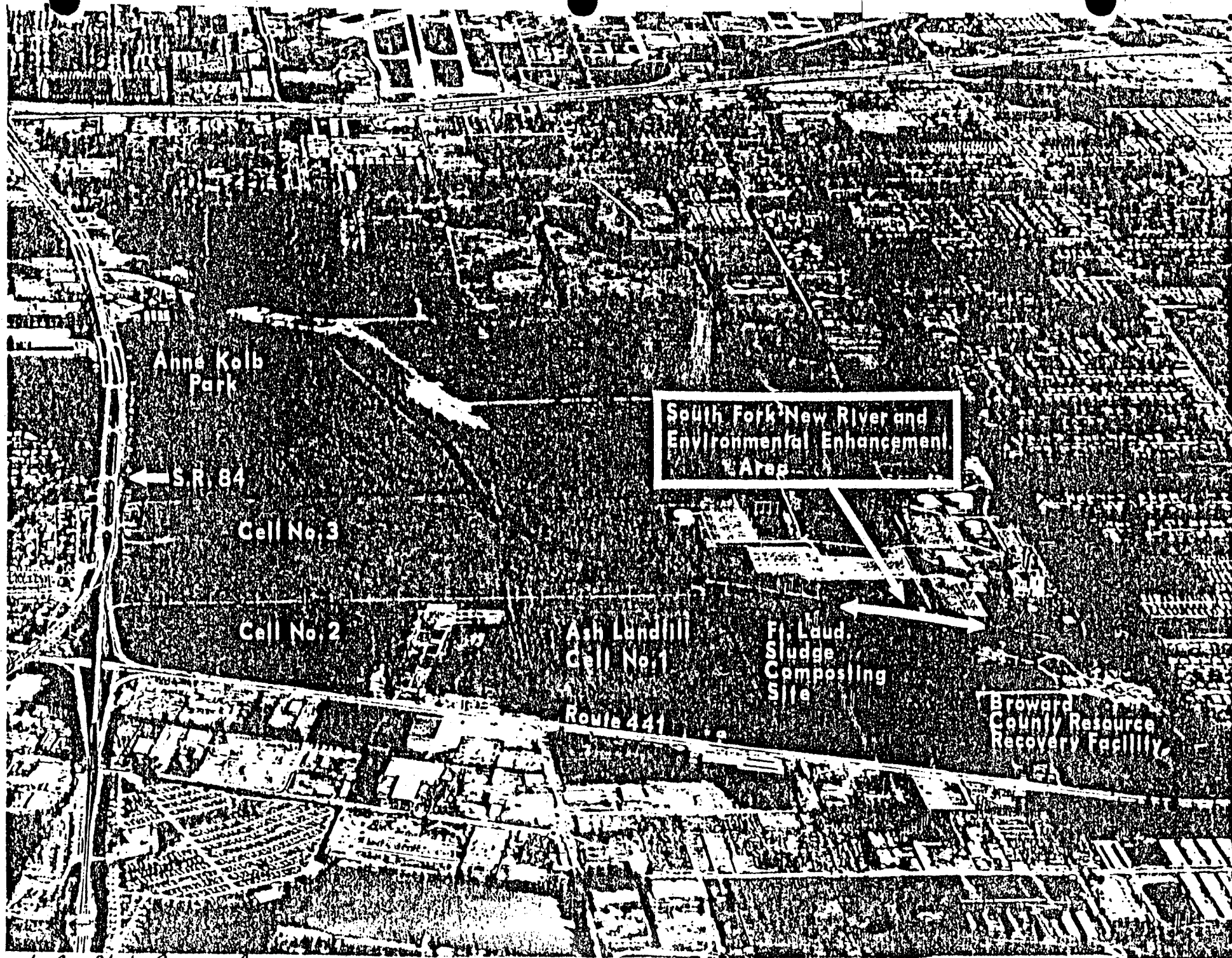


CITY OF MIAMI
COMPOST SITE

SOUTH FORK NEW RIVER
AND ENVIRONMENTAL
ENHANCEMENT AREA

BROWARD COUNTY
RESOURCE RECOVERY
FACILITY

ROUTE
441



PERSONS TO CONTACT

Peter E. Robinson, P.E.
Vice President
Hazen and Sawyer, P.C.
5950 Washington Street
Suite 301
Hollywood, Florida 33023

(305) 987-0066

James M. Hudgens
President
CZR, Incorporated
1001 U.S. Highway 1
Suite 305
Jupiter, Florida 33458

(305) 747-7455

(305) 987-0066

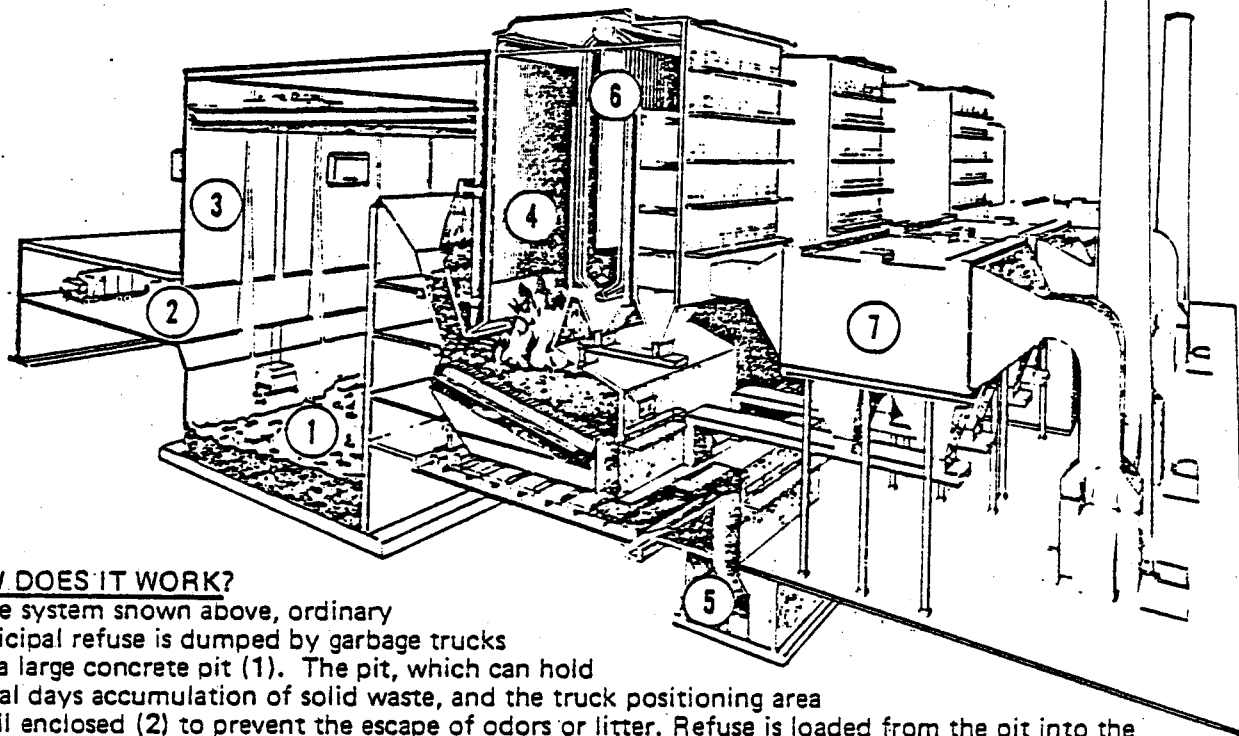
Phyllis Korab
Project Director
Resource Recovery Office
Board of County Commissioners
Room 526
236 S.E. First Avenue
Fort Lauderdale, Florida 33301

(305) 765-5844

Questions & Answers

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TABLE OF CONTENTS

Cover Letter

Aerial Photograph-Resource Recovery Site

Aerial Photograph-Resource Recovery Site and Adjacent Property

Persons to Contact

Questions and Answers, Broward County Resource Recovery Program

Table of Contents

Joint Application - Department of the Army/Florida Department of
Environmental Regulation - for Activities in
the Waters of the State of Florida

Application Figure 1	Vicinity Map
Application Figure 2	Site Plan
Application Figure 3	Cut and Fill Areas
Application Figure 4	Cut Section
Application Figure 5	Fill Section
Application Figure 6	Stormwater Outfall Detail

DESCRIPTION OF PROPOSED ACTIVITY

I. Introduction

- A. Proposed Use
- B. Need

II. Proposed Project

- A. Facilities and Process Description
- B. Cut and Fill

III. Site Selection

- A. Background
- B. Site Evaluation and Selection
- C. Recommendation

TABLE OF CONTENTS

-2-

IV. Environmental Assessment

- A. Disposal Methodology
- B. Zoning and Land Use
- C. Biological Concerns
- D. Siltation and Sedimentation
- E. Traffic
- F. Fort Lauderdale-Hollywood International Airport
- G. Air Quality
- H. Odor
- I. Noise
- J. Soils
- K. Dust
- L. Water Resources
- M. Archaeological Resources
- N. Regulatory Aspects

V. Mitigation

List of Figures and Plates

List of Attachments

LIST OF FIGURES AND PLATES

Figure	1	Vicinity Map
	2	Site Plan
	3	Schematic of Resource Recovery Facility
	4	Section View Through a Typical Resource Recovery Facility
	5	Stormwater Outfall Detail
	6	Typical Injection Well Profile
	7	Plan View Cut and Fill Areas
	8	Cut Section
	9	Fill Section
	10	Existing Solid Waste Disposal System
	11	Approximate Location of Solid Waste Centroids
	12	Zoning Map
	13	Existing Land Use and Development Trends
	14	Adjacent Property Owners
	15	National Wetlands Inventory Land Classifications
	16	Vegetation Map
	17	Soil Association Map
	18	100 Year Flood Elevation Map
	19	100 mg/l Isochlor Location Map
	20	Typical Section-Mitigation Area
	21	Typical Vegetative Profile
	22	Planting Densities

Plate	1A	Sketch of Description
	1B	Topographic Map
	1C	South New River Canal Cross Sections
	2	Storm Water and Leachate Flow Diagram
	3	Preliminary Topography
	4	Resource Recovery Facility Mitigation
	5	Residue/Unprocessible Waste Landfill Tree Survey

LIST OF ATTACHMENTS

- | | |
|--------------|--------------------------------------|
| Attachment 1 | Designation of Authorized Agent |
| 2 | Adjacent Property Owners |
| 3 | Method of Property Acquisition |
| 4 | Legal Description of Property |
| 5 | Correspondence with Federal Aviation |
| 6 | Corps of Engineers Jurisdiction |
| 7 | Vegetation Species List |
| 8 | Letter of Archaeological Clearance |

JOINT APPLICATION
DEPARTMENT OF THE ARMY/FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION
For Activities in the Waters of the State of Florida

CORPS APPLICATION NUMBER (official use only)

DER APPLICATION NUMBER (official use only)

1. APPLICANT'S NAME AND ADDRESS

B R O W A R D C O U N T Y , P H Y L L I S K O R A B
NAME

2 3 6 S . E . F I R S T A V E N U E R M . 5 2 6
STREET

F O R T L A U D E R D A L E F L 3 3 3 0 1
CITY STATE ZIP

TELEPHONE NUMBER (Day) 305 765-5844 (Night) ()

2. Name, address, zip code and title of applicant's authorized agent for permit application coordination

HAZEN AND SAWYER, P.C.
5950 Washington Street
Hollywood, Florida 33023

Peter E. Robinson, P.E.
Vice President

(See Attachment 1, Designation of
Authorized Agent)

Telephone Number 305 987-0066

3. NAME OF WATERWAY AT LOCATION OF THE ACTIVITY.

SOUTH FORK NEW RIVER CANAL

DER Code. _____
W/W Code _____

4. LOCATION WHERE PROPOSED ACTIVITY EXISTS OR WILL OCCUR.

Intersection of U.S. 441 (S.R. 7) and South Fork
New River Canal

Street, road or other descriptive location
Unincorporated

Incorporated city or town

Broward

County

25 50S 41E
Section Township Range
26° 04' 30" 80° 12' 0"

Latitude Longitude

Tax Assessors Description: (if known)

Map No. Subdiv. No. Lot No.

5. NAME AND ADDRESS INCLUDING ZIP CODE OF ADJOINING PROPERTY OWNERS WHOSE PROPERTY ALSO ADJOINS THE WATERWAY.

(See Attachment 2)

6. PROPOSED USE

Private Single Dwelling []
Commercial []

Private Multi-dwelling []
Other [] (Explain in remarks)

Public [X]

7. DESCRIPTION OF PROJECT (Use additional sheets, if necessary)

A. Structures: 1. New work ☒ Maintenance of existing structure ☐

2. Piers, docks and use: Commercial ☐ Private ☐ Public ☐

a. Single pier ☐ length _____ width _____

b. Number of piers ☐ length _____ width _____

c. Number of boat slips ☐ length _____ width _____

d. Number of finger piers ☐ length _____ width _____

e. Other (please describe) _____

3. Seawalls, revetments, bulkheads: length _____

a. Type: Vertical ☐ Riprap ☐ Slope: _____ Horizontal: _____ Vertical

b. Material to be used _____

4. Other type of structure Southern Resource Recovery Facility

B. Excavation or Dredging: New Work ☒ Maintenance work ☐ Total acreage involved _____

1. Access Channel ☐ or Canal ☐ Length _____ ft. Width _____ ft. Depth _____ ft.

2. Boat Basin ☐ or Boat Slip ☐ Length _____ ft. Width _____ ft. Depth _____ ft.

Southern Resource Recovery Facility See Attached Drawings

3. Other _____ Length _____ ft. Width _____ ft. Depth _____ ft.

4. Cubic yards: Total For project 260,000

a. _____ cyd. waterward/_____ cyd. landward of ordinary/mean high water

b. Type of material to be excavated/dredged silty, fibrous peat and quartz, sandy limestone

C. Fill:

1. Amount of material

a. Cubic yards placed waterward of ordinary/mean high water -0-

b. Cubic yards placed landward of ordinary/mean high water 260,000

c. Total acreage to be filled 18.4 Total acreage of wetlands involved 15.6

2. Containment for fill

a. Dikes ☐ b. Seawall, etc. ☐ c. Other (please explain) _____

See Attached Drawings

3. Type of fill material to be used Limestone and sand

4. Source of fill material to be used Onsite dredging and offsite sources

CDE
Work Code

DER
Code
253
403

8. Date activity is proposed to commence October 1984 ; to be completed January 1988

9. Previous permits for this project have been NONE DER # _____ Corps # _____

A. Denied (date) _____

B. Issued (date) _____

C. Other (please explain) _____

Differentiate between existing work and proposed work on the drawings.

10. Remarks (See Instruction Pamphlet for additional information required for all applications and certain activities. Use additional sheets if necessary.)

See attached report for discussion of project.

11. AFFIDAVIT OF OWNERSHIP OR CONTROL of the property on which the proposed project is to be undertaken

I CERTIFY THAT: (please check appropriate space)

[] I am the record owner, lessee, or record easement holder of the property described below.

[XX] I am not the record owner, lessee, or record easement holder of the property described below, but I will have before undertaking the proposed work the requisite property interest. (Please explain what the interest will be and how it will be acquired.) (See Attachment 3)

LEGAL DESCRIPTION OF PROPERTY SITUATED IN BROWARD COUNTY, FLORIDA
(Use additional sheets if necessary)

(See Attachment 4)

Peter E. Robinson, P.E. (Agent)

Signature

Sworn and subscribed before me at _____ County,
_____, this _____ day of _____, 19__.

NOTARY PUBLIC

My commission expires:

2. Application is made for a permit(s) to authorize the activities described herein.

- A. I authorize the agent listed in Item #2 to negotiate modifications or revisions, when necessary, and accept or assent to any stipulations on my behalf.
- B. I understand I may have to provide any additional information/data that may be necessary to provide reasonable assurance or evidence to show that the proposed project will comply with the applicable State Water Quality Standards or other environmental standards both before construction and after the project is completed.
- C. In addition, I agree to provide entry to the project site for inspectors with proper identification or documents as required by law from the environmental agencies for the purpose of making preliminary analyses of the site. Further, I agree to provide entry to the project site for such inspectors to monitor permitted work if a permit is granted.
- D. Further, I hereby acknowledge the obligation and responsibility for obtaining all of the required state, federal or local permits before commencement of construction activities. I also understand that before commencement of this proposed project I must be granted separate permits or authorizations from the U.S. Corps of Engineers, the U.S. Coast Guard, the Department of Environmental Regulation, and the Department of Natural Resources, as necessary.

I CERTIFY that I am familiar with the information contained in this application, and that to the best of my knowledge and belief such information is true, complete and accurate. I further certify that I possess the authority to undertake the proposed activities.

Peter E. Robinson, P.E., Agent

Signature of Applicant

Date

NOTE: THIS APPLICATION MUST BE SIGNED by the person who desires to undertake the proposed activity or by an authorized agent. If an agent is applying on behalf of the applicant, attach proof of authority for the agent to sign and bind the applicant.

18 U.S.C. Section 1001 provides that: Whoever in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up by any trick, scheme, or device a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than \$10,000 or imprisoned not more than five years, or both.

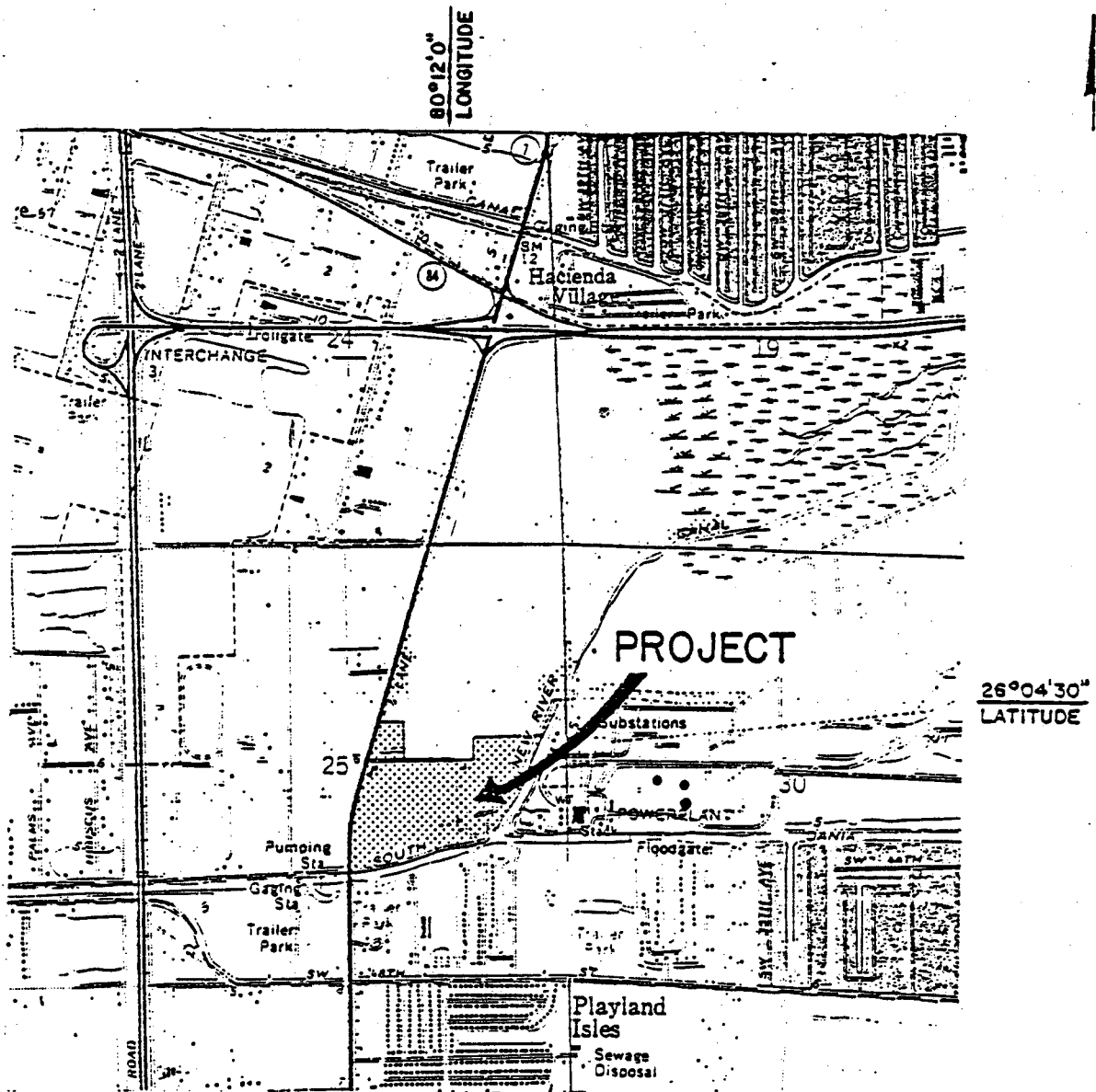
NOTICE TO PERMIT APPLICANTS

This is a Joint Application; it is NOT a Joint Permit!

You Must Obtain All Required Local, State, and Federal

Authorizations or Permits Before Commencing Work!!

For your information: Section 370.034, Florida Statutes, requires that all dredge and fill equipment owned, used, leased, rented or operated in the state shall be registered with the Department of Natural Resources. Before selecting your contractor or equipment you may wish to determine if this requirement has been met. For further information, contact the Chief of the Bureau of Licenses and Motorboat Registration, Department of Natural Resources, 3900 Commonwealth Boulevard, Tallahassee, Florida 32303. Telephone Number 904/488-1195. THIS IS NOT A REQUIREMENT FOR A PERMIT FROM THE DEPARTMENT OF ENVIRONMENTAL REGULATION.



PURPOSE: BROWARD COUNTY RESOURCE RECOVERY FACILITY
 DATUM: NGVD

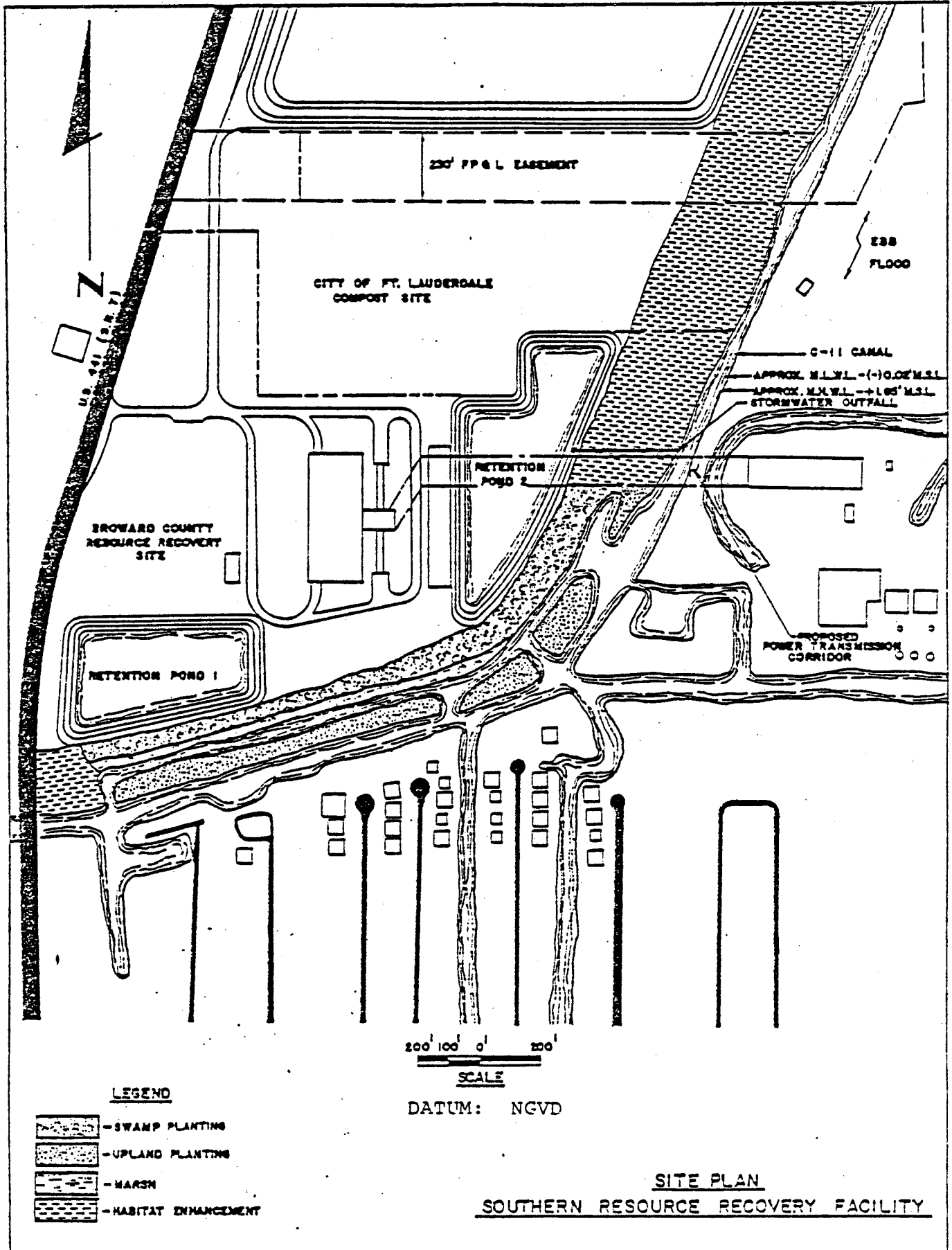
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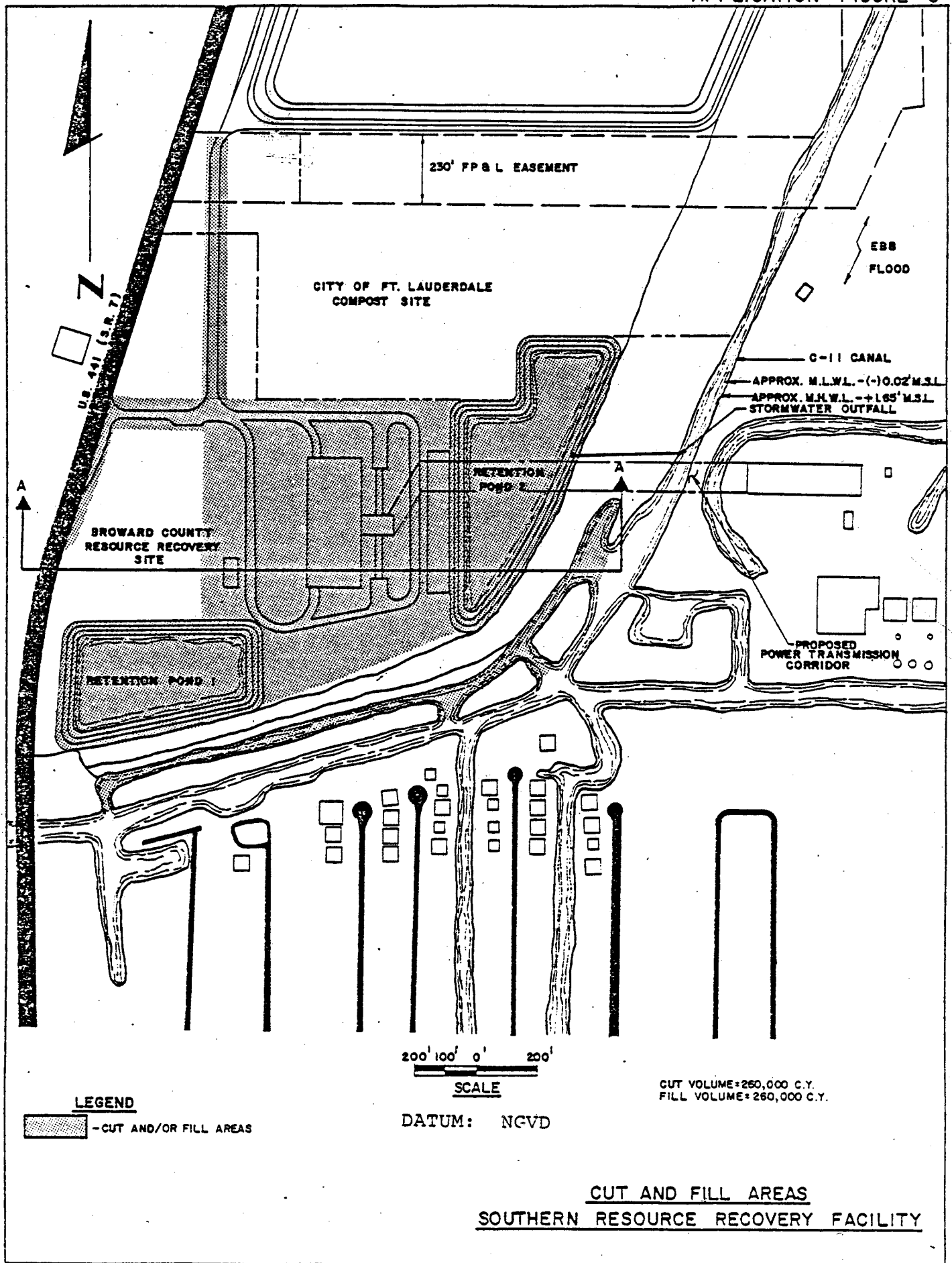
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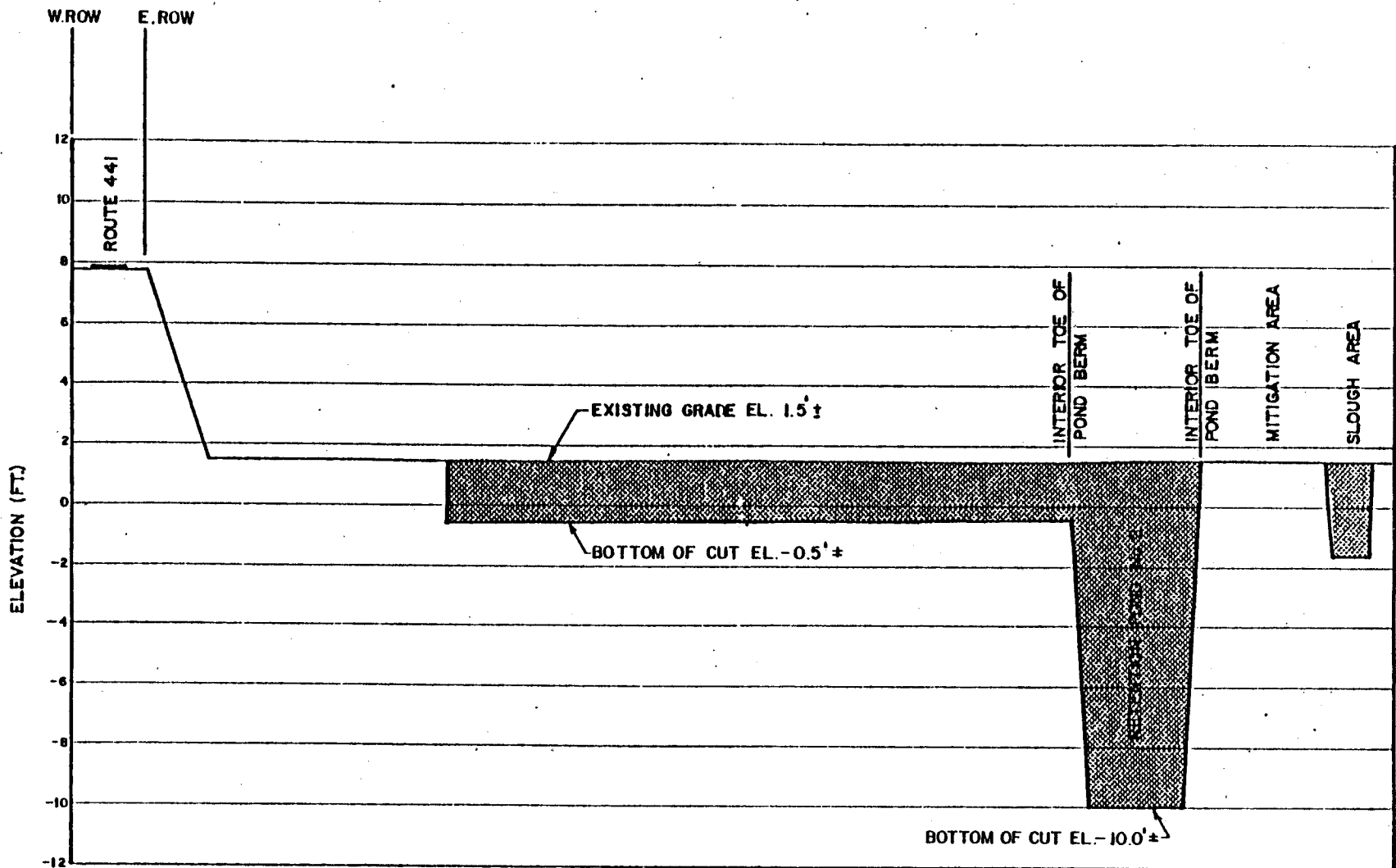
VICINITY MAP

IN AREA ADJACENT TO SOUTH FORK
 OF THE NEW RIVER

COUNTY OF BROWARD
 STATE OF FLORIDA
 APPLICATION BY BROWARD COUNTY







AREAS TO BE CUT

DATUM: NGVD

0' 200' 400'

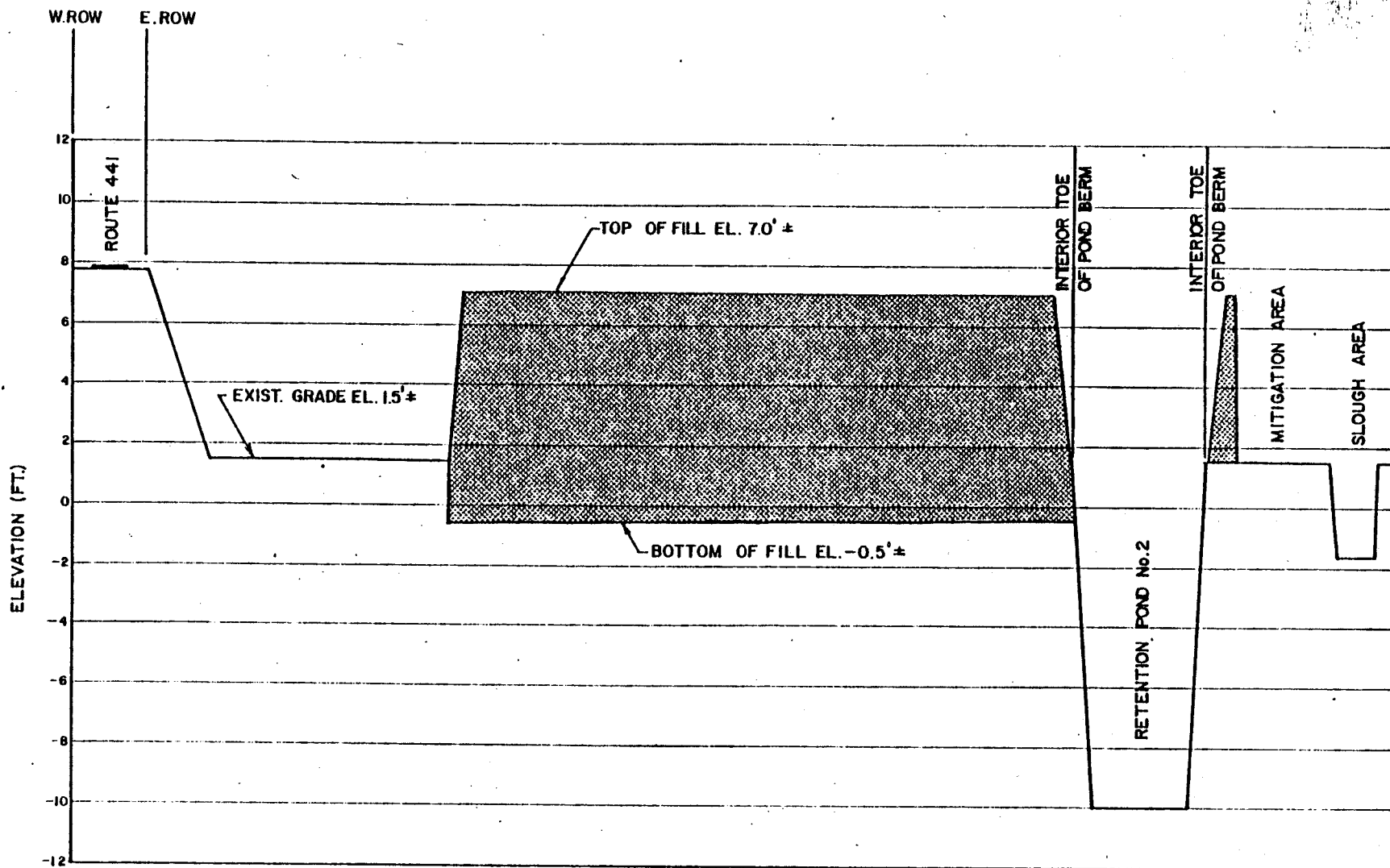
HORIZ. : 1" = 200'

0' 5' 10'

VERT. : 1" = 5'

CUT SECTION A-A

SOUTHERN RESOURCE RECOVERY FACILITY



- AREAS TO BE FILLED

DATUM: NGVD

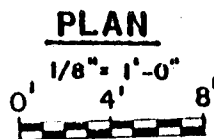
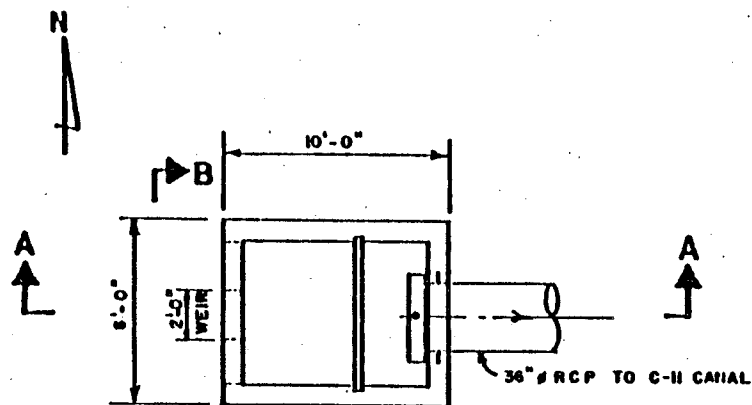
0' 200' 400'

HORIZ. : 1" = 200'

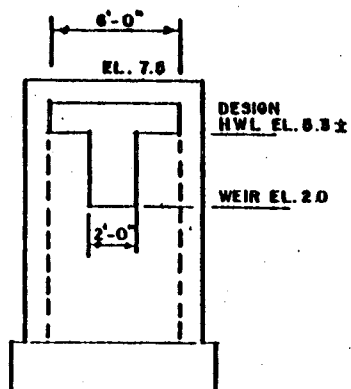
0' 5' 10'

VERT. : 1" = 5'

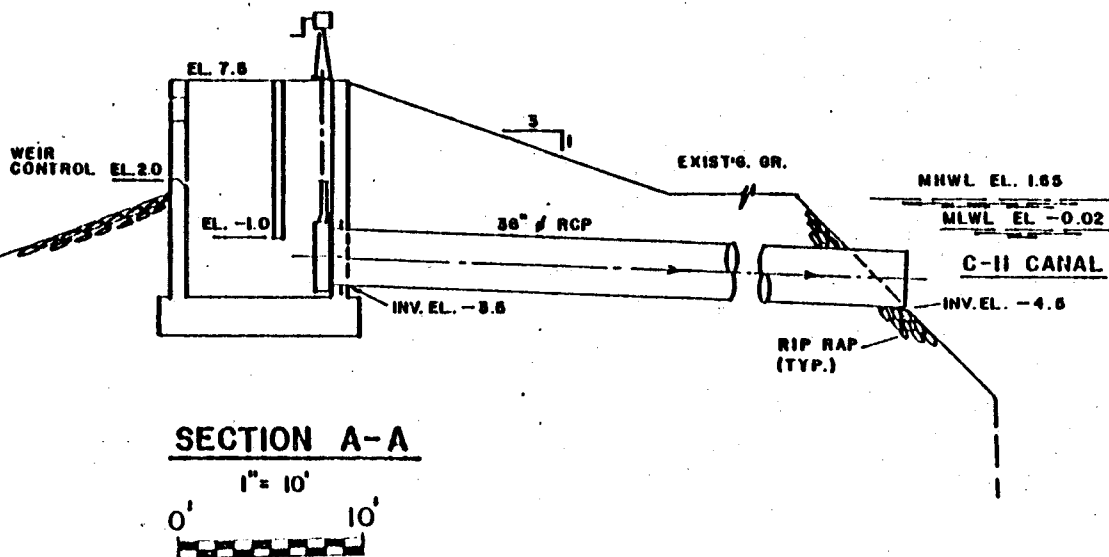
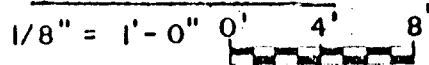
FILL SECTION A-A
SOUTHERN RESOURCE RECOVERY FACILITY



POND No. 2



FRONT VIEW B-B



NOTE

- SEE FIG. 1 FOR LOCATION OF STRUCTURE
- DATUM = NGVD

SOUTHERN RESOURCE RECOVERY FACILITY
STORMWATER OUTFALL DETAIL

DESCRIPTION OF PROPOSED ACTIVITY

SOUTHERN RESOURCE RECOVERY FACILITY
BROWARD COUNTY, FLORIDA

SUPPLEMENT TO DER FORM 17-1.203(1)

QUESTION 10

RESOURCE RECOVERY FACILITY

I. INTRODUCTION

This report is submitted as supportive documentation for a dredge and fill application in accordance with guidelines described in State of Florida Joint Permit Application .Dredge.Fill.Structures (1982). The U. S. Army Corps of Engineers (CE) and Florida Department of Environmental Regulation have reviewed the Southern Resource Recovery Facility site, and both agencies have determined that the site is within their individual jurisdiction. This document provides the necessary supportive material to describe the project, site selection, and assess impacts. Because the resource recovery facility and landfill are divided by the Broward County Central Wastewater Region compost facility, separate dredge and fill permit applications are being submitted for the resource recovery facility and the landfill.

A. Proposed Use

On October 12, 1982, Broward County authorized the preparation of a Request of Proposals (RFP) for long-term full service solid waste disposal including the design, construction, start-up, and operation of two complete resource recovery facilities (RRF). One facility will be located in the northern part of the County and one in the southern part of the County, and each will be accompanied by a residue/unprocessible waste disposal landfill. Based upon the need for specialized engineering expertise and sensitive issues associated with the project, Broward County selected the consulting team of Malcolm Pirnie, Inc., Hazen and Sawyer, P.C. and CZR, Incorporated to assist in developing the resource recovery project. The development of the RFP represents commitment to a solid waste management plan that will eliminate the use of sanitary landfills as the primary disposal method and will provide a unified approach for siting complete solid waste disposal facilities.

The technology to be utilized at the RRF will be mass burning incineration. Mass burning incineration of unprocessed municipal solid waste (MSW), combined with heat recovery, is currently the most developed and widely practiced resource recovery technique in the world.

Energy recovery, reduction of original waste volume and quality of ash residue are among the major assets of this technology. There are numerous mass burning stoker-fired incineration facilities in the United States, Canada, Europe, and Japan that have successfully demonstrated the suitability of this MSW processing method.

Prior to the County's October 12, 1982 directive, several investigations of potential resource recovery facility and sanitary landfill sites had been conducted. A site evaluation report, which presented an analysis of three potential resource recovery sites and five potential landfill sites, was submitted to Broward County on February 6, 1982. Supplemental investigations of these sites and of seven additional sites were also conducted during 1982. Reports presenting the findings of these supplemental investigations were submitted to Broward County on April 22, 1982, August 10, 1982 and October 6, 1982.

Based upon information contained in these site evaluation studies, the Board of County Commissioners of Broward County identified the Route 441 site as the most appropriate site for the southern RRF.

B. Need

Broward County generates approximately 2400 to 3000 tons per day of MSW. At present, this MSW is disposed of at the Broward County Sanitary Landfill (BCSL) in Davie and at the Central Disposal Company (Waste Management,

Inc.) landfill in Pompano Beach. The BCSL, however, is projected to exhaust its capacity in 1986 if a proposed expansion is constructed. Without the expansion, the landfill will reach capacity before the end of 1983. Once this occurs, there are no long term disposal arrangements for approximately 1200 to 1800 tons per day of MSW generated in southern Broward County.

Recognizing the need for a new long term disposal facility, Broward County proceeded with studies to select a demonstratedly successful and environmentally suitable MSW processing and resource recovery method. Due to the sensitivity of the County's sole source drinking water aquifer (Biscayne), a policy decision was made not to rely on sanitary landfills as the primary disposal solution.

A number of disposal technologies have been evaluated. The processes considered include:

- . Materials Recovery
- . Energy Recovery
 - Mass Burning (Unprepared MSW) Incineration
 - Solid, Gaseous and Liquid Refuse Derived Fuel (RDF) Combustion Systems
- . Codisposal of MSW with Sewage Sludge
- . Composting

The County has pursued development of two full service resource recovery projects. A mass burn system located at the Route 441 site has been determined by the Board of County Commissioners of Broward County to best meet the public need for the southern facility.

II. PROPOSED PROJECT

A. Facilities and Process Description

1. Introduction

The Southern Resource Recovery Facility will have capacity to receive and process approximately 1300 tpd of MSW from Southern Broward County. The RRF will be located immediately south of the Broward County Central Wastewater Region compost facility on US 441 (SR 7) in unincorporated Broward County (Figure 1, Plate 1). The facility will consist of the RRF itself, attendant roads and stormwater retention ponds, and on-site mitigation adjacent to South Fork New River Canal. The site layout for the RRF is presented in Figure 2.

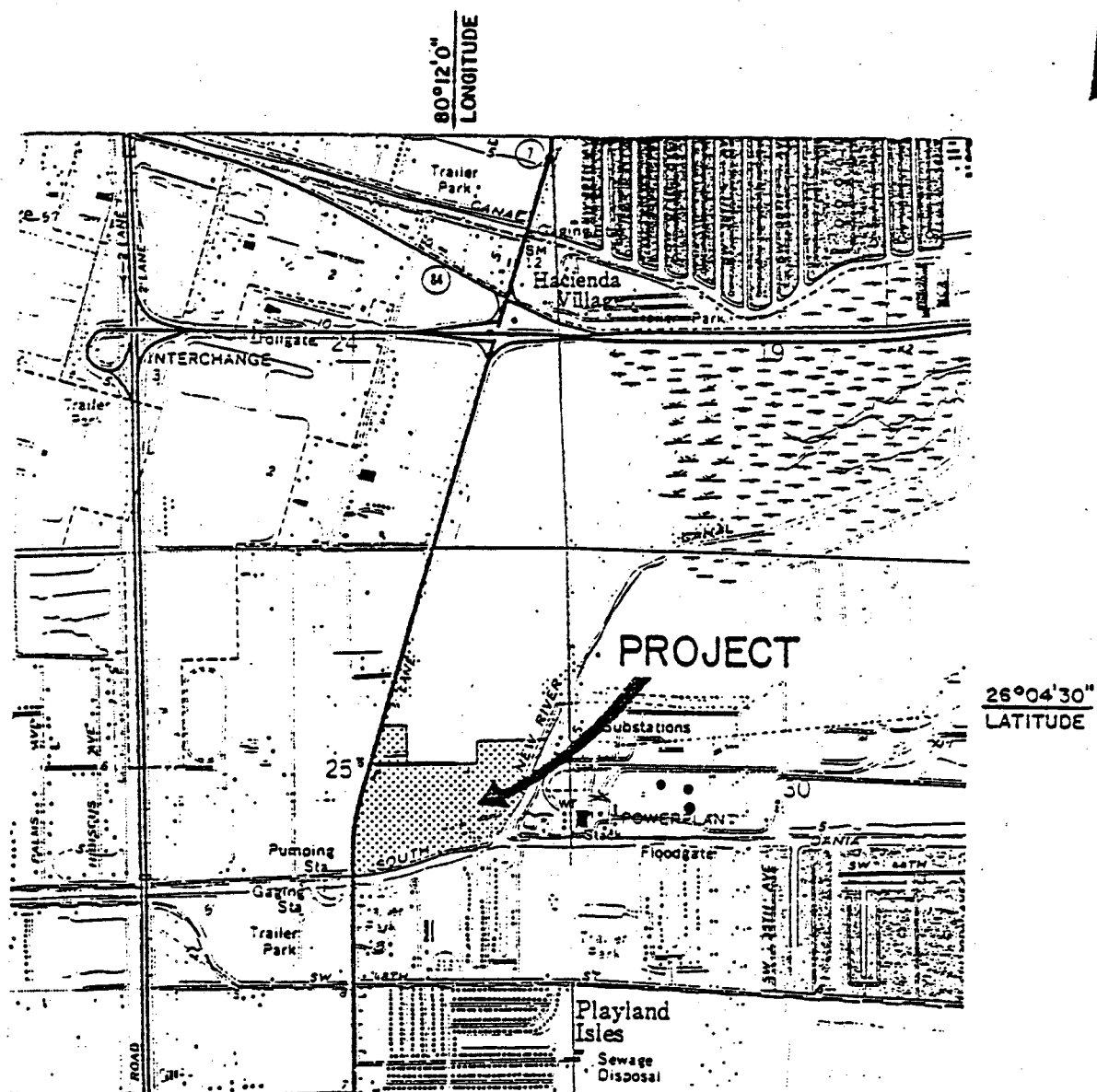
The receiving and handling area of the RRF is a completely enclosed operation. Processible waste received at the RRF will be burned to reduce the original volume by approximately 90 percent. Energy will be recovered from the combustion process to generate electricity which will be sold to Florida Power and Light Company (FP&L). Residue consisting of ash from the incineration process and fly ash from the electrostatic precipitators will be landfilled. Unprocessible wastes such as construction materials will also be landfilled directly. Ferrous metals may be salvaged and stored on site until they are sold by the operator.

2. Resource Recovery Facilities

The resource recovery facility will be a mass-burn system. Figures 3 and 4 present a schematic drawing and cross section, respectively, of typical mass burning facilities.

The solid waste disposal vehicles will maneuver in the enclosed turning platform/tipping floor area and discharge their load of MSW into the refuse storage bin. The storage bin will be sufficiently large to hold four

FIGURE 1



PURPOSE: BROWARD COUNTY RESOURCE RECOVERY FACILITY
 DATUM: NGVD

SCALE: 1000' 0' 1000' 2000'

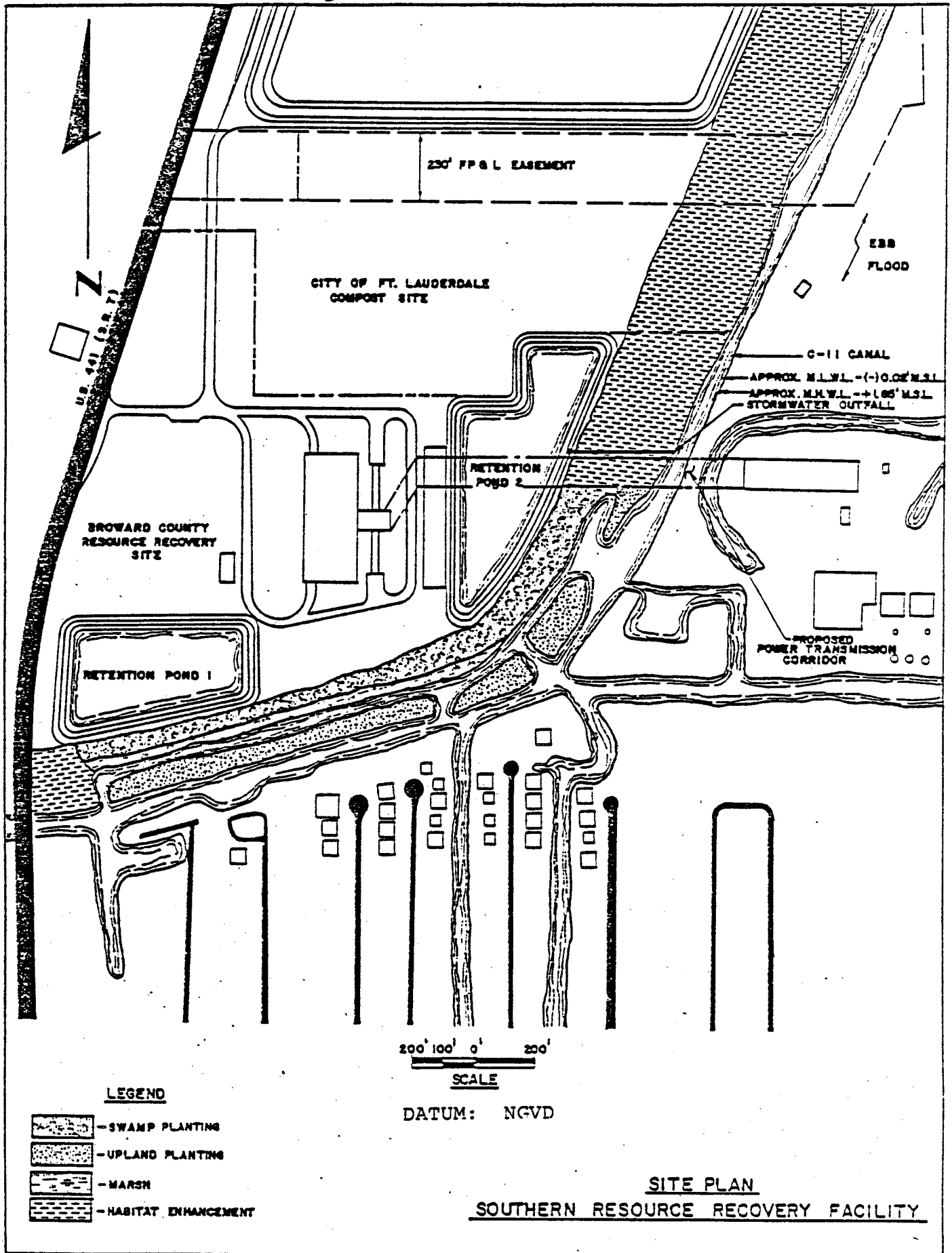
SOURCE: USC & GS T-8428 FORT LAUDERDALE SOUTH,
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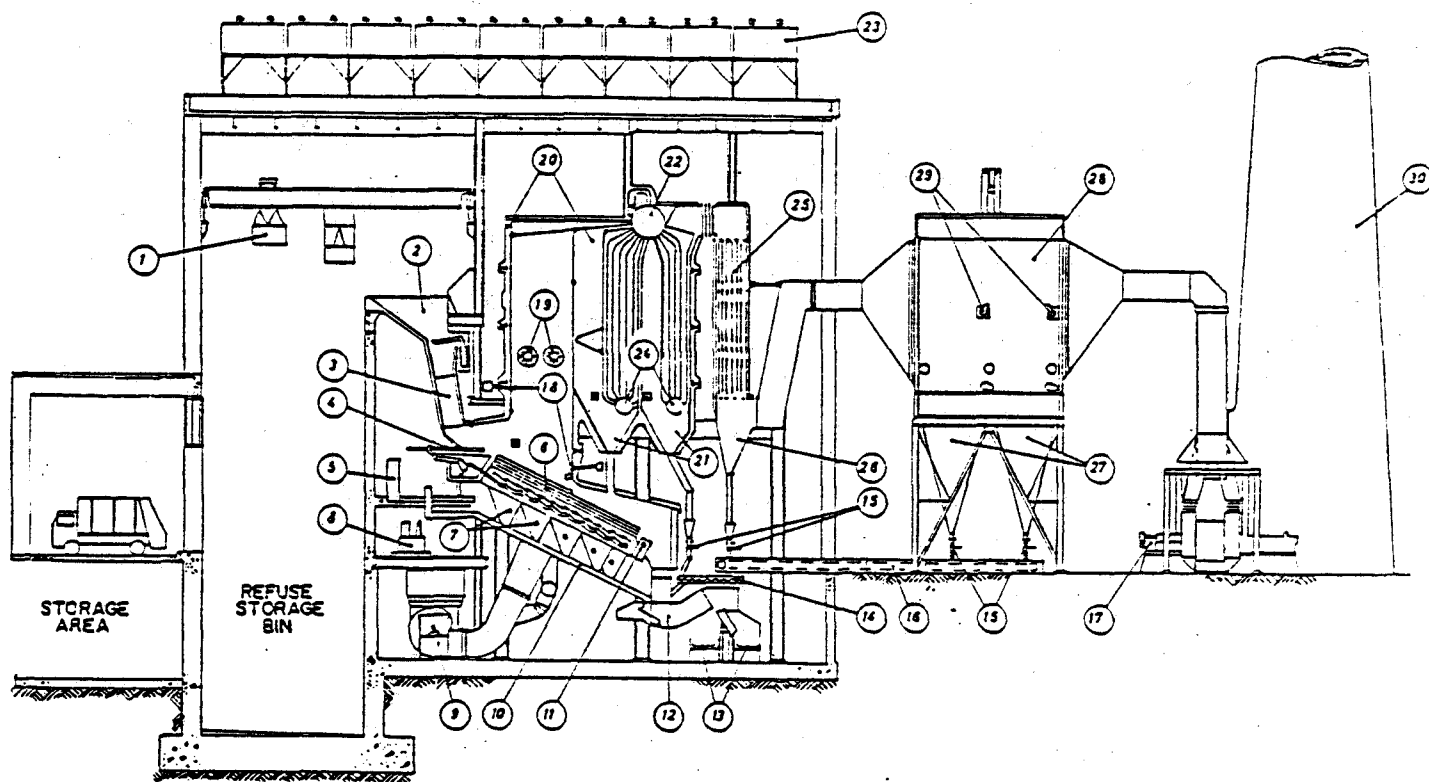
VICINITY MAP

IN AREA ADJACENT TO SOUTH FORK
 OF THE NEW RIVER

COUNTY OF BROWARD
 STATE OF FLORIDA
 APPLICATION BY BROWARD COUNTY

FIGURE 2





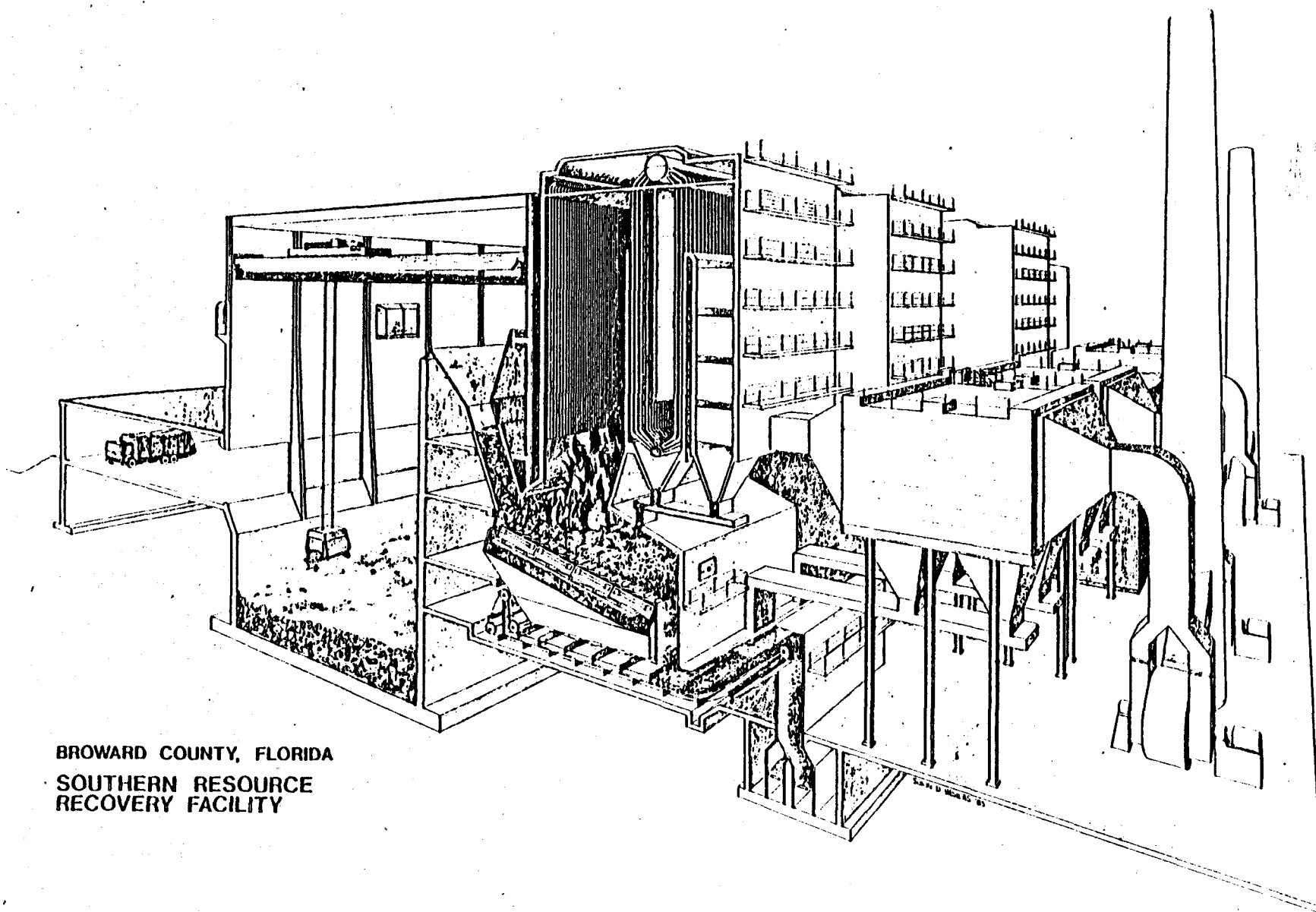
LEGEND

- 1) Crane
- 2) Refuse Hopper
- 3) Refuse Chute
- 4) Refuse Feed
- 5) Stoker Control Panel
- 6) Reverse Reciprocating Stoker
- 7) Undergrate Air Plenum Chambers
- 8) Hydraulic Pump

- 9) Forced Draft Fan
- 10) Automatic Siftings
- 11) Clinker Roll
- 12) Residue Discharger
- 13) Residue Conveyor
- 14) Fly-Ash Conditioning Screw
- 15) Rotary Valves for Fly-Ash Discharger
- 16) Fly-Ash Flight Conveyor
- 17) Induced Draft Fan
- 18) Overfire Air Nozzles
- 19) Auxiliary Burners. (100% capacity)

- 20) Radiant Waterwalls. (Welded Panel Constr.)
- 21) Boiler Fly Ash Hoppers
- 22) Steam Drums
- 23) Steam Condensers
- 24) Bottom Boiler Drums
- 25) Economizer
- 26) Economizer Fly-Ash Hopper
- 27) Fly-Ash Hoppers for Electrostatic Precipitators
- 28) Electrostatic Precipitators
- 29) Rappers for Fly-Ash Collector Plates
- 30) Chimney

Typical Mass Burning System
(IBW-Martin)



BROWARD COUNTY, FLORIDA
SOUTHERN RESOURCE
RECOVERY FACILITY

average days of incoming waste. Overhead cranes will be utilized to lift material from the storage bin to the charging hoppers of the incinerators. Provisions will be made at the facilities to accommodate additional incinerators should future conditions dictate the need for such units. The crane operators will sort combustible bulky materials from the storage bin and deposit such material in the bulk shear shredder provided at the end of the refuse storage bin. The processible waste material moves down the charging hopper and is fed into the stoker-fired incinerator. The processible waste is fed onto the stoker, where moving grates pass the waste initially through a drying zone and then into the combustion zone of the incinerator. Over and underfire air, regulated at approximately 85 to 115 percent excess combustion air, shall be provided to ensure optimal conditions for complete combustion of the light fraction of the waste and to ensure long grate bar life.

From the combustion zone, the hot gases move through the boiler and superheater where steam is generated and directed to the turbine generator to produce electricity. The gases continue to the economizer which serves to preheat the feed water that will be converted to steam in the boiler and superheater sections. After passing through the economizer, the combustion gases go through the electrostatic precipitators (or equivalent air pollution control device) for particulate removal prior to discharge through the stack.

The residue remaining on the grates after burnout shall be water cooled by spray or quenched in tanks or sumps before it is handled by the conveyors and then conveyed to the residue disposal area. Collected residue shall be hauled to the adjacent residue/unprocessible waste landfill. Fly ash from the electrostatic precipitators, superheater and economizer shall also be conveyed to the residue disposal area and then landfilled.

The back-end recovery of ferrous metals may be incorporated into the proposed facilities. However, the decision to recover materials will be made by the selected vendor based upon the economic viability of such recovery options.

The power generating equipment shall include a turbine-generator set designed such that no loss of energy production, either thermal or electrical, occurs throughout the lifetime of each facility. Each facility shall be able to process processible waste at full capacity even during scheduled and unscheduled outages of the turbine-generator sets. The turbines shall be designed for continuous operation, while the generators shall be alternating current synchronous generators.

The administrative and control facilities shall be comprised of the scale house, the administration building and the control room and office area located in the main facility building. The intake of waste to each facility shall be regulated and controlled by its weighing station's operation. The necessary information pertaining to each weighing transaction will automatically be recorded. The administrative building will house the offices of the facility manager and secretarial staff, a conference room, and visitor's area. The control room and office area are located in the main facilities to provide operating personnel with an observation point from which to view and control facility operations.

3. Water Resource Management Facilities

a. Surface Water

The surface water management system for the project will be designed to accommodate current and future site utilization. The development plan will provide the appropriate control methods for the disposal of surface runoff during rainfall periods.

The RRF site lies within the jurisdiction of the South Florida Water Management District (SFWMD). This statutory agency is authorized to implement a permitting program for the use and control of water. The conditions for issuance of the permit include the provisions of reasonable assurances that the project will:

- . provide adequate flood protection and drainage;
- . not adversely impact water quality or quantity on receiving wastes and adjacent lands;
- . not adversely impact surface and ground-water levels and flows;
- . not cause adverse environmental impacts;
- . be operated and maintained effectively;
- . not adversely affect public health;
- . be consistent with requirements of other agencies;
- . be the most publicly acceptable alternative;
- . serve a land use which is compatible with applicable zoning and land use plan designation;
- . not interfere with the legal rights of others; and,
- . not otherwise harmful to the water resources of the District.

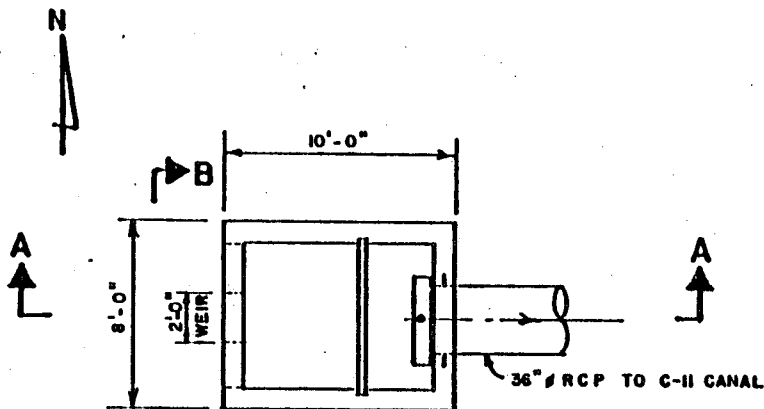
The project site is located adjacent to the South Fork of the New River Canal (Canal C-11) in tidal waters downstream from SFWMD Pump Station S-13. This station is regulated to provide flood control in upstream reaches as well as maintain adequate groundwater elevations to mitigate salt water migration. Annual average water elevations measured downstream of Pump station S-13 and in the immediate vicinity of the project site range between elevation +1.64 (flood tide) and elevation -0.02 (ebb tide), relative to mean sea level.

The project site is located east and downstream of the SFWMD C-11 east drainage basin. Rule Chapter 40E of the SFWMD sets forth design criteria for the control of area runoff quality and quantity from the site.

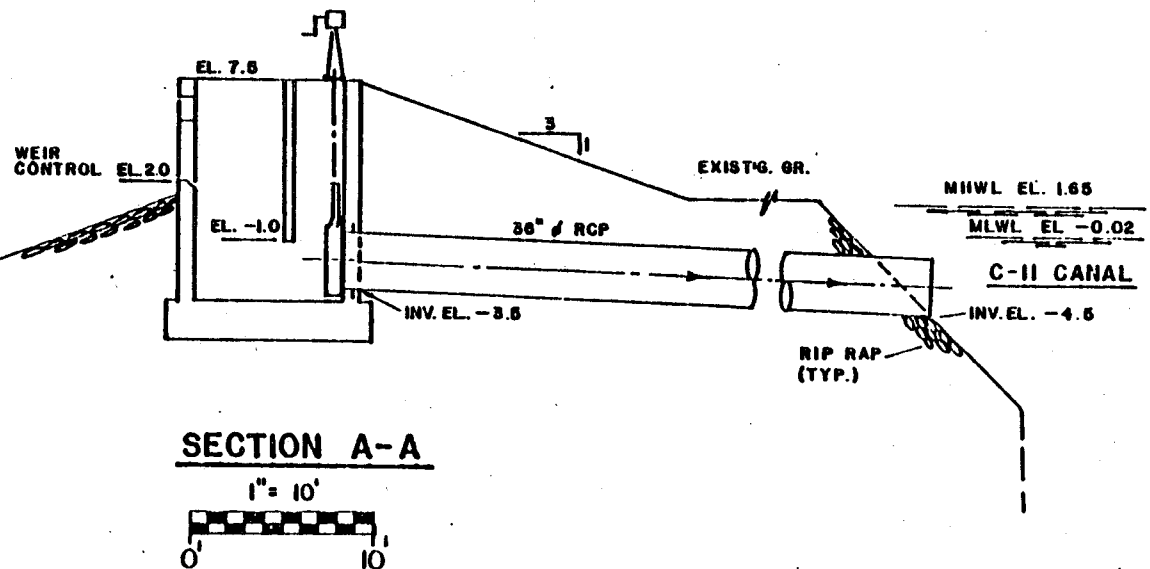
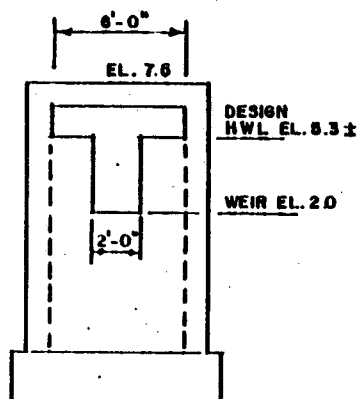
These criteria are summarized below:

- . Design Storm - 25 year
- . Storm Duration - 72 hour
- . Cumulative Precipitation - 15 inches
- . Water Quality
 - Provide a retention volume equal to 50 percent of the runoff from the 3 year 1 hour rainfall event (precipitation = 2.8 inches).
 - Provide a wet detention volume equal to 100 percent of the runoff from a 3 year 1 hour rainfall event.
- . Water Quantity
 - Limit post development peak discharges to the C-11 canal to predevelopment levels.

Stormwater quality control will be achieved in accordance with SFWMD criteria by the complete retention of 50 percent of the runoff from the 3-year 1-hour rainfall event (precipitation = 2.8 inches). It should be emphasized that this retention requirement is in excess of the Florida Department of Environmental Regulations (FDER) standards for stormwater quality control; specifically, FDER standards require that runoff from the first inch of rainfall be retained, while SFWMD criteria result in the retention of runoff from the first 1.4 inches of rainfall. The required stormwater retention will typically be provided by on-site dry retention swales and/or dry retention ponds. Disposal of retained water in these areas will be accomplished via percolation and evaporation processes. Excess runoff, beyond that which is retained in the retention areas will be conveyed to two ponds (pond 1 and pond 2). These ponds which are approximately 3.4 and 4.3 acres in area, will be constructed at the southern and eastern portions of the RRF site (Figure 2). Detained water in the ponds will be released by controlled gravity discharge, via a weir/culvert structure (Figure 5), to the C-11 canal in accordance with SFWMD discharge criteria. Specifically, post development peak discharges from the resource recovery facility site, for the 25 year-72 hour design storm, will not exceed predevelopment levels. The design high water level for the ponds will be approximately 5.3 ft., MSL with a peak discharge to the C-11 canal of approximately 25 cubic feet per second (cfs). The 36 inch culvert from pond 2 to the C-11 canal as sized will limit peak design discharge velocities to below 4 feet per second, for erosion control purposes. The weir outfall control structure will be furnished with a baffle for oil, grease and sediment control. The invert of the weir will be set at elevation 2.0 feet MEL, which is the established control elevation for the site.



POND No. 2



NOTE

- SEE FIG. 1 FOR LOCATION OF STRUCTURE
- DATUM = NGVD

SOUTHERN RESOURCE RECOVERY FACILITY
STORMWATER OUTFALL DETAIL

Where appropriate, catch basins serving paved areas within the RRF will utilize baffles in order to remove oil, solids and other objectionable materials from stormwater run-off from the site. Where practical, swales and greenways will be provided to transport runoff to on-site retention and detention areas.

b. Process Water Blow-Down

Process blow-down water will require disposal. The blow-down waste stream may be pumped either to the leachate pumping station wet well at the landfill for disposal by deep well injection or to the Hollywood regional treatment plant (Plate 2).

c. Wastewater

Wastewater produced by on-site sanitary facilities will be disposed of in a sewage force main located in Route 441 for ultimate treatment at the Hollywood regional treatment plant.

d. Injection Well Disposal

An injection well may be utilized for disposal of process water blow-down from the RRF as well as storm water and leachate from the landfill. In recent years, the use of deep injection wells for disposing of wastewater has become widespread in South Florida because of a unique combination of circumstances. The "Boulder Zone" a layer of cavernous rock saturated with salt water, underlies all of the lower part of the South Florida Peninsula between depths of 2700 to 3500 feet. Because of its cavernous nature, it is capable of storing an enormous volume of fluid and can accept injection of fluids at high rates and reasonable (economic) pressures. The Boulder Zone contains only salty water and is, therefore, suitable for wastewater disposal. Furthermore, it is overlain by a sequence of tight or impermeable rock that confine injected fluids and prevent their upward

migration into shallower zones containing brackish and fresh water.

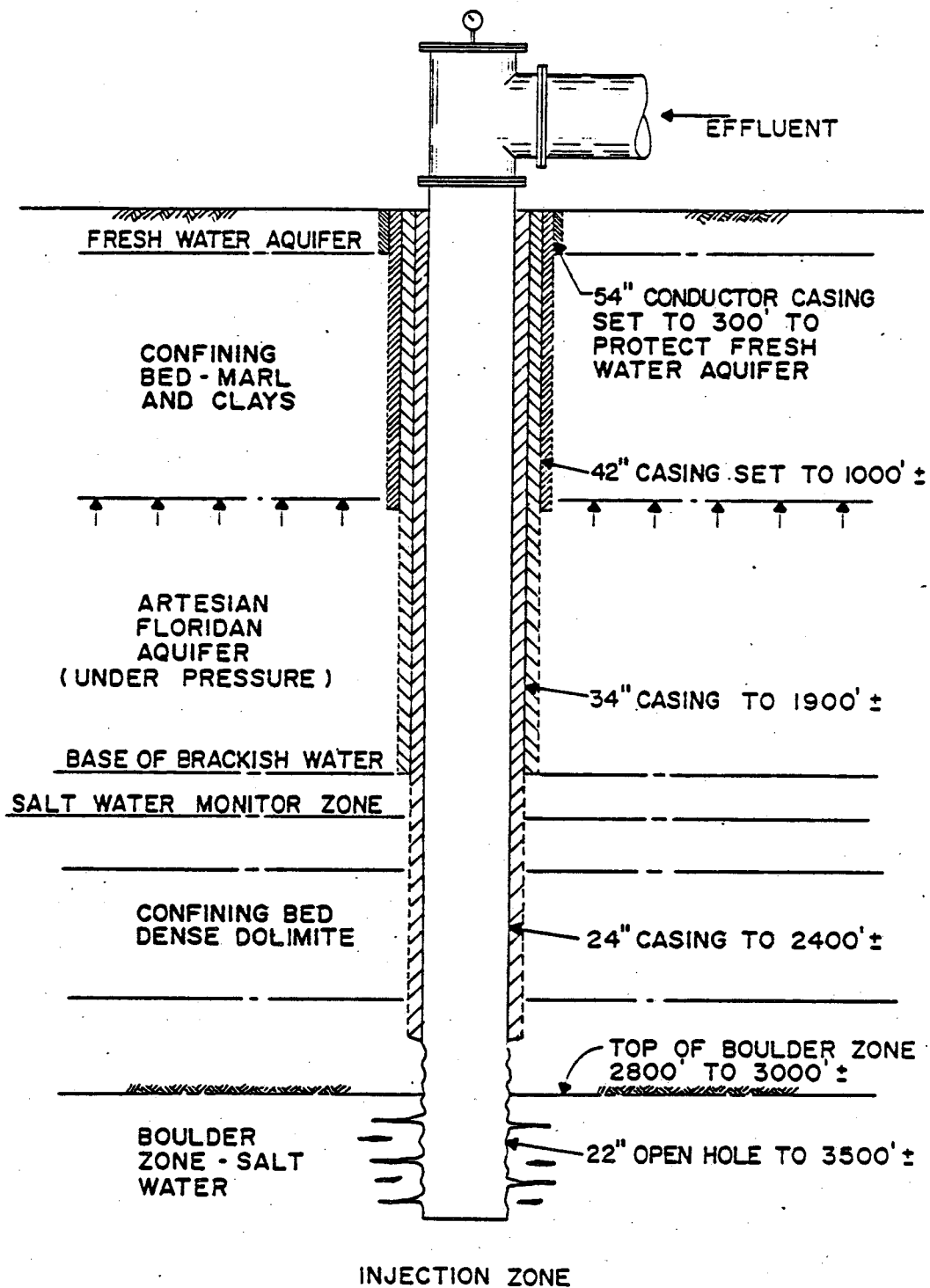
Initially, the use of the injection wells was restricted to small, privately owned facilities. Since 1974, larger communities have adopted its use because it causes no adverse environmental impact and was found to be economic (compared to other alternatives). As an example, the City of West Palm Beach has been successfully operating a regional wastewater facility with five disposal wells (including standby) since 1977. Initially, the wells handled 10 mgd (million gallons per day); today, they are receiving about 28 mgd and have handled as much as 45 mgd at pressures less than 60 psi (pounds per square inch). Monitoring of the water quality in zones above the confining beds since the start of injection shows that the effluent has remained in the Boulder Zone. The City of Fort Lauderdale has recently installed an injection well system consisting of four 24 inch diameter wells and supporting monitor wells. The well system has a capacity of 37 mgd. Similarly, the Miami-Dade Water and Sewer Authority operates an extensive network of injection and monitor wells designed to dispose as much as 100 mgd at the South Dade Wastewater Treatment Plant.

Since the inception of the large scale disposal well systems in 1974 and the successful completion of a number of these facilities, a considerable amount of technical knowledge has developed. Basically, sound engineering practice and regulatory requirements dictate that favorable conditions (highly transmissive zone containing non-potable water and overlain by a confining bed) for injection well disposal exist in an area. In addition, the well must be designed and constructed so that the integrity of the confining bed and the operating injection well are maintained. Demonstration of confining bed integrity is achieved during the exploratory drilling portion of the injection well program by the collection and interpretation of geologic

data from core and formation samples and geophysical logs. Integrity of the well is assured by using casings having sufficient wall thickness to resist corrosion and have a long life. The casings are set in the center of a larger diameter drilled bore hole and cemented in place with special blends of cements to assure sealing and provide strength. Protection of potable and other usable groundwater is provided by constructing the well with two or more lengths of "strings" of casings set to different depths. Each is a different diameter and extends from its setting point up to land surface. The inner, or injection casing, is set or seated well into the confining bed. Larger diameter casings (designated surface, intermediate and conductor casings) are set to successively shallower depth. These too are cemented completely in place. The choice as to the number of casings and their setting depths is dependent on geologic conditions. As a consequence of this type of construction, aquifers containing potable water are sealed off by the three or more different diameter steel casings and cement, assuring protection and long life. Details of a typical effluent disposal well are shown on Figure 6.

Before an injection well can be used construction and operating permits must be secured in a two step permitting process. Details of the well's design and construction are included in the construction permit application as well as those of the program for collecting the data used in proving the presence of the injection zone and the adequacy of the confining beds and for the testing of the integrity of the well. Currently, the DER has a practice of forming a Technical Advisory Committee (TAC) to review details of each application. The TAC is composed of representatives from the DER, the South Florida Water Management District, the U. S. Geological Survey, and the Broward County Environmental Quality Control Board.

TYPICAL INJECTION WELL PROFILE



The completed injection well system will include monitor wells. These will tap the first salt water bearing zone occurring above the confining bed, possibly intermediate zones and the shallow fresh water aquifer. The number of monitor zones is based on local conditions. Experience indicates that an injection system at the 441 site would require three (3) monitor zones.

The injection well design selected for a particular facility is dictated by geologic conditions and the anticipated plant discharge to be handled. The former determines the number of casing strings and their anticipated depth settings, while the latter controls the diameter of the injection casing. The size of this casing controls the choice of sizes used for the other casings.

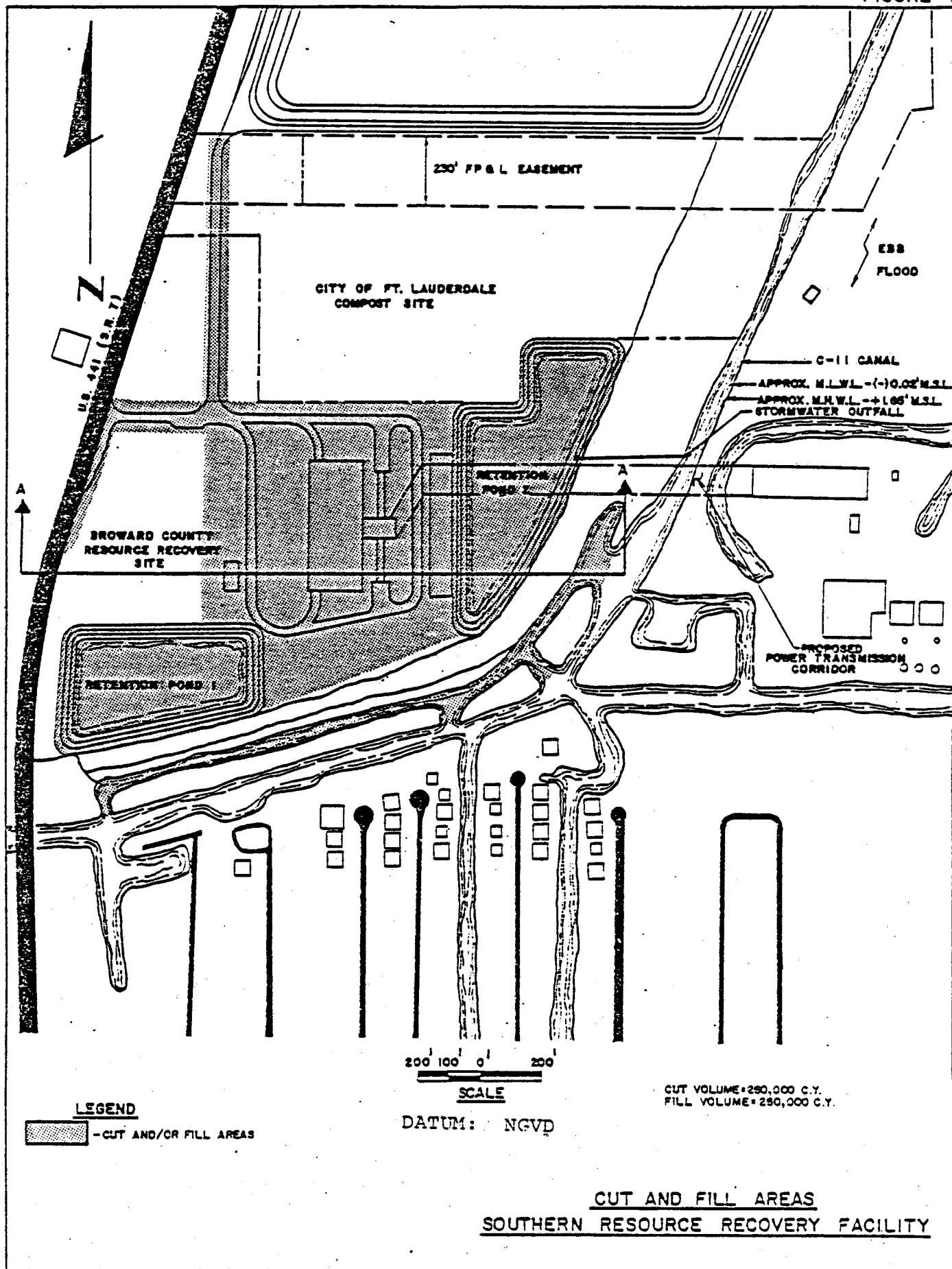
Geologic data indicate that the Boulder Zone certainly underlies the 441 site. Records from the Fort Lauderdale injection wells provide a great deal of information concerning confining beds, monitor zones and the depth and transmissivity of the injection zone. Deep well injection is a feasible and desirable method of disposal of leachate, stormwater, sewage, and process water blow-down from the RRF and landfills.

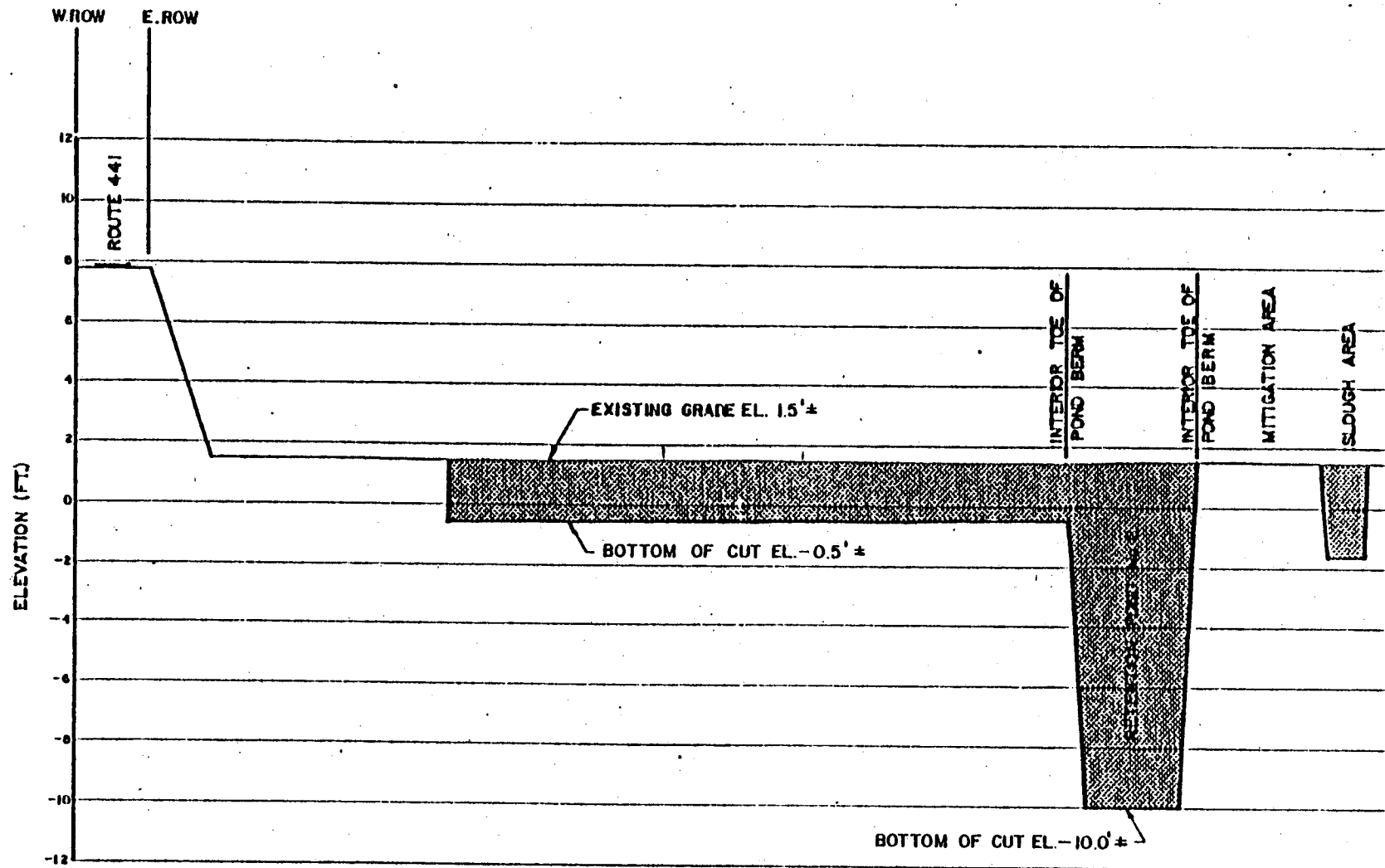
B. Cut and Fill

Development of the RRF will require 260,000 cubic yards of material to be removed and 260,000 cubic yards of material to be filled. The cut and fill areas are shown in Figure 7 and sections are included in Figures 8 and 9 which illustrate elevations of this earthwork. Existing elevations are shown on Plate 3.

Approximately two feet of muck will be removed from development areas of the site. These areas will then be filled to the 100 year flood elevation of 7.0 feet MSL.

FIGURE 7





- AREAS TO BE CUT

DATUM: NGVD

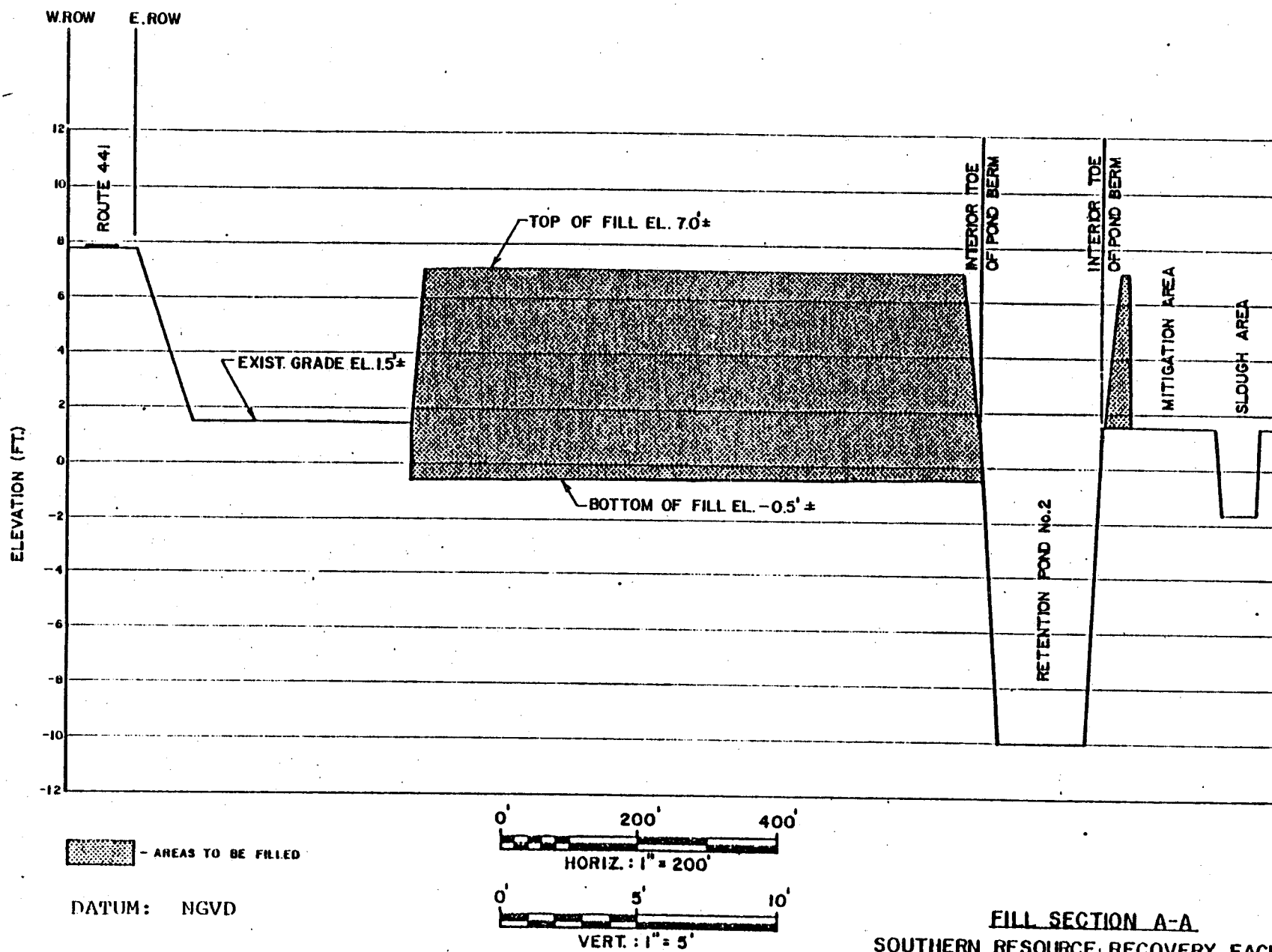
0' 200' 400'

HORIZ. : 1" = 200'

0' 5' 10'

VERT. : 1" = 5'

CUT SECTION A-A
SOUTHERN RESOURCE RECOVERY FACILITY



1. Cut

The top two feet (approximately) of material to be excavated is expected to be a silty, fibrous peat. Material below the muck is expected to be weakly cemented quartz sandy limestone with traces of silt and organics. Excavated earth will be cast on-site. Suitable material will be utilized to elevate the site to the 100 year flood elevation. Unsuitable material will be hauled off site by truck. The equipment to be utilized in the dredging operations includes backhoes, loaders, draglines and pans.

Excavated areas will be surrounded with a berm prior to dredging to prevent any run-off from contaminating waters of the State.

2. Fill

Except for the retention ponds, areas which have been cut will be filled to elevation 7.0 feet MSL. The retention ponds will be surrounded with a container berm also with a top elevation of 7.0 feet MSL. Suitable dredged sands and limestone will be obtained from local pits for construction. Suitable material from on-site dredging operations may be utilized to supplement the required fill volume.

III. SITE SELECTION

A. Background

Broward County occupies an area of approximately 1,200 square miles and is located in the southeastern portion of the State of Florida. It is bounded on the north by Palm Beach County, on the east by the Atlantic Ocean, on the south by Dade County, and on the west by Hendry and Collier Counties.

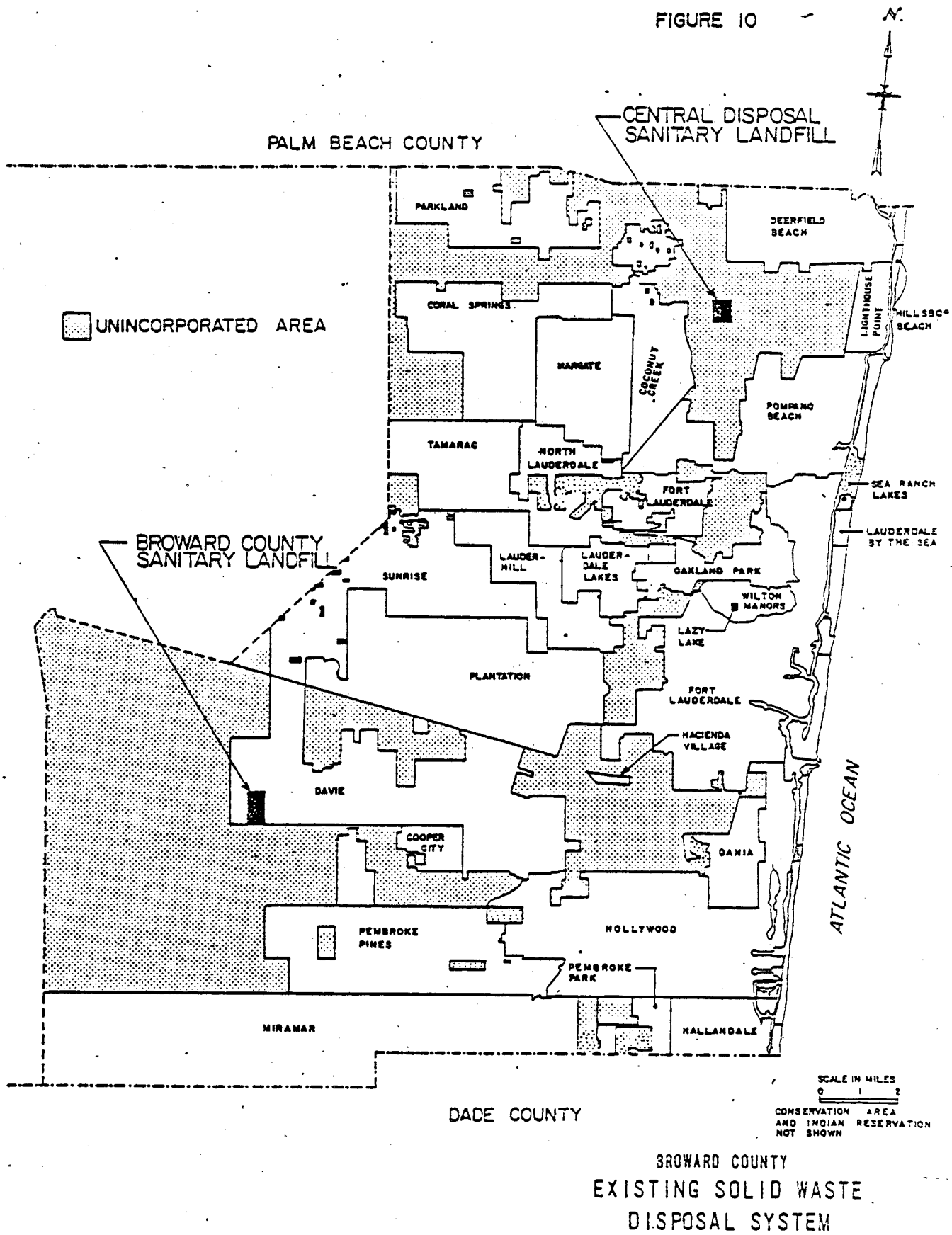
The current Broward County population is approximately 1 million, and it has been estimated that the municipal solid waste (MSW) generated by this population ranges from 2400 to 3000 tons per day. At present, the MSW generated within the County is disposed of at the following two facilities (Figure 10):

- . Broward County Sanitary Landfill at Davie
- . Central Disposal Landfill at Pompano

The first facility, the Broward County Sanitary Landfill (BCSL), is located at Orange Drive and Boy Scout Road in Davie. It is currently receiving approximately 1200 tons per day of MSW. The BCSL facility will reach capacity in October-November of 1983. Plans have been developed to expand the landfill thereby increasing the useful life to 1986. The permit for this expansion and is presently being contested in the courts.

The remaining MSW generated in the County is currently being disposed of at the second facility, the Central Disposal landfill. This landfill is located in Pompano Beach off Powerline Road, and is operated by Waste Management, Inc. The site includes a Solid Waste Reduction Center where MSW is shredded and ferrous metals are separated prior to landfill disposal. An experimental system testing the feasibility of methane production from the anaerobic decomposition of MSW is also being operated at the Pompano site.

FIGURE 10



The capacity limitations of these landfills necessitate the development of a long-term county-wide disposal plan. Recognizing this need, the County authorized the investigation of solid waste management alternatives. A policy decision was made by the County not to rely on landfill as a primary long-term disposal solution, and to concentrate on alternatives that involve the resource recovery of materials and/or energy.

Originally the County pursued the development of two separate resource recovery projects. The northern project involved a 600 tpd codisposal of MSW and sewage sludge to generate electricity. This waste-to-energy approach was planned for a facility to be located at Powerline Road, adjacent to the North District Regional Wastewater Treatment Plant. The codisposal project and the Waste Management facility at Pompano therefore accounted for 1200 tpd of MSW disposal capability. The remaining 1200 to 1800 tpd of MSW generated by the County was to be disposed of at the County landfill at Davie. A second resource recovery facility was still needed due to landfill capacity limitations.

Broward County has retained the firm of Malcolm Pirnie, Inc., in association with Hazen and Sawyer, P.C. and CZR, Incorporated to provide the services necessary to develop a long-term disposal solution for Broward County. The lead time required to implement a resource recovery project, and the limited capacity of the County landfill at Davie, make it important that a long-term solution be identified as soon as possible.

B. Site Evaluation and Selection

The first step in the investigation of solid waste management alternatives involved a generic overview of demonstrated (successfully or unsuccessfully) MSW processing and resource (energy and/or materials) recovery methods. A report summarizing the results of this overview investigation was

submitted to Broward County on February 16, 1982. The report concluded that mass burning stoker-fired incineration systems represent the most viable technology available to Broward County for implementation under the proposed project.

The recommended solid waste disposal program proposed to identify and develop two separate sites. The first site would be for construction of the recommended resource recovery facility. Approximately 25 to 30 acres are required for a 1200 to 1800 ton per day facility utilizing the recommended mass burning technology.

In 1981 the Broward County Solid Waste Division identified 3 prospective resource recovery facility sites. The criteria which were used for selection were:

- . general location
- . jurisdiction (unincorporated vs. incorporated areas)
- . size
- . existing zoning
- . land use plan designation
- . existing land use

All of the sites identified by Broward County were in unincorporated areas of the county so as to minimize the legal complexity required to obtain these sites. In addition, consideration was made of current property ownership—County owned or privately owned.

The three potential resource recovery sites were:

- Fort Lauderdale Incinerator - This site is located on Wingate Road in the City of Fort Lauderdale. It contains an incineration facility that it is no longer in operation, and currently is used to park City of Fort Lauderdale sanitation vehicles.

- Route 441 - This site is located at the southeast intersection of U.S. Route 441 and State Route 84.
- Port Everglades - While a definitive area was not specifically identified by the County, a tract bounded on the east by the Intracoastal Waterway and along the west and south by a discharge basin was reviewed.

The sites identified as potential resource recovery sites were ranked according to their acceptability as illustrated in Table 1. This ranking was based upon technical, environmental and regulatory permit considerations. All of the identified sites were considered viable with respect to marketing electricity to Florida Power and Light Company. The following summarizes the assumptions made for each line of entry in Table 1.

Overall Ranking - The tabulated rankings are based upon consideration of all technical, environmental, and regulatory aspects developed during the site evaluation. Site rankings based upon only one of these aspects may differ from the overall rankings.

Available Acreage - This line of entry presents the total acreage available for use in the development of the southern project.

Adequacy of Site Area - This line of entry indicates whether the identified site has sufficient acreage to construct the resource recovery facility and to provide for adequate on-site vehicular roadway requirements.

Potential Environmental Impacts - This line of entry is subdivided into the following specific environmental aspects: air quality, water quality, wetlands, drainage, endangered and threatened species, and adjacent land use. Each aspect is evaluated according to the ranking system described in the Table with A indicating the least negative environmental impact and E the most negative.

TABLE 1

RANKING OF RESOURCE RECOVERY SITES

	<u>Southern Portion of Route 441</u>	<u>Fort Lauderdale Incinerator</u>	<u>Port Everglades</u>
Overall Ranking	1	2	3
Available Acreage	40	44	20
Adequacy of Site Area	Yes	Yes	Marginal
Potential Environ- mental Impacts*			
Air Quality	C	D	C
Water Quality	C	D	B
Wetlands	B	A	A
Drainage	A	A	A
Endangered and Threatened Species	A	A	D
Adjacent Land Use	B	C	B
Access Roads	Adequate	Possible Upgrading Required	Possible Upgrading Required
Average Relative Transport Cost (\$1000/yr)	0	550	880
Zoning/Land Use Change Required			
Broward Co.	Yes	No	No
Other	No	No	No
Regulatory Permits			
Number Required	10	6	10
Approval Probability	High	Low	Moderate

* Potential Environmental Impacts are divided into these categories

- A - No potentially negative impact on this resource is apparent
- B - Potentially negative impacts are considered negligible and therefore acceptable
- C - Potentially negative impacts are considered acceptable only if specific mitigative or control measures are employed
- D - Potentially negative impacts are considered unacceptable, even if specific measures are employed, and are avoidable only by modifying major design features considered typical for the facility
- E - Potentially negative impacts are considered unacceptable, even if specific mitigative measures are employed, and unavoidable even if major design features considered typical for the facility are employed

Access Roads - This line of entry indicates whether the site access roadway network is adequate to support the additional truck traffic and loading that would be associated with a resource recovery facility.

Average Relative Transport Cost - These costs are the incremental transport costs for each site, relative to the site with the lowest transport cost. Costs are based upon utilization of packer trucks, a unit hauling cost of \$0.18 per ton-minute, and average truck speeds of 40 mph and 30 mph on highways and local roadways, respectively. They represent the product of the respective unit transport costs and the average quantity of MSW (1500 TPD) projected to be generated during a one-year period. These costs are preliminary estimates to be used for comparison purposes only. They do not include normal collection costs. Tabulated costs have been rounded to the nearest \$10,000 and are in 1982 dollars. The 1980 and 1990 solid waste centroids have been identified on Figure 11.

Zoning/Land Use Change Required - This line of entry indicates whether a revision to the existing local zoning or Broward County land use plan is required for implementation of the proposed resource recovery facility.

Number of Regulatory Permits Required - This line of entry lists the number of regulatory permits required for the construction of a resource recovery facility.

C. Recommendation

Based upon available information and site inspections, the Route 441 site was deemed the most suitable of the potential resource recovery sites. To summarize, this recommendation is based upon the following:

- . amount of acreage available for site development
- . consideration of potential environmental impacts

SITE NO 1
FORT LAUDERDALE
INCINERATOR SITE

1990
SOLID
WASTE
CENTROID

NW 19 TH ST

NW 31 ST AVE

SUNRISE BLVD

BROWARD BLVD

EAST LAS OLAS BLVD

DAVIE BLVD

FORT LAUDERDALE

17TH ST. CAUSEWAY

HOLLYWOOD CORP BDY

FORT LAUDERDALE AIRPORT

SITE NO 2
ROUTE 441
SITE

1980
SOLID
WASTE
CENTROID

SITE NO 3
PORT EVERGLADES
SITE

DANIA CUT OFF CANAL

ATLANTIC OCEAN

ATLANTIC OCEAN



SCALE IN MILES

LEGEND



RESOURCE RECOVERY
SITES

BROWARD COUNTY

SOLID WASTE MANAGEMENT STUDY
APPROXIMATE LOCATION OF SOLID
WASTE CENTROIDS

- . proximity of this site to the 1990 solid waste centroid and corresponding transport cost advantage
- . the adequacy of the access roadway system

As a result of the above, it was recommended that the southern 40 acres of the Route 441 site be selected as the site for construction of the proposed resource recovery system. Further discussion with the Federal Aviation Administration (FAA) was necessary to confirm that implementation of the proposed facility will be in compliance with FAA regulations. FAA has indicated that the project will be in compliance with Part 77 Regulations governing air space (Attachment 5).

IV. ENVIRONMENTAL ASSESSMENT

Construction and operation of solid waste handling and processing facilities generate significant public interest due to a variety of environmental issues. During the site selection process for the Southern Resource Recovery Facility and Residue/Unprocessable Waste Landfill numerous environmental issues were evaluated before the Board of County Commissioners of Broward County identified the best location for the project in consideration of all technical, environmental, economic and institutional issues. During the implementation stage, numerous additional public hearings will be held. Where possible, action will be taken to minimize all adverse environmental impacts.

A. Disposal Methodology

All available technology to process solid waste was reviewed by the Broward County Solid Waste Division and their consultants. Resource recovery via the mass burn/energy recovery method was the most viable process to handle the quantity of solid waste generated in Broward County in a cost effective and environmentally sound manner. The incineration process reduces the volume of processable solid waste of processable solid waste by 90 percent. The resulting ash residue is primarily inorganic and nonhazardous. The potential for environmental contamination is considerably reduced when disposing of ash residue in lieu of conventional solid waste in a landfill. The residue/unprocessable waste comprises less than 0.2 percent putrescible material and less than 4.0 percent combustible material. An additional benefit is the recovery of energy to generate electricity during the incineration process.

B. Zoning and Land Use

The Broward County Solid Waste Division will petition to have the existing zoning at the Southern Broward County Resource Recovery Facility site changed to Planned Unit Development (PUD) for planned special complex.

The majority of the project site encompasses land currently zoned M-4, for limited heavy industrial (Figure 12). Small sections of the site are zoned general business (B-3) and general industrial (M-3). The RRF will be located at least 400 feet from the nearest area zoned residential. The Broward County Control Wastewater Region compost facility is immediately north of the RRF.

Existing land use is industrial by Powell Brothers, Inc., a marine construction contractor with an office adjacent to US 441 and fabrication yard adjacent to South Fork New River Canal (Figure 13). The interior portion of the site is currently in agricultural use (pasture). The extreme northeastern corner of the site is designated as Urban Wilderness. Figure 14 shows adjacent property owners and their full names and addresses are provided in Attachment 2.

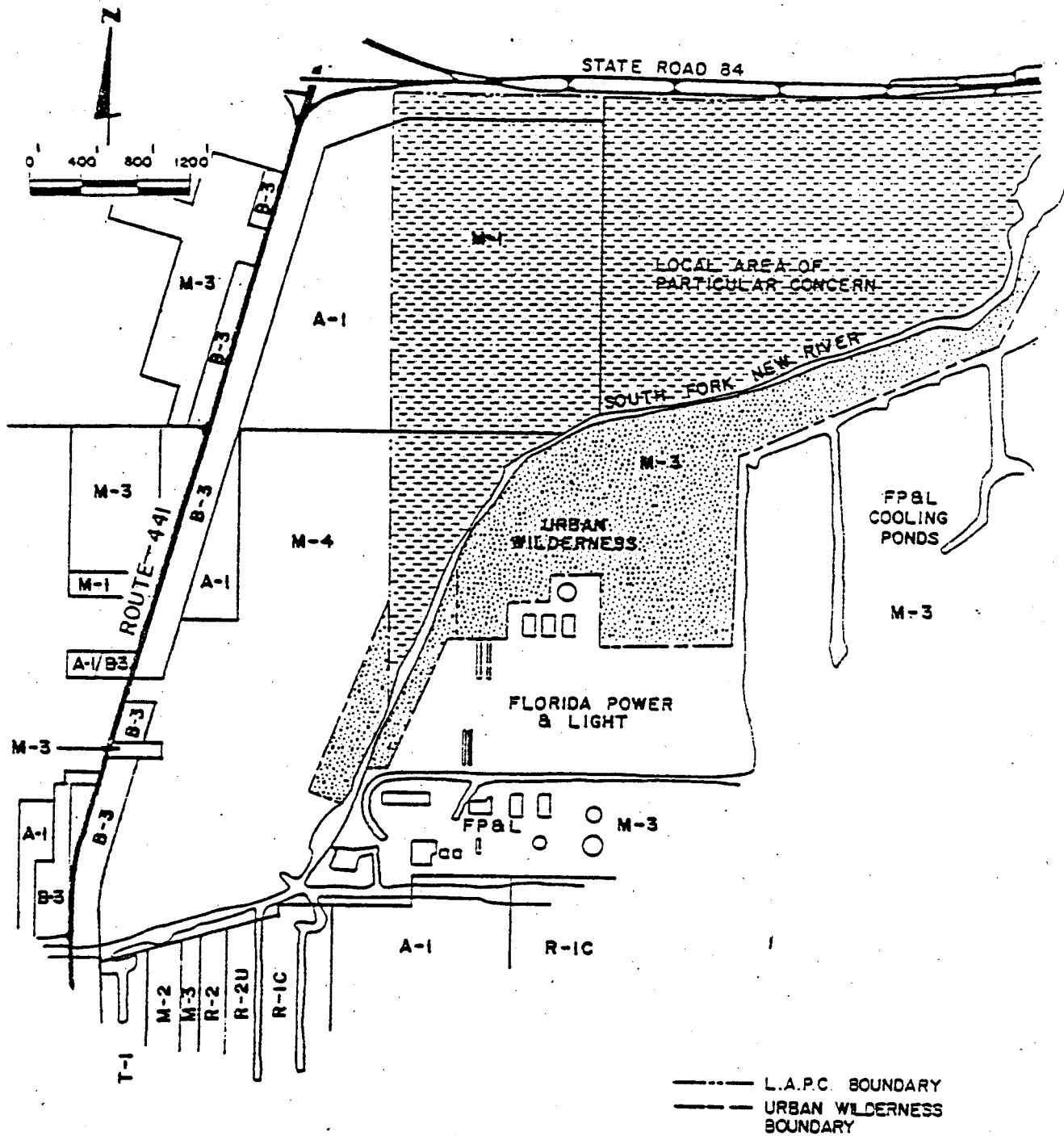
The project site comprises 50.46 acres (Attachment 4). All of the site is already man-dominated and man-impacted. The project site has been evaluated as the best overall location for the Southern Resource Recovery Facility.

C. Biological Concerns

Several biological concerns are associated with project development. First, the site contains wetlands (15.6 acres, Attachment 6) and will require dredge and fill permits from Florida Department of Environmental Regulations and U. S. Army Corps of Engineers. Second, the site includes an Urban Wilderness Area; and third, impacts to threatened and endangered species are a consideration. Each of these three issues have received significant consideration in project planning.

1. Communities

Much of the site remains covered with natural vegetation. Although none of the site has been identified as wetlands by National Wetlands Inventory Mapping (Figure 15), vegetation studies for this project do identify

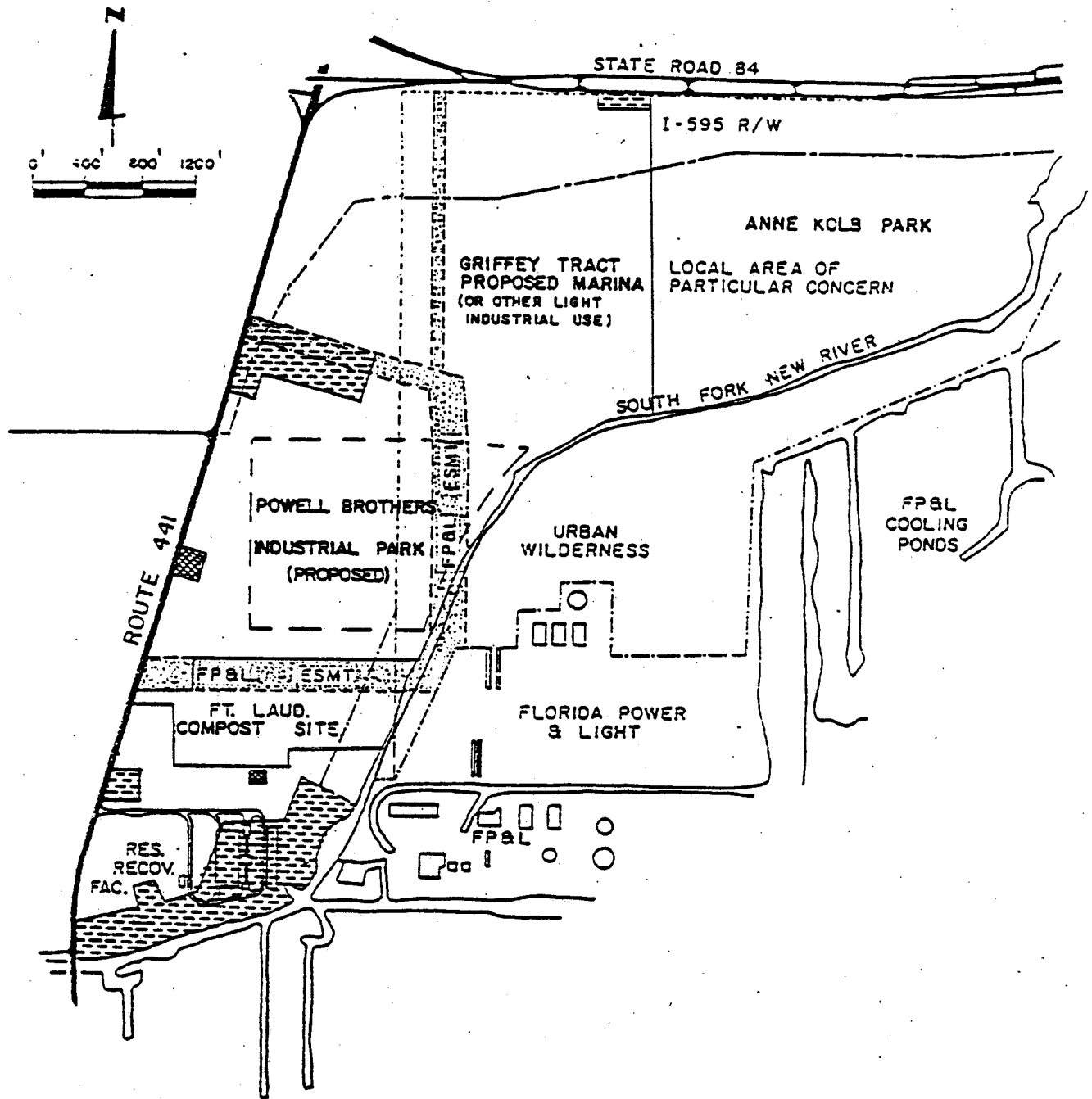


- A-1 LIMITED AGRICULTURAL DISTRICT
- B-3 GENERAL BUSINESS DISTRICT
- M-1 LIGHT INDUSTRIAL DISTRICT
- M-3 GENERAL INDUSTRIAL DISTRICT
- M-4 LIMITED HEAVY INDUSTRIAL DISTRICT
- R-1C SINGLE FAMILY RESIDENCES
- R-2 SINGLE FAMILY DUPLEX
- R-2U TWO FAMILY RESIDENCES
- T-1 TRAILER PARK DISTRICT

BROWARD COUNTY
RESOURCE RECOVERY

ZONING MAP

FIGURE 13



LEGEND

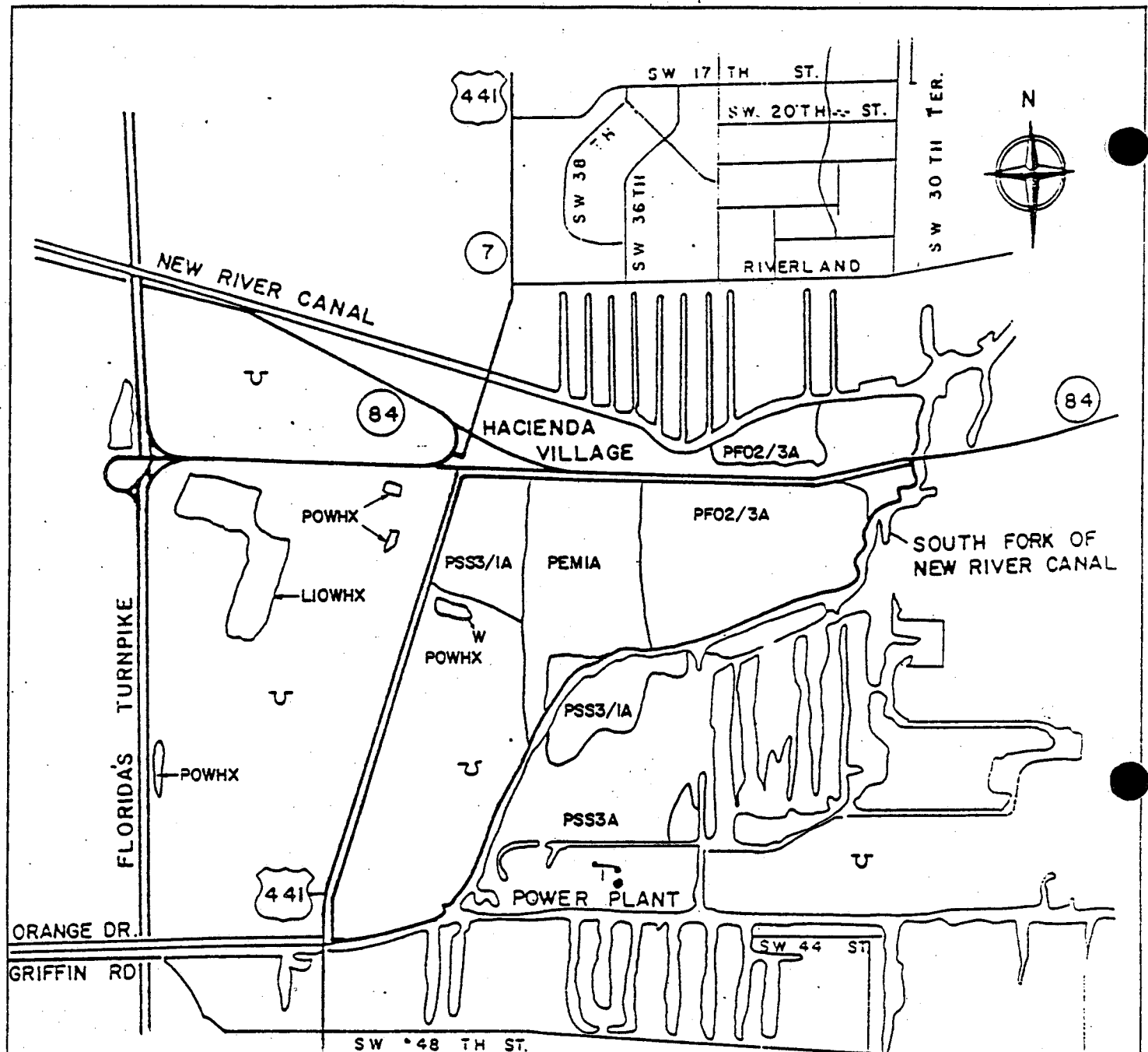
- BUSINESS
- UTILITY EASEMENT
- RESIDENCE

- URBAN WILDERNESS BOUNDARY
- L.A.P.C. BOUNDARY

BROWARD COUNTY
 RESOURCE RECOVERY
 EXISTING LAND USE
 AND DEVELOPMENT TRENDS

1





LEGEND

- PSS3/1A - PALUSTRINE, BROAD-LEAVED EVERGREEN, BROAD-LEAVED DECIDUOUS SHRUB SWAMP TEMPORARILY FLOODED, NONTIDAL
- PEMIA - PALUSTRINE, PERSISTENT EMERGENT VEGETATION, TEMPORARILY FLOODED NONTIDAL
- PFO2/3A - PALUSTRINE, NEEDLED LEAVED DECIDUOUS/BROAD-LEAVED EVERGREEN TEMPORARILY FLOODED, NONTIDAL
- POWHX - PALUSTRINE, PERMANENTLY FLOODED OPEN WATER EXCAVATED
- U - UPLAND

NATIONAL WETLANDS INVENTORY LAND CLASSIFICATIONS

part of the site as wetlands (Figure 16). U. S. Army Corps of Engineers wetlands jurisdiction at the RRF site is defined in Attachment 6. A comprehensive plant species list was developed during the field studies and is included as Attachment 7.

The wetlands of the site comprise wet pasture and shrub swamp. They have been extensively disturbed by man. When South Fork New River Canal was first dredged, the spoil material was placed adjacent to the river.

The spoil bank forms a barrier between New River and the adjacent wetlands. Additional wetland areas have been filled for roads and construction yard development. The wetlands are totally surrounded by uplands. Consequently, the wetland value has been significantly diminished. The area not utilized for the construction yard is currently active pastureland. The pasture exhibits evidence (drainage ditches) of past farming efforts. Disturbance factors are numerous at this project site and these detract both from the visible integrity of the biotic community and its functional attributes.

a. Open Water

Permanent open water exists in the New River Canal. No rooted submerged aquatic plants were found in the river. The shoreline does have scattered emergent plants in a narrow fringe, but depth of water appears to be the chief limiting factor for aquatic plants.

b. Mixed Shrub Swamp

Several small areas of shrub swamp exist on the project site. These areas comprise a variety of species including wax myrtle, willow, red maple, red bay, and Florida holly. These areas represent a transition phase from wetlands to uplands.

- W - OPEN WATER
- M - CATTAIL AND SAWGRASS MARSH
- S - CYPRESS AND RED
MAPLE SWAMP
- SS - MIXED SHRUB SWAMP
- P - WAX MYRTLE PASTURE
- MA - MAINTAINED HABITATS
- U - UPLAND HARDWOODS

VEGETATION MAP

c. Wax Myrtle Pasture

Much of the US 441 site is comprised of poorly improved pasture lands amid a sparse to moderately thick coppice of wax myrtle bushes. Surface disturbance by cattle insures that many seeds are pushed into the black mucky substrate; therefore, the groundcover is very diverse and many species of marshes and wet savannas are present. Florida holly occurs occasionally. The development of the wax myrtle dominated community probably arises from abandonment of fields, and frequent utilization by cattle delays the successional trend toward a forest community.

d. Maintained Habitats

Maintained habitats reflect man's influence. Several types of maintained habitats, exhibiting a range of conditions from dry to wet, and with mostly herbaceous to predominantly woody plants occur in the study area. Roadside shoulders are typically sandy, and covered by grasses and other herbs. The construction yard along the New River Canal is located in a grove of tall Australian pines, and only a few herbaceous plants are occasionally found beneath this type of forest canopy. Because of the diversity of microhabitats, this biotic community contains the greatest assortment of native and naturalized vegetation within the study area.

e. Upland Hardwoods

On the RRF site only one small area is classified as upland hardwoods. The vegetation is dominated by Australian pine in a previously disturbed area.

2. Urban Wilderness

The second biological concern is that the northeastern corner of the site adjacent to New River is Urban Wilderness. The area was so designated because it is part of the last vestige of natural vegetation along

South Fork New River. The 300-wide strip of urban wilderness adjacent to the river will be preserved and enhanced (Chapter V). In fact the mitigation plan includes extension of the preservation and enhancement area along the entire waterfront and not just that part designated as Urban Wilderness (Plate 4).

3. Threatened and Endangered Species

The project area is within the theoretical range of several species classified as threatened or endangered by U. S. Department of the Interior and Florida Game and Freshwater Fish Commission. Field studies during site analysis have not identified any threatened or endangered species on the site, and the probability of occurrence is low. The site has been reviewed by the U. S. Fish and Wildlife Service (Jacksonville, FL) and development is not expected to impact any endangered or threatened species (Personal Communication, 12 July 1983, Don Palmer, Endangered Species Specialist, U. S. Fish and Wildlife Service).

D. Sedimentation and Siltation

A potential impact of dredging and filling during construction is siltation and sedimentation. Berms will be constructed to contain water during dredging and filling. Sediment traps and screens will be strategically placed to trap runoff. All permanent berms constructed for the development will be grassed to prevent erosion. No discharge of sediment laden water will be made to South Fork New River Canal during construction.

E. Traffic

To establish the traffic impact of the project, an estimate of the number of trucks and employee vehicle trips resulting from the proposed 1,600 ton per day RRF was developed. The estimate was the input to the County's computerized TRIP model.

The estimated average weekday vehicle trips associated with the southern facility is 740. The principal impact will be on Route 441. The road is already over capacity from Sunrise Boulevard to the Dade County line. According to the TRIPS model, the projected traffic (due to the RRF) ranges from 172 trips north of Orange Drive (one-half of 1 percent of total traffic on link) to fewer than 50 trips south of Stirling Road and north of State Road 84. A lesser impact is on Griffin Road, from Ravenswood Road to Route 441. The southern facility will contribute from 25 to 40 trips on this road (about 0.2 percent), which is over capacity. However, the County Bond Project to widen Griffin Road will relieve this condition. The estimated road impact fees generated by the TRIPS model for the RRF project site are \$56,000. These fees and the traffic increase of less than one percent indicate that the projected traffic increase will have an insignificant impact on existing traffic patterns.

Truck traffic between the RRF and landfill will be accomplished on an internal restricted road system. Residue disposal trucks will not have to enter U. S. 441. No impacts on public transportation will be created by this phase of the operation.

F. Fort Lauderdale-Hollywood International Airport

The RRF project site is within regulated airspace of the Fort Lauderdale-Hollywood International Airport. Concerns have been expressed that RRF stack height and birds attracted to the landfill might interfere with aviation.

The site is outside the 10,000 foot restricted zone of a public airport. The stack height of the RRF will be approximately 195 feet above grade. This is below the 200 foot FAA limitation for the site. The location of the RRF will be in the southern portion of the site and the stacks will be placed outside the approach surface area to the airport. Although it is

within regulated airspace, requiring a formal notice to FAA, the facility will be in compliance with FAA regulations and no objection from the FAA is expected (Attachment 5).

G. Air Quality

Air quality guidelines have been developed by federal, state, and local agencies (Table 2). Local monitoring is conducted by the Broward County Environmental Quality Control Board (BCEQCB). The following discussion defines ambient conditions as well as those conditions which might be expected after the RRF becomes operational.

1. Ambient Air Quality

Data on ambient air quality in the vicinity of the RRF are available from two BCEQCB monitoring stations. Carbon monoxide is monitored at a station less than 0.5 mile from the RRF, and total suspended particulates, nitrogen dioxide, and sulfur dioxide are monitored at a second site approximately 2.5 miles west of the Route 441 site.

At the carbon monoxide station, the maximum 1-hour standard of 35 ppm for carbon monoxide was not exceeded in 1981. However, this site recorded the three highest one hour concentrations in the Broward County during the year. High values were 26.5, 23.5 and 17.0 ppm. This site also had the three highest 8-hour concentrations in 1981, two of which exceeded the standard of 10.0 ppm. These concentrations were 9.8 and 9.1 ppm. Particulates monitored in 1981 at the second site had an annual geometric mean of 41.2 ug/m³, well below the Federal, State, and County standards. The maximum 24-hour concentration of suspended particulates at this site was 111.8 ug/m³, which is also less than established standards. The annual arithmetic means for nitrogen dioxide and sulfur dioxide were approximately 0.014 ppm and less than 0.001

TABLE 2

AMBIENT AIR QUALITY STANDARDS

Pollutant (1)	Federal Primary	Federal Secondary	State & County
Suspended Particulates			
Annual Geometric Mean	75	60	60
Maximum 24 hr concentration (2)	260	150	150
Sulfur Dioxide			
Annual Arithmetic Mean	80 (0.03 ppm)		60 (0.02 ppm)
Maximum 24 hr concentration (2)	365 (0.14 ppm)		260 (0.1 ppm)
Maximum 3 hr concentration		1,300 (0.5 ppm)	1,300 (0.5 ppm)
Carbon Monoxide			
Maximum 8 hr concentration (2)	10 (9 ppm)	Same as Federal	Same as Federal
Maximum 1 hr concentration	40 (35 ppm)	Primary	Primary
Photo Chemical Oxidants			
Maximum 1 hr concentration (2)	240 (0.12 ppm)	160 (0.08 ppm)	Same as Federal
Nitrogen Dioxide			
Annual Arithmetic Mean	100 (0.05 ppm)	Same as Federal	Same as Federal
		Primary	Primary
Hydrocarbons			
Maximum 3 hr concentration (6-9 a.m.) (2,3)	160 (0.24 ppm)		160 (0.24 ppm)
Lead			
Quarterly Arithmetic Mean	1.5	Same as Federal	None Established

(1) All measurements are in $\mu\text{g}/\text{m}^3$ except CO which is mg/m^3 .

(2) Concentration limits not to be exceeded more than once per year.

(3) Used as guide in devising plans to achieve oxidant standards.

ppm, respectively, significantly below established standards. Monitoring data from nearby stations indicate that total suspended particulates, nitrogen dioxide, and sulfur dioxide are within Federal, State, and County standards.

2. Emission Rates of Resource Recovery Facilities

A range of emission rates are reported in the technical literature regarding pollutant emissions from municipal solid waste resource recovery facilities. The results of two literature surveys are provided in Table 2.

Because of the range of pollutant emissions reported, values were selected to develop an upper limit of acceptable emission rates, for an air quality impact model. These emission values are listed in Table 3, and they represent conservative estimates of emission rates to be used as a basis of preliminary environmental analysis for the RRF. Actual emission rates for the proposed facility may be somewhat lower.

3. Air Quality Impact Model Simulation for RRF

A USEPA approved computer assisted screening model called PTMAX (Point of Maximum Concentration) was used to identify areas of maximum air quality impact within a 100 kilometer radius of stack emissions. Using the emission values in Table 3, the PTMAX model determined the maximum air quality impact resulting from the proposed resource recovery facility under a wide range of meteorological conditions based on stability class and wind speed combinations.

The results of the PTMAX screening model for determining potential air quality impacts in any direction at any distance within a 100 kilometer radius of the proposed facility indicate that this facility will not significantly affect ambient air quality with respect to TSP, NO_x, and SO₂ pollutants. Although a quarterly impact was not developed for lead, the PTMAX

Table 3

Results of Air Emission Studies at Resource Recovery Facilities

A.D. Little to O'Brien & Gere March 1981 Onondaga Report (lbs of pollutant per ton of refuse charged)		State of Vermont Agency of Environmental Conservation Proposed Application for Approval to Construct New Air Contaminant Source October 9, 1981 (cover letter to Mr. J. Ogden) Burlington Vermont Resource Recovery Project
TSP (PM)	0.69 - 1.57	0.7 - 1.6
SO ₂	1.0 - 3.6	1.0 - 8.8
CO	0 - 27	0.02 - 35.0
NO _x	0.40 - 3.2	0.4 - 3.6
Pb	0.04 - 0.32	0.04 - 0.32

Table 4

Selected Pollutant Emission Rates
For Preliminary Environmental Analysis*

TSP (PM)	0.9 lbs/ton
NO _x	1.5 lbs/ton
SO _x	2.5 lbs/ton
CO	0.6 lbs/ton
Pb	0.1 lbs/ton

*Pounds of pollutant per ton of solid waste

"worst case" analysis result of a 0.98 ug/m increment for a 1-hour impact interval indicates that lead concentrations will fall below the quarterly standard of 1.5 ug/m .

Carbon monoxide levels at a monitoring station on Route 441, just north of Route 84, periodically exceeded the 8-hour Federal, State and County standard in 1982 as a result of the level of traffic and development in the area. To specifically evaluate the effects of carbon monoxide emissions from the resource recovery facility and associated truck traffic on ambient carbon monoxide levels, EPA-approved models were applied to the proposed emission sources. The FTMAX model was used to determine projected increases in carbon monoxide levels attributable to emissions from the resource recovery facility. The model results indicated that there would be a maximum increase of only 0.033 ppm in ambient carbon monoxide levels due to the operation of the resource recovery facility. Because truck traffic in the area would increase as a result of site use for solid waste facilities, the HIWAY model was used to evaluate projected carbon monoxide levels resulting from this anticipated traffic. The model indicated that there would be an increase at the carbon monoxide monitoring station of 0.032 ppm attributable to truck traffic associated with the resource recovery site. In total, therefore, an increase of 0.065 ppm carbon monoxide above ambient levels is anticipated due to the resource recovery process and truck emissions. Regulatory guidelines indicate that an increase of less than 0.437 ppm in the 8-hour ambient concentration of carbon monoxide is considered insignificant in terms of contributing to exceedances of applicable air quality standards. Based upon the above analysis, the projected increase in ambient carbon monoxide levels from point and mobile sources associated with the proposed project should not have a significant impact on local air quality.

RRF plant design will include the necessary scrubbers and precipitators to efficiently control stack discharge. Based upon preliminary computer simulations, air quality will not be significantly impacted by operation of the RRF.

H. Odor

Solid waste handling facilities are perceived to generate offensive odors which impact people in adjacent areas. Odor should not be a problem at the RRF. The RRF will be completely enclosed, and malodorous gas generated by incoming solid waste will be controlled by negative air pressure in the facility. The air will be fed into the furnaces where destruction of odor causing compounds will occur.

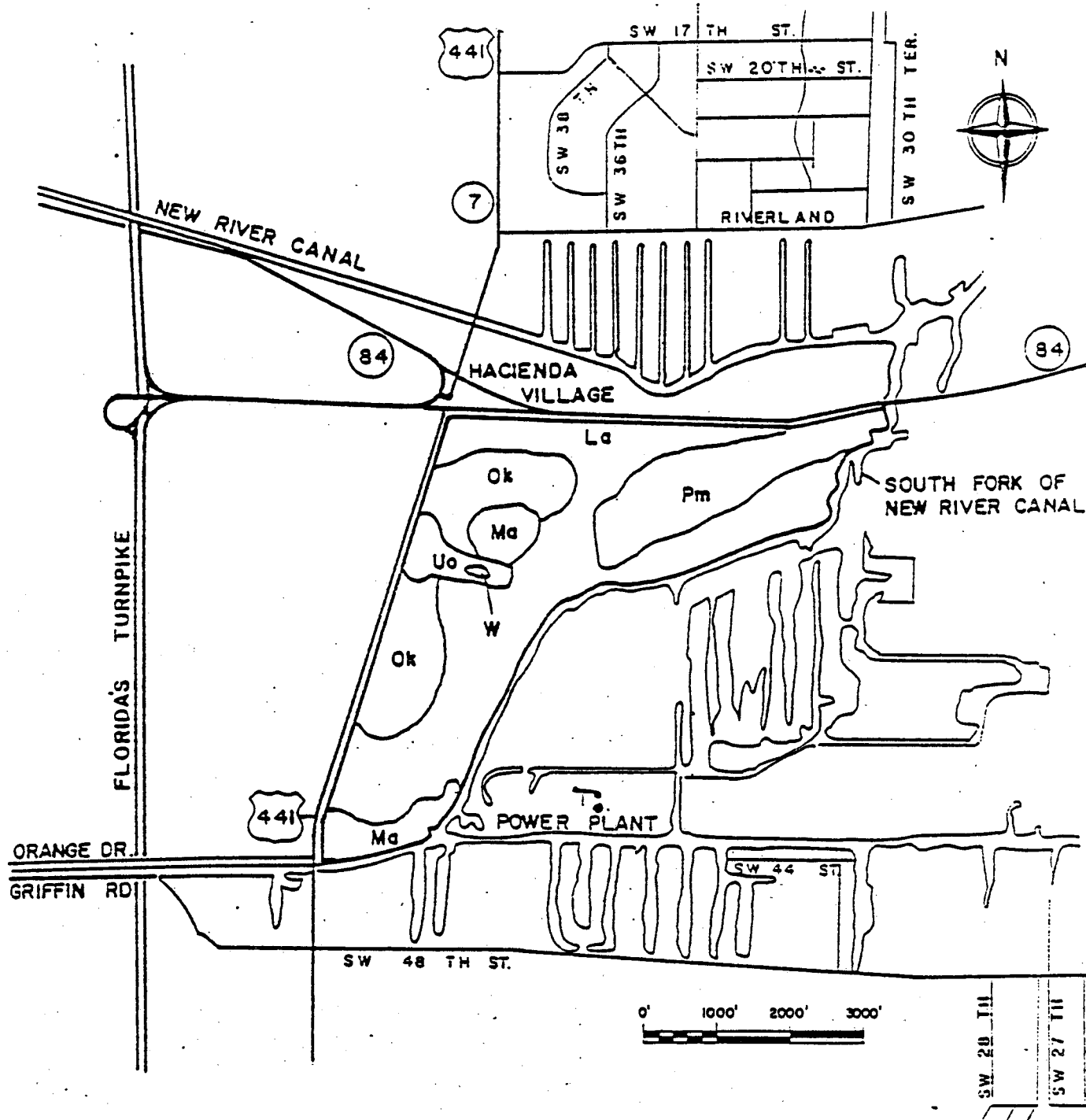
The products of the RRF will consist of inorganic, nonprocessable waste and residue ash generated by the mass burn RRF. The residue ash will consist of the inorganic minerals of the processed waste. It will be odorless and will not attract insects, rodents or birds.

I. Noise

Noise will be generated by operation of the waste handling and processing equipment in the RRF. Noise for the RRF will not significantly impact the adjacent residential areas. Acoustic design of the plant will meet County codes. All equipment will be enclosed in the RRF which will baffle the sound generated in the plant. Noise in the residential area will also be attenuated by distance which will be a minimum of 400 feet from the nearest house to the RRF. Because the site is located adjacent to two major highways, U. S. 441 and SR 84, on site noise from vehicular traffic will be insignificant.

J. Soils

A partial inventory of the soils of Broward County was published in 1976; however, this report did not include the area east of Florida's Turnpike in the southern part of the county. Since 1976, USDA Soil Conservation Service



SOIL SERIES

La - LAUDERHILL MUCK
 Ma - MARGATE FINE SAND
 Ok - OKEELANTA MUCK
 Pm - PLANTATION MUCK
 Uo - URBAN LAND COMPLEX
 W - WATER

SOURCE: U.S.D.A. SOIL CONSERVATION SERVICE DRAFT

SOIL ASSOCIATIONS MAP

has completed draft mapping of remaining portions of the county, and Figure 17 is based upon the draft soils survey. The project site comprises five soil series: Lauderhill muck, Margate fine sand, Plantation muck, Ckeelanta muck, and Urban Land Complex.

1. Lauderhill Muck (La)

This series is nearly level, organic soil underlain by limestone at a depth of 20-40 inches. Because it is organic, it is subject to oxidation when not flooded. These soils in undisturbed condition are flooded 6 to 12 months per year. They have rapid permeability and a very high available water capacity.

2. Margate Fine Sand (Ma)

Margate sands are nearly level poorly drained soils which are flooded one to four months per year. They are underlain by limestone at depths of 20 to 40 inches. Margate sands have rapid permeability, and available water capacity is low in all layers.

3. Ckeelanta Muck (CK)

This series comprises nearly level poorly drained organic soils underlain by sand at depths of 16 to 40 inches. Limestone is under the surface at depths of greater than 51 inches from the surface. Because they are organic, oxidation is rapid when they are not flooded. These soils have rapid permeability and a very high available water capacity.

4. Plantation Muck (Pm)

Plantation mucks are nearly level very poorly drained soils which are underlain by sand and limestone. The limestone occurs at depths of 25 to 35 inches. Permeability is rapid and available water capacity is very high.

5. Urban Land Complex (Uo)

This series is 50 to 70 percent udcrthents and 30 to 50 percent urban lands and comprises lawns, playgrounds, streets, sidewalks, etc. They are poorly to moderately drained and are made up of 20 to 30 inch layers of sand, rock, and/or shell over the natural soil. Permeability is generally rapid, and available water capacity is generally low.

Detailed soils investigations have been performed for various parcels within the project area, including the Fort Lauderdale Compost Facility site (KBC, Consultants, Inc.), the Powell Brothers Industrial Tract (East Coast Testing & Engineering, Inc.), and the Griffey Tract (Florida Testing & Engineering Co.). The KBC report prepared for engineering studies for Fort Lauderdale Composting Facility is the most comprehensive of the three reports. The reports are in general concensus in their separate geotechnical descriptions; the surface soil is peat (1.2 - 4.4 feet thick), followed respectively by a sandy calcerous silt (0.1 - 2.2 feet thick), medium to fine sand (0.2 - 3.6 feet thick), and limestone. Depth to limestone ranges from 3 to 7 feet with an average of 4.5 feet.

The geotechnical studies indicate that the soils are unsuitable for construction and that site development will require removal of the surface soils (muck) and replacement by crushed limestone fill prior to construction.

K. Dust

Dust will be generated in the RRF as solid waste is processed. All dust will be contained in the enclosed facility. The residue ash product of the RRF is expected to have an average moisture content of 30 percent which should be sufficient to minimize emissions.

L. Water Resources

Water resource impacts are an important concern of this project, and thorough discussion of the control procedures for on-site water was provided in Section II.A.3. This section provides a recapitulation of Section II.A.3, a description of a 100-year flood consideration, and groundwater.

1. Water Management

The initial stormwater runoff from the resource recovery site will be intercepted and retained in swales and/or retention ponds on the site. Excess runoff, beyond that which is captured in the retention areas, will be conveyed to two detention ponds. These ponds will detain the excess runoff and release it at a controlled rate to the C-11 canal. Drainage facilities for the resource recovery sites will meet South Florida Water Management District criteria for surface water management.

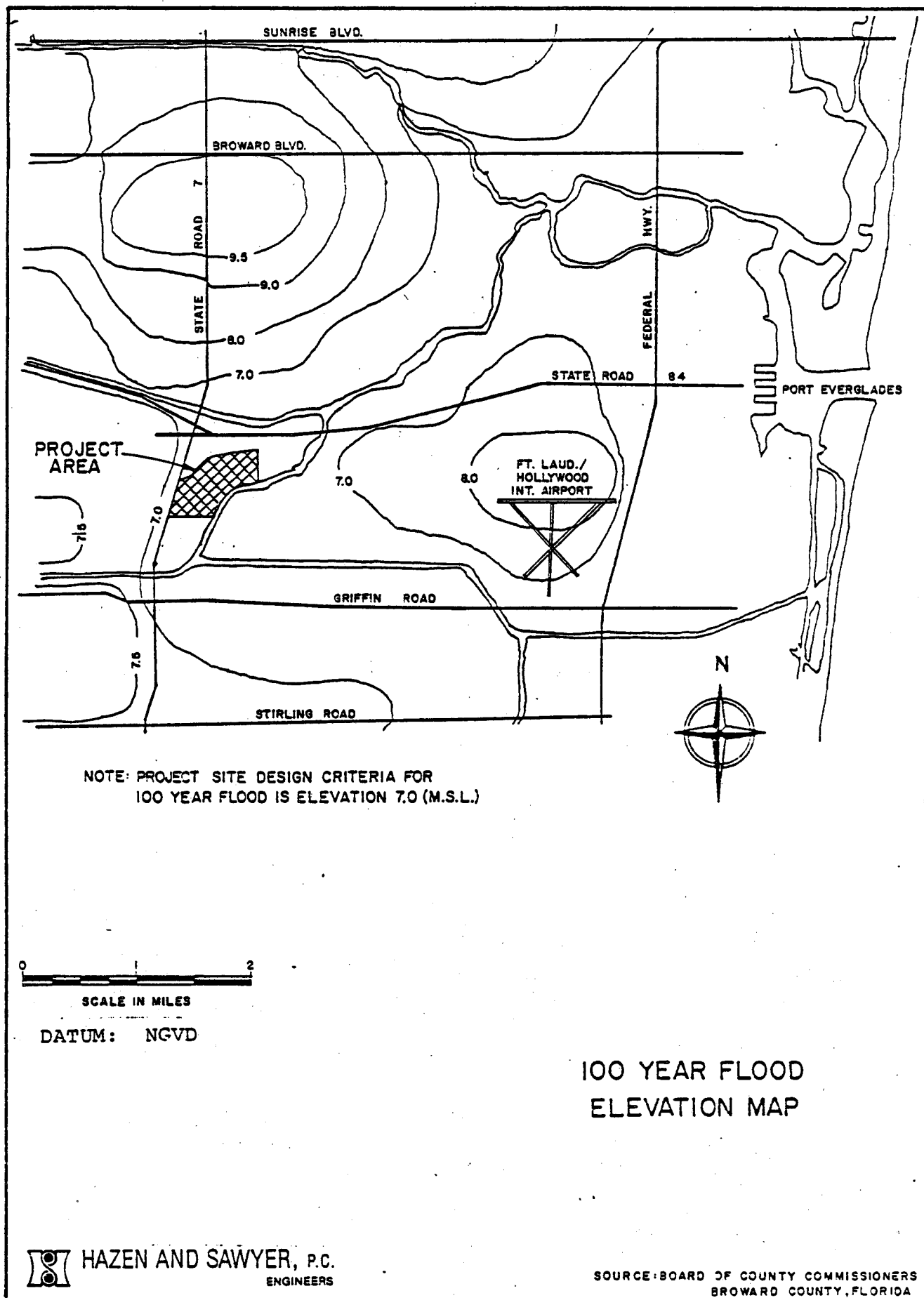
2. Flood Zone

Project design criteria for the 100-year flood in the development area is elevation 7.0 feet MSL in accordance with Broward County standards. The RRF site will be filled to a minimum of 7.0 feet during development; therefore, this portion of the project will be at or above the established 100-year flood elevation (Figure 18).

3. Ground Water

The Biscayne Aquifer underlies the entire eastern and central portion of Broward County and is the sole source of municipal water supply in the County. The aquifer is composed of limestone, sandstone and sand, and ranges in thickness from 200 feet along the coastline to a thin edge in the Everglades, 30 to 40 miles inland. The Biscayne Aquifer is highly productive

FIGURE 18



with yields reaching 7,000 gallons per minute. Recharge is principally through rainfall. The canal systems also play an important and complex role in groundwater recharge and discharge.¹

The water table elevation of the Biscayne Aquifer in the area around the project site has been tentatively determined by the USGS for two periods in 1981. The water table was approximately one foot above mean sea level in mid-March. The elevation in early October, during the rainy season, was about two feet above mean sea level.²

The project site is on the western edge of the large coastal area subject to saltwater intrusion.³ The 1964 USGS report which plotted the 1000 mg/l isochlor line (Figure 19) indicates that the resource recovery facility is just outside the 1000 mg/l isochlor line. A more recent study indicates that the salt intrusion has advanced and the resource recovery facility may now be within the 1000 mg/l isochlor line.⁴

M. Archaeological Resources

The State of Florida, Division of Archives, History and Records Management, reviewed a map of the area for evaluation of known or potential archaeological resources at the site. The probability of any significant occurrence of historic or archaeological resources is very low. Therefore, no further investigation is required prior to construction (Attachment 8).

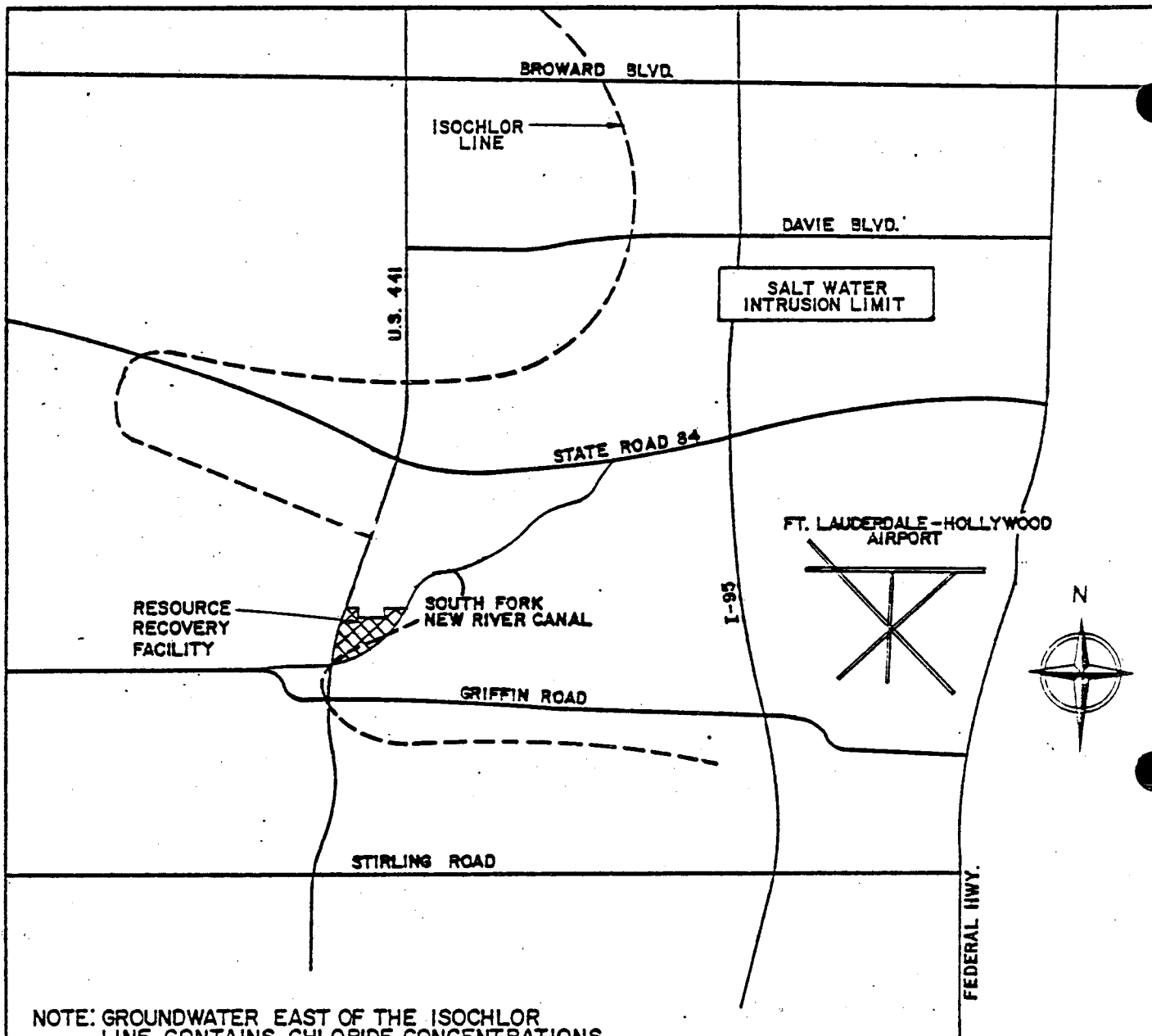
¹U. S. Geological Survey, Biscayne Aquifer, Southeast Florida, Water Resources Investigation 78-107, September 1978.

²U. S. Geological Survey, Provisional Maps Depicting Altitude of the Biscayne Aquifer in Broward County, March 16-20 and October 7-8, 1981.

³Broward County, Florida; Map of Potable Water Service Areas, Approximate Limits of Saltwater Intrusion and Existing Well Fields from U. S. Geological Survey, Water Summary, South Florida, May 1979.

⁴Bearden, H. W. Ground Water Resources of the Hollywood Area, Florida, Water Resources Investigation 77, U. S. Geological Survey and Florida Department of Natural Resources, 1974.

FIGURE 19



NOTE: GROUNDWATER EAST OF THE ISOCHLOR LINE CONTAINS CHLORIDE CONCENTRATIONS GREATER THAN 1000 MG/L.

LOCATION MAP 1000 MG/L ISOCHLOR



N. Regulatory Aspects

The following permits or regulatory approvals are required for the development of the Southern Resource Recovery Facility. Although considered unlikely at this time, it is possible that Development of Regional Impact Regulations could be imposed on the resource recovery project. An assessment of whether or not the project is a DRI is being made by the State Department of Veteran and Community Affairs.

1. USEPA Prevention of Significant Deterioration Permit

The resource recovery facility will be subject to USEPA Prevention of Significant Deterioration (PSD) review and permitting due to the expected emission rates of regulated pollutants. Based on results obtained from nearby monitoring stations, ambient air quality levels in the area are well within federal, state, and county standards. Modeling results have indicated that emissions from the proposed resource recovery facility will not cause the contravention of these standards. Therefore, a resource recovery facility on this site should not significantly degrade existing air quality, and it is anticipated that a PSD permit application will be approved.

2. Federal Aviation Administration Part 77 Regulations

The project site is within 10,000 feet of the Hollywood-Fort Lauderdale International Airport. Because the proposed resource recovery facility will have a stack height of about 185 feet above grade, it will be within regulated airspace and subject to Federal Aviation Administration (FAA) review under the Part 77 Regulations. Although FAA review is required for the proposed stack, the site is not situated within a precision instrument approach, and it is anticipated that FAA approval will be granted.

3. State Air Pollution Control Permit

Construction and operation of the resource recovery facility site will require permit approval from the Florida Department of Environmental Regulation (DER). Requirements for DER permit approval are generally parallel to requirements for USEPA PSD permit approval. As with the PSD review and permitting process, it is anticipated that DER permit approval for an air pollution source site will be granted.

4. State Underground Injection Control Permit

Wastewaters will be disposed of through deep well injection into the Boulder zone. An injection well for this purpose will require a DER permit. Because the Boulder Zone does not contain potentially potable groundwater supplies and is isolated from other potable or potentially potable supplies by an overlying confining layer, DER permit approval is anticipated.

5. State Solid Waste Facility Permit

Construction and operation of the resource recovery facility are subject to DER permit approval. DER regulations contain provisions and criteria which must be incorporated into solid waste facility plans. A preliminary site inspection was made by DER representatives to verify the acceptability of the project site. A preliminary determination was made that assuming all regulatory requirements would be satisfied, permit approval will be forthcoming.

6. Dredge and Fill Permits

Dredge and fill permits are required from U. S. Army Corps of Engineers and Florida Department of Environmental Regulations. These regulatory agencies will review the project in consideration of wetlands impacts and need for the project. Need for the project has been demonstrated and project development include a mitigation plan to compensate for wetland losses.

7. South Florida Water Management District Surface Water
Management Permit

The management of surface waters on the project site is subject to approval from the South Florida Water Management District (SFWMD).

As discussed previously, water management has been designed to meet or exceed SFWMD requirements. Permit approval for a surface water management system based on SFWMD criteria is anticipated.

8. South Florida Water Management District Industrial Water Use
Permit

At the project site, groundwater can be used for make-up or cooling water in the resource recovery process. Water of suitable quality may be obtained from either the Biscayne or Floridan Aquifer. Such withdrawal is subject to SFWMD permit approval. It is anticipated that an industrial water use permit will be granted for the project site.

9. Broward County Construction/Operation Licenses for Air
Pollution Sources

Similar to USEPA PSD and State DER approvals, it is expected that the Broward County Environmental Quality Control Board (BCEQCB) will issue the necessary licenses for construction and operation of the resource recovery facility.

10. Broward County Construction/Operation Licenses for Disposal
Wells

The construction and operation of the proposed injection well is subject to BCEQCB approval. Injection of wastewaters into the Boulder Zone is expected to receive approval from the BCEQCB.

11. Broward County Construction/Operation Licenses for Solid Waste
Pollution Sources

The BCEQCB has regulatory authority over the construction and operation of solid waste facilities. A site inspection performed by the appropriate BCEQCB representative confirmed that with incorporation of stipulated design and operating criteria into the proposed plans for the resource recovery and landfill facilities, the BCEQCB will grant permit approval.

12. Broward County Construction/Operation Licenses for Noise
Pollution Sources

The BCEQCB grants licenses for the construction and operation of noise generating facilities. The proposed facilities site are subject to these licensing requirements. Licensing approval is expected, contingent upon the incorporation of appropriate measures to mitigate noise impacts.

V. MITIGATION

Development of the resource recovery facility will require that approximately 15.6 acres of wetlands be removed and filled. To compensate for the wetland losses, a mitigation plan has been developed as an integral part of the development. Mitigation will be accomplished on-site adjacent to South Fork New River Canal and will comprise 14.98 acres (Plate 4). Because the mitigation plan will create wetlands of greater values per unit area than those which will be lost and effectively extends the Urban Wilderness Area, the mitigation more than offsets the losses.

In order to assist in development of the mitigation plan, a special tree survey of the site was conducted. For the purpose of the survey, trees were identified as woody vegetation with a diameter breast height (dbh) of a minimum of 3 inches and an overall height of 7 feet. The tree survey (Plate 5) enabled a plan to be developed which would minimize impact to the more significant vegetation in the mitigation area. Landscaping will be done around existing trees. Large clumps of trees such as found at the northeastern and southwestern end of the mitigation area will be preserved. As appropriate, these areas will be enhanced by removal of discarded construction materials, selective removal of exotic species, and planting of native species.

On-site mitigation/enhancement will be accomplished in a strip adjacent to South Fork New River Canal. This mitigation will extend the riverfront natural area from the south end of the Urban Wilderness Area (northeastern corner of project site) to the US 441 bridge over South Fork New River Canal (Plate 4). The width of the strip will be 300 feet in the Urban Wilderness Area and 200 feet wide south of the Urban Wilderness Area to the US 441 bridge.

The first phase of the mitigation plan entails environmental enhancement by removing the discarded construction materials and equipment which litter the area. The other major elements of the on-site mitigation plan include:

- . removal of parts of the dredge spoil berm and associated exotic vegetation.
- . reshaping the land to establish more valuable wetland habitat similar to that which originally occurred adjacent to New River including: (1) swamp at or above average high water level; (2) marsh between average high water level and average low water level; and, (3) shallow water at depths two to three feet below mean sea level.
- . planting the marsh and swamp with species originally extant in the New River Swamp. Plantings for the marsh would include species such as pickerel weed, duck potato, sawgrass, etc., and plantings for the swamp would include species such as cypress, red maple, pond apple, and cabbage palms.
- . controlling exotic plants such as cajeput, Australian pine, and Brazilian pepper on an as needed basis until the plantings become well established.

A typical section showing the elevations in the mitigation area is shown in Figure 20. Elevation of swamp will be slightly above average highwater (+1.65 MSL) and marsh elevation will be slightly below average low water (-0.02 MSL). Open water areas will be excavated to -2.0 MSL. Swamp areas will be planted with cypress, red maple, pond apple, and sabal palms (Figure 21). Marsh areas are expected to quickly regenerate naturally, but they will also be

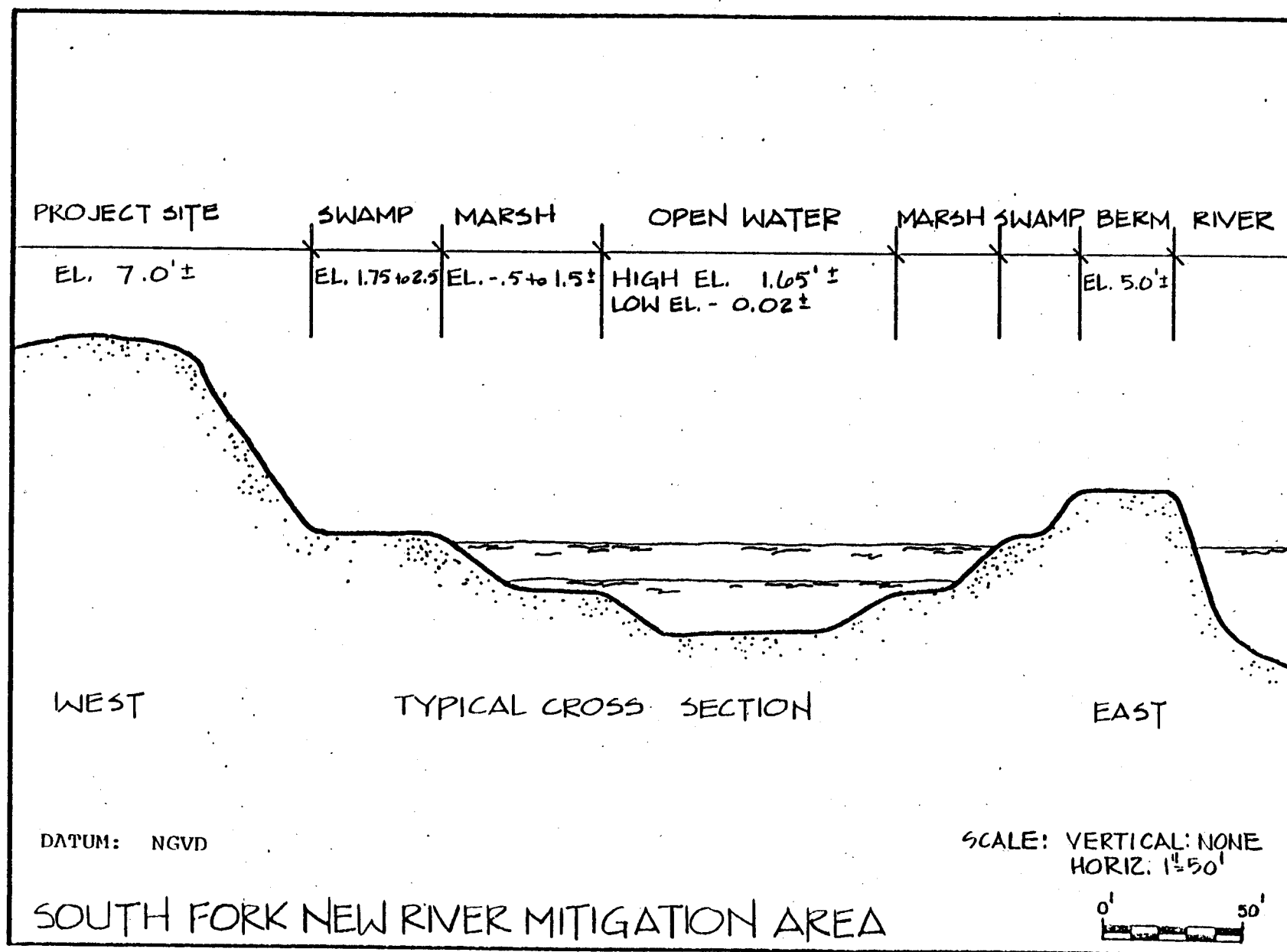


FIGURE 20

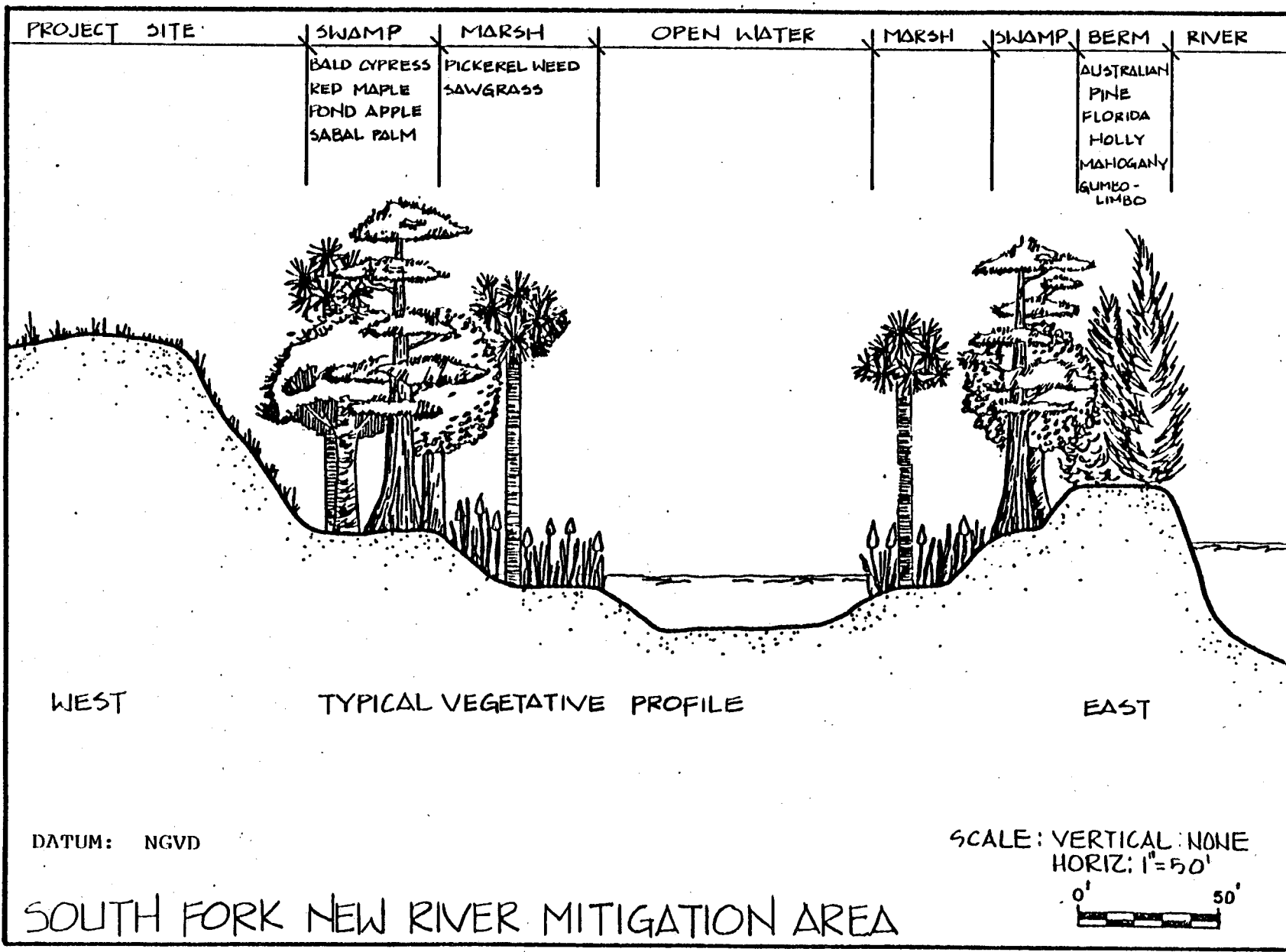


FIGURE 21

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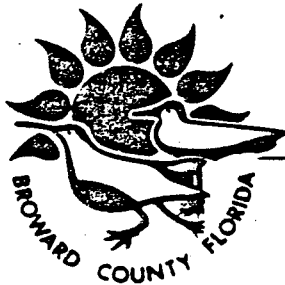
planted with pickerel weed and arrow arum. Barren upland areas will be planted with mahogany and gumbo-limbo to create a hardwood hammock environment in an area presently dominated by Australian pine. Planting densities are provided in Figure 22.

The proposed mitigation/environmental enhancement will have several positive benefits which will otherwise likely never be realized by Broward County. The mitigation area effectively extends the Urban Wilderness Area and will provide a wide natural buffer between the river and development. The area will restore wildlife and fish habitat contiguous with New River; thus, wetland values in the mitigation area will be greater per unit area than the wetlands which will be lost. The enhancement area will provide an aesthetic setting for boaters using New River, and the newly created shallow water habitat will create a new recreational opportunity for shallow draft vessels such as canoes. The area could be developed with a theme title such as "Cypress Slough" and could provide a unique recreational opportunity for the people of Broward County.

AREA	SPECIES	SIZE	DENSITY
SWAMP	BALD CYPRESS	8'	20 / ACRE
	RED MAPLE	SEEDLING	70 / ACRE
	POND APPLE	8'	10 / ACRE
	SABAL PALM	SEEDLING	70 / ACRE
		8'	10 / ACRE
		SEEDLING	30 / ACRE
		8'	4 / ACRE
		SEEDLING	80 / ACRE
UPLAND	MAHOGANY	8'	10 / ACRE
	GUMBO - LIMBO	8'	5 / ACRE
MARSH	PICKEREL WEED	CULMS	400 / ACRE
	ARROW - ARUM	CULMS	400 / ACRE

FIGURE 22

SOUTH FORK NEW RIVER MITIGATION AREA



County Administrator's Office
Room 248, Broward County Courthouse
Fort Lauderdale, Florida 33301
(305) 765-5121

September 8, 1983

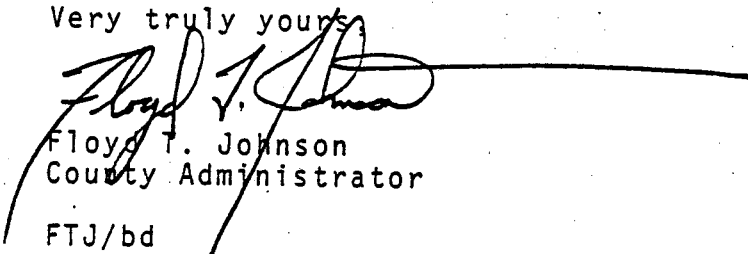
Attn: Mr. Jeremy Craft
State of Florida
Department of Environmental Regulation
2562 Executive Center Circle East
Montgomery Building
Tallahassee, Florida 32301

Re: Dredge and Fill Permit Application for Southern Broward
County Resource Recovery Facility

Dear Mr. Craft:

I have designated Peter E. Robinson, P.E., Vice-President of Hazen and Sawyer, P.C., 5950 Washington Street, Hollywood, Florida, as the authorized agent for the dredge and fill permit application for the above referenced project. Mr. Robinson is authorized to negotiate modifications and revisions when necessary, and accept or assent to any stipulation on our behalf.

Very truly yours,


Floyd T. Johnson
County Administrator

FTJ/bd

ADJACENT LAND OWNERS

Ackerly Realty

5500 NW 77 Ct., Miami 33166

Bost, W. A.

4301 South State Rd. 7, Ft. Lauderdale 33314

Broward Lobster, Inc.

4501 SW 44 Avenue, Ft. Lauderdale 33314

Central Broward Drainage District

8020 Stirling Road, Hollywood 33024

Concrete Inv., Inc.

P. O. Box 144, Hollywood 33022

Cramer, Hugh B. and Maurer, Kenneth

3901 South State Road 7, Ft. Lauderdale 33314

Flite, R.

4400 SW 42 Turn., Ft. Lauderdale 33314

Florida Power & Light Company

P. O. Box 8248, Ft. Lauderdale, 33310

Green, V. G.

46735 SW 43rd Turn., Ft. Lauderdale 33314

Powell Brothers, Inc.

P. O. Box 14550, Ft. Lauderdale 33302

Ramgoh Sales

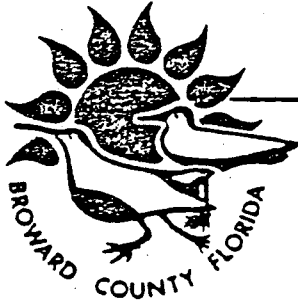
4500 S. State Rd. 7, Ft. Lauderdale 33314

Smith, J. T.

4501 SW 43 Avenue, Ft. Lauderdale 33314

West Dixie Farms Block 2 (contains 8 parcels)

1. Florida Power & Light, P. O. Box 8248, Ft. Lauderdale 33310
2. Florida Power & Light, P. O. Box 8248, Ft. Lauderdale 33310
3. Florida Power & Light, P. O. Box 8248, Ft. Lauderdale 33310
4. Kinsman, George C., c/o FP&L Tax Dept., P. O. Box 8248, Ft. Lauderdale 33310
5. Powell Brothers, 4400 SR 7, Ft. Lauderdale 33314
6. Powell Brothers, 440 SR 7, Ft. Lauderdale 33314
7. Powell Brothers, 440 SR 7, Ft. Lauderdale 33314
8. Powell Brothers, 440 SR 7, Ft. Lauderdale 33314



Property Division

521 S. Andrews Avenue
Fort Lauderdale, Florida 33301

August 19, 1983

Ref: 83/21

HAND DELIVERED

Patrick Davis, Environmental Engineer
Hazen and Sawyer, P. C.
5950 Washington Street
Hollywood, Florida 33023

Re: Broward County Resource Recovery -
Site Acquisition

Dear Mr. Davis:

Jim Hudgens of CZR, Inc. has requested that I furnish you with a brief overview that indicates the acquisition process that Broward County follows on projects.

Normally, the first process that takes place is site or route selection. In the case of resource recovery, both sites have now been identified. Having identified the site, we then request title information from an independent abstract company. Simultaneously, it is requested that survey work be performed that will give us the appropriate maps and sketches for negotiations, a legal description of each individual ownership involved, and the amount of acreage involved with each ownership. Other survey information is requested based on the individual needs concerned with each specific project.

As soon as survey and title information is received, we retain the services of one or more independent fee appraisers to establish fair market value of each property concerned. When these formal appraisals are received, they are reviewed by a staff review appraiser.

As soon as we have an approved appraisal work product, the appraisal is turned over to our professional negotiation team and an agent is assigned to make contact with the owner, and negotiations begin.

Should all negotiation attempts fail, property value data and suit information is forwarded to our Office of General Counsel for litigation under Florida Eminent Domain proceedings. Normally, our attorneys will file what is known as a "quick take action" under Florida statutes, which involves a hearing with the judge and condemnee. The judge then determines if we have shown sufficient proof of public necessity, whether our estimate of value is in good faith, the amount of monies to be deposited in the court registry, and the date that the county shall take physical possession of the property.

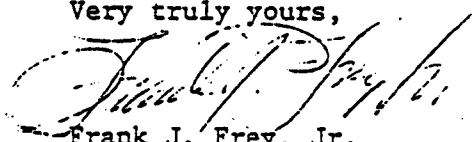
Patrick Davis, Environmental Engineer
Broward County Resource Recovery -
Site Acquisition

Page 2

In the case of "quick take" procedures, there would be a final adjudication by jury trial at some point after the Order of Taking, to determine the actual amount of compensation to be paid to the property owner. Any given project at this point would then proceed toward development and construction.

If I may be of further assistance, please advise.

Very truly yours,



Frank J. Frey, Jr.
Director

FJF:rf

CC: Tom Elliott, Asst. Director, Finance & Adm. Systems
Phyllis Korab, Coordinator

LEGAL DESCRIPTION

A parcel of land lying within the East One Half (E 1/2) of Section 25, Township 50 South, Range 41 East, being all of Tracts 18 and 19 and a portion of Tracts 15, 16 and 20 of the John W. Newman Survey as recorded in Plat Book 2, Page 26, of the Public Records of Dade County, Florida, TOGETHER WITH all of Lots 4 through 8, inclusive of Block 2, West Dixie Farms as recorded in Plat Book 24, Page 36, 9f the Public Records of Broward County, Florida, being more particularly described as follows:

COMMENCING at the East Quarter (E 1/4) corner of said Section 25; thence South $88^{\circ} 34' 16''$ West along the South line of the Northeast One Quarter (NE 1/4) of said Section 25, a distance of 491.85 feet to the easterly boundary of aforesaid Tract 16, said point also being the POINT OF BEGINNING; thence South $20^{\circ} 05' 06''$ West, along said easterly boundary 492.28 feet to the Southeast corner of aforesaid Tract 18; thence South $35^{\circ} 44' 42''$ West along the southeasterly boundary of said Tract 18, a distance of 508.13 feet; thence South $72^{\circ} 06' 20''$ West, along the southerly boundary of said Tract 18 and aforesaid Tract 19, a distance of 1053.32 feet to the Southeast corner of aforesaid Tract 20; thence South $76^{\circ} 30' 24''$ West, along the southerly boundary of said Tract 20, a distance of 529.67 feet to the easterly right-of-way line of State Road No. 7; thence North $01^{\circ} 51' 23''$ West, along said easterly right-of-way line, 248.90 feet; thence northerly along said easterly right-of-way line and along the arc of a tangent curve, concave to the East, having a radius of 1810.08 feet, a delta of $16^{\circ} 43' 20''$, an arc distance of 528.28 feet; thence tangent to said curve North $14^{\circ} 51' 56''$ East, along said easterly right-of-way line, 1120.96 feet to the Northwest corner of aforesaid Lot 4, Block 2; thence North $88^{\circ} 34' 16''$ East along the North line of said Lot 4, a distance of 239.67 feet to the Northeast corner of said Lot 4; thence South $01^{\circ} 42' 40''$ East, along the East boundary of Lots 4 through 8 inclusive, 524.08 feet to the Southeast corner of said Lot 8; thence North $88^{\circ} 34' 16''$ East, along a line 50.00 feet North of and parallel with the aforesaid South line of the Northeast One Quarter (NE 1/4), 843.36 feet; thence North $01^{\circ} 42' 40''$ West, 210.00 feet; thence North $88^{\circ} 34' 16''$ East along a line 260.00 feet North of and parallel with the said South line of the Northeast One Quarter (NE 1/4) 648.41 feet to aforesaid easterly boundary of Tract 16; thence South $20^{\circ} 05' 06''$ West, along said easterly boundary, 279.47 feet to the point of beginning.

Said parcel lying within Broward County, Florida, containing 50.46 acres more or less.

Subject to rights of way and easements of record.

- Correspondence with FAA
Relative to
Fort Lauderdale-Hollywood
International Airport

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Miami Airports District Office
Post Office Box 59-2014
Miami, Florida 33159



1983 JAN 10 1983

1983 JAN 10 PM 2:25
FEDERAL AVIATION ADMINISTRATION

Mr. Edward J. Jablonowski, Director
Broward County Solid Waste Division
Governor's Club - Room 526
236 S.E. First Avenue
Fort Lauderdale, Florida 33301

Dear Mr. Jablonowski:

This responds to your November 18, 1982, letter inquiring about Federal Aviation Administration comments regarding the establishment of a mass-burning resource recovery facility adjacent to U.S. Route 441 between State Road 84 and the south fork of the New River Canal.

At that location it is our understanding that the site would be at least 10,000 feet west from the nearest point of the nearest runway at Fort Lauderdale-Hollywood International Airport.

On December 17, 1982, Mr. Ron Mills of Malcolm Pirnie, the Environmental Engineer for this project, was called by Mr. Lee Guenther for clarification of your letter. He said there were about 25 mass burn technology facilities in operation in the U.S.A. One is in Saugus, Massachusetts, operated by Refuse Energy Systems Company. He provided the following information:

1. The unprocessable trash to be landfilled is non-combustible material such as construction debris, cans, etc. This material will contain less than .2% putrescible material. This landfill will be covered daily.
2. The tipping and sorting will be under cover and completely enclosed. The building will have doors which can be closed in the event of a temporary breakdown. In the event of a prolonged breakdown of the facility, the garbage will be trucked to the landfill in Pompano.
3. The ash goes through a quenching tank to cool it. When it leaves the tank it contains 30% moisture by weight, therefore it does not cause a dust problem and has no attraction to birds. It will be placed in lined pits. Periodically this will be covered. Rain water may cause these pits to pond. (However, with all the other bodies of water now existing near the site, this should not be a problem. Writer's note.)

Page No. 2

4. All the packers and trucks will be covered. The only uncovered material coming into the facility will be in private vehicles such as pick-up trucks.

Provided the operation is conducted as Mr. Mills outlined, this facility should not create a greater bird problem than now exists. The attraction of birds is our greatest concern in waste disposal operations.

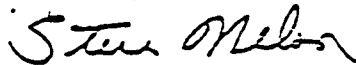
A few suggestions are offered:

1. Any accidental spills outside the facility should be cleaned up immediately.
2. The sponsor should be prepared, when the facility starts operation, to scare away any birds. If birds are not permitted to develop a habit of flocking there, they will stay away.

The enclosed FAA Form 7460-1 should be completed so that all of the aeronautical impacts of the proposed facility can be determined. This review has been preliminary and concerns for the heights of building and structures or possible vision and other hazards were not considered.

Please let me know if you have any questions concerning this matter.

Sincerely,



Steve Nelson
Airport Planning and
Development Specialist

Enclosure

MALCOLM
PIRNIE

MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

June 24, 1982

FAA Southern Regional Office
P.O. Box 20636
Atlanta, GA 30320

Attention: Mr. Carl Stokoe,
Airspace Specialist/ASO-530

Re: Proposed Resource Recovery Facility to be
located in Broward County, Florida

Gentlemen:

This letter confirms our telephone conversations on April 21 and June 21, 1982, during which FAA limitations that may apply to the subject project were informally discussed.

Per our discussion, the proposed resource recovery facility site is within 3 nautical miles of the Hollywood/Ft. Lauderdale airport reference point. Therefore, the facility stack must be no higher than 200 feet above grade (Part 77.23(a)(2) of the DOT Federal Aviation Regulations).

Given the above 200 feet above grade limitation, the stack should also pose no problem with respect to any of the VOR approach patterns to runway 9L at the Ft. Lauderdale airport. This is based on preliminary calculations which indicate that a 260 foot stack height limitation would apply to the proposed site in order to provide the required 300 foot buffer beneath the minimum allowable aircraft altitude of 560 feet over the site.

-2-

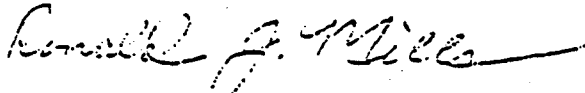
MALCOLM
PIRNIE

With respect to other air navigation obstruction standards specified in the FAA Regulations, such as height limitations to comply with Precision Instrument Approach Pattern imaginary surfaces, the proposed facility appears to meet applicable requirements.

If the above information is contrary to your understanding of the issues discussed, please contact me at your earliest convenience. We thank you for your assistance.

Sincerely,

MALCOLM PIRNIE, INC. -----



Ronald J. Mills
Project Scientist

RJM/pas

Approved



SAJRD-P

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232

JUL 1 6 1982

Mr. Edward J. Jablonowski, Director
Solid Waste Division, Broward County
Governor's Club, Room 526
236 Southeast First Avenue
Fort Lauderdale, Florida 33301

1982 JUL 19 PM 2:25
SOLID WASTE DIVISION

Dear Mr. Jablonowski:

Reference is made to your letter of 21 May 1982 requesting determinations of Department of the Army jurisdiction for fill associated with solid waste disposal at three sites in Broward County. These are the Resource Recovery Site adjacent to the South Fork of the New River, the Davie Landfill Site in central Broward County, and the proposed Correctional Institute Landfill Site in East Everglades wetlands.

A representative of our Miami Beach Area Office inspected the Resource Recovery Site on 21 June 1982 and the Davie and Correctional Institute sites on 23 June 1982. The approximate north half of the Resource Recovery Site was found to constitute wetlands adjacent to the South Fork, New River, and as such, will require a Department of the Army permit for fill proposed therein. The extent of these wetlands is generally depicted on the inclosed January 1981 aerial photocopy, attachment C.

The Miami Beach Area Office reported the entire Davie site to be improved pasture constituting uplands. As such, a Department of the Army permit will not be required for fill associated with solid waste disposal at this site.

However, the Correctional Institute site was confirmed to retain a prevalence of wetland plant species indigenous to the East Everglades throughout the site. Therefore, a Department of the Army permit will be required for any fill associated with solid waste disposal in these wetlands as well.

Also inclosed for your use in submitting applications for either or both of the Resource Recovery or Correctional Institute sites are Department of the Army application booklets and forms. If further information or assistance are required in this regard, you may contact Mr. Vic Anderson, Senior

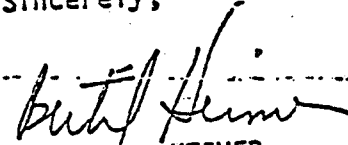
JUL 1 6 1982

JRD-P

F. Edward J. Jablonowski, Director

Project Manager either at the letterhead address or telephone (904) 791-1668.
Your continuing cooperation with the Department of the Army regulatory
program is appreciated.

Sincerely,



BERTIL A. HEIMER
Chief, Permits Branch

2 Incl
As stated

RESOURCE RECOVERY SITE



WETLAND

(6)

WETLAND

UPLAND

UPLAND

PLANT SPECIES LIST

List of vascular plants identified during field reconnaissance, June, 1983, of the US 441 Resource Recovery Facility site, Broward County, Florida. Nomenclature follows that of Godfrey and Wooten (1979, 1981), Long and Lakela (1971), or Lakela and Long (1976).

<u>Scientific Name</u>	<u>Common Name</u>
<u>Acalypha setosa</u>	(Three-seeded mercury)
<u>Acer rubrum</u>	Red maple
<u>Acrostichum danaeifolium</u>	Giant leather fern
<u>Agalinis fasciculata</u>	(Gerardia)
<u>Albizia lebbek</u>	Woman's tongue
<u>Alternanthera philoxeroides</u>	Alligator weed
<u>Amaranthus spinosus</u>	Spiny pigweed
<u>Ambrosia artemisiifolia</u>	Ragweed
<u>Ampelopsis arborea</u>	Pepper-vine
<u>Andropogon glaucopsis</u>	(Broomsedge)
<u>Andropogon virginicus</u> var. <u>abbreviatus</u>	(Broomsedge)
<u>Anemia adiantifolia</u>	Pine fern
<u>Annona glabra</u>	Pond-apple
<u>Apios americana</u>	Potato-bean
<u>Asclepias incarnata</u>	Swamp milkweed
<u>Aster</u> sp.	(Aster)
<u>Axonopus furcatus</u>	(Carpet grass)
<u>Baccharis glomeruliflora</u>	(Groundsel-tree)
<u>Bacopa caroliniana</u>	Blue-hyssop
<u>Bidens pilosa</u>	(Beggar ticks)
<u>Blechnum serrulatum</u>	(Blechnum fern)
<u>Boehmeria cylindrica</u>	Bog-hemp
<u>Borreria terminalis</u>	n.c.n.
<u>Buchnera floridana</u>	(Bluehearts)
<u>Bulbostylis ciliatifolia</u> var. <u>ciliatifolia</u>	n.c.n.
<u>Capraria biflora</u>	n.c.n.
<u>Casuarina equisetifolia</u>	Australian pine
<u>Centella asiatica</u>	False pennywort
<u>Cephalanthus occidentalis</u>	Cotton buttonbush
<u>Cestrum diurnum</u>	Day jessamine
<u>Chenopodium ambrosioides</u>	Mexican tea
<u>Chloris glauca</u>	Fingergrass
<u>Chrysobalanus icaco</u>	Cocoa-plum
<u>Cladium jamaicense</u>	Saw-grass
<u>Coccoloba uvifera</u>	Sea-grapes
<u>Commelina</u> sp.	(Dayflower)
<u>Conoclinium coelestinum</u>	Mistflower
<u>Conyza canadensis</u>	Dwarf horseweed
<u>Crinum americanum</u>	Swamp-lily
<u>Crotalaria retusa</u>	(Rattlebox)
<u>Cynanchum angustifolium</u>	(Sand-vine)
<u>Cyperus compressus</u>	(Galingale)
<u>Cyperus elegans</u>	(Galingale)
<u>Cyperus globulosus</u>	(Galingale)
<u>Cyperus haspan</u>	(Galingale)
<u>Cyperus ligularis</u>	(Galingale)
<u>Cyperus polystachyos</u>	(Galingale)

Cyperus rotundus
Cyperus sesquiflorus
Cyperus strigosus
Cyperus surinamensis
Desmodium canum
Dichromena colorata
Digitaria serotina
Echinochloa crusgalli
Eclipta alba
Eleocharis atropurpurea
Eleocharis cellulosa
Eleocharis interstincta
Eragrostis sp.
Erechtites hieracifolia
Eremochloa ophiuroides
Erianthus giganteus
Erigeron vernus
Eupatorium capillifolium
Eupatorium mikanioides
Eustoma exaltatum
Ficus aurea
Fimbristylis spathacea
Fuirena squarrosa
Galium tinctorium var. tinctorium
Gaura angustifolia
Heliotropium polyphyllum
Heterotheca subaxillaris
Hydrocotyle umbellata
Hydrolea corymbosa
Hypericum brachyphyllum
Hypericum myrtifolium
Hypericum tetrapetalum
Hyptis alata
Ilex cassine
Ipomoea sagittata
Juncus marginatus
Juncus megacephalus
Juncus polycephalus
Justicia ovata
Kosteletzkya virginica
Lachnanthes caroliniana
Lactuca intybacea
Lantana camara
Lantana involucrata
Lepidium virginicum
Ludwigia alata
Ludwigia microcarpa
Ludwigia peruviana
Lythrum lineare
Manisurus rugosa
Melaleuca quinquenervia
Melanthra angustifolia
Metopium toxiferum
Mikania scandens

Nut-grass
 (Galingale)
 (Galingale)
 (Galingale)
 (Tick trefoil)
 White-top sedge
 (Crabgrass)
 Barnyard grass
 n.c.n.
 (Spikerush)
 (Spikerush)
 (Spikerush)
 (Love grass)
 Fireweed
 Centipede grass
 Giant plume grass
 (Fleabane)
 Dog-fennel
 (Boneset)
 Catchfly-gentian
 Strangler fig
 n.c.n.
 (Umbrella-grass)
 (Bedstraw)
 Southern gaura
 (Heliotrope)
 (Golden aster)
 (Water pennywort)
 (Waterleaf)
 (St.-John's-wort)
 (St.-John's-wort)
 (St.-John's-wort)
 (Bitter mint)
 Dahoon holly
 (Morning-glory)
 (Rush)
 (Rush)
 (Rush)
 n.c.n.
 Seashore marsh-mallow
 Red-root
 Wild lettuce
 Shrub verbenia
 (Lantana)
 Pepper grass
 n.c.n.
 n.c.n.
 Primrose-willow
 (Loosestrife)
 (Jointgrass)
 Cajeput
 n.c.n.
 Poison-tree
 Climbing hempweed

<u>Mitreola petiolata</u>	(Miterwort)
<u>Myrica cerifera</u>	Wax-myrtle
<u>Myrsine guianensis</u>	Myrsine
<u>Osmunda regalis</u> var. <u>spectabilis</u>	Royal fern
<u>Oxalis corniculata</u>	Lady's sorrel
<u>Panicum hemitomon</u>	Maidencane
<u>Panicum repens</u>	Torpedo grass
<u>Panicum sp.</u>	(Panic grass)
<u>Parthenocissus quinquefolia</u>	Virginia creeper
<u>Paspalum dilatatum</u>	Dallis grass
<u>Paspalum distichum</u>	Knot-grass
<u>Paspalum floridanum</u>	Florida paspalum
<u>Paspalum urvillei</u>	Vasey grass
<u>Passiflora suberosa</u>	Corky-stemmed passionflower
<u>Peltandra virginica</u>	Green arum
<u>Persea palustris</u>	Swamp-bay
<u>Phlebodium aureum</u>	Golden polypody
<u>Phragmites australis</u>	Common reed
<u>Phyla nodiflora</u>	(Frog-fruits)
<u>Phyllanthus caroliniensis</u>	(Leaf-flowers)
<u>Physalis viscosa</u> ssp. <u>maritima</u>	(Ground cherry)
<u>Phytolacca americana</u>	Pokeweed
<u>Plantago major</u>	Common plantain
<u>Pluchea rosea</u> var. <u>rosea</u>	(Marsh-fleabane)
<u>Poinciana regia</u>	Royal poinciana
<u>Poinsettia heterophylla</u>	Painted leaf
<u>Polygala grandiflora</u>	(Milkwort)
<u>Polygonum punctatum</u>	(Smartweed)
<u>Polypremum procumbens</u>	n.c.n.
<u>Pontederia cordata</u> var. <u>lancifolia</u>	Lance-leaved pickerelweed
<u>Proserpinaca palustris</u>	(Mermaid-weed)
<u>Proserpinaca pectinata</u>	(Mermaid-weed)
<u>Psidium guajava</u>	Guava
<u>Psilotum nudum</u>	Whisk fern
<u>Psychotria undata</u>	(Wild coffee)
<u>Rhynchelytrum roseum</u>	Natal grass
<u>Rhynchospora caduca</u>	(Beak-rush)
<u>Rhynchospora inundata</u>	(Beak-rush)
<u>Roystonea elata</u>	Royal palm
<u>Sabal palmetto</u>	Cabbage palmetto
<u>Sagittaria lancifolia</u>	(Arrowhead)
<u>Sagittaria latifolia</u> var. <u>latifolia</u>	Common arrowhead
<u>Salix caroliniana</u>	Carolina willow
<u>Sambucus canadensis</u>	Elderberry
<u>Sarcostemma clausum</u>	Milk withe
<u>Saururus cernuus</u>	Lizard's-tail
<u>Schinus terebinthifolius</u>	Brazilian pepper
<u>Scleria verticillata</u>	(Nut-rush)
<u>Setaria geniculata</u>	Knotroot bristlegrass
<u>Sida acuta</u>	n.c.n.
<u>Sida rhombifolia</u>	n.c.n.
<u>Smilax laurifolia</u>	Bamboo-vine
<u>Solanum americanum</u>	Common nightshade
<u>Sonchus oleraceus</u>	Common sow thistle

Sporobolus indicus
Sporobolus poiretii
Stachytarpheta jamaicensis
Taxodium ascendens
Teuchrium canadense
Thelypteris kunthii
Thelypteris palustris
Tillandsia fasciculata
Tillandsia polystachia
Tillandsia recurvata
Tillandsia setacea
Toxicodendron radicans
Trema micrantha
Trifolium repens
Typha angustifolia
Typha domingensis
Typha latifolia
Urena lobata
Verbesina virginica
Vitis aestivalis
Vitis rotundifolia
Wedelia trilobata
Xyris sp.
Zizaniopsis miliacea

Smutgrass
(Dropseed)
Blue porterweed
Cypress
Germander
Kunth's shield fern
Marsh-fern
n.c.n.
n.c.n.
Ball moss
n.c.n.
Poison ivy
Florida trema
White clover
Narrowleaf cat-tail
Southern cat-tail
Common cat-tail
Bur mallow
Frost-weed
Summer grape
Muscadine grape
n.c.n.
(Yellow-eyed grass)
Water millet

RECEIVED

AUG 11 1983



Attachment 8

Page 1 of 2

HAZEN & SAWYER, P.C.
Hollywood, Fla.

FLORIDA DEPARTMENT OF STATE

George Firestone
Secretary of State

DIVISION OF ARCHIVES,
HISTORY AND RECORDS MANAGEMENT
The Capitol, Tallahassee, Florida 32301
(904) 488-1480

July 22, 1983

In Reply Refer to:

Louis D. Tesar
Historic Preservationist
(904) 487-2333

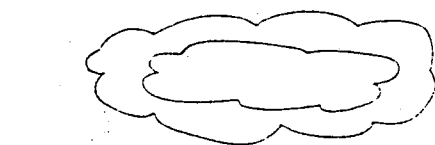
Mr. Rhodes Robinson, Vice President
Coastal Zone Resources, Inc.
1001 U.S. Highway 1, Suite 305
Jupiter, Florida 33458

RE: Your Letter of June 28, 1983
Cultural Resource Assessment Request
Proposed Development of Two Resource Recovery Facilities and
Associated Landfills, Broward County, Florida

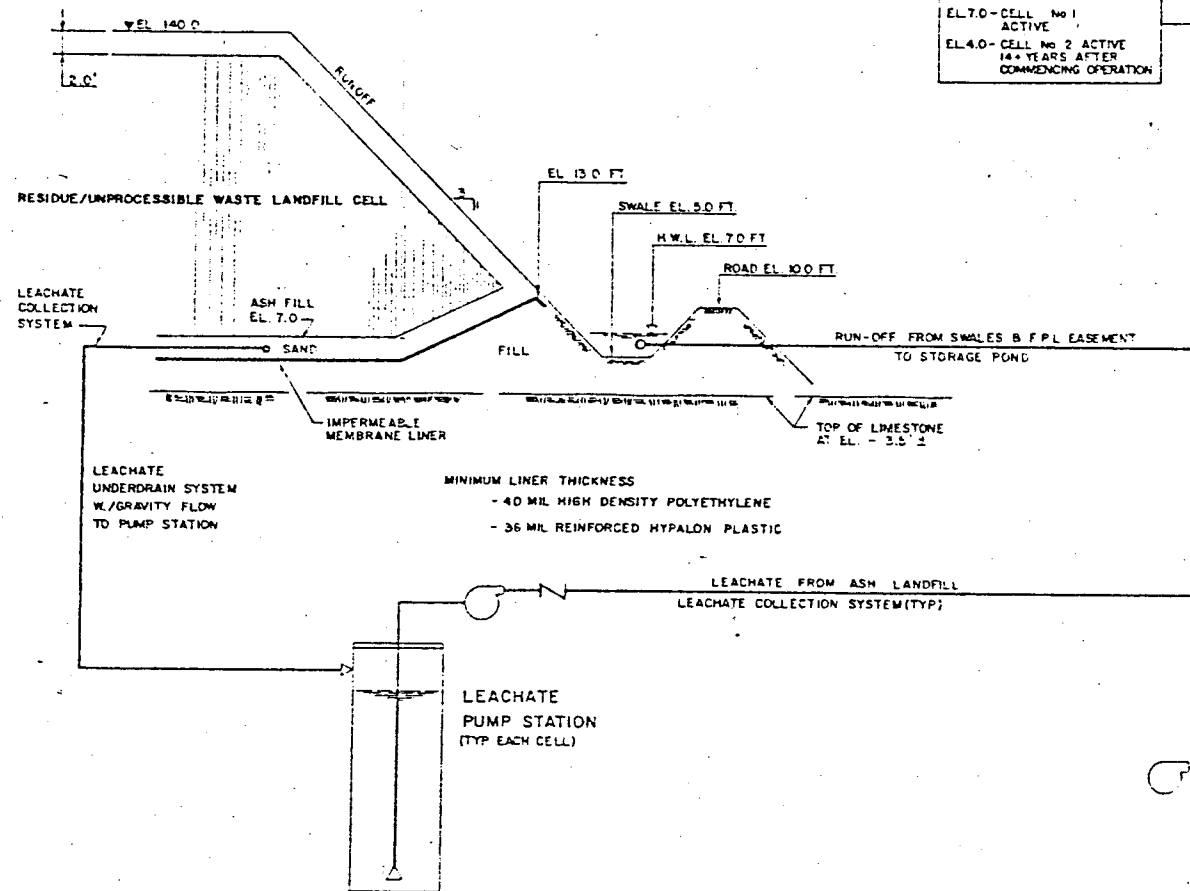
Dear Mr. Robinson:

In accordance with the procedures contained in 36 C.F.R., Part 800 ("Procedures for the Protection of Historic and Cultural Properties"), we have reviewed the above referenced project for possible impact to archaeological and historical sites or properties listed, or eligible for listing, in the National Register of Historic Places. The authorities for these procedures are the National Historic Preservation Act of 1966 (Public Law 89-665) as amended by P.L. 91-243, P.L. 93-54, P.L. 94-422, P.L. 94-458 and P.L. 96-515, and Presidential Executive Order 11593 ("Protection and Enhancement of the Cultural Environment").

A review of the Florida Master Site File indicates that no archaeological or historical sites are recorded for the project area. Furthermore, because of the location of the project, it is considered highly unlikely that any significant, unrecorded sites exist in the vicinity. Therefore, it is the opinion of this office that the proposed project will have no effect on any sites listed, or eligible for listing, in the National Register of Historic Places, or otherwise of national, state or local significance.



FINAL 2 FOOT COVER (CAPPING)
- 12 INCHES PLANTING SOIL W./VEGETATIVE COVER
- 6 INCHES BENTONITE SOIL MIXTURE (IMPERMEABLE)
- 6 INCHES CRUSHED LIMESTONE



EL. 7.0 FT. - 100 YEAR FLOOD ELEVATION

SOUTH FORK OF NEW RIVER CANAL

TIDAL ELEVATIONS
H.W.L. EL. +1.65 FT.
L.W.L. EL. -0.02 FT.

DISCHARGE STRUCTURE
WEIR SETTING
EL. 7.0 - CELL No. 1
ACTIVE
EL. 4.0 - CELL No. 2 ACTIVE
14+ YEARS AFTER
COMMENCING OPERATION

STORM WATER OVERLAND
FLOW DISCHARGE
ENERGY
DISPERSION
POND
EL. -3.0'

STORM WATER
RETENTION POND
H.W.L. EL. 7.0
L.W.L. EL. 2.0
POND BOTTOM EL. (-110')
INTO LIMESTONE

FINE SCREENS
(2 REDD.)

WET WELL
No. 1

WET WELL
No. 2

BLOW-OFF LINE FOR WATER HAMMER
AND SURGE CONTROL

SCREEN AND PUMP FACILITIES

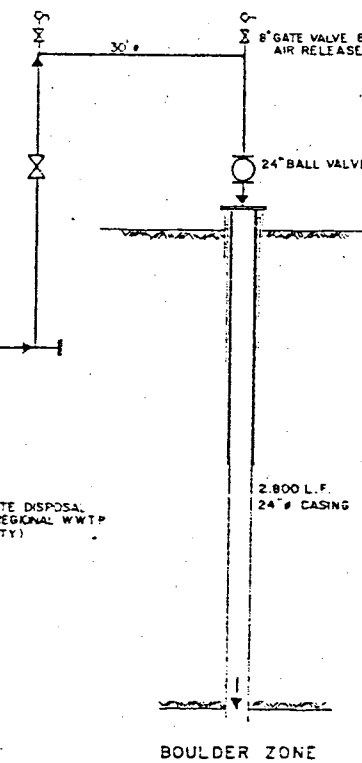
LEGEND

- SURGE RELIEF VALVE
- BUTTERFLY VALVE NORMALLY OPEN
- BUTTERFLY VALVE NORMALLY CLOSED
- AIR RELEASE VALVE
- CHECK VALVE
- PUMP
- SLIDE OR SLUICE GATE
- FLOW METER

STORM WATER DISCHARGE

FIRST 14+ YEARS ALL RUN-OFF
CAPTURED ON SITE WILL BE
RETAINED ON SITE OR PUMPED
INTO THE DISPOSAL WELL

24" DIAMETER
DISPOSAL WELL TO
THE BOULDER ZONE

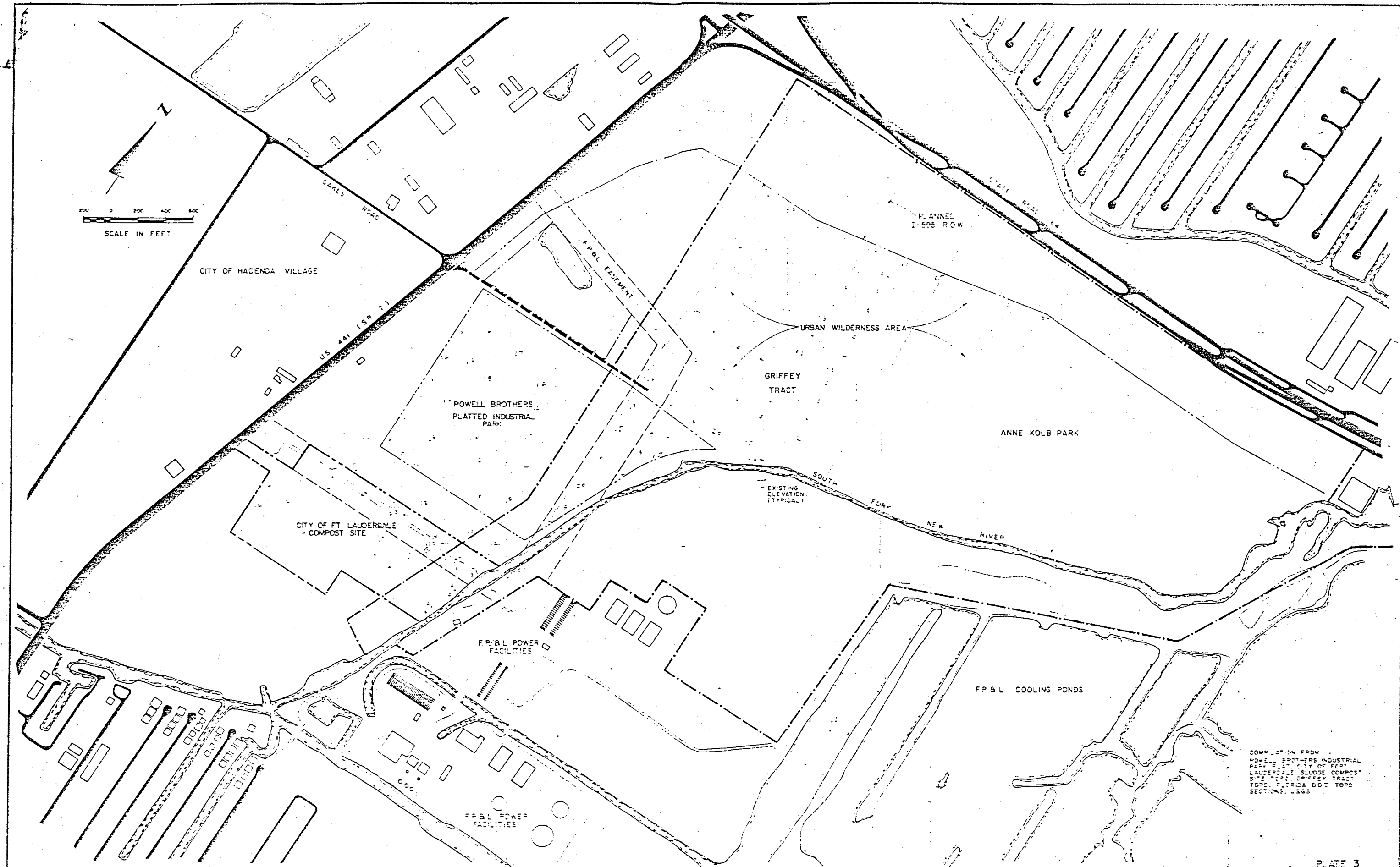


HOLLYWOOD
WWTF

ATLANTIC OCEAN

NOTE: ALL ELEVATIONS AT NGVD

DESIGNED: PER	HAZEN AND SAWYER, P.C. ENGINEERS	SCALE: NONE	CONTRACT: BOARD OF COUNTY COMMISSIONERS BROWARD COUNTY, FLORIDA	SOLID WASTE DIVISION RESOURCE RECOVERY	DATE: SEPT 10, 1983
4 11-2-83 FDCR/COE APPLICATION	PER: DRAWN: JMT		CLIENTS PROJECT: RRF		
3 10-25-83 TAC REVIEW	PER: CHECKED: PAC				
2 10-17-83 FDCR/COE APPLICATION	PER: PROJ ENGR: PER				
1 10-15-83 OFFICE OF PLANNING					
NO DATE ISSUED FOR					



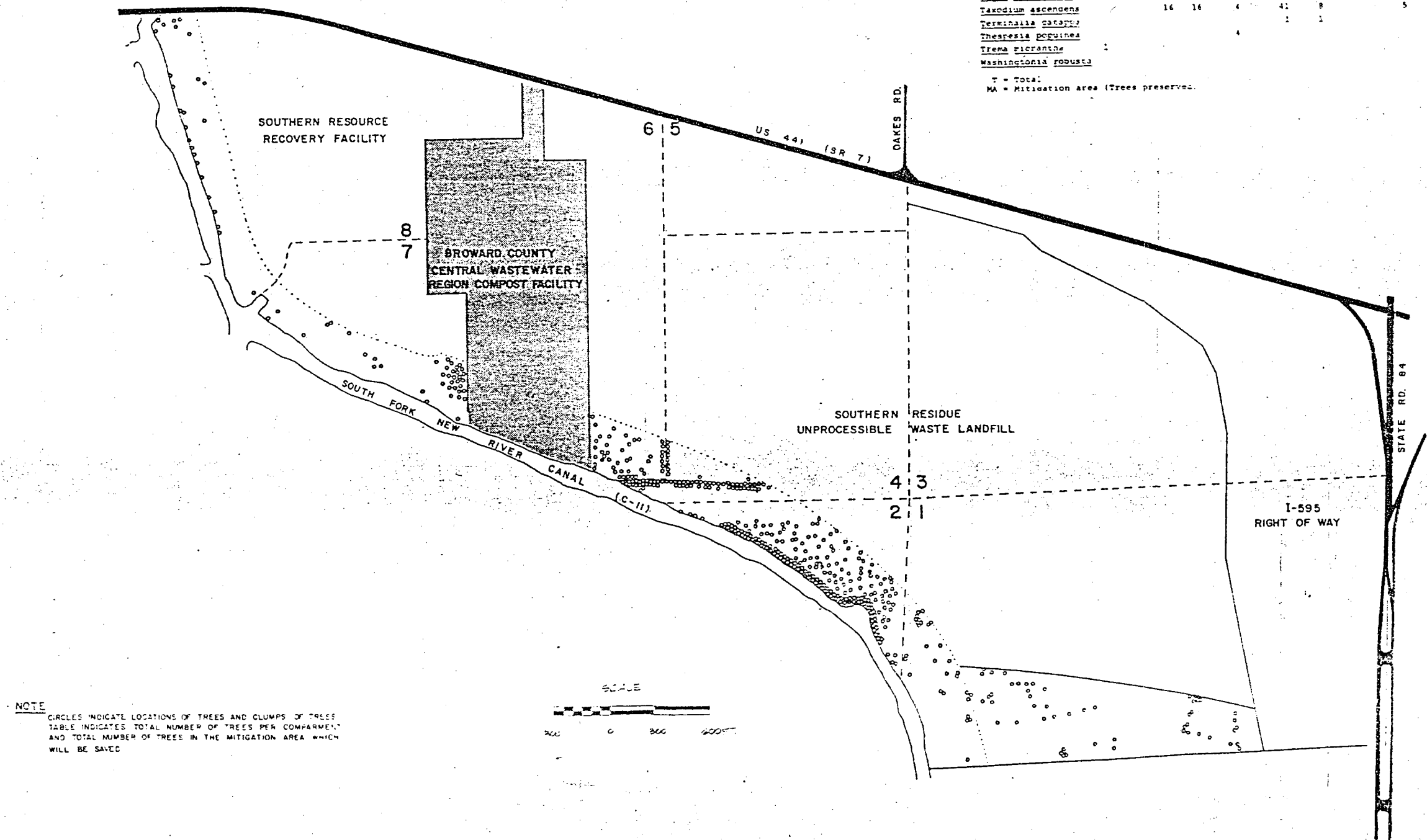
COMPILED FROM
 POWELL BROTHERS INDUSTRIAL
 PARK CITY OF FT.
 LAUDERDALE SLUDGE COMPOST
 SITE TOPO. GRIFFEY TRACT
 TOPO. FLORIDA DOT TOPO
 SECTIONS, 1983

PLATE 3

DESIGNED: _____ DRAWN: _____ CHECKED: _____ PROJ. ENGR: _____		ALL ELEVATIONS REFERENCED TO NGVD		HAZEN AND SAWYER ENGINEERS		CONTRACT RESOURCE RECOVERY BOARD OF COUNTY COMMISSIONERS BROWARD COUNTY, FLORIDA		SOLID WASTE DIVISION RESOURCE RECOVERY		DATE: SEP 1, 1991 SHEET: 1 OF 1	
4. 100% P2 FEE/DOCK APPLICATION 100% 5. 100% P2 FEE/DOCK APPLICATION 100% 6. 100% P2 FEE/DOCK APPLICATION 100% 7. 100% P2 FEE/DOCK APPLICATION 100% 8. 100% P2 FEE/DOCK APPLICATION 100%		PREPARED BY: _____ DATE: _____		MIAMI HOLLYWOOD WILMINGTON NEW YORK MOUNTAIN VIEW		PRELIMINARY TOPOGRAPHY OF ROUTE 44		ENGINEER'S PROJECT: _____		_____	

SCIENTIFIC NAME	T		MA		T		MA		T		MA		T		MA		T		MA	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
<i>Acer rubrum</i>	2	2	235	14	56	59	46	136	1	6	1	0	5	0						
<i>Annona glabra</i>	1	1	14	1	13	127	62	40	15	15			82	12						
<i>Cestrum diurnum</i>													1	0						
<i>Chrysocarpus laevis</i>			2	2		1	1						1	1						
<i>Coccoloba uvifera</i>						1	1	1					6	5	9	4				
<i>Ficus alba</i>			20	20	3	22	17	28												
<i>Ficus elastica</i>					1															
<i>Ficus sp.</i>					1															
<i>Ilex cassine</i>			13	8	33	5	2	4							2	0				
<i>Mangifera indica</i>								1												
<i>Metopium toxiferum</i>			43	43		5	2													
<i>Myrica cerifera</i>			22	18	27	79	40	110	61	19	206	87	111	0						
<i>Myrsine guianensis</i>			17	16	65	57	15	96	14	13			2	2						
<i>Persea palustris</i>			206	153	144	42	18	148	21	22	22	10	15	1						
<i>Prunus caroliniana</i>			7																	
<i>Psidium guajava</i>																				
<i>Rovstoea elata</i>						12	10	1	1	1	12	4	1	1						
<i>Sabal palmetto</i>	201	77	20	20	28	38	12	9	2	1	2	2								
<i>Salix caroliniana</i>			7	7	3	26	5	29	20	2	43	14	45	2						
<i>Taxodium ascendens</i>			16	16	4	41	8		5	5	1	1								
<i>Terminalia catappa</i>						1	1													
<i>Thespesia populnea</i>																				
<i>Trema micrantha</i>																				
<i>Washingtonia robusta</i>																				

T = Total
MA = Mitigation area (Trees preserved)



NOTE
CIRCLES INDICATE LOCATIONS OF TREES AND CLUMPS OF TREES
TABLE INDICATES TOTAL NUMBER OF TREES PER COMPARTMENT
AND TOTAL NUMBER OF TREES IN THE MITIGATION AREA WHICH
WILL BE SAVED

PLATE 5

DESIGNED: _____	ALL ELEVATIONS REFERENCED TO N.G.V.D.	HAZEN AND SAWYER, P.C. ENGINEERS	SCALE: 1" = 300'	CONTRACT: _____	BOARD OF COUNTY COMMISSIONERS BROWARD COUNTY, FLORIDA	SOLID WASTE DIVISION RESOURCE RECOVERY	DATE: SEPT. 12, 1983
DRAWN: _____				CLIENTS PROJECT: _____			SHEET: 1 of 1
CHECKED: _____				ENGINEERS PROJECT: _____	SOUTHERN RESOURCE RECOVERY FACILITY AND RESIDUE / UNPROCESSABLE WASTE LANDFILL TREE SURVEY		DESK: 9154-21
PROJECT: _____							

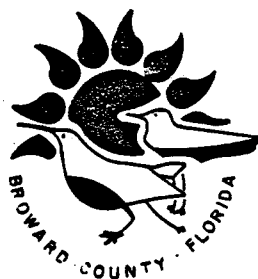
**FLORIDA DEPARTMENT OF ENVIRONMENTAL
REGULATION**

U.S. DEPARTMENT OF THE ARMY

**JOINT APPLICATION FOR ACTIVITIES IN
THE WATERS OF THE
STATE OF FLORIDA**

**SOUTHERN RESIDUE/UNPROCESSIBLE
WASTE LANDFILL**

BROWARD COUNTY, FLORIDA



SEPTEMBER, 1983

**HAZEN AND SAWYER, P.C.
CZR, INCORPORATED
MALCOLM PIRNIE, INC.**

DREDGE AND FILL PERMIT APPLICATION

SOUTHERN RESIDUE/UNPROCESSIBLE WASTE LANDFILL

BROWARD COUNTY, FLORIDA

SEPTEMBER 1983

Hazen and Sawyer, P.C.
CZR, Incorporated
Malcolm Pirnie, Inc.

PERSONS TO CONTACT

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Resource Recovery Office
Board of County Commissioners
Room 526
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Fort Lauderdale, Florida 33301

(305) 765-5844

HAZEN AND SAWYER, P.C.

ENGINEERS



5950 WASHINGTON STREET • HOLLYWOOD, FLORIDA 33023 • (305) 987-0066
(305) 625-4101

September 12, 1983

Mr. Jeremy Craft
State of Florida
Department of Environmental Regulation
6562 Executive Center Circle East
Montgomery Building
Tallahassee, FL 32301

Re: Dredge and Fill Permit Application for Southern Broward Residue/
Unprocessable Waste Landfill

Dear Mr. Craft:

On behalf of Broward County, we are submitting an application for activities in the waters of the State of Florida. The application is being made for dredge and fill of wetlands at the Southern Residue/Unprocessable Waste Landfill located on the intersection of US 441 and SR 7 in Broward County. The wetlands have been declared to be within the Department of Environmental Regulation (DER) and the U. S. Army Corps of Engineers jurisdiction.

The residue/unprocessable waste landfill is part of Broward County's solid waste management plan. The facility will provide the necessary municipal solid waste management for the southern part of the County until year 2007. The landfill will service the public in providing Broward County with an effective, reliable, and environmentally sound municipal solid waste management system.

Approximately 100 sites were evaluated during a lengthy site selection study. On the basis of location, costs, size, sociological impacts, environmental sensitivity, zoning/land use compatibility, transportation, and jurisdictional control, the US 441 site was selected as the best over-all location for the Southern Residue/Unprocessable Waste Landfill. The site is located near the solid waste centroid for the southern part of Broward County and has adequate space for the landfill and ancillary development. The site location provides sufficient buffer space from residential areas.

Although the site is mostly wetlands, it is the best location for the landfill in consideration of all factors. The site has been previously impacted and recent plans for parts of the area have included a major industrial park and a marina. On-site mitigation (32 acres) includes preserving and enhancing a 300 foot wide Urban Wilderness area adjacent to

Mr. Jeremy Craft

-2-

September 12, 1983

South Fork New River Canal. Mitigation will include removing exotic vegetation, excavating of certain areas to create marsh, swamp and open water habitat, and planting upland and wetland species. Off-site mitigation (15.5 acres) has been planned for a new county park. This mitigation entails creating marsh and hammock environments in a shrub thicket.

We are most anxious to proceed on this project since the County's existing landfill capacity is quite limited and construction of the resource recovery facility requires a long lead time prior to operation. If you have any questions or need additional information, please contact our office.

Very truly yours,

HAZEN AND SAWYER, P.C.

Peter E. Robinson, P.E.
Vice President

/jt

Enclosure

HAZEN AND SAWYER, P.C.

TABLE OF CONTENTS

Cover Letter	
Persons to Contact	
Table of Contents	
Joint Application - Department of the Army/Florida Department of Environmental Regulation - for Activities in the Waters of the State of Florida	
Application Figure 1	Vicinity Map
Application Figure 2	Site Plan
Application Figure 3	Cut and Fill Areas
Application Figure 4	Cut Section
Application Figure 5	Fill Section
Application Figure 6	Stormwater Outfall Location Plan
Application Figure 7	Stormwater Outfall Detail
Black and White Aerial Photograph	

DESCRIPTION OF PROPOSED ACTIVITY

- I. Introduction
 - A. Proposed Use
 - B. Need
- II. Proposed Project
 - A. Facilities and Process Description
 - B. Cut and Fill
- III. Residue/Unprocessible Waste Landfill Site Selection
 - A. Background
 - B. Initial Site Evaluation and Selection
 - C. Additional Site Evaluation
 - D. Final Site Selection

TABLE OF CONTENTS

-2-

IV. Environmental Assessment

- A. Disposal Methodology
- B. Zoning and Land Use
- C. Biological Concerns
- D. Siltation and Sedimentation
- E. Traffic
- F. Fort Lauderdale-Hollywood International Airport
- G. Odor
- H. Noise
- I. Soils
- J. Dust
- K. Water Resources
- L. Archaeological Resources
- M. Regulatory Aspects

V. Mitigation

List of Figures and Plates

List of Attachments

LIST OF FIGURES AND PLATES

Figure 1	Vicinity Map
2	Site Plan
3	Stormwater Outfall Location Plan
4	Stormwater Outfall Detail
5	Typical Injection Well
6	Cut and Fill Areas
7	Typical Cut Section
8	Typical Fill Section
9	Existing Solid Waste Disposal System
10	General Locations of Correctional Institute, Chapel Trail, and Sportatorium Sites
11	General Location of Davie and Markham Park Sites
12	Location of Sites A-H
13	Location of Site K-p
14	Location of Proposed North and South Resource Recovery Facilities
15	Zoning Map
16	Existing Land Use and Development Trends
17	Adjacent Property Owners
18	National Wetlands Inventory Land Classifications
19	Vegetation Map
20	Soils Map
21	100 Year Flood Elevation Map
22	Location of 1000 mg/l Isochlor
23	Typical Cross Section-On-site Mitigation
24	Typical Vegetative Profile On-Site Mitigation
25	Planting Densities-On-site Mitigation
26	Vicinity Map-Tree Tops Park
27	Plan View Tree Tops Park Mitigation Area
28	Typical Cross Section Tree Tops Park Mitigation Area
29	Vegetative Profile-Tree Tops Park Mitigation Area
30	Planting Density-Tree Tops Park Mitigation Area
Plate 1	Survey
2	Tree Scale Section Through Landfill
3	Water Management Schematic
4	Swale Section
5	Topography
6	Tree Survey
7a	Site Plan-On-site Mitigation Area
7b	Site Plan-On-site Mitigation Area
7c	Site Plan-On-site Mitigation Area

LIST OF ATTACHMENTS

- | | |
|--------------|---|
| Attachment 1 | Authorization of Designated Agent |
| 2 | Adjacent Property Owners |
| 3 | Method of Property Acquisition |
| 4 | Legal Description of Property (Retype) |
| 5 | Letter by W. A. Feder Relative to Landfill Leachate |
| 6 | Landfill Leachate in Denmark |
| 7 | Resolution of the Town of Davie |
| 8 | Legal Opinion to Town of Davie from Law Offices of
Arnstein, Gluck, and Lehr |
| 9 | Plant Species List |
| 10 | Correspondence with the Federal Aviation
Administration |
| 11 | Letter of Archaeological Clearance |

JOINT APPLICATION
DEPARTMENT OF THE ARMY/FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION
For Activities in the Waters of the State of Florida

CORPS APPLICATION NUMBER (official use only)

DER APPLICATION NUMBER (official use only)

1. APPLICANT'S NAME AND ADDRESS

B | R | O | W | A | R | D | C | O | U | N | T | Y | P | H | Y | L | L | I | S | K | O | R | A | B |
NAME

2 | 3 | 6 | S | . | E | . | F | I | R | S | T | A | V | E | N | U | E | R | M | . | 5 | 2 | 6 |
STREET

F | O | R | T | L | A | U | D | E | R | D | A | L | E | F | L | 3 | 3 | 3 | 0 | 1 |
CITY STATE ZIP

TELEPHONE NUMBER (Day) 305) 765-5844 (Night) ()

2. Name, address, zip code and title of applicant's authorized agent for permit application coordination

HAZEN AND SAWYER, P.C.
5950 Washington Street
Hollywood, Florida 33023
Telephone Number 305) 987-0066

Peter E. Robinson, P.E.
Vice President
(See Attachment 1, Designation of
Authorized Agent)

3. NAME OF WATERWAY AT LOCATION OF THE ACTIVITY.

South Fork New River Canal

DER Code. _____
W/W Code _____

4. LOCATION WHERE PROPOSED ACTIVITY EXISTS OR WILL OCCUR.

Intersection of US 441 (SR7) and SR 84 24,25 50S 41E
Street, road or other descriptive location 19.30 50S 42E
Section Township Range

Unincorporated 26°04'30" 80°12'0"
Incorporated city or town Latitude Longitude

Broward Tax Assessors Description: (if known)
County

Map No. Subdiv. No. Lot No.

5. NAME AND ADDRESS INCLUDING ZIP CODE OF ADJOINING PROPERTY OWNERS WHOSE PROPERTY ALSO ADJOINS THE WATERWAY.

(See Attachment 2)

6. PROPOSED USE

Private Single Dwelling [] Private Multi-dwelling [] Public [x]
Commercial [] Other [] (Explain in remarks)

7. DESCRIPTION OF PROJECT (Use additional sheets, if necessary)

A. Structures: 1. New work ☒ Maintenance of existing structure ☐

2. Piers, docks and use: Commercial ☐ Private ☐ Public ☐

- a. Single pier ☐ length _____ width _____
b. Number of piers ☐ length _____ width _____
c. Number of boat slips ☐ length _____ width _____
d. Number of finger piers ☐ length _____ width _____
e. Other (please describe) _____

3. Seawalls, revetments, bulkheads: length _____

a. Type: Vertical ☐ Riprap ☐ Slope: _____ Horizontal: _____ Vertical _____

b. Material to be used _____

4. Other type of structure Southern Residue/Unprocessable Waste Landfill

B. Excavation or Dredging: New Work ☒ Maintenance work ☐ Total acreage involved _____

1. Access Channel ☐ or Canal ☐ Length _____ ft. Width _____ ft. Depth _____ ft.
2. Boat Basin ☐ or Boat Slip ☐ Length _____ ft. Width _____ ft. Depth _____ ft.
3. Other Southern Residue/Unprocessable Waste Landfill Length _____ ft. Width _____ ft. Depth _____ ft. See attached drawings

4. Cubic yards: Total for project 530,000

a. _____ cyd. waterward/ 530,000 cyd. landward of ordinary/mean high water

b. Type of material to be excavated/dredged Silty, fibrous peat, quartz sand, limestone

C. Fill:

1. Amount of material

a. Cubic yards placed waterward of ordinary/mean high water -0-

b. Cubic yards placed landward of ordinary/mean high water 1,570,000

c. Total acreage to be filled 152 Total acreage of wetlands involved 133

2. Containment for fill

a. Dikes ☐ b. Seawall, etc. ☐ c. Other (please explain) _____

3. Type of fill material to be used Limestone and sand

4. Source of fill material to be used On-site dredging and off-site sources

CDE
Work Code

DER
Code
253
403

8. Date activity is proposed to commence October 1984; to be completed dredging and filling will be phased during the 20-year project life.

9. Previous permits for this project have been NONE DER # _____ Corps # _____

A. Denied (date) _____

B. Issued (date) _____

C. Other (please explain) _____

Differentiate between existing work and proposed work on the drawings.

10. Remarks (See Instruction Pamphlet for additional information required for all applications and certain activities. Use additional sheets if necessary.)

See attached report for discussion of project.

11. AFFIDAVIT OF OWNERSHIP OR CONTROL of the property on which the proposed project is to be undertaken

I CERTIFY THAT: (please check appropriate space)

☐ I am the record owner, lessee, or record easement holder of the property described below.

☒ I am not the record owner, lessee, or record easement holder of the property described below, but I will have before undertaking the proposed work the requisite property interest. (Please explain what the interest will be and how it will be acquired.) (See Attachment 3)

LEGAL DESCRIPTION OF PROPERTY SITUATED IN BROWARD COUNTY, FLORIDA
(Use additional sheets if necessary)

(See Attachment 4)

Peter E. Robinson, P.E. (Agent)

Signature

Sworn and subscribed before me at _____ County,
_____, this _____ day of _____, 19__.

NOTARY PUBLIC

My commission expires:

17. Application is made for a permit(s) to authorize the activities described herein.

- A. I authorize the agent listed in Item #2 to negotiate modifications or revisions, when necessary, and accept or assent to any stipulations on my behalf.
- B. I understand I may have to provide any additional information/data that may be necessary to provide reasonable assurance or evidence to show that the proposed project will comply with the applicable State Water Quality Standards or other environmental standards both before construction and after the project is completed.
- C. In addition, I agree to provide entry to the project site for inspectors with proper identification or documents as required by law from the environmental agencies for the purpose of making preliminary analyses of the site. Further, I agree to provide entry to the project site for such inspectors to monitor permitted work if a permit is granted.
- D. Further, I hereby acknowledge the obligation and responsibility for obtaining all of the required state, federal or local permits before commencement of construction activities. I also understand that before commencement of this proposed project I must be granted separate permits or authorizations from the U.S. Corps of Engineers, the U.S. Coast Guard, the Department of Environmental Regulation, and the Department of Natural Resources, as necessary.

I CERTIFY that I am familiar with the information contained in this application, and that to the best of my knowledge and belief such information is true, complete and accurate. I further certify that I possess the authority to undertake the proposed activities.

Peter E. Robinson, P.E. (Agent)

Signature of Applicant

Date

NOTE: THIS APPLICATION MUST BE SIGNED by the person who desires to undertake the proposed activity or by an authorized agent. If an agent is applying on behalf of the applicant, attach proof of authority for the agent to sign and bind the applicant.

18 U.S.C. Section 1001 provides that: Whoever in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up by any trick, scheme, or device a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than \$10,000 or imprisoned not more than five years, or both.

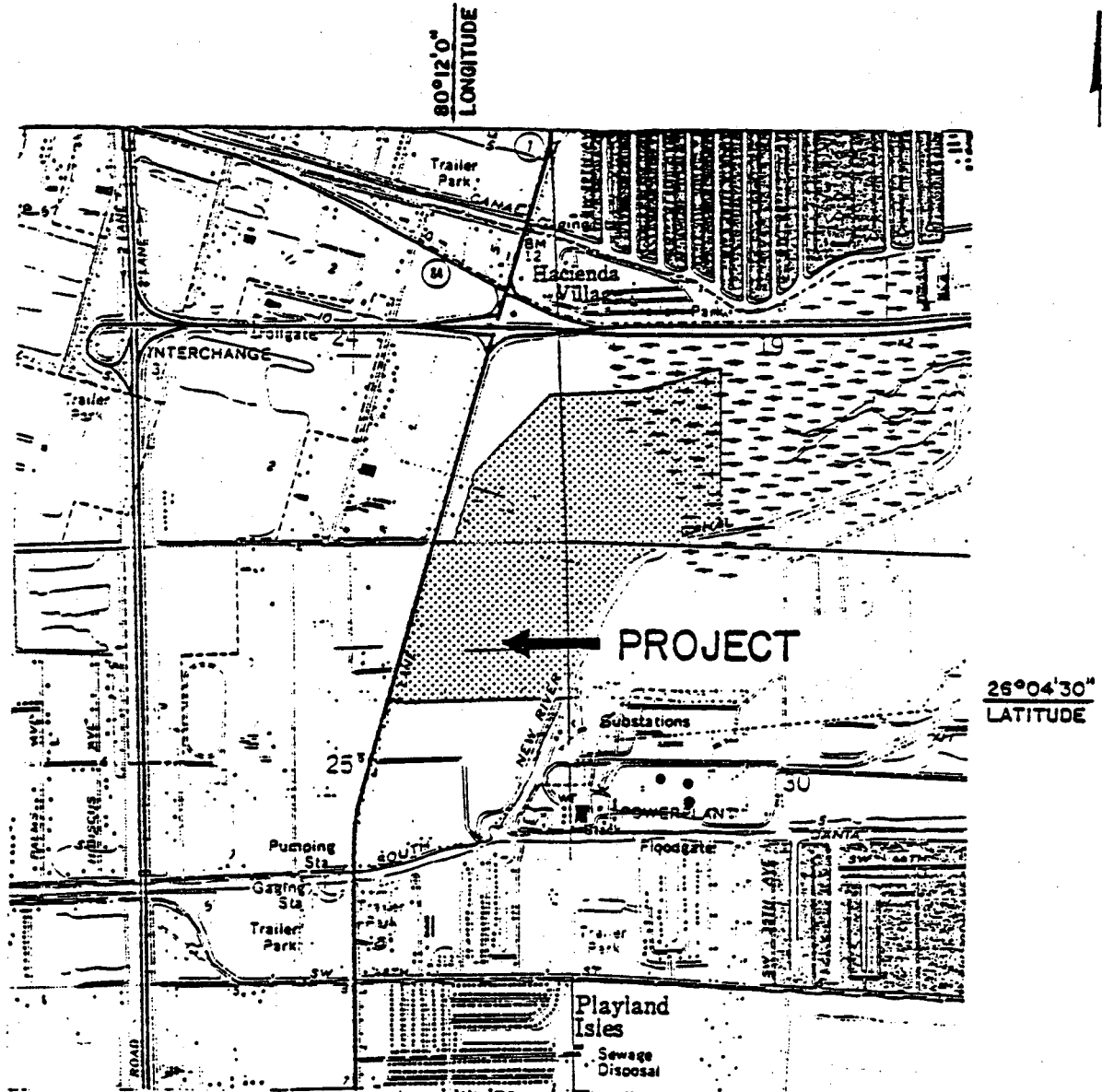
NOTICE TO PERMIT APPLICANTS

This is a Joint Application; it is NOT a Joint Permit!

You Must Obtain All Required Local, State, and Federal

Authorizations or Permits Before Commencing Work!!

For your information: Section 370.034, Florida Statutes, requires that all dredge and fill equipment owned, used, leased, rented or operated in the state shall be registered with the Department of Natural Resources. Before selecting your contractor or equipment you may wish to determine if this requirement has been met. For further information, contact the Chief of the Bureau of Licenses and Motorboat Registration, Department of Natural Resources, 3900 Commonwealth Boulevard, Tallahassee, Florida 32303. Telephone Number 904/488-1195. THIS IS NOT A REQUIREMENT FOR A PERMIT FROM THE DEPARTMENT OF ENVIRONMENTAL REGULATION.



PURPOSE: SOUTHERN RESIDUE / UNPROCESSIBLE WASTE LANDFILL
 DATUM: MEAN SEA LEVEL

SCALE: 1000 0 1000 2000

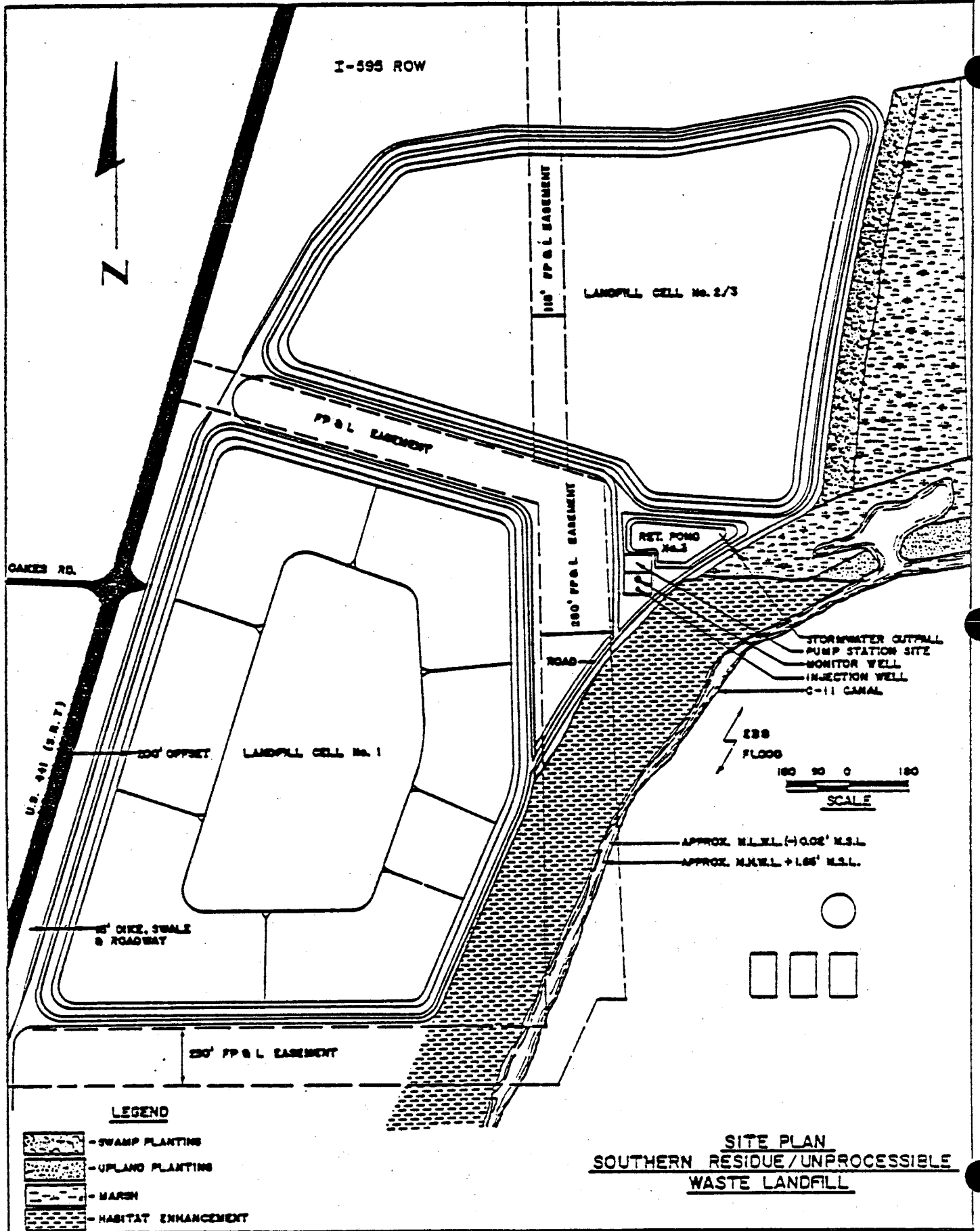
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 FLORIDA QUADRANGLE (1962 PHOTO REVISED 1969)

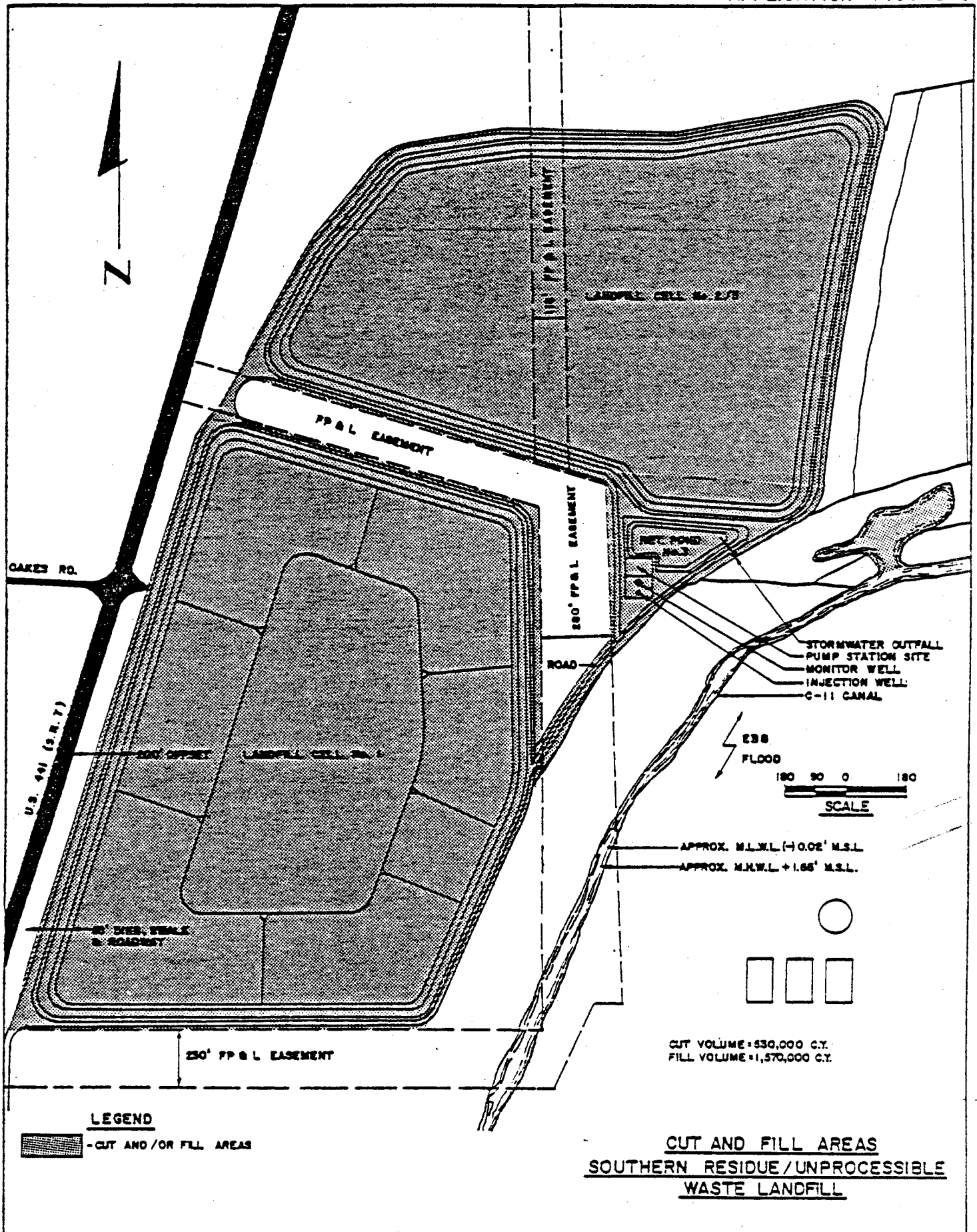
VICINITY MAP

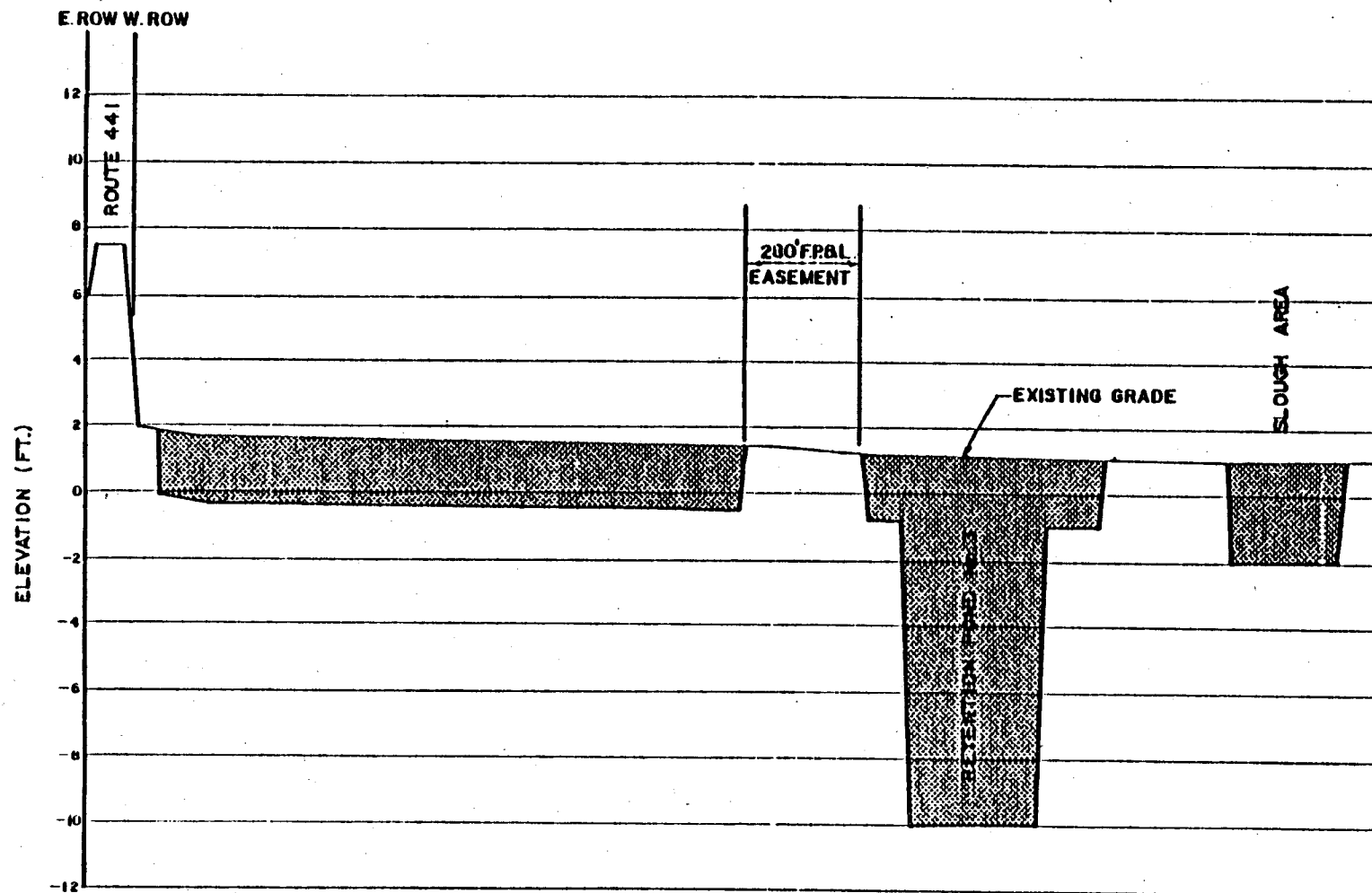
IN AREA ADJACENT TO SOUTH FORK
 OF THE NEW RIVER

COUNTY OF BROWARD
 STATE OF FLORIDA
 APPLICATION BY BROWARD COUNTY

SHEET OF DATE



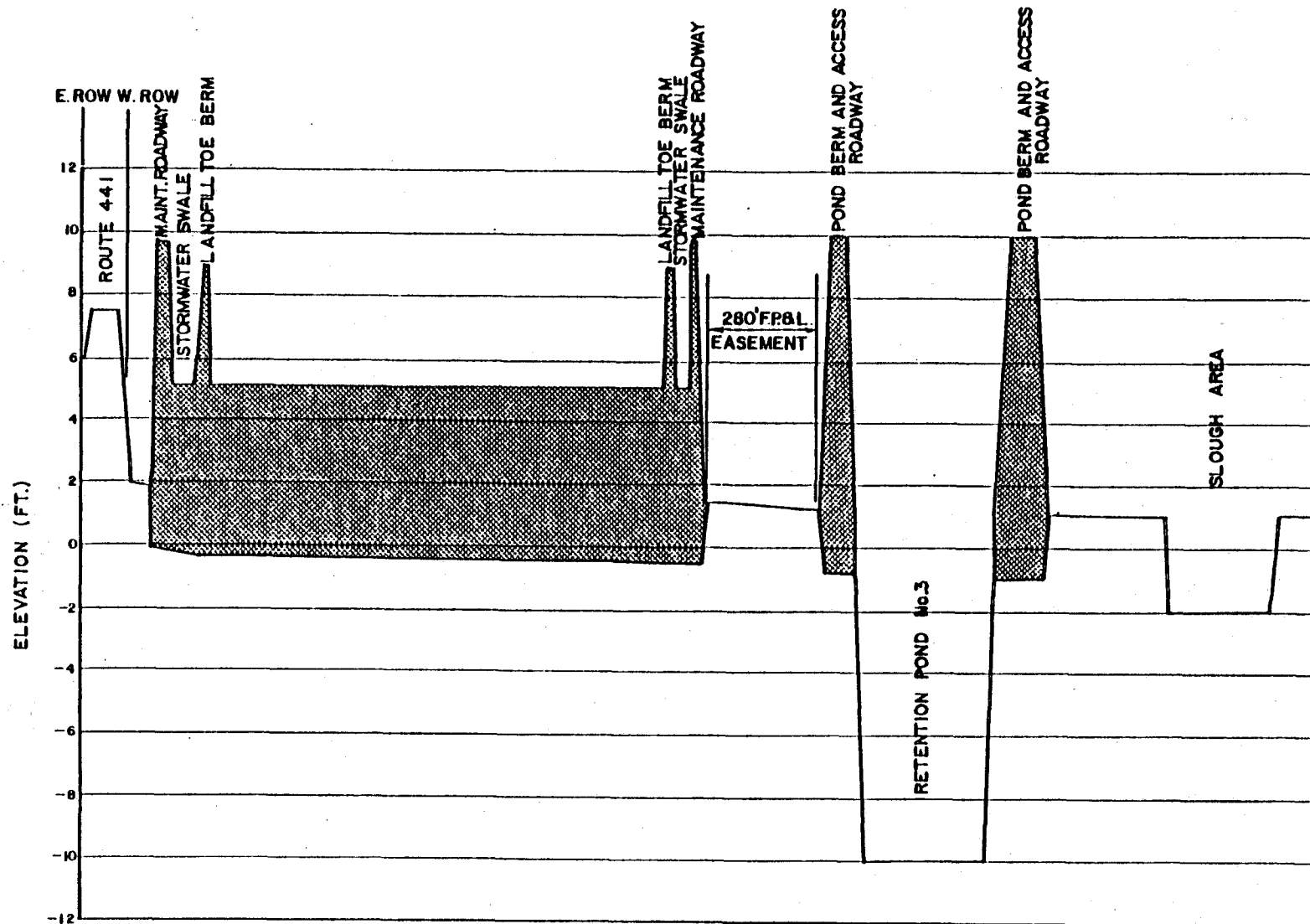




 - AREAS TO BE CUT

SCALE: HORIZ: 1"=400'
VERT: 1"=5'

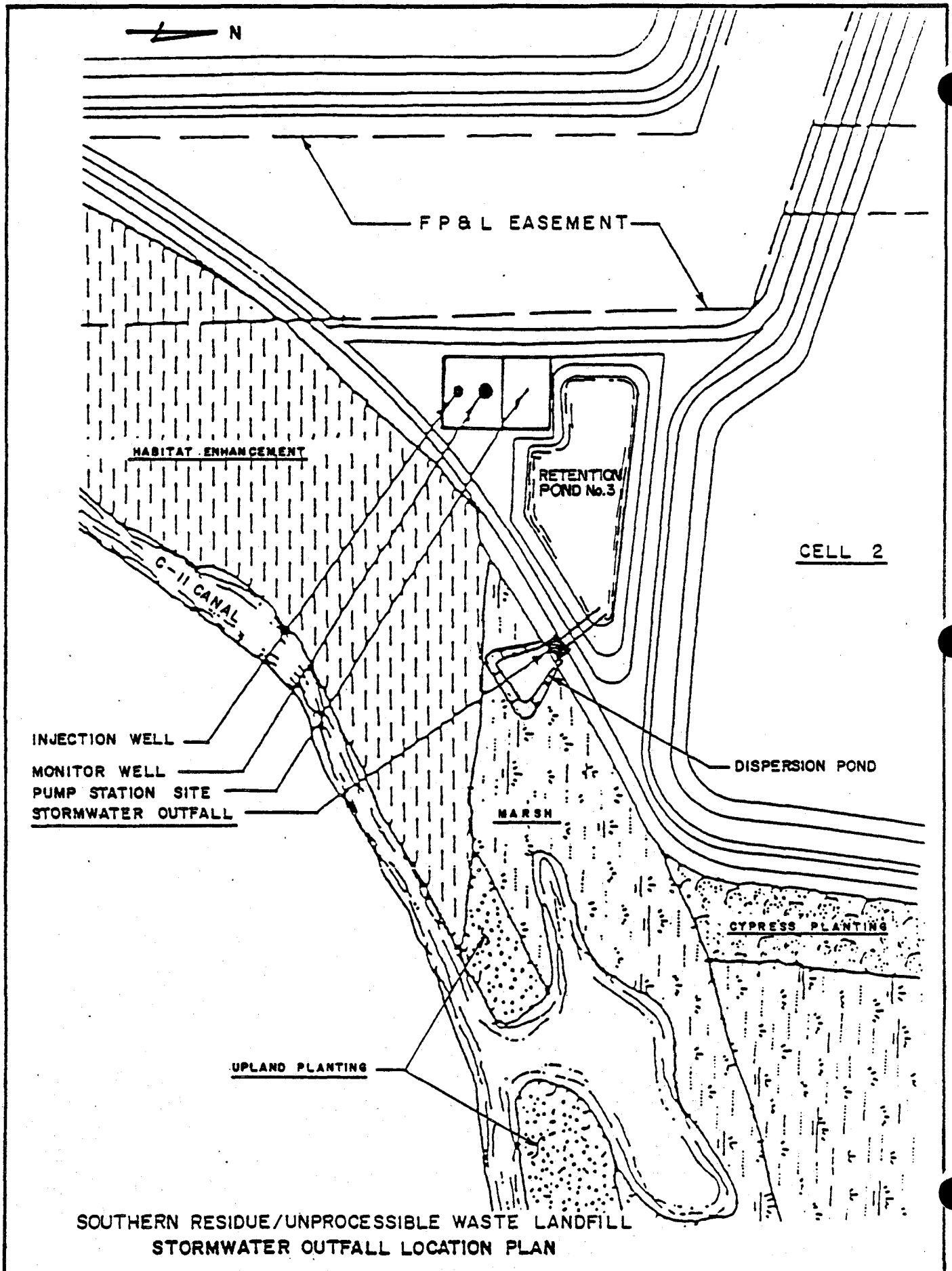
CUT SECTION A-A
SOUTHERN RESIDUE/UNPROCESSIBLE
WASTE LANDFILL

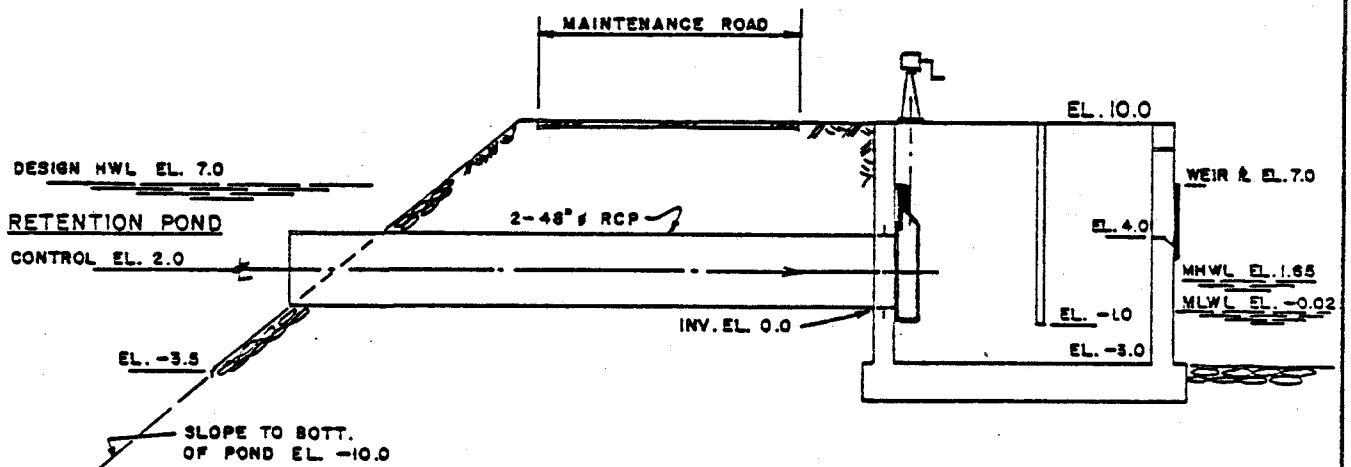
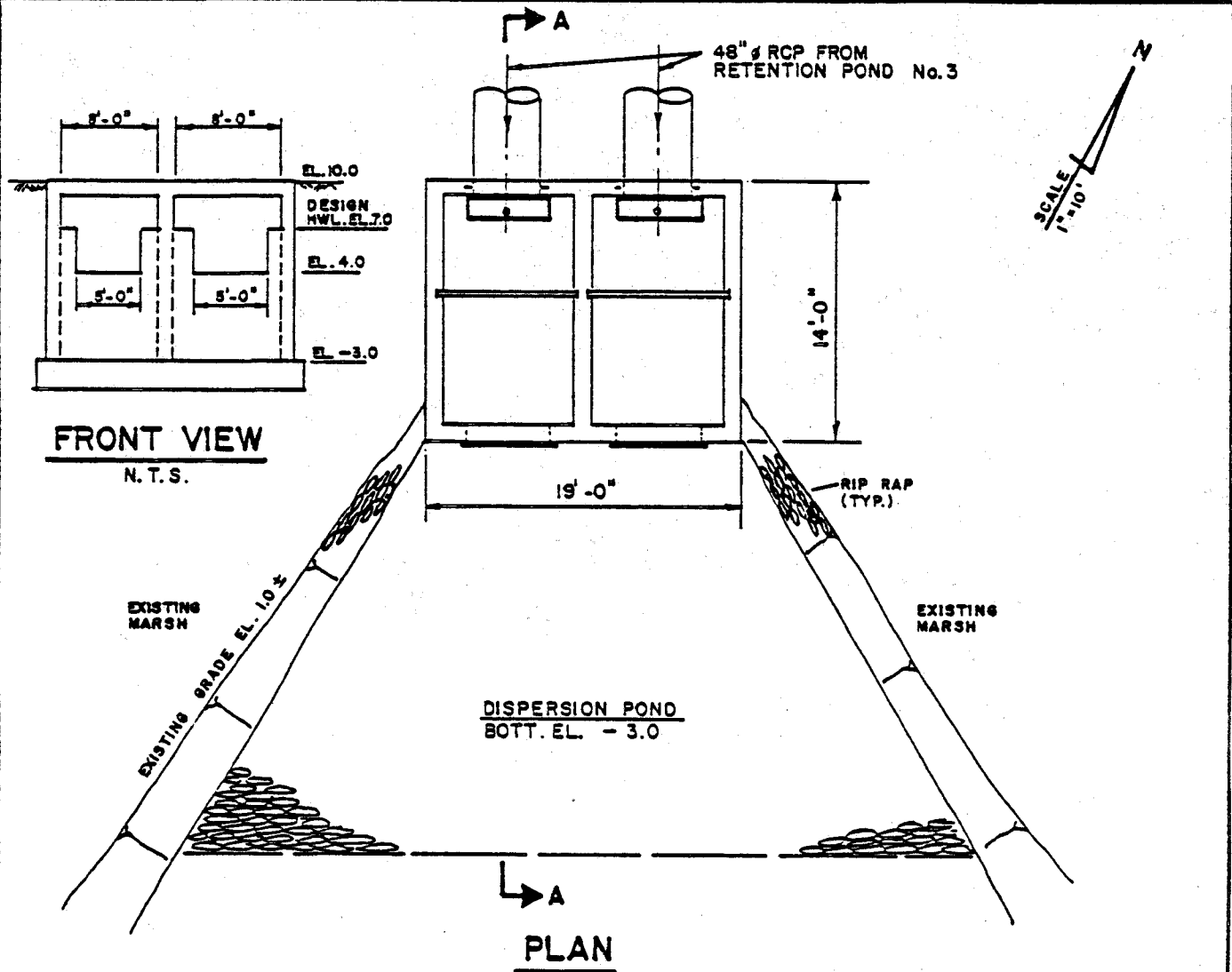


— AREAS TO BE FILLED

SCALE: HORIZ: 1"=400'
VERT: 1"=5'

FILL SECTION A-A
SOUTHERN RESIDUE/UNPROCESSIBLE
WASTE LANDFILL

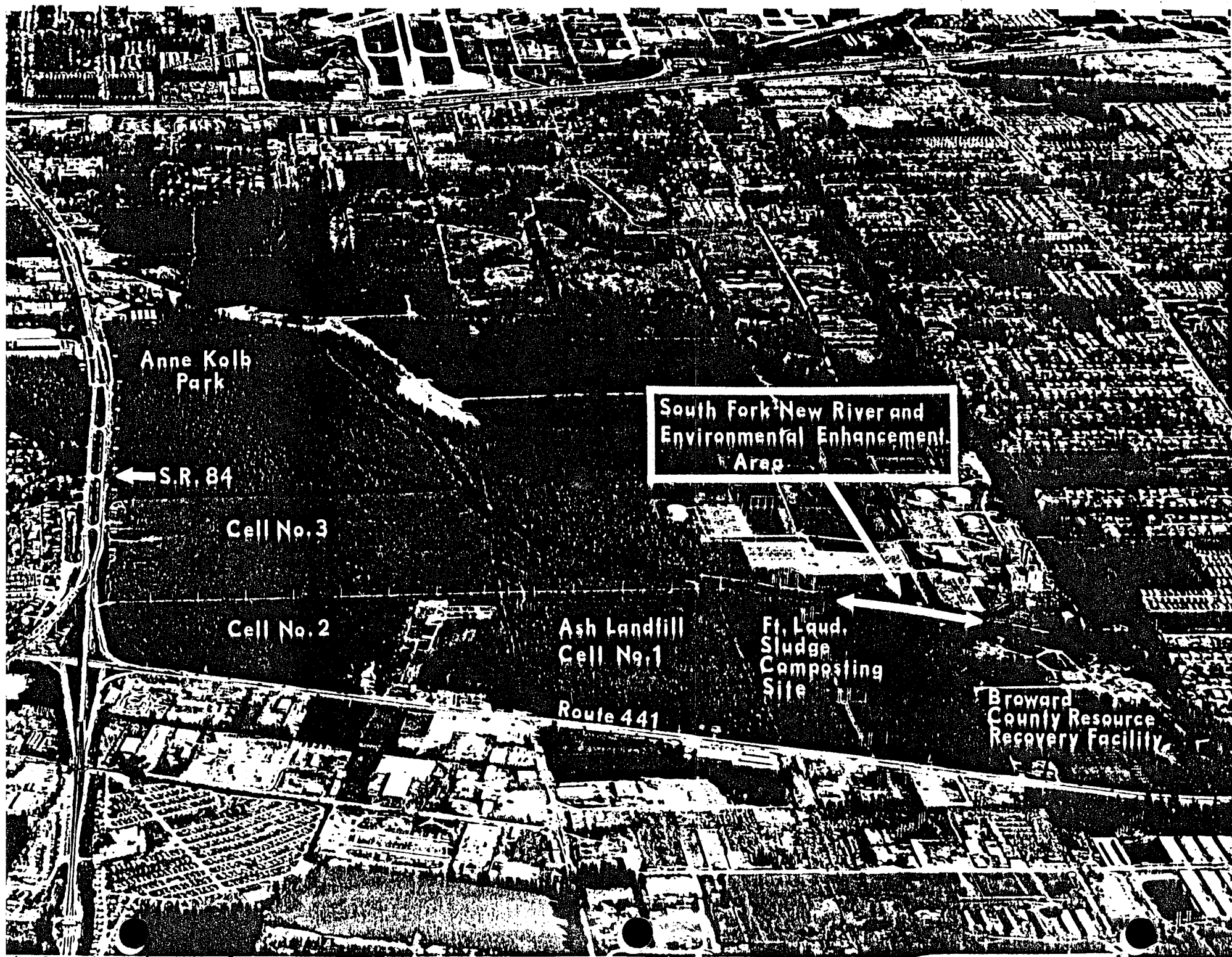




NOTE:
DATUM = MSL

SECTION A-A

SOUTHERN RESIDUE/UNPROCESSABLE WASTE LANDFILL
STORMWATER OUTFALL DETAIL



DESCRIPTION OF PROPOSED ACTIVITY

SOUTHERN RESIDUE/UNPROCESSIBLE WASTE LANDFILL

BROWARD COUNTY, FLORIDA

SUPPLEMENT TO DER FORM 17-1.203(1)

QUESTION 10

I. INTRODUCTION

This report is submitted as supportive documentation for a dredge and fill application in accordance with guidelines described in State of Florida Joint Permit Application .Dredge.Fill.Structures (1982). The U. S. Army Corps of Engineers (CE) and Florida Department of Environmental Regulation have reviewed the Southern Residue/Unprocessable Waste Landfill site, and both agencies have determined that the site is within their individual jurisdiction. This document provides the necessary supportive material to describe the project, site selection, and assess impacts. Because the resource recovery facility and landfill are divided by the Broward County Central Wastewater Region compost facility, separate dredge and fill permit applications are being submitted for the RRF and landfill development.

A. Proposed Use

On October 12, 1982, Broward County authorized the preparation of a Request of Proposals (RFP) for long-term full service solid waste disposal including the design, construction, start-up, and operation of two complete resource recovery facilities (RRF). One facility will be located in the northern part of the County and one in the southern part of the County, and each will be accompanied by a residue/unprocessable waste disposal landfill. Based upon the need for specialized engineering expertise and sensitive issues associated with the project, Broward County selected the team of Malcolm Pirnie, Inc., Hazen and Sawyer, P.C. and CZR, Incorporated to assist in developing the resource recovery project. The development of the RFP represents commitment to a solid waste management plan that will eliminate the use of sanitary landfills as the primary disposal method and will provide a unified approach for siting complete solid waste disposal facilities (RRF and residue/unprocessable waste landfill).

The technology to be utilized at the RRF will be mass burning incineration. Mass burning incineration of unprocessed municipal solid waste (MSW), combined with heat recovery, is currently the most developed and widely practiced resource recovery technique in the world.

Energy recovery, reduction of original waste volume and quality of ash residue are among the major assets of this technology. There are numerous mass burning stoker-fired incineration facilities in the United States, Canada, Europe, and Japan that have successfully demonstrated the suitability of this MSW processing method.

Prior to the County's October 12, 1982 directive, several investigations of potential resource recovery facility and sanitary landfill sites had been conducted. A site evaluation report, which presented an analysis of three potential resource recovery sites and five potential landfill sites, was submitted to Broward County on February 6, 1982. Supplemental investigations of these sites and of seven additional sites were also conducted during 1982. Reports presenting the findings of these supplemental investigations were submitted to Broward County on April 22, 1982, August 10, 1982 and October 6, 1982.

Based upon information contained in these site evaluation studies, the Board of County Commissioners of Broward County identified the Route 441 site as the most appropriate site for the southern full service facility.

B. Need

Broward County generates approximately 2400 to 3000 tons per day of municipal solid waste. At present, this MSW is disposed of at the Broward County Sanitary Landfill (BCSL) in Davie and at the Central Disposal Company (Waste Management, Inc.) landfill in Pompano Beach. The BCSL, however, is

projected to exhaust its capacity in 1986 if a proposed expansion is constructed. Without the expansion, the landfill will reach capacity before the end of 1983. Once this occurs, there are no long term disposal arrangements for approximately 1200 to 1800 tons per day of MSW generated in Broward County.

Recognizing the need for a new long term disposal facility, Broward County proceeded with studies to select a demonstratedly successful and environmentally suitable MSW processing and resource recovery method. Due to the sensitivity of the County's sole source drinking water aquifer (Biscayne), a policy decision was made not to rely on landfill as a primary disposal solution.

A number of disposal technologies have been evaluated. The processes considered include:

- . Materials Recovery
- . Energy Recovery
 - Mass Burning (Unprepared MSW) Incineration
 - Solid, Gaseous and Liquid Refuse Derived Fuel (RDF) Combustion Systems
- . Codisposal of MSW with Sewage Sludge
- . Composting

The County has pursued development of two full service resource recovery projects. A mass burn system located at the Route 441 site has been determined by the Board of County Commissioners of Broward County to best meet the public need for the southern facility.

II. PROPOSED PROJECT

A. Facilities and Process Description

1. Introduction

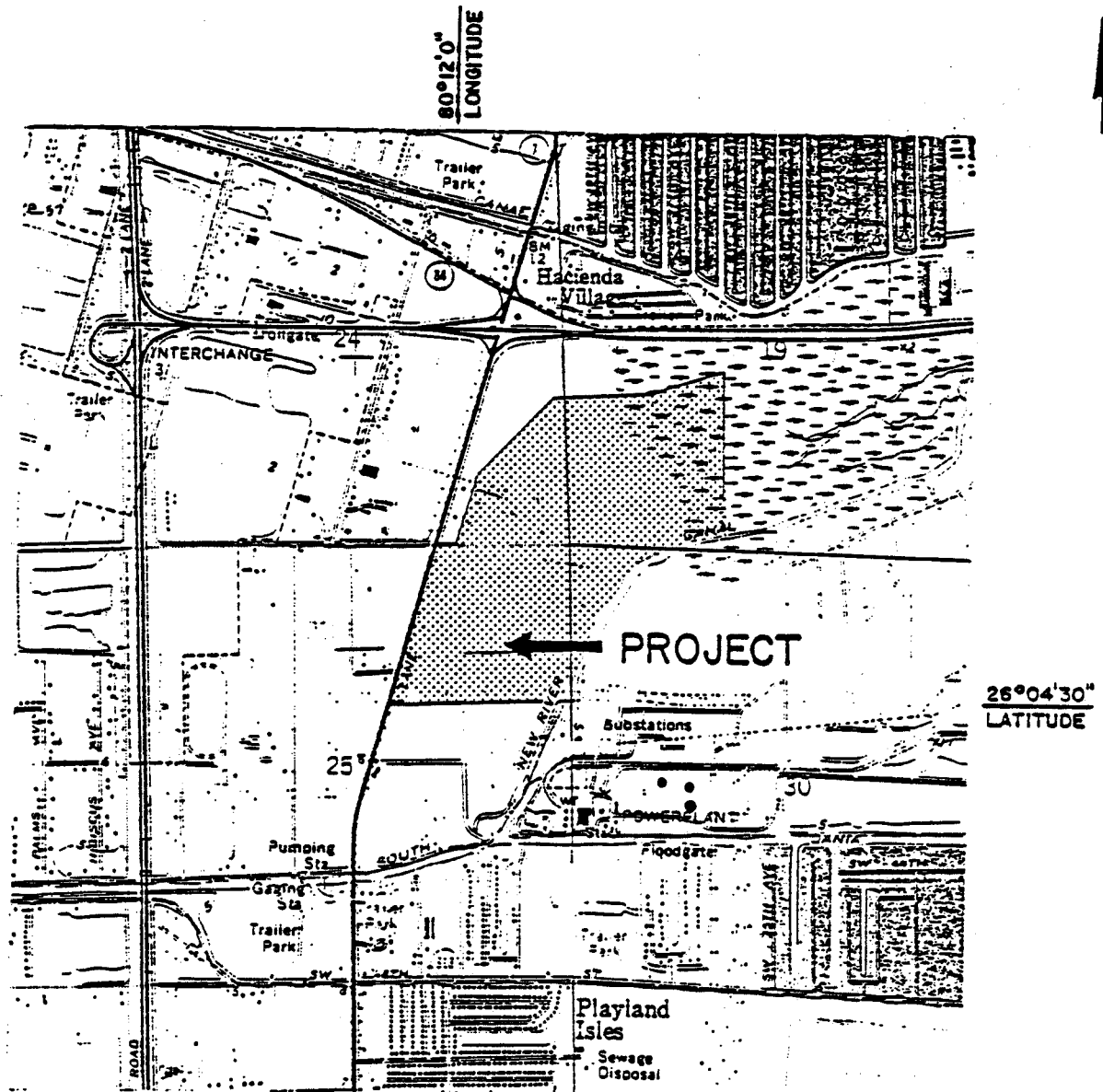
The Southern Residue/Unprocessable Waste Landfill will receive approximately 390-530 tpd of residue and unprocessable waste from the RRF. The landfill will be located at the intersection of US 441 (SR 7) and SR 84 in unincorporated Broward County (Figure 1, Plate 1). The project will consist of the landfill, attendant facilities for water management, and on-site mitigation adjacent to South Fork New River Canal. The total project will comprise 198 acres. The site layout for the landfill is presented in Figure 2.

Processible waste received at the RRF will be burned to reduce the original volume by approximately 90 percent. Residue consisting of ash from the incineration process and fly ash from the electrostatic precipitators will be landfilled. Unprocessable wastes such as construction materials will also be landfilled directly. Ferrous metals may be salvaged and stored on site until they are sold by the operator.

2. Landfill

Ash residue from the RRF and unprocessable solid waste will be landfilled on site (Figure 2). At no time will the ash residue produced at the plant be greater than 25 percent of the weight of the incoming waste. Approximately 116 acres of the site will be used for the landfill and an estimated 12 million cubic yards of ash residue and unprocessable waste will be landfilled over the 20 year life expectancy of the project. The landfill will initially receive approximately 390 tpd of residue and unprocessable waste with this total increasing to an estimated 530 tpd in later years. Table 1 provides the estimated volume of landfilled material on a yearly basis 1987-2007.

FIGURE 1



PURPOSE: SOUTHERN RESIDUE/UNPROCESSABLE WASTE LANDFILL
 DATUM: MEAN SEA LEVEL

SCALE: 1000 0 1000 2000

SOURCE: USC & GS T-8428 FORT LAUDERDALE SOUTH,
 FLORIDA QUADRANGLE (1962 PHOTO REVISED 1969)

VICINITY MAP

IN AREA ADJACENT TO SOUTH FORK
 OF THE NEW RIVER

COUNTY OF BROWARD
 STATE OF FLORIDA
 APPLICATION BY BROWARD COUNTY

SHEET OF DATE

FIGURE 2

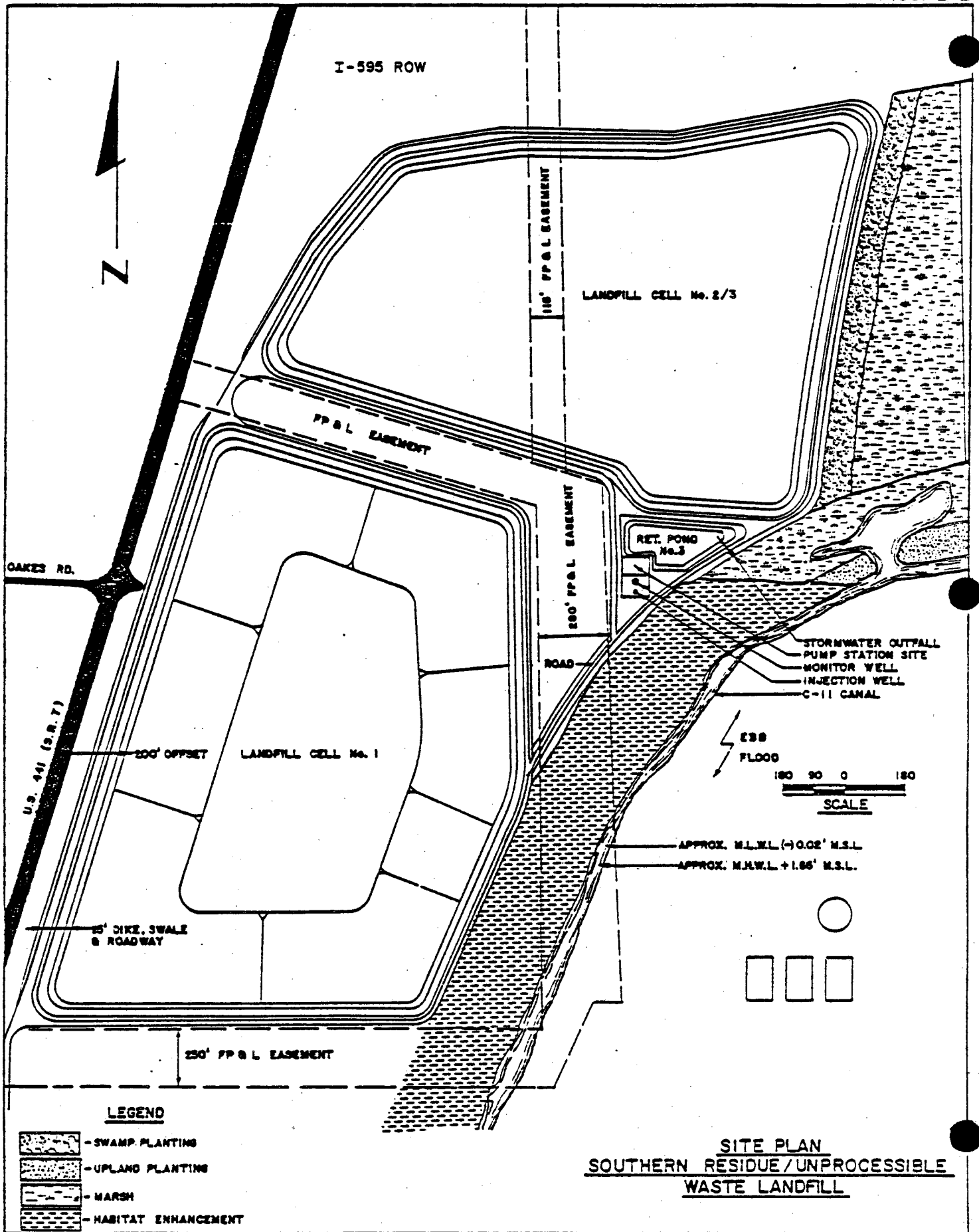


TABLE 1

ESTIMATED VOLUME REQUIREMENTS FOR RESIDUE/UNPROCESSABLE WASTE
LANDFILL TO BE LOCATED AT THE SOUTHERN SITE

Year	Estimated Residue ¹ to Southern Landfill (TPY)	Estimated Unprocessable Waste ² to Southern Landfill		Cumulative Total ³ of Residue & Unprocessable Waste to Southern Landfill (Cubic Yards)
		Tons per Year	Cubic Yards Per Year	
1987	142,000	117,000	292,000	471,000
1988	146,000	119,000	298,000	954,000
1989	149,000	124,000	310,000	1,453,000
1990	153,000	128,000	320,000	1,967,000
1991	156,000	130,000	325,000	2,490,000
1992	159,000	131,000	328,000	3,020,000
1993	162,000	133,000	332,000	3,557,000
1994	165,000	135,000	338,000	4,103,000
1995	168,000	137,000	342,000	4,658,000
1996	170,000	141,000	352,000	5,225,000
1997	173,000	142,000	355,000	5,799,000
1998	176,000	144,000	360,000	6,382,000
1999	178,000	146,000	365,000	6,971,000
2000	181,000	148,000	370,000	7,571,000
2001	183,000	150,000	375,000	8,177,000
2002	185,000	151,000	378,000	8,789,000
2003	187,000	153,000	382,000	9,409,000
2004	188,000	155,000	388,000	10,034,000
2005	191,000	155,000	388,000	10,663,000
2006	192,000	159,000	398,000	11,304,000
2007	194,000	159,000	398,000	11,948,000
	<u>3,598,000</u>	<u>2,957,000</u>	<u>7,394,000</u>	

¹Calculated as follows: for 1987 (from p. 42 of draft RFP) 2,600 tpd x 0.60 percentage of total processable waste available to southern resource recovery facility) x 0.25 (percentage of waste by weight remaining as residue after incineration) x 365 day/yr - 142,000 tons per year. Density of Residue is assumed to be 2,000 lbs/cubic yard.

²Assumes that 50 percent of all unprocessable waste will be landfilled at the southern facility's residue/unprocessable landfill and that such waste will have a landfilled density of 800 lbs/cubic yard: i.e. for 1987 from p. 42 of draft RFP) 640 tpd x 0.50 x 365 day/yr - 116,800 or 117,000 tpy.

$$117,000 \text{ tons} \times \frac{2000 \text{ lbs}}{\text{ton}} \times \frac{1 \text{ cu.yd.}}{800 \text{ lbs.}} \times 292,000 \text{ cubic yards/year}$$

³Includes an allowance of 8 percent of total volume for cover materials.

The material will be filled in a series of subcells within each landfill area. All materials deposited in the fill will be placed at or above the 100-year flood elevation. Landfill faces exposed to public view will be capped and landscaped as filling progresses.

When a landfill area is completed to design grades it will be closed in accordance with federal, state and local regulatory agency requirements. In addition, final cover will consist of a layer of impervious material having a permeability of 10^{-7} cm/sec or less, covered with sufficient top soil to support the growth of vegetative cover. Roadways will be extended to the crown of the landfill for long term maintenance. The landfill will be filled to approximate elevation 140 feet MSL. A true scale section of the completed landfill is shown in Plate 2.

The landfill mass is expected to be a stable, inorganic material which would not be subject to the anaerobic decomposition processes with associated noxious end products common to the landfilling of organic solid wastes. Hazardous waste will not be accepted at the resource recovery facilities or residue/unprocessable waste landfill. The residue/unprocessable waste landfill is not expected to attract insects, rodents, or birds associated with landfills in which raw waste is deposited.

Each landfill cell will be lined with an impermeable membrane liner. The permeability ("K" factor) of the complete lining system will be approximately 1×10^{-7} cm/sec. Any leachate will then be conveyed to a pump station for ultimate disposal. The leachate will be disposed of in a deep well injection system. Leachate will always be kept separate from stormwater.

3. Water Resource Management Facilities

a. Surface Water

The surface water management system for the project will be designed to accommodate current and future site utilization. A schematic of water management for the project is provided in Plate 3. A phased development plan is envisioned in order to address such issues as the routing and treatment of runoff from active portions of a landfill cell and concerns regarding the quality and appropriate control methods for the disposal of surface runoff during rainfall periods.

The Route 441 site lies within the jurisdiction of the South Florida Water Management District (SFWMD). This statutory agency is authorized to implement a permitting program for the use and control of water. The conditions for issuance of the permit include the provisions of reasonable assurances that the project will:

- . provide adequate flood protection and drainage;
- . not adversely impact water quality or quantity on receiving wastes and adjacent lands;
- . not adversely impact surface and ground-water levels and flows;
- . not cause adverse environmental impacts;
- . be operated and maintained effectively;
- . not adversely affect public health;
- . be consistent with requirements of other agencies;

- . be the most publically acceptable alternative;
- . serve a land use which is compatible
with applicable zoning and land use plan
designation;
- . not interfere with the legal rights of
others; and,
- . not otherwise harmful to the water
resources of the District.

The project site is located adjacent to the South Fork of the New River Canal (Canal C-11) in tidal waters downstream from SFWMD Pump Station S-13. This station is regulated to provide flood control in upstream reaches as well as maintain adequate groundwater elevations to mitigate salt water migration. Annual average water elevations measured downstream of Pump station S-13 range between elevation +1.64 (flood tide) and elevation -0.02 (ebb tide), relative to mean sea level.

The project site is located east and downstream of the SFWMD C-11 east drainage basin. Rule Chapter 40E of the SFWMD sets forth design criteria for the control of area runoff quality and quantity from the site.

These criteria are summarized below:

- . Design Storm - 25 year
- . Storm Duration - 72 hour
- . Cumulative Precipitation - 15 inches

- . Water Quality

- Provide a retention volume equal to 50 percent of the runoff from the 3 year 1 hour rainfall event (precipitation = 2.8 inches).
- Provide a wet detention volume equal to 100 percent of the runoff from a 3 year 1 hour rainfall event.

- . Water Quantity

- Limit post development peak discharges to the C-11 canal to predevelopment levels.

The surface water management system for the landfill site is designed to accommodate current and future site utilization. A phased operational plan is envisioned in order to address such issues as the handling and treatment of runoff from active portions of a landfill cell and concerns regarding the quality and appropriate control methods for the disposal of surface runoff from the landfill areas during rainfall periods.

(1) Preclosure Operation

Preclosure operations will be conducted to provide the required protection for water resources. The major preclosure operations are described below:

1. Before material is deposited within a given landfill cell:
 - a. The landfill cell will be surrounded by a perimeter access road which will serve as a dike to prevent on-site runoff from impacting off-site areas (Plate 4).

- b. The landfill cell will be surrounded by a grassed perimeter swale system (Plate 4).
- c. The landfill cell will have an impermeable bottom liner and underdrain system to capture any leachate generated within the landfill.

2. Typically stormwater runoff from active areas within a landfill subcell will be directed to one or more empty subcells for temporary storage. The stored runoff will be collected in the landfill cell underdrain system and conveyed, along with the landfill leachates, to a common collection sump, before ultimate disposal via deep well injection. This collection and disposal system is entirely separate from the stormwater management facilities. Disposal of leachate in the injection well will occur first, before any surface runoff is disposed of via the injection well.

3. The 441 landfill site will ultimately consist of two landfill cells. Each cell will be surrounded by a perimeter access road which will serve as a dike in order to insure all surface runoff is contained on site.

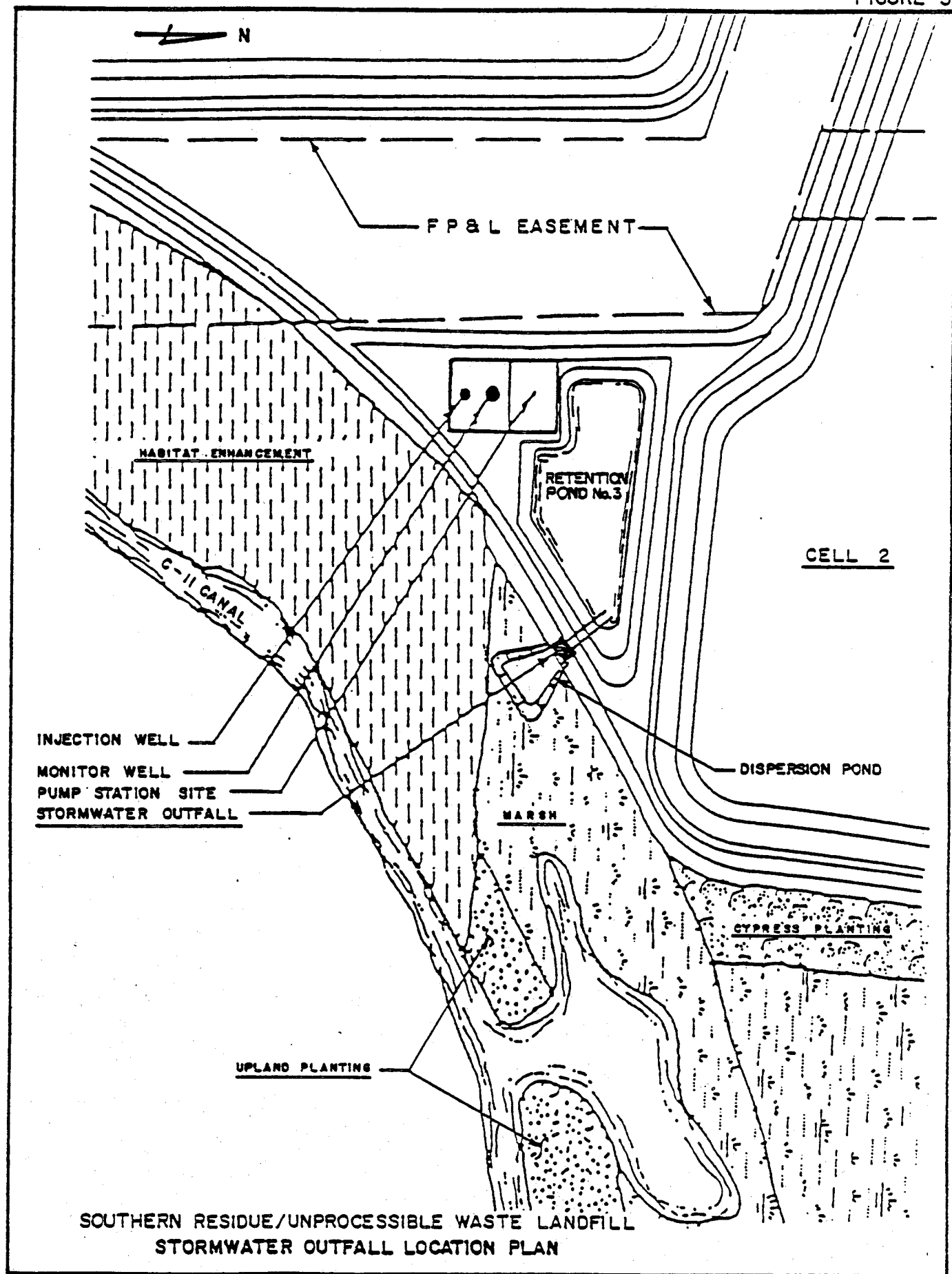
A grassed perimeter swale (Plate 4) will be located between the toe of each landfill cell and the cell's perimeter access road. During periods of rainfall, stormwater will run off the landfill and be captured in the perimeter swale system. Runoff from the landfill which is captured in the perimeter swale systems will typically drain via culverts beneath the access road to a central stormwater ponding area from where final disposal can take place. The location of this ponding area and the ultimate method of stormwater runoff disposal will vary as the landfill site is developed, as indicated in Sections 4 and 5 below.

4. The development plan for the landfill site will initially involve ash disposal in landfill cell 1, which is expected to occur over a period of 14 years, (i.e. 1987 to 2001). During this entire 14 year period, the area set aside for landfill cell number 2 will be diked and utilized as a temporary retention area for runoff from landfill cell 1. This will be accomplished by connecting the perimeter swale around landfill cell 1 to the retention area by culverts passing under the perimeter road. Thus, during rainfall periods stormwater runoff from the landfill cell will first be captured in its perimeter swale system and then flow by gravity through the culverts to the diked retention area. The retention area will be connected by pipes to a retention pond which is located near the southeast corner of landfill cell 2. A pump station at the pond will allow the water in the pond to be pumped down a deep injection well. Runoff will typically flow from the perimeter swale(s) to the retention area and then to the retention pond where final disposal will be provided down the injection well.

During the first 14 years of landfill operations (i.e. 1987 to 2001), all runoff (25 year - 72 hour design storm) from landfill cell 1, including the rain which falls directly on the retention areas will be totally captured and disposed of down the injection well. During the design storm, water elevations in the retention pond will peak at an approximate elevation of 7.0 feet MSL. An emergency overflow structure (Figure 3) will be installed at the retention pond (typically, weir plates at elevation 7.0 feet) to allow stormwater discharges to the C-11 Canal, for very extreme events in excess of the 25 year - 72 hour design storm.

5. By the year 2001, landfill cell 1 will be completely filled and inactive and will have been closed in accordance with federal, state and local regulatory agency requirements. This includes final

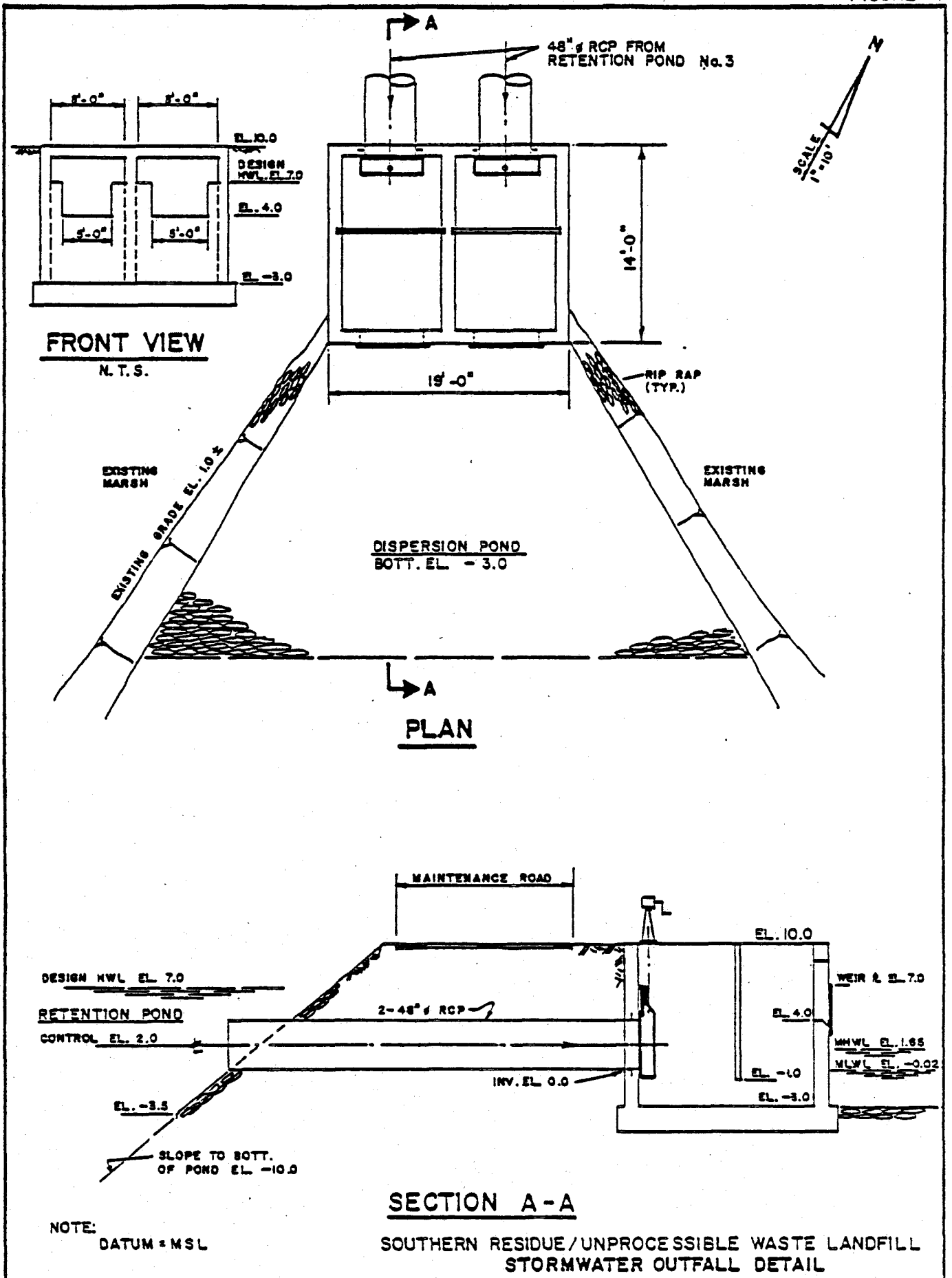
FIGURE 3



capping with two feet of earth and muck and seeding to create an established vegetative cover. At this time, (year 2001) the remaining landfill cell 2, will become the final site for active landfilling.

During the continued development of the landfill site, a major objective of the stormwater management system will be to utilize remaining available land for stormwater retention purposes. Thus, during the landfilling of cell 2, unused portions of the cell 2 site will be set aside for stormwater retention purposes. Additional stormwater storage will be provided in the diked Florida Power and Light (FPL) easement area. Runoff from landfill cell 1 and the developed portions of landfill cell 2 will be directed via culverts to these areas. Culverts will connect these areas to the retention pond for ultimate disposal. As available on-site stormwater storage is depleted due to the continued filling of cell 2, surface discharges from the retention pond to the C-11 canal will be utilized to supplement injection well disposal for flood control purposes. When filling of landfill cell 2 is complete (year 2007) stormwater storage will be available solely in the FP&L easement area and the retention pond. At this time, stormwater quality control at the landfill site will be achieved in accordance with SFWMD criteria by the complete retention of 50 percent of the runoff from the 3 year-1 hour rainfall event (precipitation = 2.8 inches). This will be accomplished by the removal of weir plates which will create a notch in the control weirs at elevation 4.0 feet MSL (Figure 4). Thus runoff will pond in the retention pond from the control elevation (i.e. elevation 2.0 feet MSL) to elevation 4.0+ feet MSL. This retained water will be disposed of only via deep well injection (i.e. no surface discharge). After sufficient retention storage has been provided (i.e. water levels in the retention pond rise above elevation 4.0 feet MSL), surface

FIGURE 4



discharges over the weir to the C-11 canal will then occur. These discharges are utilized to supplement the injection well discharge capacity for flood control purposes in order to continue to maintain the design high water elevation for the site at 7.0 feet MSL. Given the provided retention storage in the retention pond and the large discharge capacity of the injection well (much greater than the percolation rates which are normally achieved in a traditional retention pond) it is anticipated that for most smaller storm events all surface runoff would be disposed of via deep well injection. In fact, the injection well has the capacity to dispose of the entire retention volume within a period of six hours. Since the injection well will be actively disposing of stormwater during the rainfall event, a significantly greater volume of runoff than what is indicated by the retention storage volume could be disposed of before any outflows to the C-11 Canal would occur.

It should be emphasized that SFWMD retention requirements are in excess of the Florida Department of Environmental Regulations (FDER) standards for stormwater quality control. Specifically, FDER standards require that the runoff from the first inch of rainfall be retained, while SFWMD criteria result in the retention of the runoff from the first 1.4 inches of rainfall.

In order to provide receiving water protection, the weir notch from the retention pond to the C-11 Canal is specifically designed to limit surface discharges to the C-11 Canal to predevelopment or natural levels for the 25 year - 72 hour design storm, in accordance with SFWMD discharge criteria. For the design storm, peak discharges from the retention pond to the C-11 Canal will be limited to under 100 cubic feet per second (cfs). If no stormwater management controls were provided at the site (i.e. no stormwater

storage areas, control weirs or injection well discharges), the design peak discharge from the developed landfill site would be over 1400 cfs. Thus, a significant dampening has been provided by the surface water management system to limit discharges to natural levels.

Potential erosion impacts from discharges during this extreme storm event will be eliminated by providing sufficient energy dissipation and dispersion prior to discharge. This will be accomplished by a rip-rapped dispersion pond (Figure 3) which will disperse flows from the weir outfall structures into the wetlands buffering the C-11 canal, with eventual sheetflow discharge to the C-11 canal.

(2) Post Closure Operation

Final closure of a landfill cell includes several operations to ensure long-term protection of surrounding waters:

1. At final closure each landfill cell (i.e. 1 and 2) will have been closed in accordance with federal, state and local regulatory agency requirements. This includes capping with two feet of earth and muck and seeding. Thus, resulting runoff will not come in contact with landfilled material.
2. SFWMD water quality and quantity criteria will be satisfied by the retention of an initial portion of the landfill runoff within the FP&L easement area and retention pond with ultimate disposal via deep well injection.
3. Controlled gravity discharges to the C-11 Canal will be utilized to supplement disposal via deep well injection for flood control purposes. Discharges to the C-11 Canal will meet SFWMD discharge criteria.

b. Leachate

Leachate which is generated within the ash landfill due to intrusion of rainfall will be collected and disposed in an injection well. The first stage of leachate collection will be liquid retention at the base of the landfills. This will be accomplished via the employment of an impermeable bottom liner. As leachate collects at the bottom of the fill, it will be directed to gravel packed trenches by sculptured bottom sloping. Once in the trench, leachate enters a system of perforated polyvinyl-chloride underdrains and is conveyed to a common collection sump. The liquid will be pumped from each of the cells to the injection well pump station for ultimate disposal in the deep well.

It should be noted that the ash landfill will consist of stable, inorganic residue of an incineration operation. The landfill mass is not expected to be subject to the anaerobic decomposition processes with associated noxious end products common to the landfilling of organic solid wastes.

Test data of leachate from ash landfills serving existing mass burn facilities indicate that the percolate will have a negligible environmental impact. More specifically, it has been found that trace elements (including heavy metals) do not appear in appreciable quantities. The principal determinant of the low concentrations is the high pH value of the ash. Even with an acidic rainfall (pH = 4.0) the pH of the leachate remains high, indicating a large buffering capacity inherent in the ash. Depending upon the trace inorganic, dissolution of heavy metal generally occurs around a pH of 6.0.

Attachments 5 and 6 are included to provide further information on this topic. Attachment 5 refers to a facility in Saugus,

Massachusetts. Attachment 6 references a study by the Danish Geotechnical Institute and Water Quality Institute, on a facility in Denmark, reported in 1975.

Although it is expected that the leachate will be innocuous, no discharge will be permitted into the surficial aquifer. As previously stated, the landfills will incorporate impermeable membrane bottom liners. The completed liner system will have a permeability ("k" factor) not greater than 1×10^{-7} cm/sec. All leachate will be collected and disposed of via deep well injection.

c. Injection Well Disposal

An injection well will be utilized for disposal of leachate and stormwater from the landfill site and process water blow-down from the RRF. In recent years, the use of deep injection wells for disposing of wastewater has become widespread in South Florida because of a unique combination of circumstances. The "Boulder Zone," a layer of cavernous rock saturated with salt water, underlies all of the lower part of the South Florida Peninsula between depths of 2700 to 3500 feet. Because of its cavernous nature, it is capable of storing an enormous volume of fluid and can accept injection of fluids at high rates and reasonable (economic) pressures. The Boulder Zone contains only salty water and is, therefore, suitable for wastewater disposal. Furthermore, it is overlain by a sequence of tight or impermeable rock that confine injected fluids and prevent their upward migration into shallower zones containing brackish and fresh water.

Initially, the use of the injection wells was restricted to small, privately owned facilities. Since 1974, larger communities have adopted its use because it causes no adverse environmental impact and was found to be economic (compared to other alternatives). As an example, the City of West Palm Beach has been successfully operating a regional wastewater facility with five disposal wells (including standby) since 1977. Initially, the wells

handled 10 mgd (million gallons per day); today, they are receiving about 28 mgd and have handled as much as 45 mgd at pressures less than 60 psi (pounds per square inch). Monitoring of the water quality in zones above the confining beds since the start of injection shows that the effluent has remained in the Boulder Zone. The City of Fort Lauderdale has recently installed an injection well system consisting of four 24 inch diameter wells and supporting monitor wells. The well system has a capacity of 37 mgd. Similarly, the Miami-Dade Water and Sewer Authority operates an extensive network of injection and monitor wells designed to dispose as much as 100 mgd at the South Dade Wastewater Treatment Plant.

Since the inception of the large scale disposal well systems in 1974 and the successful completion of a number of these facilities, a considerable amount of technical knowledge has developed. Basically, sound engineering practice and regulatory requirements dictate that favorable conditions (highly transmissive zone containing non-potable water and overlain by a confining bed) for injection well disposal exist in an area. In addition, the well must be designed and constructed so that the integrity of the confining bed and the operating injection well are maintained. Demonstration of confining bed integrity is achieved during the exploratory drilling portion of the injection well program by the collection and interpretation of geologic data from core and formation samples and geophysical logs. Integrity of the well is assured by using casings having sufficient wall thickness to resist corrosion and have a long life. The casings are set in the center of a larger diameter drilled bore hole and cemented in place with special blends of cements to assure sealing and provide strength. Protection of potable and other usable groundwater is provided by constructing the well with two or more lengths of "strings" of casings set to different depths. Each is a different diameter and extends from its setting point up to land surface. The inner, or injection casing, is set

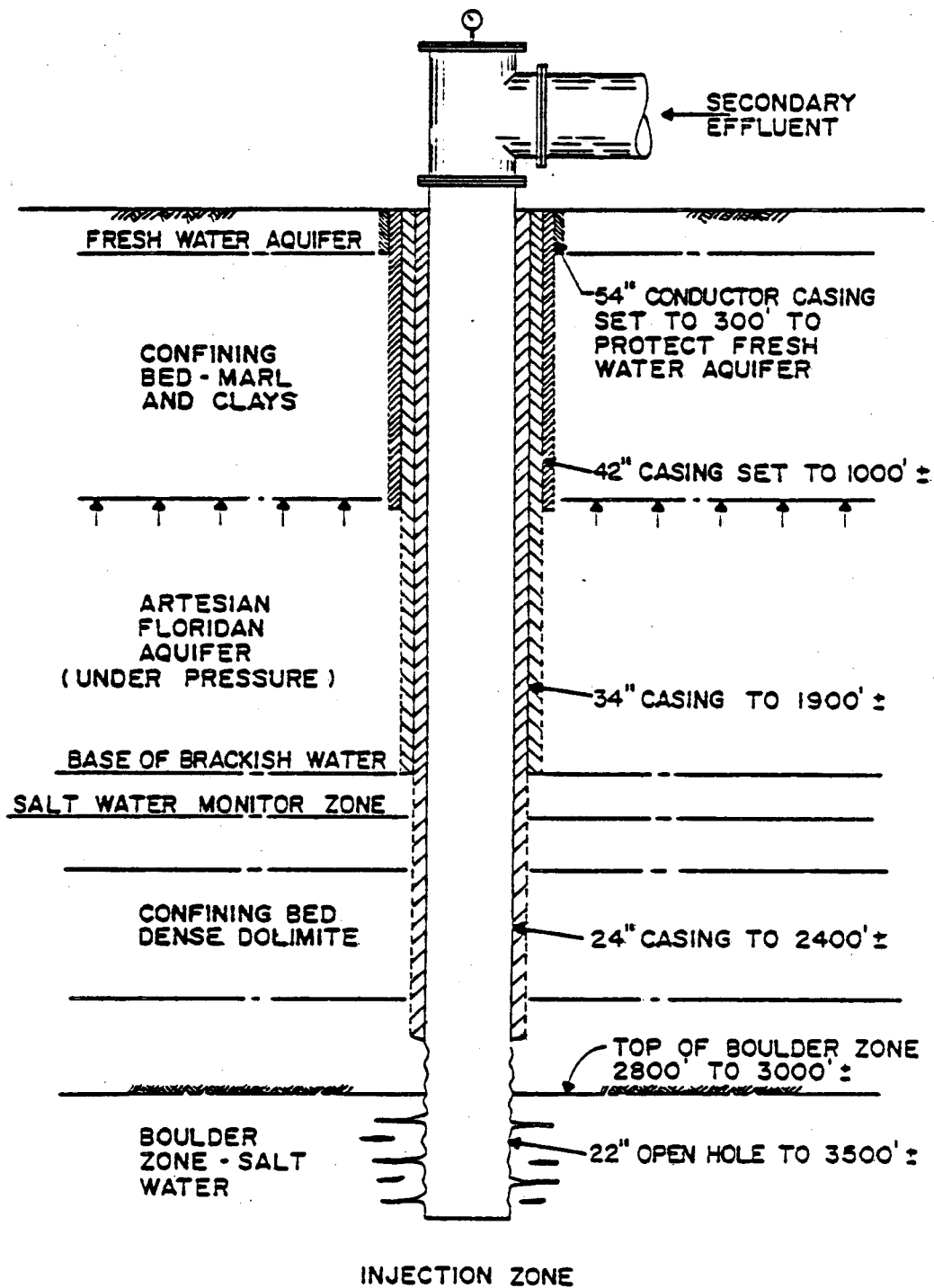
or seated well into the confining bed. Larger diameter casings (designated surface, intermediate and conductor casings) are set to successively shallower depth. These too are cemented completely in place. The choice as to the number of casings and their setting depths is dependent on geologic conditions. As a consequence of this type of construction, aquifers containing potable water are sealed off by the three or more different diameter steel casings and cement, assuring protection and long life. Details of a typical effluent disposal well are shown on Figure 5.

Before an injection well can be used construction and operating permits must be secured in a two step permitting process. Details of the well's design and construction are included in the construction permit application as well as those of the program for collecting the data used in proving the presence of the injection zone and the adequacy of the confining beds and for the testing of the integrity of the well. Currently, the DER has a practice of forming a Technical Advisory Committee (TAC) to review details of each application. The TAC is composed of representatives from the DER, the South Florida Water Management District, the U. S. Geological Survey, and the Broward County Environmental Quality Control Board.

The completed injection well system will include monitor wells. These will tap the first salt water bearing zone occurring above the confining bed, possibly intermediate zones and the shallow fresh water aquifer. The number of monitor zones is based on local conditions. Experience indicates that an injection system at the 441 site would require three (3) monitor zones.

The injection well design selected for a particular facility is dictated by geologic conditions and the anticipated plant discharge to be handled. The former determines the number of casing strings and their

TYPICAL INJECTION WELL PROFILE



HAZEN AND SAWYER, P.C.
ENGINEERS

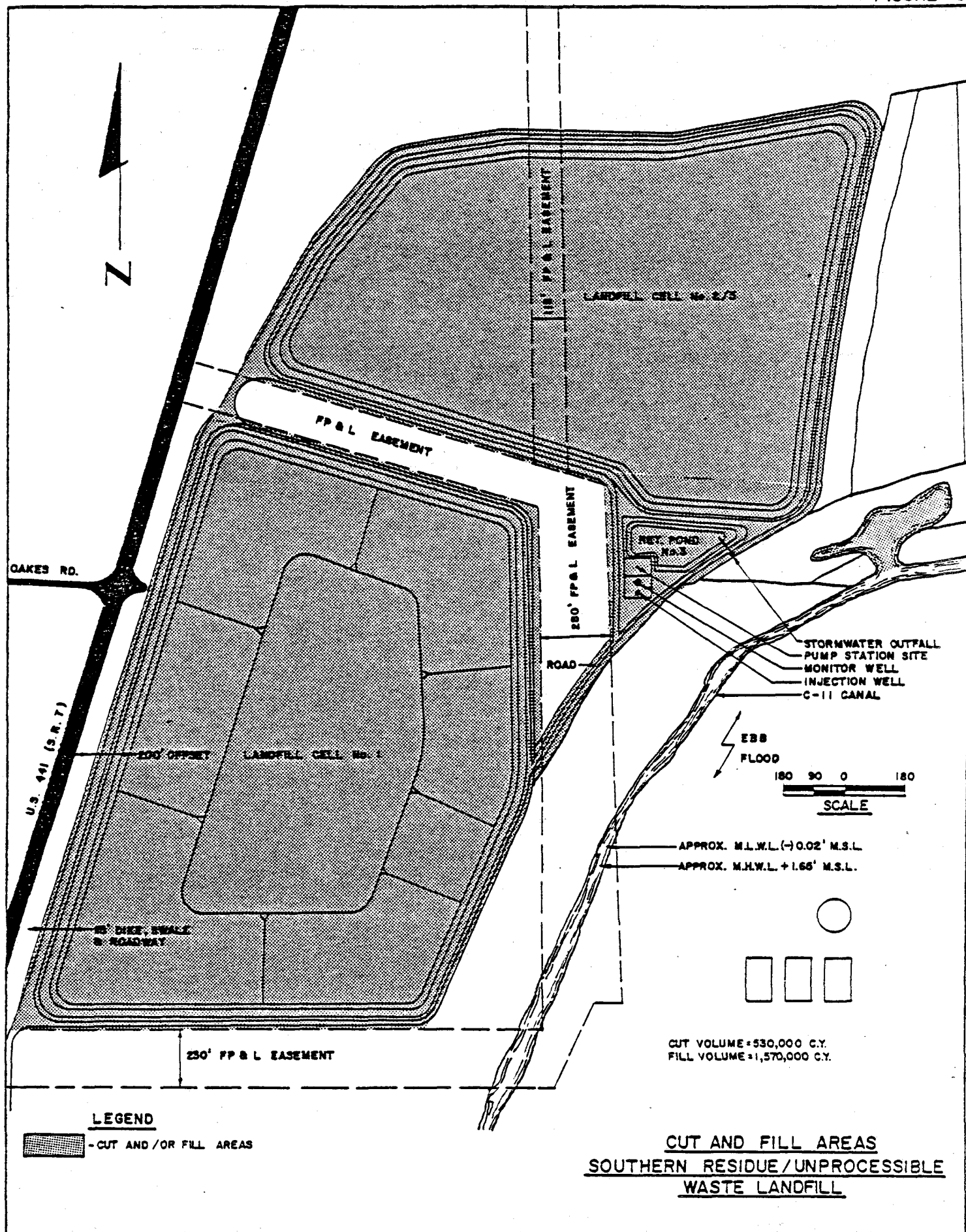
anticipated depth settings, while the latter controls the diameter of the injection casing. The size of this casing controls the choice of sizes used for the other casings.

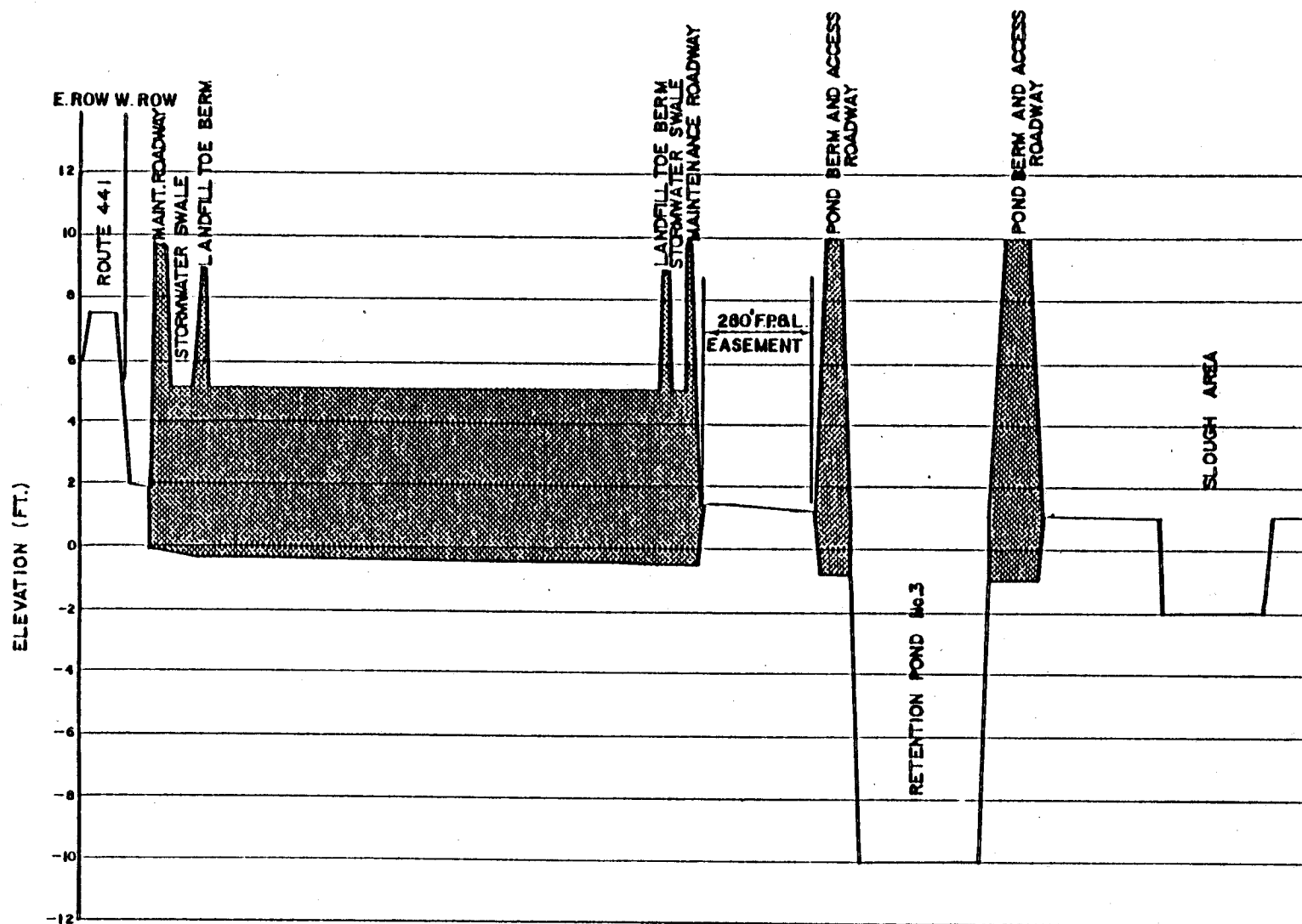
Geologic data indicate that the Boulder Zone certainly underlies the 441 site. Records from the Fort Lauderdale injection wells provide a great deal of information concerning confining beds, monitor zones and the depth and transmissivity of the injection zone. Deep well injection is a feasible and desirable method of disposal of leachate, stormwater, sewage, and process water blow-down from the RRF and landfills.

B. Cut and Fill

Over the 20 year project life, approximately 530,000 cubic yards of material will be removed and 1,570,000 cubic yards of material will be filled to provide an earthwork foundation for the landfill as well as roadway and berm construction. The cut and fill areas are shown in Figure 6 and sections are included in Figures 7 and 8 which illustrate elevations of this earthwork. Approximately two feet of muck will be removed from all construction area. Cut and fill quantities are based upon topographic data for the site (Plate 5).

The landfill site will be filled as necessary to a base elevation of 5.5 (Figure 8). From elevation 5.5, a six-inch layer of sand will be placed to cushion the membrane liner and a 18-inch layer of sand will be deposited on top of the liner as protection prior to landfilling of any residue or unprocessable waste. The volume of sand used to protect the membrane liner is considered construction material and has not been included in the total fill volume described above.





 - AREAS TO BE FILLED

SCALE: HORIZ: 1" = 400'
VERT: 1" = 5'

FILL SECTION A-A
SOUTHERN RESIDUE/UNPROCESSIBLE
WASTE LANDFILL

1. Cut

The top two feet (approximately) of material to be excavated are expected to be a silty, fibrous peat or muck. The remainder of the excavated material is expected to be fine to medium grain quartz and silica sands with traces of silts and organics. Excavated earth will be cast on-site. Suitable material will be utilized for the construction of landfill cell berms and the maintenance roadways. Unsuitable material will be hauled off site by truck. The equipment to be utilized in the dredging operations include backhoes, loaders, draglines and pans.

Excavation will be phased through the project life. As additional landfill volume is required, new areas will be dredged in preparation for liner installation. Excavated areas will be surrounded with a berm (landfill toe berm or the maintenance roadway) prior to dredging to prevent any run-off from contaminating waters of the State.

2. Fill

Filling will occur to bring the landfill subbase to elevation 5.5. Landfill berms will be constructed as landfilling progresses and an elevated maintenance roadway will surround the site (Figure 1).

Residue will be placed on the filled areas of the landfill to elevation 140 MSL.

Dredged sands and limerock from local pits will be utilized for berm and roadway construction. Suitable materials from on-site dredging will supplement these earthwork operations.

III. RESIDUE/UNPROCESSIBLE WASTE LANDFILL SITE SELECTION

A. Background

Broward County occupies an area of approximately 1,200 square miles and is located in the southeastern portion of the State of Florida. It is bounded on the north by Palm Beach County, on the east by the Atlantic Ocean, on the south by Dade County, and on the west by Hendry and Collier Counties.

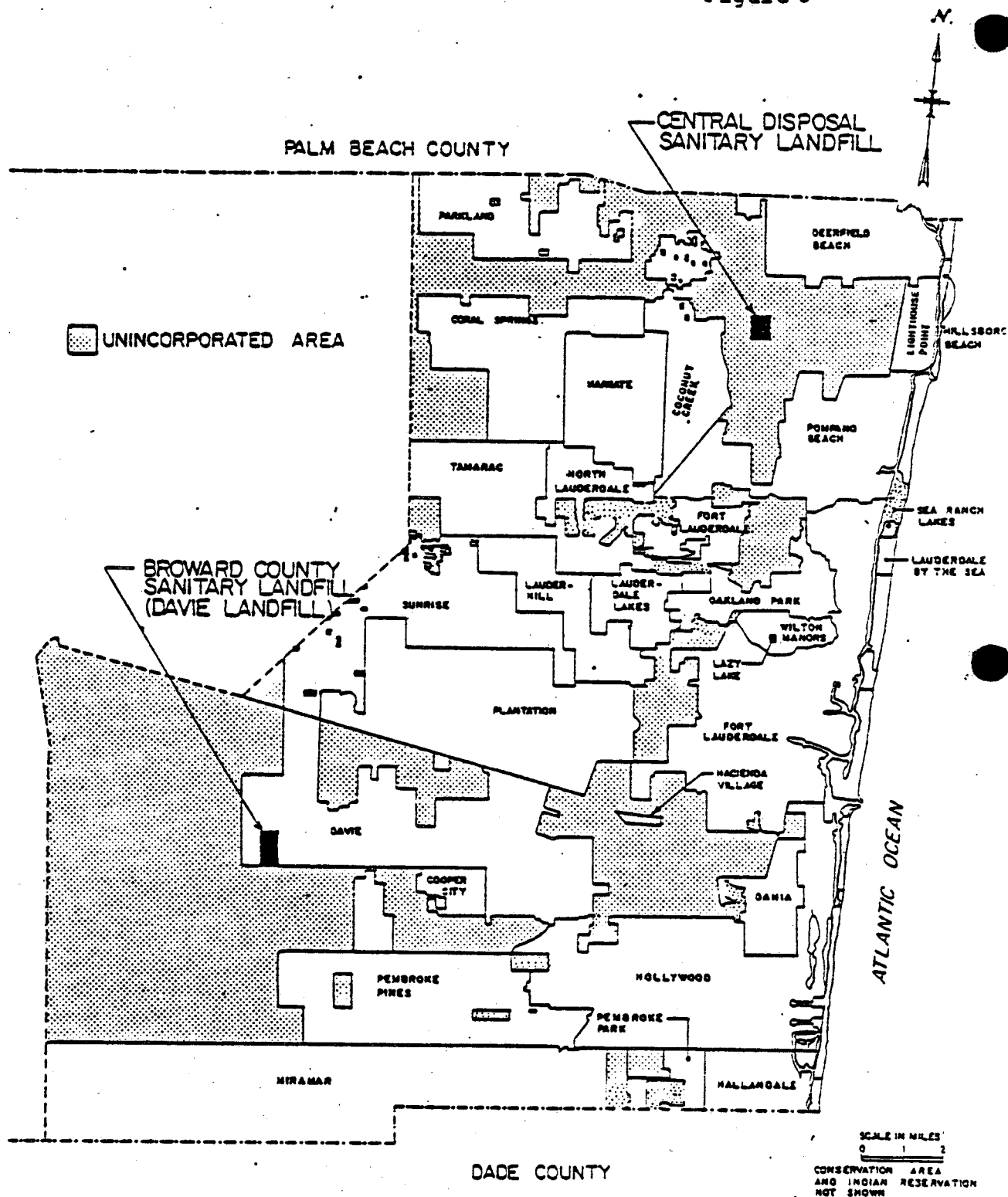
The current Broward County population is approximately 1 million, and it has been estimated that the municipal solid waste (MSW) generated by this population ranges from 2400 to 3000 tons per day. At present, the MSW generated within the County is disposed of at the following two facilities (Figure 9):

- . Broward County Sanitary Landfill (Davie Landfill)
- . Pompano Landfill

The first facility, the Broward County Sanitary Landfill (BCSL), is located at Orange Drive and Boy Scout Road in Davie. It is currently receiving approximately 1200 tons per day of MSW. The BCSL facility will reach capacity in October-November of 1983. Plans have been developed to expand the landfill thereby increasing the useful life to 1986. The permit for this expansion has been contested in the courts.

The remaining MSW generated in the County is currently being disposed of at the second facility, the Pompano landfill (Central Disposal Sanitary Landfill). This landfill is located in Pompano Beach off Powerline Road, and is operated by Waste Management, Inc. Broward County has a long-term commitment with Waste Management for the disposal of 600 tons per day of MSW at this site. The site includes a Solid Waste Reduction Center where MSW is shredded and

Figure 9



BROWARD COUNTY
EXISTING SOLID WASTE
DISPOSAL SYSTEM

ferrous metals are separated prior to landfill disposal. An experimental system testing the feasibility of methane production from the anaerobic decomposition of MSW is also being operated at the Pompano site.

The capacity limitations of these landfills necessitate the development of a long-term county-wide disposal plan. Recognizing this need, the County authorized the investigation of solid waste management alternatives. A policy decision was made by the County not to rely on landfill as a primary long-term disposal solution and to concentrate on alternatives that involve the resource recovery of materials and/or energy.

Originally the County pursued the development of two separate resource recovery projects. The northern project involved a 600 tpd codisposal of MSW and sewage sludge to generate electricity. This waste-to-energy approach was planned for a facility to be located at Powerline Drive, adjacent to the North District Regional Wastewater Treatment Plant. The codisposal project and the Waste Management facility at Pompano therefore accounted for 1200 tpd of MSW disposal capability. The remaining 1200 to 1800 tpd of MSW generated by the County was to be disposed of at the County landfill at Davie. A second resource recovery facility was still needed due to landfill capacity limitations.

Broward County selected the firm of Malcolm Pirnie, Inc., in association with Hazen and Sawyer, P.C. and William F. Cosulich Associates, P.C. to provide the engineering services necessary to develop a long-term disposal solution for Broward County. The lead time required to implement a resource recovery project, and the limited capacity of the County landfill at Davie, make it important that a long-term solution be identified as soon as possible.

B. Initial Site Evaluation and Selection

The first step in the investigation of solid waste management alternatives involved a generic overview of demonstrated (successfully or unsuccessfully) MSW processing and resource (energy and/or materials) recovery methods. A report summarizing the results of this overview investigation was submitted to Broward County on February 16, 1982. The report concluded that mass burning stoker-fired incineration systems represent the most viable technology available to Broward County for implementation under the proposed project.

The recommended solid waste disposal program proposed to identify and develop two separate sites. The first site would be for construction of the recommended resource recovery facility. Approximately 25 to 30 acres are required for a 1200 to 1800 ton per day facility utilizing the recommended mass burning technology.

The second site to be identified was for the development of a new landfill to replace the BCSL. The new landfill was required for disposal of MSW during the interim period from when the BCSL reaches capacity until construction of the proposed waste-to-energy facility is complete. In addition, proposed waste-to-energy facility is complete. In addition, the new landfill would have long-term disposal capacity for the ash residue produced at the proposed resource recovery facility, MSW that cannot be processed at the proposed facility and MSW generated during periods when the proposed facility is shut down for maintenance.

In 1981 the Broward County Solid Waste Division identified 5 prospective landfill sites. The criteria which were used for selection were:

- . general location
- . jurisdiction (unincorporated vs. incorporated areas)
- . size
- . municipal incorporation
- . existing zoning
- . land use plan designation
- . existing land use

The existing zoning and probability of successfully changing the current classification to A-6 to allow for a sanitary landfill was a prime consideration. Another consideration was if the property was currently owned by the County or owned by a private individual(s).

On three dates in March, 1981, the County advertised a Request for Proposals for a sanitary landfill. As a result of this advertisement, two (2) sites were submitted for consideration by agents for private ownership. Broward County staff identified three (3) additional sites which appeared suitable in view of the previously mentioned criteria.

The five potential landfill sites identified were denoted as follows:

- Correctional Institute - This site represents between 480 and 710 acres surrounding the Womens Correctional Institute located between Stirling Road and Sheriden Street.
- Chapel Trail - This site consists of approximately 1830 acres located northeast of the intersection of Hollywood Boulevard and U. S. Route 27.
- Sportatorium - This site consists of approximately 440 acres located north of Hollywood Boulevard. The Sportatorium and the Miami/ Hollywood Speedway are located on this site.
- Davie - This site is comprised of approximately 420 acres located adjacent to the existing Broward County Sanitary Landfill at the northwest intersection of Orange Drive and Shotgun Road.

- Markham Park - This 150 acre site is located in the eastern portion of the park, north of State Route 84 and west of Southwest 148th Avenue.

The consulting team again advertised for potential sites on 5 dates in May, 1982. There was no response to this request.

The detailed evaluation of the potential sites was presented in the February 1982 site evaluation report to the Broward County Commission and Solid Waste Advisory Committee. Supplemental information was tendered in an April 22, 1982, report.

Table 2 summarizes the technical, environmental, and regulatory permit aspects of the 5 sites identified by Broward County as potential landfills and ranks them according to their acceptability for the County's long-term waste disposal needs. The general location of these sites is shown in Figures 10 and 11. The following summarizes the assumptions made for each line of entry in Table 2:

Overall Ranking - This line of entry indicates the site rankings based upon consideration of all technical, environmental and regulatory aspects developed during the site evaluation. Site rankings based upon only one of these aspects may differ from the overall rankings.

Available Acreage - This line of entry presents the total acreage available for use in the development of the southern project.

Site Area Adequacy - This line of entry indicates whether the identified site has sufficient acreage for the development of a sanitary landfill to satisfy the County's long-term waste disposal needs.

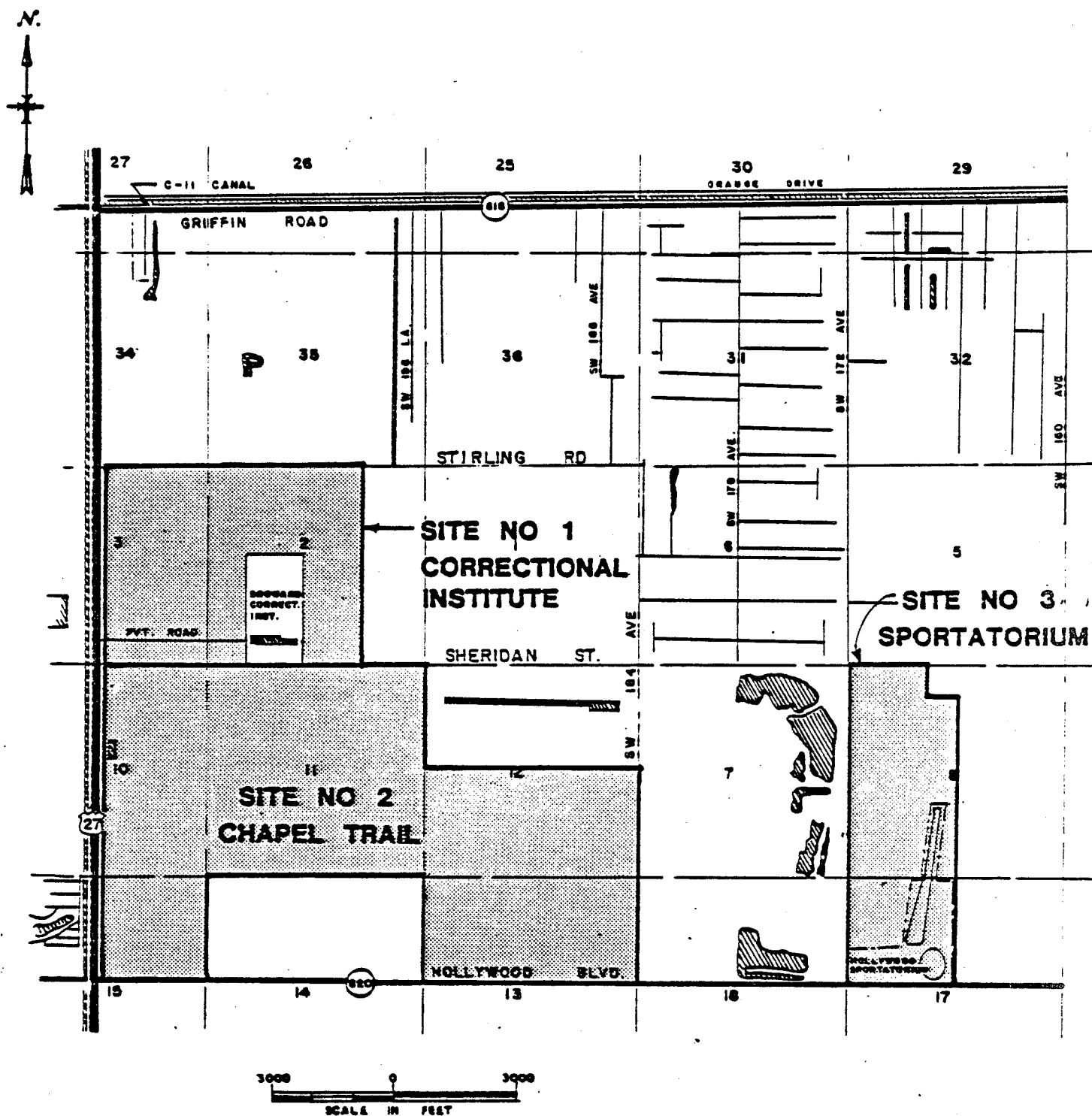
Potential Environmental Impacts - This line of entry is subdivided into the following specific environmental aspects: air quality, water quality,

TABLE 2

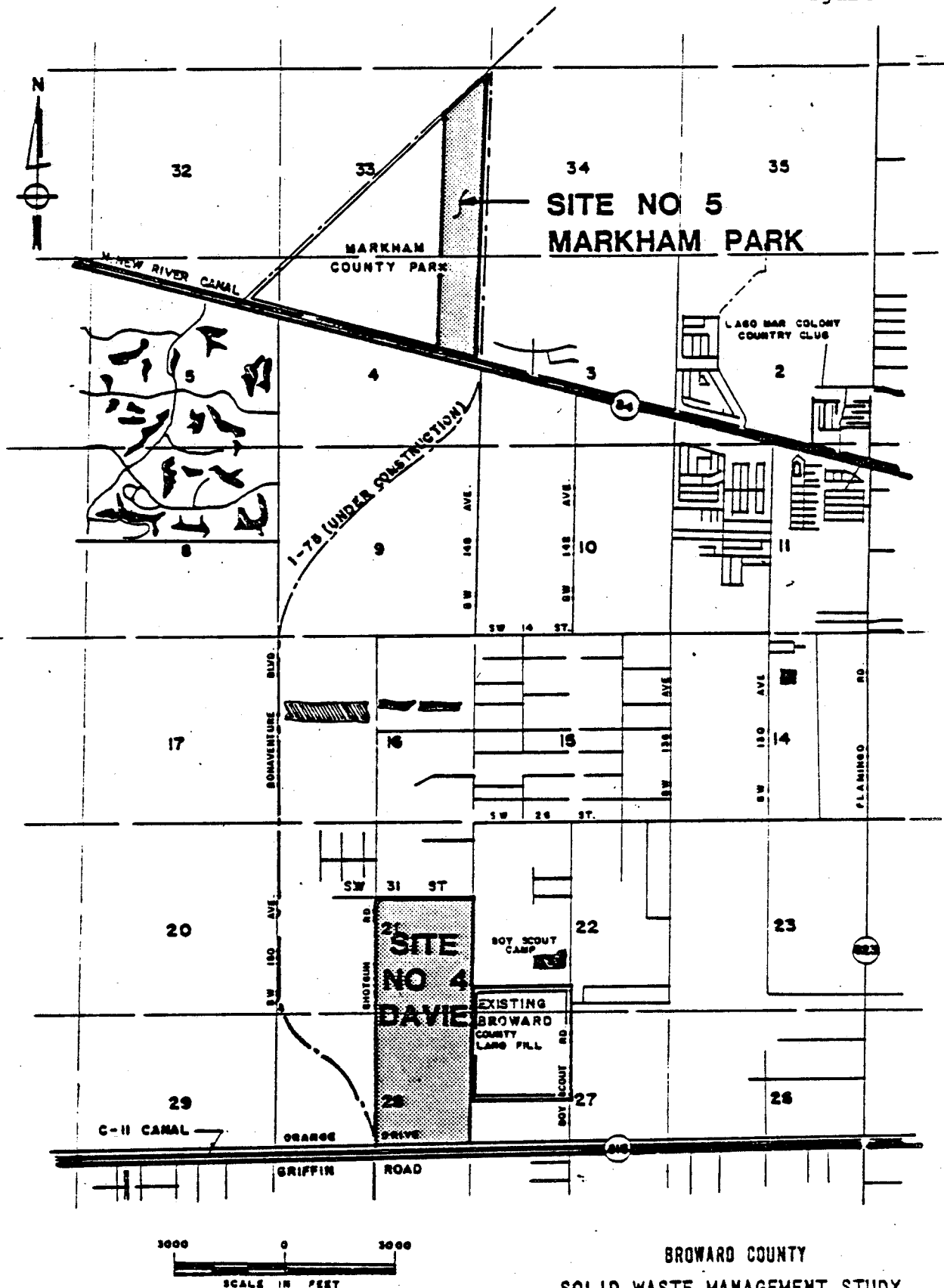
RANKING OF LANDFILL SITES

	<u>Davie</u>	<u>Correctional Institute</u>	<u>Chapel Trail</u>	<u>Sportatorium</u>	<u>Markham Park</u>
Overall Ranking	1	2	3	4	5
Available Acreage	420	710	1830	430	150
Site Area Adequacy	Yes	Yes	Yes	Marginal	No
Potential Environmental Impacts*					
Air Quality	A	A	A	A	A
Water Quality	C	C	C	C	C
Wetlands	A	B	B	B	B
Drainage	A	B	B	B	B
Endangered and Threatened Species	A	A	A	A	A
Adjacent Land Use	C	C	C	C	C
Development Cost					
Land Acquisition (\$/Acre)	25,000	15,000	10,000	20,000	-
Site Preparation (\$/Acre)	25,000	50,000	50,000	50,000	25,000
Average Relative Transport Cost (\$1000/yr)	0	1,400	1,400	800	300
Zoning/Land Use Change Required					
Broward Co.	Yes	Yes	Yes	Yes	Yes
Other	No	No	Yes	Yes	No
Regulatory Permits					
Number Required	3	5	5	5	5
Approval Probability	High	Moderate	Moderate	High	High

- * Potential Environmental Impacts are divided into these categories
- A - No potentially negative impact on this resource is apparent
 - B - Potentially negative impacts are considered negligible and therefore acceptable
 - C - Potentially negative impacts are considered acceptable only if specific mitigative or control measures are employed
 - D - Potentially negative impacts are considered unacceptable, even if specific measures are employed, and are avoidable only by modifying major design features considered typical for the facility
 - E - Potentially negative impacts are considered unacceptable, even if specific mitigative measures are employed, and unavoidable even if major design features considered typical for the facility are employed



BROWARD COUNTY
 SOLID WASTE MANAGEMENT STUDY
 GENERAL LOCATION OF CORRECTIONAL
 INSTITUTE, CHAPEL TRAIL
 AND SPORTATORIUM SITES



LEGEND

SITE No. 4- DAVIE

SITE No. 5 MARKHAM PARK

BROWARD COUNTY
SOLID WASTE MANAGEMENT STUDY
GENERAL LOCATION OF DAVIE
AND MARKHAM PARK SITES

wetlands, drainage, endangered and threatened species, and adjacent land use. The system utilized rates the impacts on each of these environmental aspects as described in the table with A indicating the least and E the most negative environmental impact.

Development Cost - This line of entry is subdivided into estimated costs for land acquisition and site preparation. All monetary figures are in 1982 dollars. The land acquisition costs are approximate figures based upon recorded offers or market prices in the general area. Site Preparation Costs are for site excavation and subsequent refilling to acceptable grade elevations. This costs do not include normal landfill development costs nor do they include any provisions for unknown subsurface conditions.

Average Relative Transport Cost - This line of entry represents the incremental transport costs for each site, relative to the site with the lowest transport cost. Costs are based upon the product of the previously described unit transport costs and the average annual quantity of MSW projected to be delivered to the facility. These costs were preliminary estimates to be used for comparison purposes only. They do not include normal collection costs. Tabulated costs are rounded to the nearest \$100,000 and are in 1982 dollars.

Zoning/Land Use Change Required - This indicates whether a revision in the local zoning or the Broward County land use plan is required for development of the site as a sanitary landfill.

Number of Regulatory Permits Required - This line of entry lists the number of regulatory permits required for site development as a sanitary landfill.

Initial Recommendation:

The Davie site appeared to be the most suitable of the potential landfill sites identified by the County. This conclusion was based upon the following factors:

- . The Davie site contains adequate acreage to satisfy the County's long-term waste disposal needs
- . The relative absence of potentially negative environmental impacts associated with use of this site.
- . Projected development costs for the Davie site are estimated to be the least for the alternative sites under consideration
- . Of all the alternative sites, the Davie site is closest to the solid waste centroids and to the recommended resource recovery site. This results in an estimated annual transport cost that is 12 to 40 percent less than that required for the other sites under consideration
- . Landfill development at the Davie site does not require a zoning change from the local municipality

Based upon these considerations, it was recommended that the Davie site be developed as a sanitary landfill to fulfill the County's long term waste disposal needs.

Further investigation of this site was recommended to establish the design criteria for the landfill development plan. It was imperative that the landfill be designed to prevent leachate percolation into the underlying aquifer, and ensure that the landfill operation does not adversely affect the neighboring environs.

C. Additional Site Evaluations

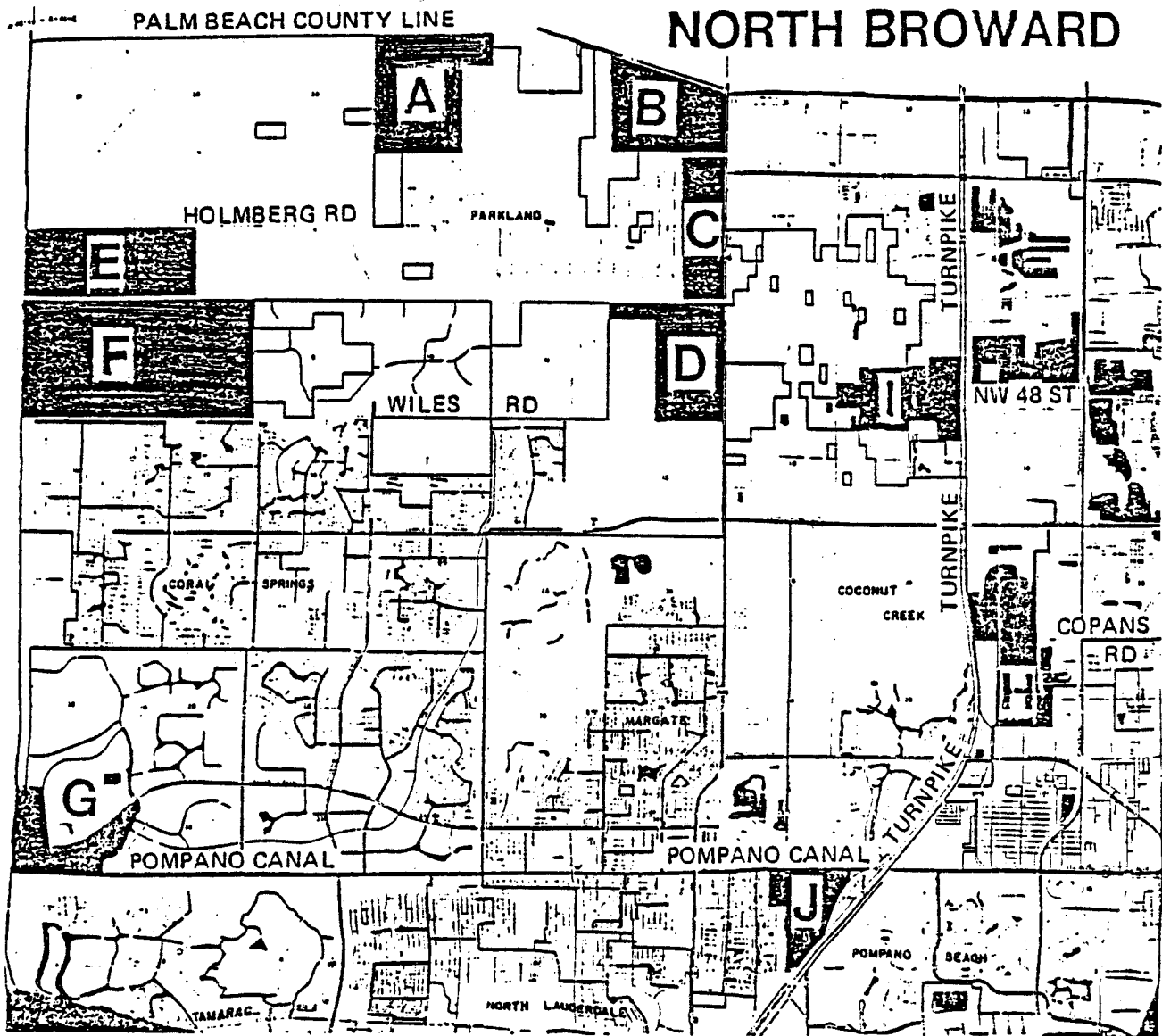
Early in 1982, Broward County suspended all work on the northern project for the codisposal of MSW and sewage sludge by incineration. Therefore additional quantities of MSW would be disposed of in the proposed resource recovery facility and landfill. The Solid Waste Division of Broward County performed an additional landfill site selection study. Using aerial photographs, 97 additional sites were identified (excluding the five sites previously suggested). A set of site selection criteria was developed and 81 sites were excluded. These criteria were:

- . Developed Area: Parcels that were clearly developed or being developed, based on evidence from observation, street maps and aerial photographs, were eliminated because it was assumed the cost of purchasing such areas would be prohibitive and would be strongly opposed by landowners and residents.
- . Location: Parcels within the unincorporated area of the County were considered because it was assumed that the necessary land use plan amendments and zone changes could not be obtained in a municipality.
- . Size: Parcels of approximately 300 acres within a section were the minimum size considered. Smaller parcels were considered if their combination with parcels in adjacent sections would achieve the 300 acre threshold. The 300 acre minimum was used because it was assumed that smaller parcels would reduce the effective lifespan of a landfill operation.

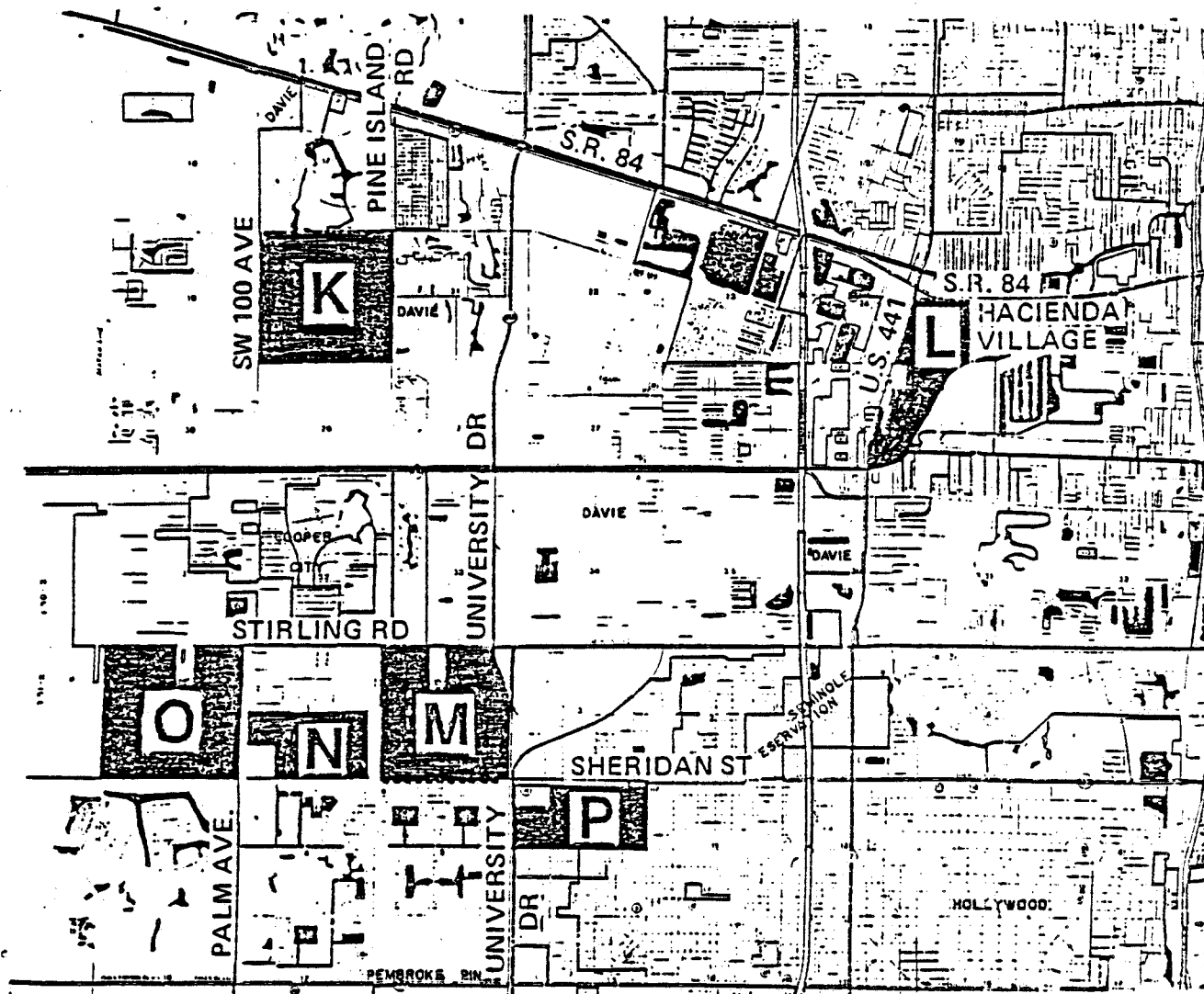
- . Developments of Regional Impact: Active and approved D.R.I.s were excluded from consideration because it was assumed that acquisition costs would be prohibitive.
- . Waterbodies: Parcels that included large waterbodies, such as abandoned rock pits, were eliminated, based on the assumption that filling the waterbodies would be impractical.

Sixteen possible sites (see Figures 12 and 13) met the above criteria and were subjected to further evaluation, using the following criteria:

- . Surrounding Existing Land Use: The type of land use and its density were considered for compatibility and possible neighborhood opposition.
- . Surrounding Proposed Land Use: The land use type and density of any proposed projects or plats in progress were identified for compatibility.
- . Existing Land Use On Site: The site land use type was examined for compatibility with and adaptability to a possible operation.
- . Proposed Land Use On Site: Proposed uses were examined for compatibility and for present commitment.



SOUTH BROWARD



- . Access: Roads adjacent to, leading to, or cutting through the site, as well as proposed roadway corridors, were examined for compatibility, adequacy and possible neighborhood opposition.
- . Environmental Sensitivity: Local Areas of Particular Concern (IAPC) and Urban Wilderness Areas, both on and adjacent to the site, were identified to determine environmental compatibility.
- . Ownership Pattern: The number of landowners, and the size of their parcels on the site were examined to find sites with approximately 3 owners or less.
- . Jurisdiction by Other Agencies: Where it was known that agencies outside Broward County would have additional review or permitting powers (e.g., the FAA or the Army Corps of Engineers), they were noted.

Table 3 represents the findings of the Solid Waste Division. Of the sixteen sites considered 9 were eliminated for reasons including IAPC status, size, parkland status and presence of development on-site.

The following sites were further evaluated on the same level of detail as the five sites previously investigated. These sites were:

1. Site A (Section 47-41-34)
2. Site E (Section 48-41-6&5)

TABLE 3

BROWARD COUNTY, OFFICE OF PLANNING EVALUATION
OF SIXTEEN ADDITIONAL LANDFILL SITES - JUNE 1982

CRITERIA	PARCELS															
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Contiguous 300 acres	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Limited Adjacent Residential Development			X	X	X	X		X	X			X				
Arterial Access Can Be Obtained		X	X	X		X	X	X	X		X	X	X	X	X	X
Access not thru Residential Area on Local Street		X	X	X		X	X	X	X		X	X	X	X	X	X
Not an LAPC, Unique Natural Area or Urban Wilderness Area	X	X		X	X	X		X	X				X	X	X	X
Not Adjacent to an LAPC, Unique Natural Area or Urban Wilderness Area	X		X		X	X		X	X		X		X	X	X	X
Few Owners	X	X	X	X	X		X	X		X	X	X	X		X	
No Substantial Capital Improve- ments on Site	X	X	X	X	X			X	X	X	X		X	X	X	

X = Site Meets the Criteria

NOTE: THIS TABLE DOES NOT DENOTE A RANKING OR A RECOMMENDATION!

3. Site F (Section 48-41-7&8)
4. Site H (Section 48-42-21&28)
5. Site I (Section 48-42-8&17)
6. Site M (Section 51-41-4)
7. Site O (Section 51-41-6)

Site locations are shown in Figures 12 and 13 .

The Broward County staff investigated certain aspects of the above sites including:

- . an evaluation of existing and planned land use at or adjacent to each site, and the impact of landfill usage on such land use
- . an evaluation of the impact of projected truck traffic on existing and planned roadways serving each site
- . a determination that each site is or is not within an incorporated area of Broward County

The Broward County Office of Planning staff evaluated the existing land use on and around each of the seven possible landfill sites. The potential impacts of a landfill operation on these uses were also evaluated. For all the sites, development of a landfill would eliminate existing land uses in the developed area. Other impacts would depend on the kind and degree of uses both around the site, and on the portion of the site (if any) not used for landfill. All the proposed sites were found to be located within the unincorporated portion of the county.

The existing uses on the seven identified sites can be summarized as follows:

<u>Site</u>	<u>Land Use On-Site</u>	<u>Surrounding Land Use</u>
A	Agricultural	Low density residential, agricultural, vacant land
E	Vacant land	Vacant land, agricultural conservation area
F	Vacant land	Industrial, commercial, medium density residential, vacant land, conservation area, agricultural
I	Vacant land	Scattered residential, agricultural, industrial, vacant land, mobile home park, excavation pit
H	Vacant land	Excavation pit, industrial, commercial, scattered residential, wastewater treatment plant, jail
M	Agricultural, several residences, church offices	Medium density residential commercial, municipal park, agricultural hospital
O	Primarily agricultural, vacant land, small residential area	Low to high density residential, vacant land, agricultural

It was concluded that a landfill operation would have some effects on land uses surrounding all the proposed sites. The degree of effect would depend on the kind and intensity of the uses and the location of the landfill within the specific site.

The Broward County Office of Planning staff also evaluated the impacts of truck traffic on existing and planned roadways serving each of the seven proposed landfill sites. The evaluation was based on records of current county traffic, estimated traffic increases based on data from approved plats, and from standard calculations in the Highway Capacity Manual.

The staff assumed that the number of trucks required for any of the landfill sites would be approximately 145 vehicles per day, assuming packer-type equipment.

In determining the impact of the landfill on the roads serving the sites, it was assumed (using Highway Capacity Manual standards) that five percent of

peak hour traffic in 1984 would consist of trucks. The landfill-generated trucks were added to that percentage.

The results of this investigation showed that the increases in truck traffic generated by a landfill operation would not significantly affect traffic loads on major roads near any of the study sites. The greatest increases in volume at peak hour are about seven percent, and the highest increases tend to occur on roads with low volumes that are below capacity. In only two cases, both on Wiles Road, does the increased traffic move from full capacity to over capacity, and that excess was found to be marginal.

A study by the consulting team supplemented the County evaluation of the seven sites by investigating several specific aspects of each site in addition to those listed above. The following specific factors for each of the seven new sites are:

- . immediate site access
- . land use and aesthetics
- . soil resources
- . flood potential
- . development costs
- . vegetation and natural habitat
- . site-specific regulatory requirements

Table 4 presents a summary of the factors evaluated for each of the seven sites under consideration. A brief description of each line of entry is as follows:

Impacts on Adjacent Land Use - This line entry indicates the potential for adverse impacts on adjacent usage such as residential developments, public water supply systems, and public facilities. Consideration was given to the potential magnitude, extent, and duration of such impacts.

TABLE 4

ADDITIONAL LANDFILL SITE EVALUATION

SUMMARY

	<u>Site A</u>	<u>Site E</u>	<u>Site F</u>	<u>Site H</u>	<u>Site I</u>	<u>Site M</u>	<u>Site O</u>
Impact on Adjacent Land Use -	Moderate	Major	Major	Minor	Moderate	Major	Major
General Soil Suitability -	Good	Marginal	Marginal	Good	Good	Good	Good
Fill Depth to 100 Year Flood Elevation (ft) -	1.00	1.00	1.50	0	0	3.25	3.50
Estimated Development Cost (\$/Ac) -	12,400	21,000	17,800	900	7,500	28,900	28,500
Vegetation Type -	Upland	Wetland	Wetland	Upland	Wetland	Upland	Upland
Regulatory Permits Number Required -	3	5	5	3	5	3	3
Approval Probability -	low	low	low	high	low	low	low

General Soil Suitability - This entry indicates general suitability of soils in terms of potential landfill development and operation. Determinations of suitability were based upon consideration of a lined landfill with a leachate collection system. Coarse-textured soils are thus considered good since little or no excavation would be required. Soils with high organic and moisture content (muck) underlying a site to a depth of less than 60 inches are considered marginal (excavation to this depth would be required). Such soils underlying a site at depths greater than 60 inches are considered unsuitable (a significant amount of excavation would be required).

Fill Depth to 100-Year Flood Elevation - The tabulated values represent the average depth of fill required to raise the site ground elevation to the 100-year flood elevation, thereby maintaining a separation between landfilled solid waste and future flood waters. These are weighted values distributing the required fill depth over the entire site.

Estimated Development Cost - The illustrated costs are rough estimates of the cost required to develop each site to a suitable condition for construction of a landfill cell. These costs include clearing, grubbing, excavation and removal of unsuitable materials and placement of select fill. They do not include any costs associated with construction of the cell itself (such as berm construction, grading, installation of line and leachate collection system, cover, etc.). All costs are at 1982 monetary levels.

Vegetation Type - This entry indicates the type of vegetation on the site in terms of predominance or occurrence of upland versus wetland species. The presence of wetland species indicates the potential need to obtain an Army Corps of Engineers and/or Florida DER Dredge and Fill Permit.

Number of Regulatory Permits Required - This line of entry lists the number of regulatory permits required for site development as a sanitary landfill. The accompanying descriptions indicate the anticipated probability

of receiving the necessary permit approvals based on preliminary discussions with the applicable regulatory agencies.

Recommendations

Based upon the factors evaluated in the consultant's study, it was concluded that Site H (the Copans Road Site) was the only site which should be considered for further evaluation in comparison with the previously recommended Davie and Women's Correctional Institute sites. It was determined that landfill development at this site would have a minimal impact on adjacent land use and the probability of acquiring the necessary permit approvals for this site is considered to be high. The soils at Site H were found suitable for the proposed landfill development, and the existing ground elevations are at or above the 100-year flood elevation. As a result, the estimated cost to develop this site was found significantly lower than for the other sites under consideration.

Landfill development at any of the remaining sites would have a higher potential for adverse impacts on adjacent land use, and the probability of acquiring the necessary permit approvals for any of these sites would be low. The soil conditions and ground elevations at these sites indicate that landfill development would require relatively high capital costs.

D. Final Site Selection

Background

On October 12, 1982, the County authorized the preparation of a Request for Proposals (RFP) for long-term full service waste disposal including the design, construction, start-up, and operation of two complete resource recovery facilities, one in northern and one in southern Broward, each with an accompanying residue/unprocessable waste disposal landfill. The development of

this RFP represented a commitment to a waste management plan that will eliminate the use of a sanitary landfill as a primary disposal method and will provide a unified approach for siting complete solid waste disposal facilities (resource recovery facility and residue/unprocessable waste landfill).

Prior to the County's October 12, 1982 directive, several investigations of potential resource recovery facility and sanitary landfill sites had been conducted as previously outlined. Based upon information contained in these site evaluation studies, the most appropriate site for the northern full service facility has been tentatively identified as the Copans Road site (previously referred to as Site H). The previous evaluations for the southern site indicated that the acceptability rating of the top ranked sites were relatively close. As a result of this and the fact that the prior evaluations were not based upon the full service approach, the County decided to reevaluate the top three ranked southern sites. These sites have been identified as the Route 441 (also referred to as Site L in the previous site selection reports), Broward Correctional Institute (BCI), and Davie sites.

Subsequent studies were performed to analyze the technical, environmental and regulatory aspects associated with the three most suitable southern sites, and to rank these sites according to their acceptability for the development of the southern full service disposal project, including the resource recovery facility and accompanying residue/unprocessable waste landfill. In addition, subsequent investigations of the Copans Road site were performed to determine its suitability for a resource recovery and residue/unprocessable waste landfill facility.

Based upon available information, data from previous on-site investigations, and discussions with appropriate regulatory personnel, each site was assessed to determine:

- . Site development requirements
- . Adequacy of the site to contain the southern resource recovery facility and an accompanying residue/unprocessable waste landfill
- . Proximity to energy market(s)
- . Estimated cost of transporting waste to the site
- . Traffic impact of utilizing the site
- . Environmental constraints
- . Permitting requirements

Based on this assessment the technical, environmental, and regulatory aspects of each of the identified sites were summarized and ranked according to their overall viability for development of the southern resource recovery facility and accompanying residue/unprocessable waste landfill.

The three southern sites are ranked according to their overall acceptability in Table 5. All the sites were found viable with respect to marketing electricity to FP&L. The ranking system used for Table 5 was very similar to prior evaluation methods. The ranking criteria used are summarized below:

Overall Ranking - The tabulated rankings are based upon consideration of all technical, environmental and regulatory aspects developed during the site evaluation. Site rankings based upon only one of these aspects may differ from the overall rankings.

Available Acreage - This line of entry presents the total acreage available for use in the development of the southern project, which includes both the resource recovery facility and associated landfill.

Site Adequacy - This line of entry indicates whether the identified site has sufficient acreage to construct the resource recovery facility and to

TABLE 5
RANKING OF SOUTHERN SITES

	<u>Route 441</u>	<u>Davie</u>	<u>BCI</u>
Overall Ranking	1	2	3
Available Acreage	205	380	630
Site Adequacy	Adequate	More than Adequate	More than Adequate
Estimated Annual Site Acquisition and Preparation Costs (\$1000)	2,150	800	970
Annual Waste Transport Costs (\$1000)	2,340	4,590	6,310
Project Traffic Impact (\$1000)	60	30	30
Potential Environmental Impacts*			
Air Quality	1	1	1
Water and Soil Resources	1	1	3
Vegetation and Wildlife Habitat	1	1	1
Adjacent Land Use	2	2	2
Regulatory Permits			
Number Required	15	12	14
Approval Probability	Good	Good**	Moderate

* These ratings are based upon the assumption that the proposed mitigating measures for development of the southern resource recovery facility and residue/unprocessable waste landfill are implemented. Ratings range from 1 to 3, with 1 indicating the least and 3 indicating the most potential for negative impact.

** This rating is based upon the assumption that the Davie site is not within the corporate boundaries of the Town of Davie. Should future litigation determine that the site is within the corporate boundaries of the Town of Davie, this rating would be lowered to Poor.

construct and operate the residue/unprocessable waste landfill for the 20-year planning period from 1987 until 2007. It also includes buffer, storm drainage and on-site vehicular requirements.

Estimated Annual Site Acquisition and Preparation Costs - The tabulated costs represent the annual amortization in 1983 dollars required to acquire and prepare for landfill development each of the identified sites assuming an annual interest rate of 10 percent over the 20-year planning period. These costs are based upon recorded offers and market prices in the general area of the sites, and estimates for excavation of unsuitable materials and refilling to 100-year flood elevations at each site. They do not include normal landfill or resource recovery facility development costs, nor do they include any provisions for unknown subsurface conditions.

Estimated Annual Waste Transport Costs - These tabulated costs are in 1983 dollars and represent the cost to transport processible and unprocessible waste from four southern Broward subregions to each of the identified sites. They are based upon unit haul costs of \$0.12 per ton-minute for processible waste and \$0.17 per ton-minute for unprocessible waste and an average truck speed of 30 mph. These costs are preliminary estimates to be used for comparison purposes only. They do not include normal collection costs.

Projected Traffic Impacts - This line of entry presents the estimated costs, as generated by the TRIPS computer program, required to upgrade the access roadway system to each site to accommodate the additional traffic projected for the southern project.

Potential Environmental Impacts - This line of entry is subdivided into the following specific environmental aspects: air quality, water and soil resources, vegetation and wildlife habitat, and adjacent land use. The system utilized rates the impact that the proposed project, including mitigating measures, would have on each of these environmental aspects with 1 indicating the least and 3 the most negative environmental impact.

Regulatory Permits - Under this item is the number of permits or regulatory approvals required and the anticipated probability of receiving the necessary permits and approvals based upon preliminary discussions with the applicable regulatory agencies.

Recommendations

As illustrated in Table 5 and as previously discussed, all three sites were found viable for development of the southern resource recovery facility and associated residue/unprocessable waste landfill. Each of the identified sites, however, has advantages and disadvantages associated with its use. The Davie and BCI sites would require less acquisition and preparation costs than the Route 441 site. However, the centralized location of the Route 441 site more than offsets this disadvantage through the cost savings in annual waste transport costs.

The Davie and Route 441 sites appear preferable to the BCI site from an environmental standpoint. With regard to permitting and regulatory considerations, the probability of acquiring the necessary permits and approvals appears good at both the Davie and Route 441 sites. Utilization of the Davie site, however, requires a lower number of permits and consequently less time and effort than would be required for the Route 441 site. However, this conclusion depends upon the judgment that the Davie site is in an unincorporated area. This judgment has been challenged by the Town of Davie, which has threatened litigation on this issue. The Town of Davie on March 3, 1982 passed a resolution (No. R-82-19 [Attachment 7]) opposing development of the Davie site as a future landfill. Attachment 8 presents the Town of Davie's opinion on the legal status of the lands referred to as the Davie site. Davie counsel contends that the lands were duly annexed by the Town and that jurisdiction will revert to the Town if the character of the lands become "urban in character."

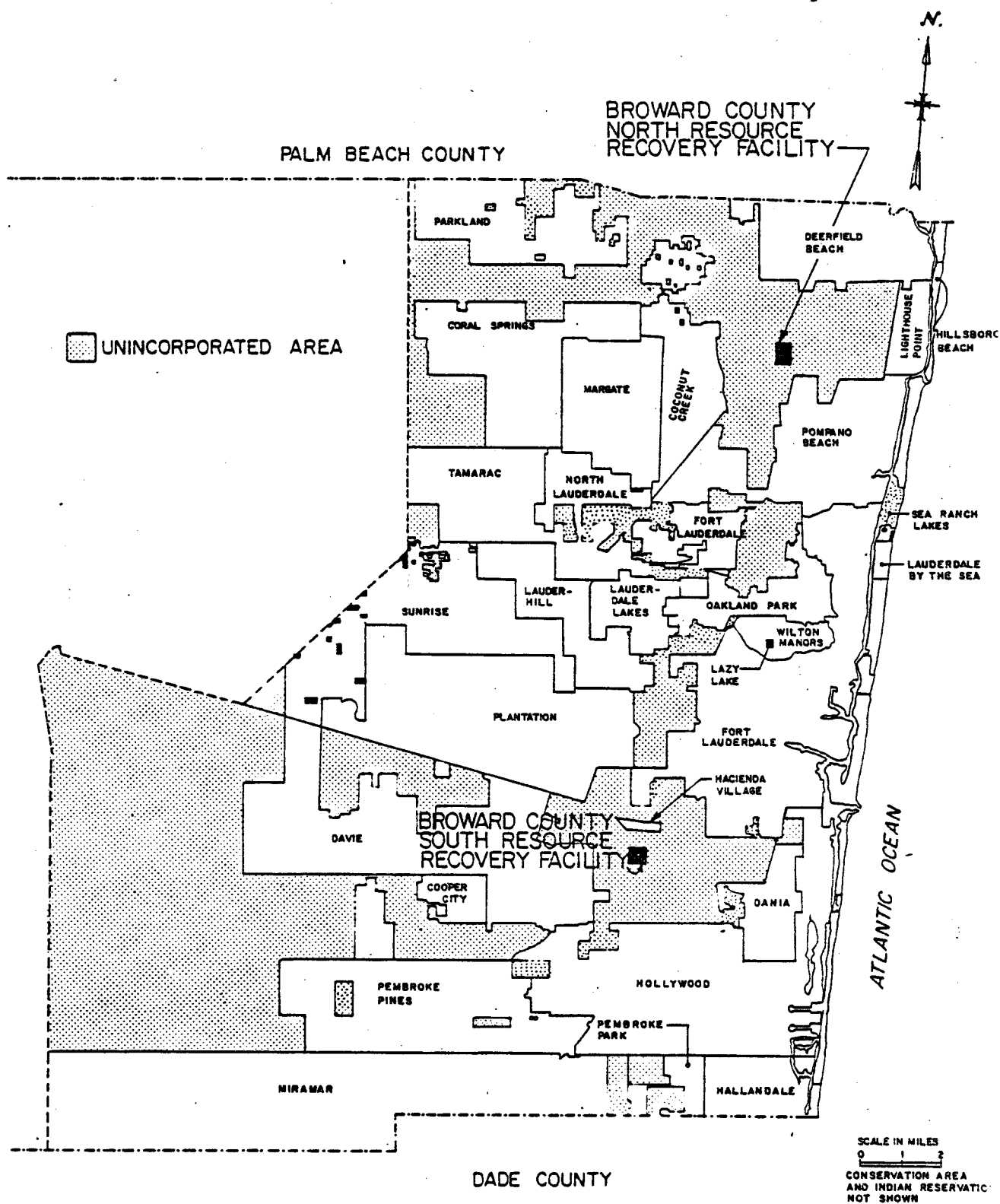
Regardless of actual legal status, it is apparent that litigation will occur. Such litigation will likely impose unacceptable delays on the project and will further complicate permitting requirements. The Town of Davie has recently petitioned the State of Florida to revoke the County's permit to operate the existing landfill and to deny a permit for an interim expansion. One administrative hearing has already occurred and the prospect of future litigation must be considered in the site selection process.

In summary, it appeared that the Route 441 and Davie sites were closely rated and are preferable to the BCI site based upon environmental and permitting considerations. With regard to technical considerations, the Route 441 site is the most suitable as a result of the advantages inherent with its centralized location. As a result, the top ranked site is the Route 441 site. The general location of the Route 441 site is shown in Figure 14.

The site selection process resulted in 6 consultants' reports. The preceding discussion is a synthesis of the site selection based upon the following reports:

1. Solid Waste Management Alternatives, Site Evaluation, February 1982 (MPI)
2. Additional Investigation, Site Evaluation April 1982 (MPI)
3. Solid Waste Management Program, Additional Site Evaluation, August 1982 (MPI)
4. Evaluation of Seven Candidate Landfill Sites September 1982 Broward County Solid Waste Division
5. Site H October 1982 (H&S/MPI/W.C.)
6. Site Evaluation March 1983 (MPI)

Figure 14



BROWARD COUNTY
LOCATION OF PROPOSED
NORTH AND SOUTH
RESOURCE RECOVERY FACILITIES

IV. ENVIRONMENTAL ASSESSMENT

Construction and operation of solid waste handling and processing facilities generate significant public interest due to a variety of environmental issues. During the site selection process for the Southern Resource Recovery Facility and Residue/Unprocessable Waste Landfill numerous environmental issues were evaluated before the Board of County Commissioners of Broward County identified the best location for the project in consideration of all technical, environmental, economic and institutional issues. During the implementation stage, numerous additional public hearings will be held. Where possible, action will be taken to minimize all adverse environmental impacts.

A. Disposal Methodology

All available technology to process solid waste was reviewed by the Broward County Solid Waste Division and their consultants. Resource recovery via the mass burn/energy recovery method was the most viable process to handle the quantity of solid waste generated in Broward County in a cost effective and environmentally sound manner. The incineration process reduces the volume of processable solid waste of processable solid waste by 90 percent. The resulting ash residue is inorganic and nonhazardous. The potential for environmental contamination is considerably reduced when disposing of ash residue in lieu of conventional solid waste in a landfill. An additional benefit is the recovery of energy to generate electricity during the incineration process.

B. Zoning and Land Use

The Broward County Solid Waste Division will petition to have the existing zoning at the Southern Residue/Unprocessable Landfill site changed to Planned Unit Development (PUD) for planned special complex.

The majority of project site encompasses land currently zoned for limited heavy industrial, general industrial and limited agriculture (Figure 15). Small sections of the site are zoned general business and general industrial. The landfill cells will be located at least 400 feet from the nearest residential area.

Existing land use in the area includes several small businesses and one residence around the periphery of the site (Figure 16). The Central Broward Wastewater Region composting facility will be constructed at the southern end of the site (Figure 16). A large industrial park is currently proposed for the area immediately north of the compost facility. An area designated as the "Griffey" tract located at the northern end of the property had been proposed as a marina. Much of the interior portion of the site is undeveloped and it is currently in agricultural use (pasture). Adjacent land owners are identified in Figure 17; full addresses are provided in Attachment 2.

The Griffey tract and a 300-foot wide strip facing South Fork New River Canal have been designated as Local Area of Particular Concern and Urban Wilderness (Figure 16).

The two landfill cells, attendant development, and mitigation will require 198 acres for development. Without the project, much of the area might be developed in piecemeal fashion by private entrepreneurs. This project is in the public interest and, the project site has been evaluated as the best overall location for the Southern Residue/Unprocessable Waste Landfill.

C. Biological Concerns

Several major biological concerns are associated with project development. First, the vegetation of the site is predominantly wetlands and

FIGURE 15

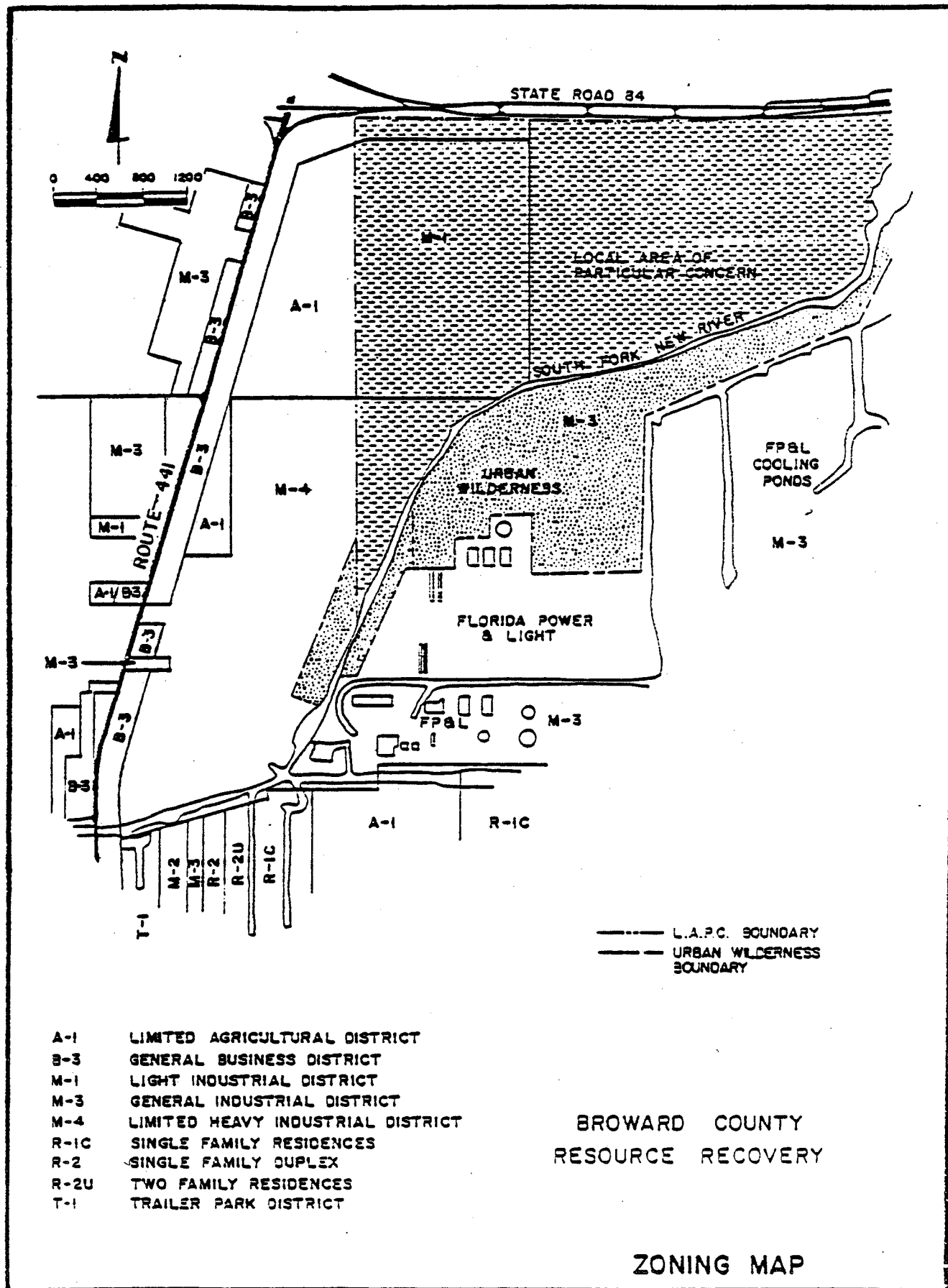


FIGURE 16

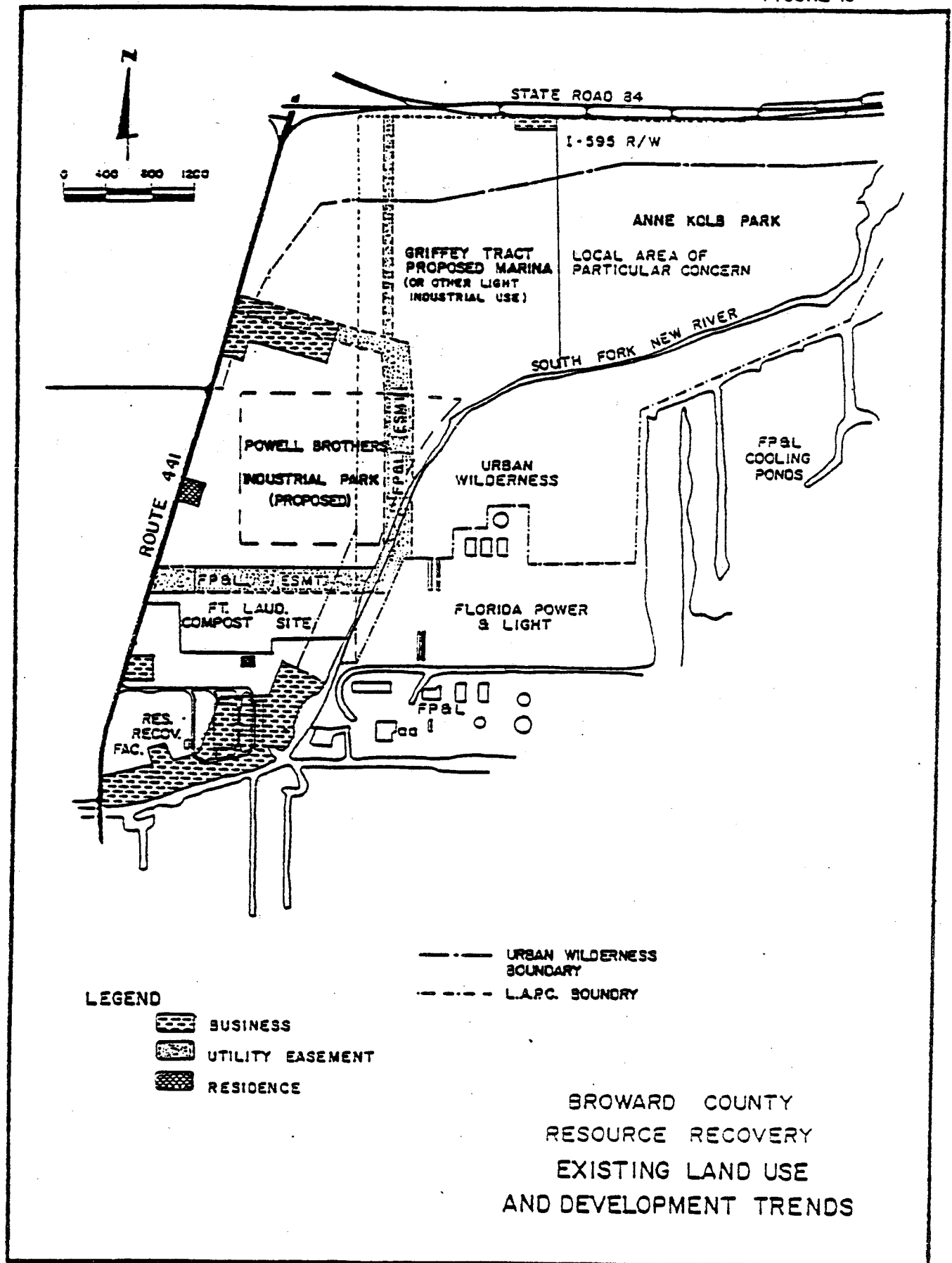
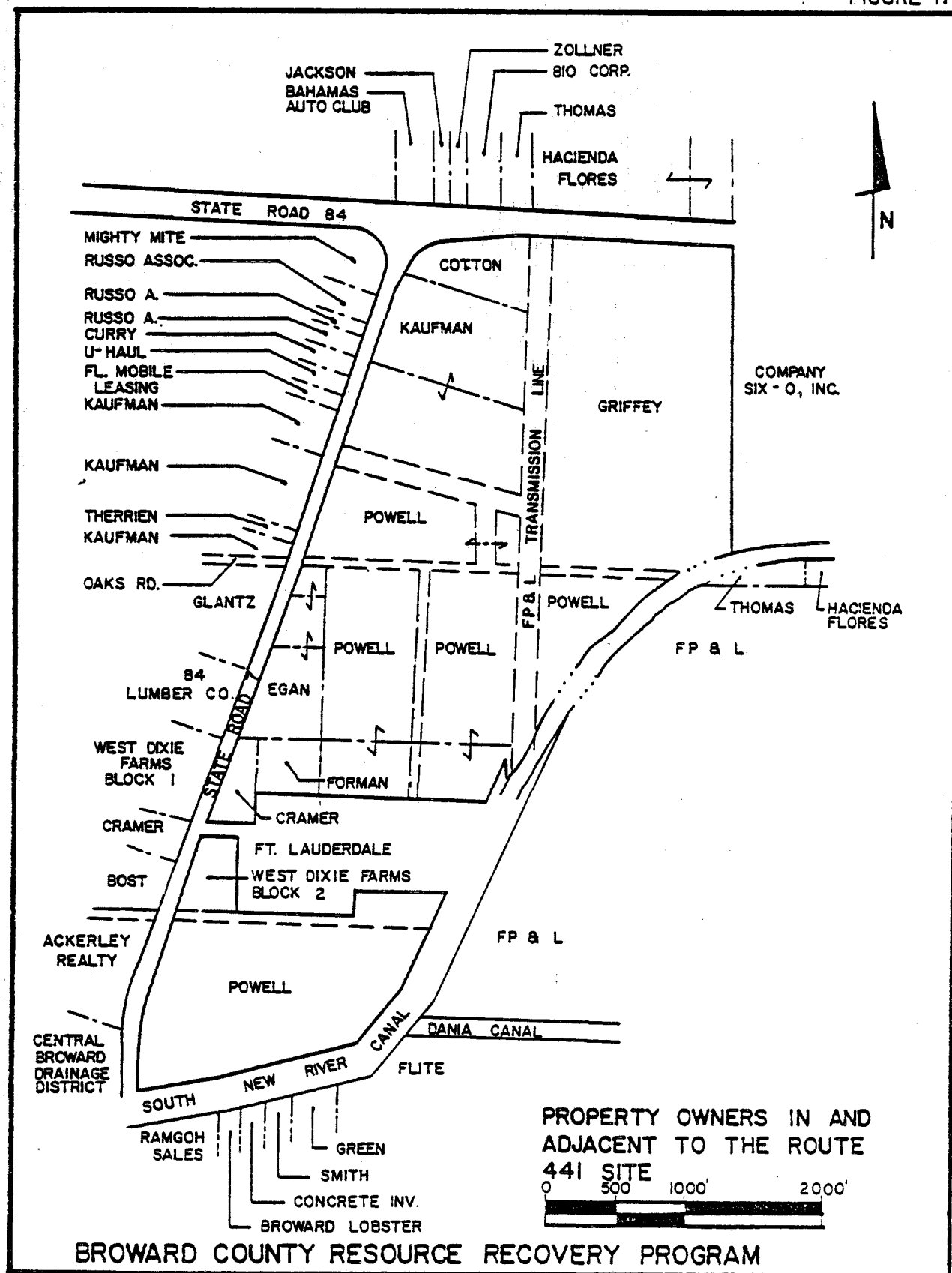


FIGURE 17



will require dredge and fill permits from Florida Department of Environmental Regulation and U. S. Army Corps of Engineers. Secondly, landfill cell 2 is partially located in an Urban Wilderness Area adjacent to South Fork New River Canal and the largest remnant of the New River Swamp which is a relatively pristine, cypress-red maple-pond apple forested wetland. Finally, impacts to threatened and endangered species are a consideration. Each of these three issues have received significant consideration in project planning.

1. Communities

Much of the site remains covered with natural vegetation. Portions of the site have been identified as wetlands by National Wetlands Inventory Mapping (Figure 18). Field studies for this project identified more wetlands than identified on the National Wetlands Inventory mapping (Figure 19). A comprehensive plant species list was developed during the field studies and is included as Attachment 9.

The wetlands of the site consist of marsh, shrub swamp, wax myrtle pasture, open water, and swamp forest. They have been extensively disturbed by man. First, when South Fork New River Canal was dredged, the spoil material was placed adjacent to the river. The spoil bank forms a barrier between New River and the adjacent wetlands; consequently, wetland values have been significantly diminished. The wetlands have been dissected and isolated by utility corridors. Most of the wax myrtle pasture and shrub swamp is currently being utilized for cattle production, and much of the area exhibits evidence (drainage ditches) of past farming efforts. Disturbance factors are numerous at this project site, and these detract both from the visible integrity of the biotic community and its functional attributes.

FIGURE 18

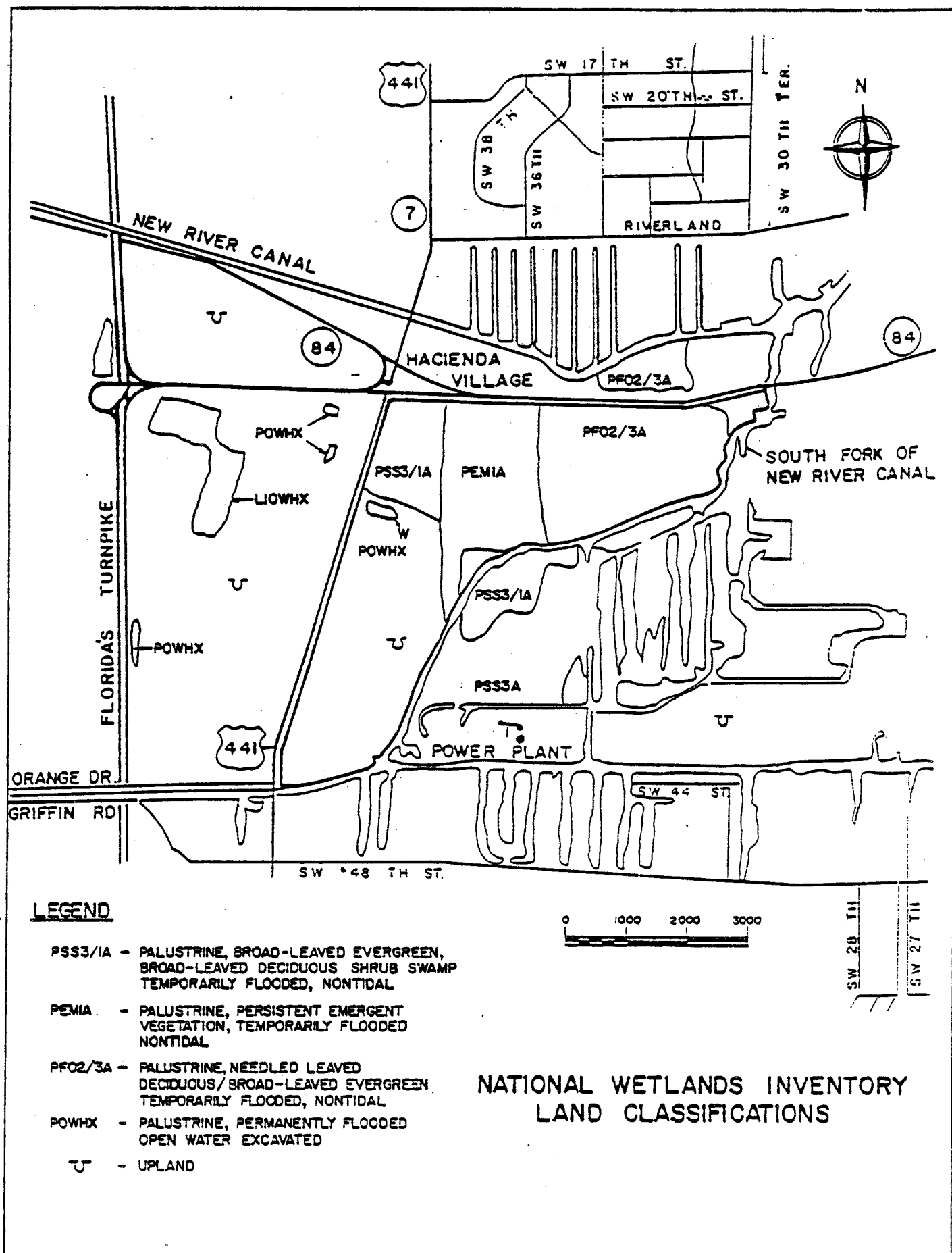
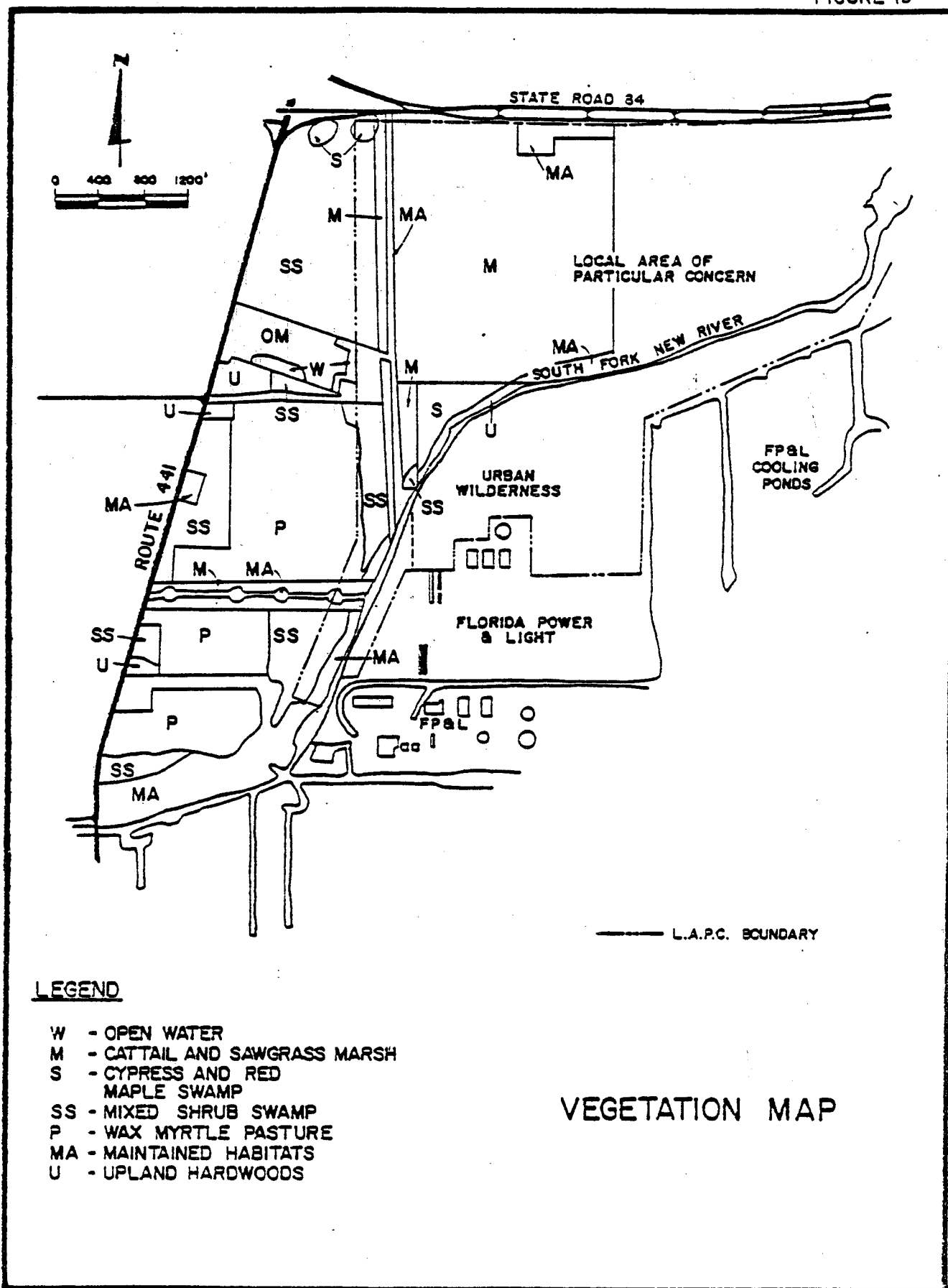


FIGURE 19



a. Open Water

Permanent open water exists in the New River Canal, in a small borrow pit near the northeast corner on SR 7, and in a rectangular pond south of this nursery. No rooted submerged aquatic plants were found in any of these bodies of water. The shorelines commonly have emergent plants in a narrow fringe, but depth of water appears to be the chief limiting factor for aquatic plants.

b. Cattail-Sawgrass Marsh

An extensively disturbed marshy area extends from US 84 south, is bounded on the east by the Anne Kolb Park Cypress tract, on the west by the low berm beneath a Florida Power and Light transmission line, and on the south by a berm associated with a gas pipeline. Although historic photography was not available for inspection, the location of this community and cypress stumps present indicate that it was previously covered by cypress swamp or mixed red maple-cypress-and wax myrtle. The present vegetation is characterized by scattered cabbage palmetto trees, wax-myrtle bushes, and very tall herbaceous plants including three species of cattails, sawgrass, water millet, and galingales. Shallow water areas contain colonies of swamp-lily, arrowhead, and lance-leaved pickerelweed. Many other marsh and swamp species are scattered throughout the community.

c. Cypress-Red Maple Swamp

This biotic community is dominated by an open canopy of mostly short deciduous trees, and with a shrub layer that is comprised of mostly evergreen woody plants, interspersed with dense colonies of sawgrass. Occasionally, in the wetter portions, giant leather ferns are abundant. The trees that occur in this community, with the exception of infrequent Australian

pinus, often have a profusion of air plants, and these species contribute to the tropical or "jungle" appearance of the swamp. That portion of the project area included in this community type is far less impressive than the cypress swamp of adjacent Anne Kolb Park.

d. Mixed Shrub Swamp

A large tract of cutover, disturbed thicket lies east of SR 7 in the northeast quadrant of the project area. The community contains remnant trees of red maple and cypress that would suggest that the site was formerly cypress and red maple swamp. Locally high areas are usually populated by Australian pine, or sometimes cajuput saplings. An overgrown canal extends in a north-south direction along the west margin of an FP&L utility line. Several bulldozed openings exist and usually connect with SR 7. The area is marked with shallow depressions and dotted with small rises where stumps and slash have been pushed aside. Other areas identified as mixed shrub swamp predominantly Florida holly, wax myrtle, buttonbush and willows. Many species occur here, both herbaceous, marshland ones, as well as shrubs.

e. Wax Myrtle Pasture

Much of the US 441 site is comprised of poorly improved pasture lands amid a sparse to moderately thick coppice of wax myrtle bushes. Surface disturbance by cattle insures that many seeds are pushed into the black mucky substrate; therefore, the groundcover is very diverse and many species of marshes and wet savannas are present. Occasionally on higher ground exotic species can become established, and it is not surprising to find occasional Florida holly or Australian pine seedlings or saplings in this zone. The development of the wax myrtle dominated community probably arises from abandonment of fields, and frequent utilization by cattle delays the successional trend toward a forest community.

f. Maintained Habitats

Several types of maintained habitats exhibiting a range of conditions from dry to wet, and with mostly herbaceous to predominantly woody plants occur in the study area. Roadside shoulders are typically sandy, and covered by grasses and other herbs. The large power line corridors tend to be slightly wetter. Roadside shoulders are typically sandy, and covered by grasses and other herbs. The large power line corridors tend to be slightly wetter. They also contain a few woody species and several more herbaceous species than what is encountered along the rights-of-way of SR 7 and SR 84. The gas line corridor is wet, and in places, is covered by standing water or marsh vegetation. Several disturbed areas have grown up into groves of tall Australian pines, and very few herbaceous plants are seldom found beneath this type of forest canopy. Because of the diversity of microhabitats, this biotic community contains the greatest assortment of native and naturalized vegetation within the study area.

g. Upland Hardwoods

Situated mostly along the high berm of dredged material on the banks of the New River Canal, upland hardwoods show characteristics not only of drier south Florida hammocks but also of highly disturbed spoil banks found near limestone mines and by drainage canals. The rocky spoil supports ferns, various shrubs, and low but large-crowned trees. Strangler figs are present as young seedlings and as canopy plants. The edge of the uplands nearest the New River Canal may contain exotic species that have arrived by floating to the site; the side of the berm away from the canal sometimes contains swamp species that edge upward.

2. Urban Wilderness

The second biological concern is that portion of the project area which has been designated Urban Wilderness Area, i.e. a 300 foot-wide strip of waterfront and the marsh in the northwestern corner of the site (Figure 16). The area was designated Urban Wilderness because it is the last vestige of natural vegetation along South Fork New River. The 300 foot-wide strip of urban wilderness adjacent to the river will be preserved and enhanced (Chapter V). Much of the area identified as the Griffey Tract (Figure 16), will be utilized as the location for landfill cell 2 which is critical to the project. This area is currently a sawgrass marsh of which up to an 800 foot swath fronting SR 84 will be required for I-595 right of way (Figure 16). Cypress stumps throughout the marsh indicated that it was previously part of the swamp forest adjacent to the west, and that the area regenerated to sawgrass after it was cut over.

3. Threatened and Endangered Species

The project area is within the theoretical range of several species classified as threatened or endangered by U. S. Department of the Interior and Florida Game and Freshwater Fish Commission. Field studies during site analysis have not identified any threatened or endangered species on the site, and the probability of occurrence is low. The site has been reviewed by the U. S. Fish and Wildlife Service (Jacksonville, FL) and development is not expected to impact any endangered or threatened species (Personal Communication, 12 July 1983, Don Palmer, Endangered Species Specialist, U. S. Fish and Wildlife Service).

D. Sedimentation and Siltation

A potential impact of dredging and filling during construction is siltation and sedimentation. Berms will be constructed to contain water during

dredging and filling. Sediment traps and screens will be strategically placed to trap runoff. All permanent berms constructed for the development will be grassed to prevent erosion. No discharge of sediment laden water will be made to South Fork New River Canal during construction.

E. Traffic

Truck traffic between the RRF and landfill will be accomplished on an internal restricted road system. Trucks will not have to enter U. S. 441. No impacts on public transportation will be created by this phase of the operation.

F. Fort Lauderdale-Hollywood International Airport

The project site is within regulated airspace of the Fort Lauderdale-Hollywood International Airport. Concerns have been expressed that landfill might attract birds to the landfill which could interfere with aviation.

The landfill height will be approximately 132 feet (140 feet above MSL) above grade. This is well below the 200 foot FAA limitation for the site. Although it is within regulated airspace, requiring a formal notice to FAA, the facility will be in compliance with FAA regulations and no objection from the FAA is expected (Attachment 10).

The landfill material will not attract birds because it is stable and will essentially have no organic matter. Since the ash will have a 30 percent moisture content, no dust problem will be generated.

G. Odor

Solid waste handling facilities and landfills are perceived to generate offensive odors which impact people in adjacent areas. Odor will be no problem at the landfills. The material placed on the landfill will consist of inorganic, nonprocessable waste and residue ash generated by the mass burn RRF.

The residue ash will consist of the inorganic minerals of the processed waste. It will be odorless and will not attract insects, rodents or birds.

H. Noise

The only noise that will be generated at the landfill site will be trucks traveling to and from the RRF. Because the site is located adjacent to two major highways, U. S. 441 and SR 84, on site noise from vehicular traffic will be insignificant.

I. Soils

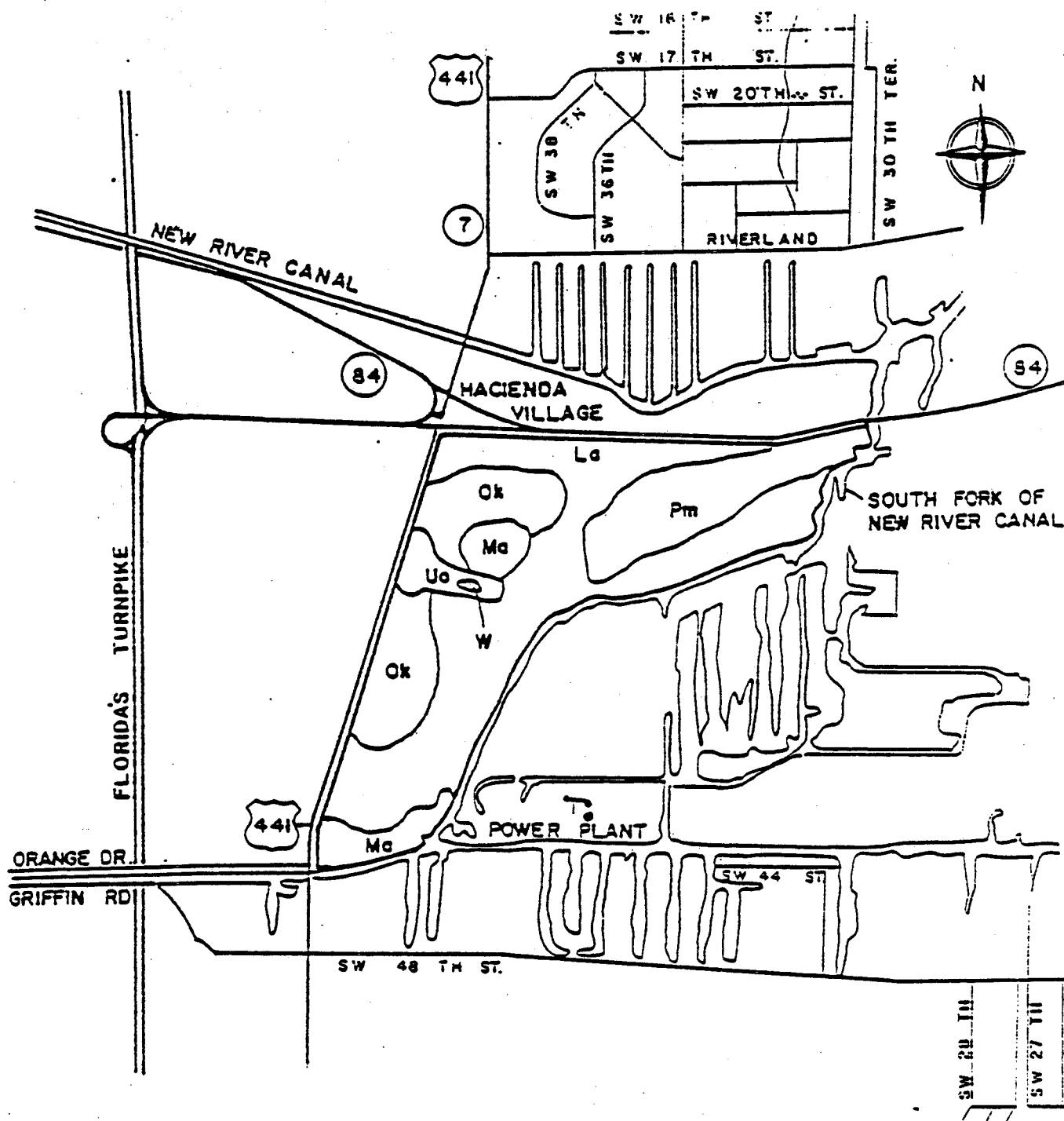
A partial inventory of the soils of Broward County has published in 1976, however, this report did not include the area east of Florida's Turnpike in the southern part of the county. Since 1976, USDA Soil Conservation Service has completed draft mapping of remaining portions of the county, and Figure 20 is based upon the draft soils survey. The project site comprises five soil series: Lauderhill muck, Margate fine sand, Plantation muck, Okeelanta muck, and Urban Land Complex.

1. Lauderhill Muck (La)

This series is nearly level, organic soil underlain by limestone at a depth of 20-40 inches. Because it is organic, it is subject to oxidation when not flooded. These soils in undisturbed condition are flooded 6 to 12 months per year. They have rapid permeability and a very high available water capacity.

2. Margate Fine Sand (Ma)

Margate sands are nearly level poorly drained soils which are flooded one to four months per year. They are underlain by limestone at depths of 20 to 40 inches. Margate sands have rapid permeability, and available water capacity is low in all layers.

SOIL SERIES

La - LAUDERHILL MUCK
 Ma - MARGATE FINE SAND
 Ok - OKEELANTA MUCK
 Pm - PLANTATION MUCK
 Uo - URBAN LAND COMPLEX
 W - WATER

SOURCE: U.S.D.A. SOIL CONSERVATION SERVICE DRAFT

SOIL ASSOCIATIONS MAP

3. Okeelanta Muck (OK)

This series comprises nearly level poorly drained organic soils underlain by sand at depths of 16 to 40 inches. Limestone is under the surface at depths of greater than 51 inches from the surface. Because they are organic, oxidation is rapid when they are not flooded. These soils have rapid permeability and a very high available water capacity.

4. Plantation Muck (Pm)

Plantation mucks are nearly level, very poorly drained soils which are underlain by sand and limestone. The limestone occurs at depths of 25 to 35 inches. Permeability is rapid and available water capacity is very high.

5. Urban Land Complex (Uo)

This series is 50 to 70 percent udorthents and 30 to 50 percent urban lands and comprises lawns, playgrounds, streets, sidewalks, etc. They are poorly to moderately drained and are made up of 20 to 30 inch layers of sand, rock, and/or shell over the natural soil. Permeability is generally rapid, and available water capacity is generally low.

Detailed soils investigations have been performed for various parcels within the project area, including the Fort Lauderdale Compost Facility site (KBC, Consultants, Inc.), the Powell Brothers Industrial Tract (East Coast Testing & Engineering, Inc.), and the Griffey Tract (Florida Testing & Engineering Co.). The KBC report prepared for engineering studies for Fort Lauderdale Composting Facility is the most comprehensive of the three reports. The reports are in general consensus in their separate geotechnical descriptions; the surface soil is peat (1.2 - 4.4 feet thick), followed respectively by a sandy calcerous silt (0.1 - 2.2 feet thick), medium to fine sand (0.2 - 3.6 feet thick), and limestone. Depth to limestone ranges from 3 to 7 feet with an average of 4.5 feet.

The geotechnical studies indicate that the soils are unsuitable for construction and that site development will require removal of the surface soils (peat) and replacement by crushed limestone fill prior to construction.

J. Dust

Dust will be generated in the RRF as solid waste is processed. All dust will be contained in the enclosed facility. The residue ash product of the RRF will have 30 percent moisture content. Hence it will be dustless.

K. Water Resources

Water resource impacts are an important concern of this project, and thorough discussion of the control procedures for on-site water was provided in Section II.A.3. This section provides a recapitulation of Section II.A.3, a description of a 100-year flood consideration, and groundwater.

1. Water Management

a. Runoff

The landfill will ultimately consist of two landfill cells. Each cell will be surrounded by a perimeter access road which will serve as a dike in order to insure all surface runoff is contained on site.

A grassed perimeter swale will be located between the toe of each landfill cell and the cell's perimeter access road. During periods of rainfall, stormwater will run off the landfill and be captured in the perimeter swale system. The perimeter swale systems will discharge to a retention pond where final stormwater disposal will take place.

During the first 14+ years of landfill operations all design surface runoff will be disposed via an injection well. After this period, runoff will be disposed of via deep well injection supplemented by

controlled surface discharge to the C-11 canal. Drainage facilities for the landfill will meet South Florida Water Management District criteria for surface water management.

b. Leachate

An impermeable bottom liner will be placed at the base of each landfill. Leachate which is generated within the ash landfill due to intrusion of rainfall will be collected and disposed of in an injection well. The leachate collection and disposal system will be entirely separate from the stormwater management facilities. Disposal of leachate in the injection well will occur first, before any surface runoff is disposed of via the injection well. All ash will be deposited in the landfill above the 100 year flood elevation. Leachate will not enter the surficial aquifer as it will be disposed of by deep well injection.

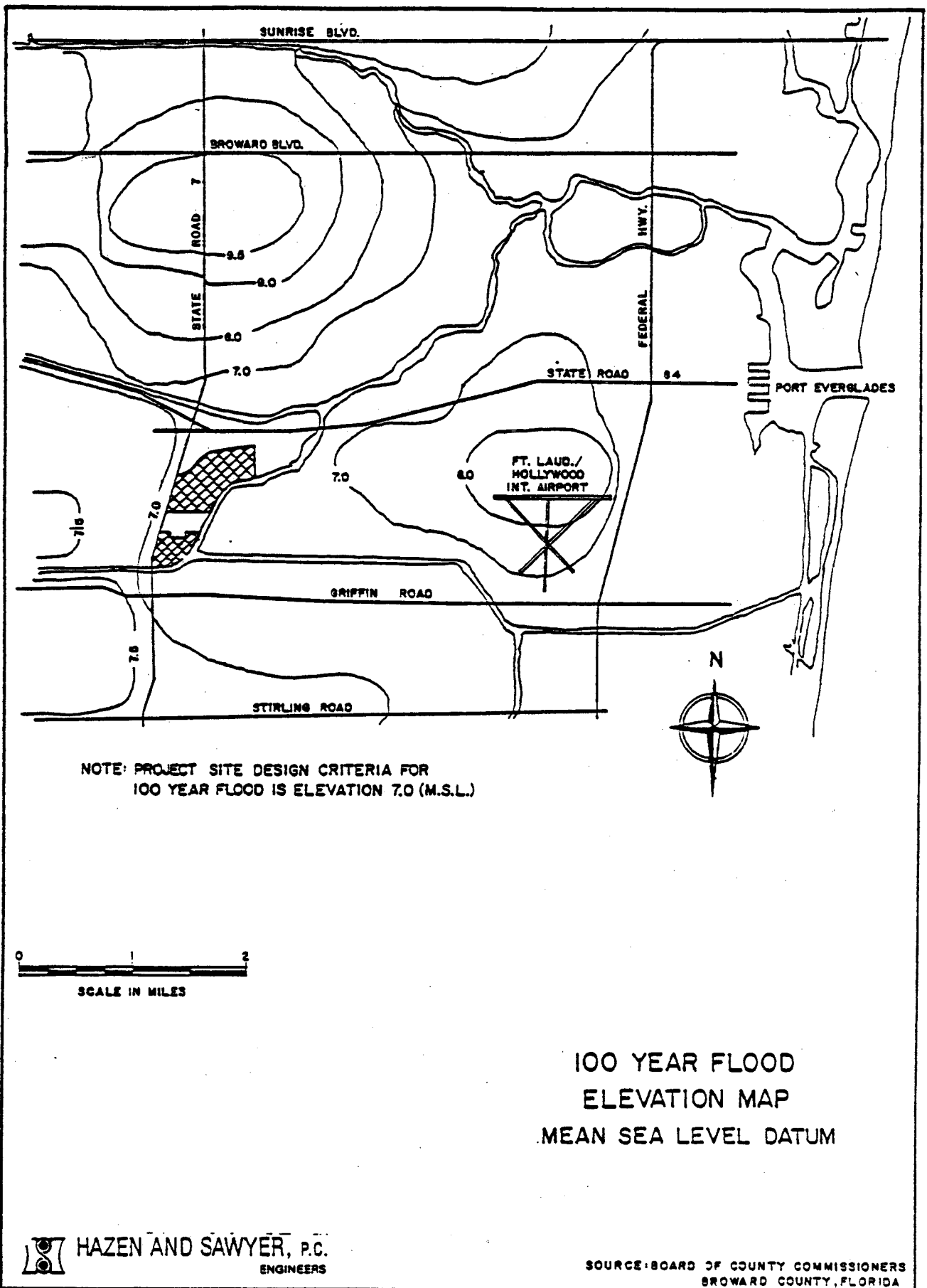
2. Flood Zone

Project design criteria for the 100-year flood in the development area is elevation 7.0 feet MSL in accordance with Broward County standards. The resource recovery facility site will be filled to a minimum of 7.0 feet during development; therefore, this portion of the project will be at or above the established 100-year flood elevation (Figure 21). Similarly, all materials deposited in the landfill cells will be placed at or above elevation 7.0 feet MSL.

3. Ground Water

The Biscayne Aquifer underlies the entire eastern and central portion of Broward County and is the sole source of municipal water supply in the County. The aquifer is composed of limestone, sandstone and sand, and ranges in thickness from 200 feet along the coastline to a thin edge in the

FIGURE 21



Everglades, 30 to 40 miles inland. The Biscayne Aquifer is highly productive with yields reaching 7,000 gallons per minute. Recharge is principally through rainfall. The canal systems also play an important and complex role in groundwater recharge and discharge.¹

The water table elevation of the Biscayne Aquifer in the area around the project site has been tentatively determined by the USGS for two periods in 1981. The water table was approximately one foot above mean sea level in mid-March. The elevation in early October, during the rainy season, was about two feet above mean sea level.²

The project site is on the western edge of the large coastal area subject to saltwater intrusion.³ Much of the landfill area is within the 1000 mg/l isochlor line (Figure 22). A more recent study indicates that the salt intrusion may have advanced further inland.⁴

L. Archaeological Resources

The State of Florida, Division of Archives, History and Records Management, reviewed a map of the area for evaluation of known or potential archaeological resources at the site. The probability of any significant occurrence of historic or archaeological resources is very low. Therefore, no further investigation is required prior to construction (Attachment 11).

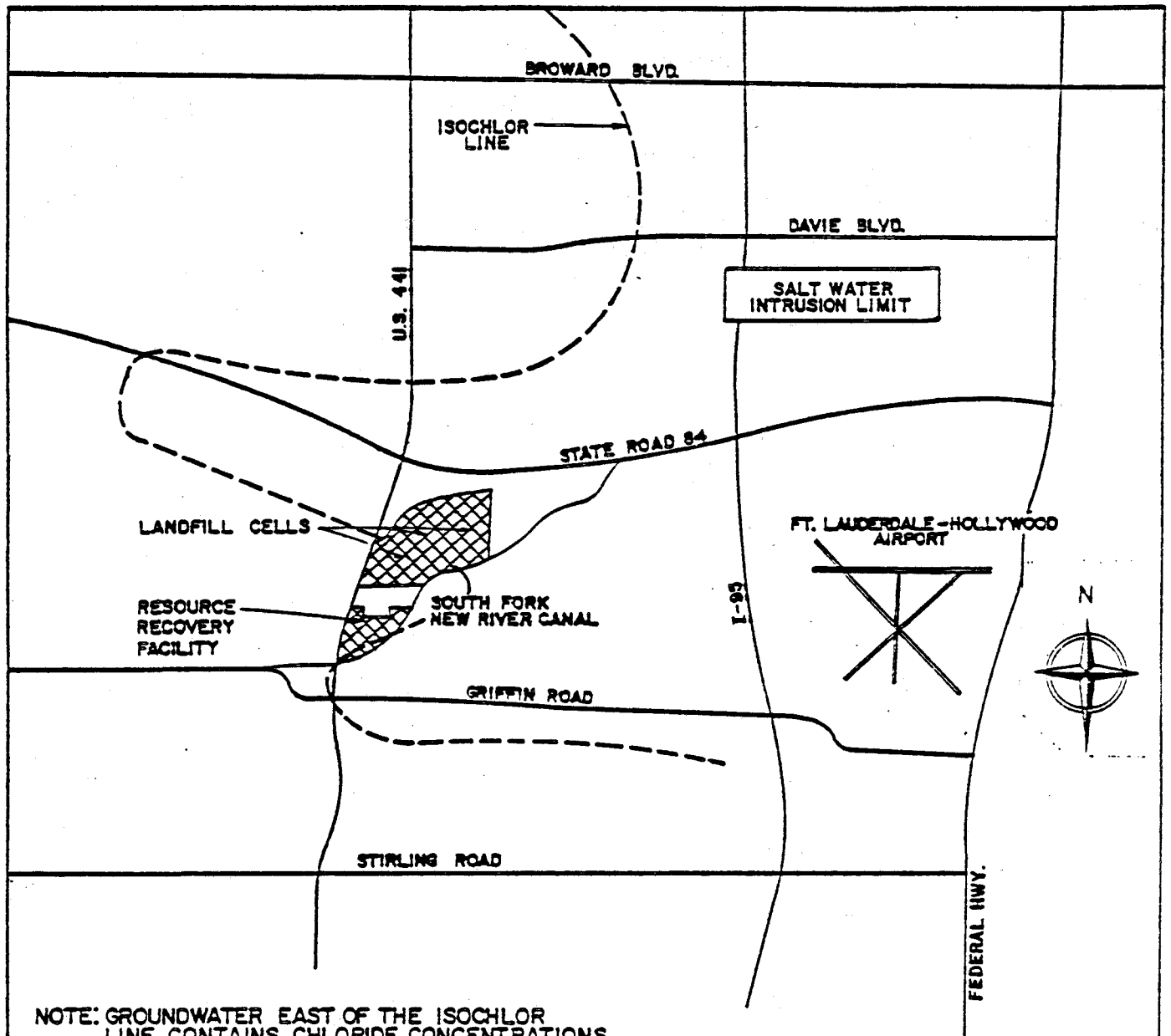
¹U. S. Geological Survey, Biscayne Aquifer, Southeast Florida, Water Resources Investigation 78-107, September 1978.

²U. S. Geological Survey, Provisional Maps Depicting Altitude of the Biscayne Aquifer in Broward County, March 16-20 and October 7-8, 1981.

³Broward County, Florida; Map of Potable Water Service Areas, Approximate Limits of Saltwater Intrusion and Existing Well Fields from U. S. Geological Survey, Water Summary, South Florida, May 1979.

⁴Bearden, H. W. Ground Water Resources of the Hollywood Area, Florida, Water Resources Investigation 77, U. S. Geological Survey and Florida Department of Natural Resources, 1974.

FIGURE 22



NOTE: GROUNDWATER EAST OF THE ISOCHLOR LINE CONTAINS CHLORIDE CONCENTRATIONS GREATER THAN 1000 MG/L.

LOCATION MAP 1000 MG/L ISOCHLOR



M. Regulatory Aspects

The following permits or regulatory approvals are required for the development of the Southern Residue/Unprocessable Waste Landfill. Although considered unlikely at this time, it is also possible that Development of Regional Impact Regulations could be imposed on the resource recovery project. An assessment of whether or not the project is a DRI is being made by the State Department of Veteran and Community Affairs.

1. Federal Aviation Administration Part 77 Regulations

The project site is within airspace of the Fort Lauderdale-Hollywood International Airport. Concerns have been expressed that birds might be attracted to the landfill and would therefore be an aviation hazard. The landfill will not attract birds because the material is residue ash and unprocessable nonorganic material. FAA's concurrence is expected (Attachment 10).

2. State Underground Injection Well Permit

Landfill leachate, thermal wastewaters from the RRF, and site run-off will be disposed of through deep well injection into the Boulder Zone. An injection well for this purpose will require a DER permit. Because the Boulder Zone does not contain potentially potable groundwater supplies and is isolated from other potable or potentially potable supplies by an overlying confining layer, DER permit approval is anticipated.

3. State Solid Waste Facility Permit

Construction and operation of the landfill facilities are subject to DER permit approval. DER regulations contain provisions and criteria which must be incorporated into solid waste facility plans. A

preliminary site inspection was made by DER representatives to verify the acceptability of the project site. A preliminary determination was made that assuming all regulatory requirements would be satisfied, permit approval will be forthcoming.

4. State Dredge and Fill Permits

U. S. Army Corps of Engineers and Florida Department of Environmental Regulation have reviewed the site and ruled that it is within their individual jurisdictions. On the basis of the urgent need for the project, the detailed site selection process, and the mitigation (Chapter V) proposed for the project, it is anticipated the permits will be approved.

5. South Florida Water Management District Surface Water Management Permit

The management of surface waters on the landfill site is subject to approval from the South Florida Water Management District (SFWMD). As discussed previously, surface run-off will principally be collected and injected into the Boulder Zone. Permit approval for a surface water management system based on SFWMD criteria is anticipated.

6. Broward County Construction/Operation Licenses for Disposal Wells

The construction and operation of the proposed injection well on the project site is subject to BCEQCB approval. The license is expected to receive approval from the BCEQCB.

7. Broward County Construction/Operation Licenses for Solid Waste
Pollution Sources

The BCEQCB has regulatory authority over the construction and operation of solid waste facilities. A site inspection performed by the appropriate BCEQCB representative confirmed that with incorporation of stipulated design and operating criteria into the proposed plans for the resource recovery and landfill facilities, the BCEQCB will grant permit approval.

V. MITIGATION

Development of the landfill requires that 123 acres of wetlands be filled. To compensate for wetland losses, a mitigation plan has been developed as an integral part of the landfill development. Mitigation includes on-site and off-site work. On-site mitigation comprises 31.8 acres of Urban Wilderness Area, and off-site mitigation comprises 15.5 acres in Tree Tops Park.

The mitigation plan has been developed in careful consideration of a tree survey which was made to comply with the Code of Broward County. The code defines a tree as being woody vegetation with a diameter breast height (dbh) of 3 inches and an overall height of 7 feet; exotic species—Brazilian pepper, cajeput, and Australian pines—are not counted. Plate 6 shows the results of the tree survey. Based upon the results of the tree survey, mitigation plans were prepared to conserve existing trees. Excavation to create open water, marsh, and swamp environments has to be designed to avoid impacts to existing trees.

A. On-site Mitigation

On-site mitigation entails preservation and enhancement of 31.8 acres. The area east of landfill cell 2 will be preserved as a buffer between the landfill and the cypress swamp (Ann Kolb Park) to the east. The width of the buffer area will be 250 feet wide on the northern end increasing to 550 feet wide on the southern end. A 50-foot strip adjacent to the landfill berm will be planted with cypress trees (Figures 23, 24, 25).

A small lagoon connecting with South Fork New River Canal will be excavated in the extreme northeastern corner of the site to provide shallow open water habitat from a dredged material berm. The lagoon will be excavated to an elevation of -2.00 MSL; it will enhance the adjacent wetlands by

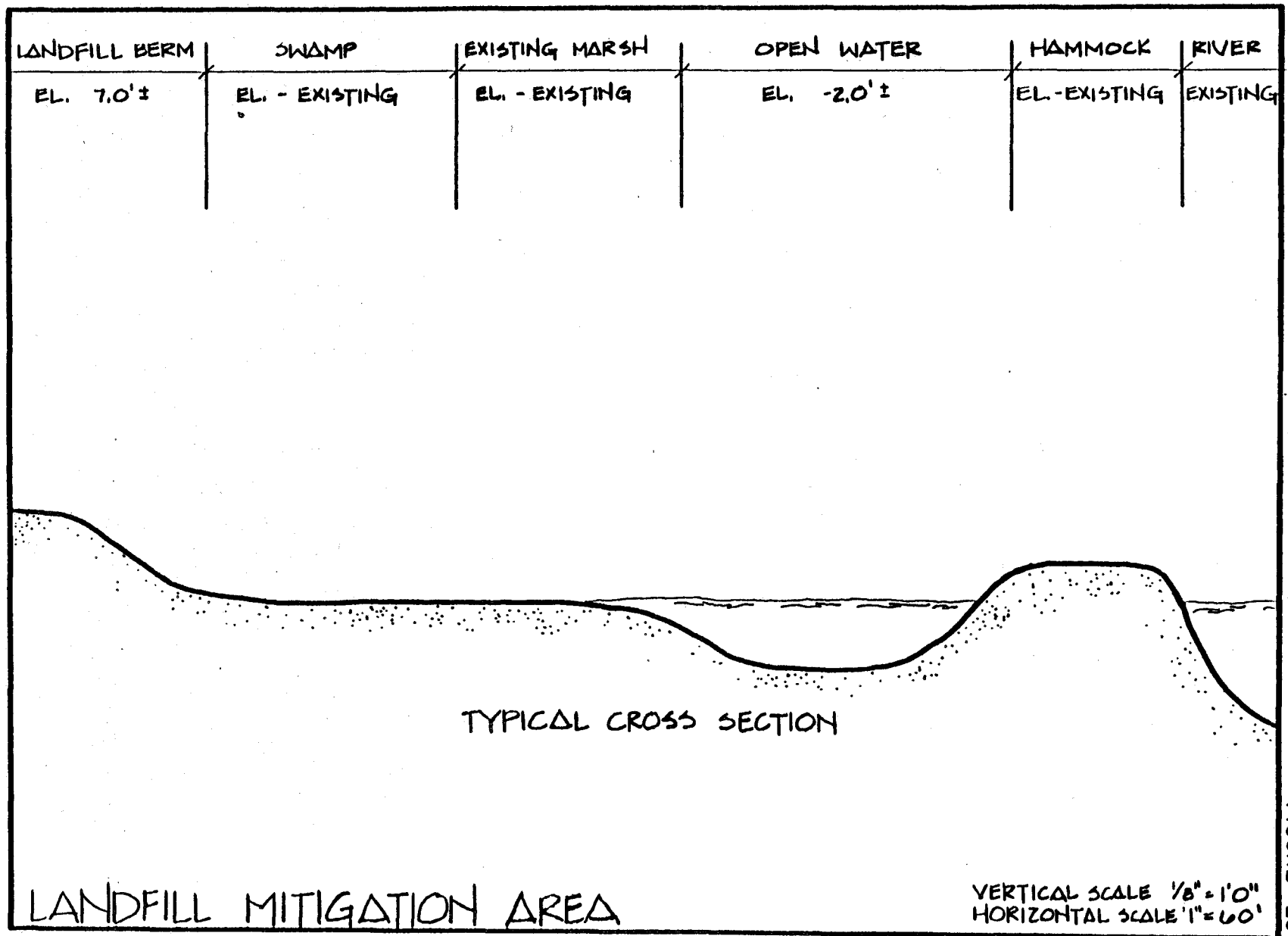


FIGURE 23

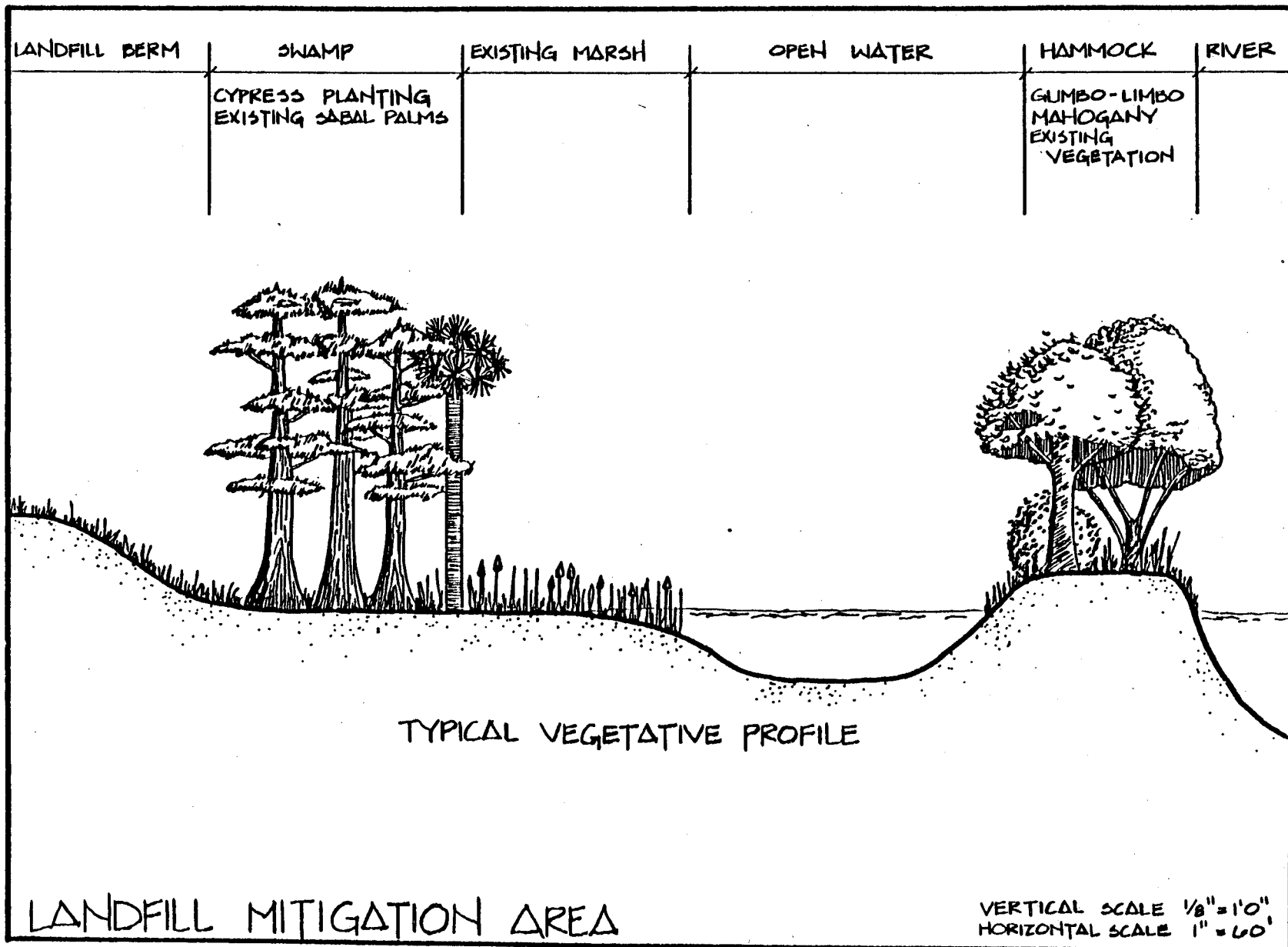


FIGURE 24

AREA	SPECIES	SIZE	DENSITY
SWAMP	BALD CYPRESS	8'	50 / ACRE
HAMMOCK	GUMBO-LIMBO MAHOGANY	8' 8'	25 / ACRE 25 / ACRE

LANDFILL MITIGATION AREA

PLANTING DENSITY

providing the opportunity for natural shallow flooding of adjacent wetlands on an intermittent basis. Flooding, a natural phenomenon which is part of floodplain wetland ecology, has been prevented by the berm of spoil which was placed beside the river when it was dredged.

Most of the 300-foot wide Urban Wilderness strip adjacent to the river will be preserved, but it also will be enhanced by (1) removing an accumulation of trash and discarded construction materials, (2) removing exotic vegetation, and selective planting of wetland (cypress, red maple, etc.) and upland species (mahogany, gumbo-limbo, etc.). Plates 7, 8, and 9 provide a plan view of the on-site mitigation.

B. Off-Site Mitigation

Tree Tops Park, a new County facility located at the corner of Orange Drive and Golden Shoe Road also will be used for the mitigation (Figure 26). The mitigation plans have been developed in close coordination with the Broward County Parks Department. For this project, mitigation entails creating a semi-permanently flooded sawgrass marsh and hardwood hammock from an existing wax myrtle-saltbush shrub thicket (Figure 27). The mitigation area comprises a total of 15.5 acres, 13.3 acres of which will be sawgrass marsh and 2.2 acres of which will be hardwood hammock. A site plan and associated drawings are attached hereto as part of the permit application. Figure 27 is a plan view of the mitigation area, and Figure 28 shows a sectional view of final elevations. Figure 29 is a rendering of the site after planting. Planting details are described in Figure 30.

The water level in the pond will be maintained approximately +2.5 feet (msl) although the water level may occasionally rise to +3.0 feet during wet periods because the park is within one of SFWMD's retention areas. Marsh



SOURCE: USGS QUAD. N2600 COOPER CITY, FL

100

2

1

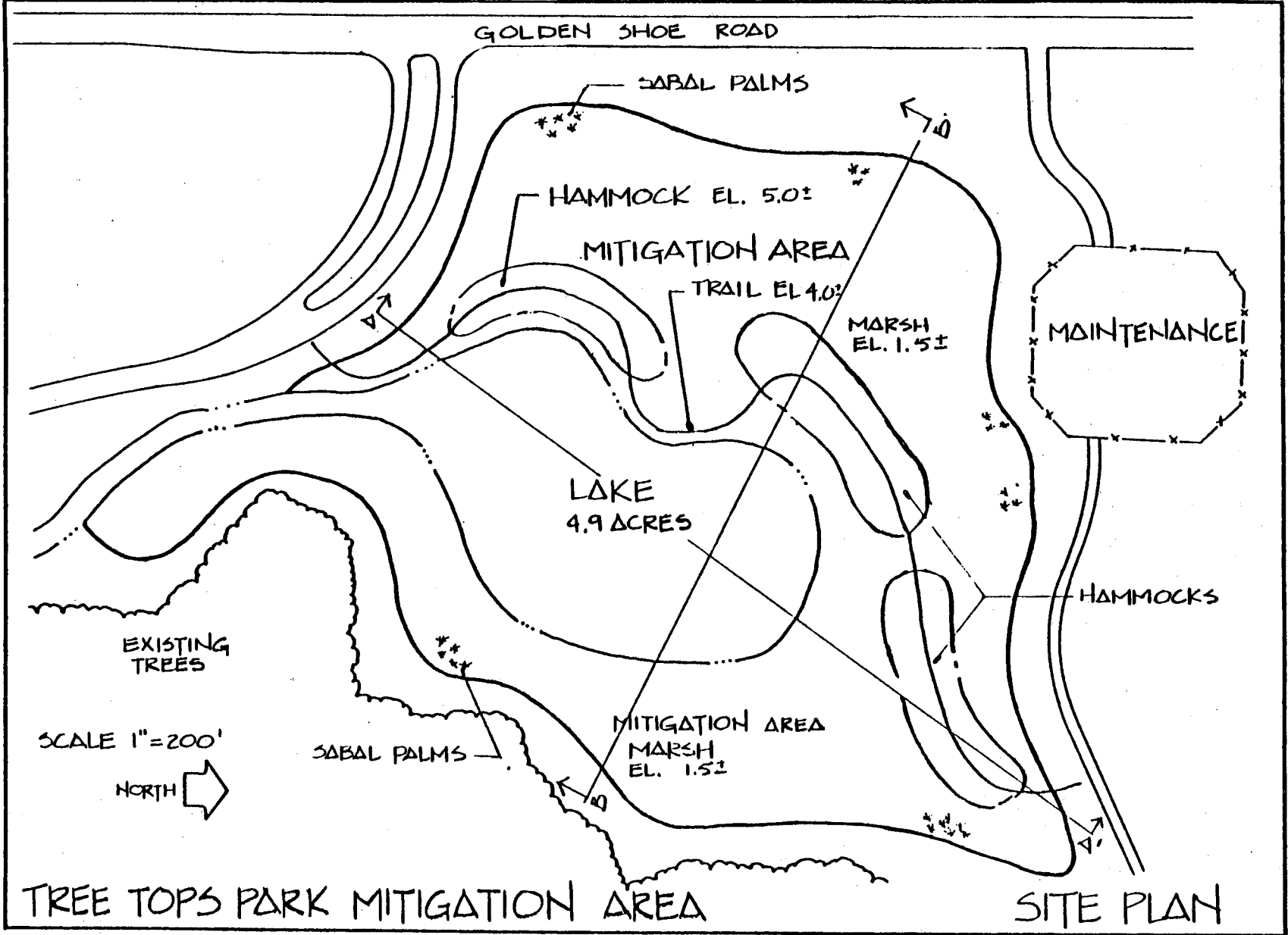
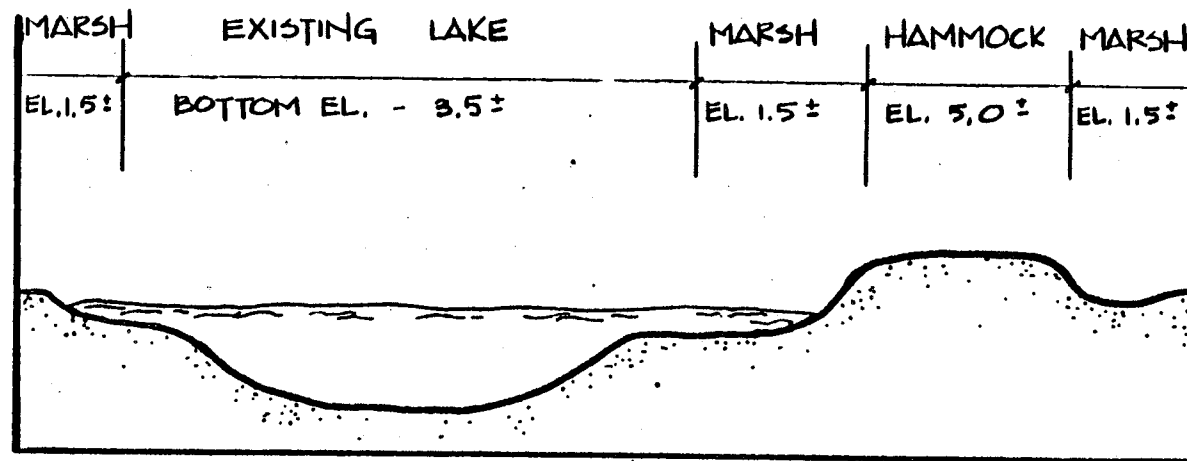
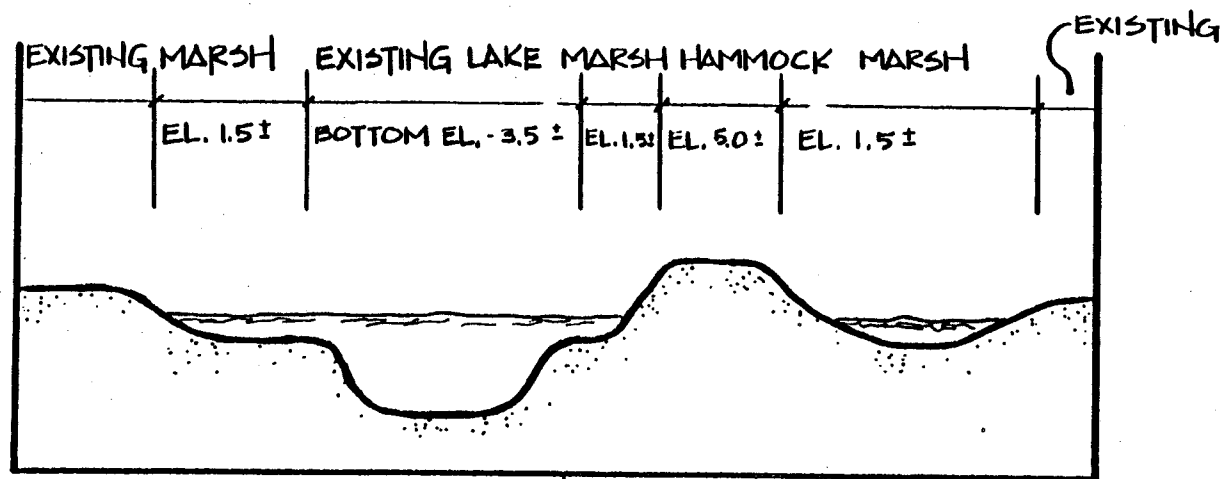


FIGURE 27



SECTION A-A'



SECTION B-B'

TREE TOPS PARK MITIGATION AREA

HORIZONTAL SCALE 1"=200'
VERTICLE SCALE 1"=8'0"

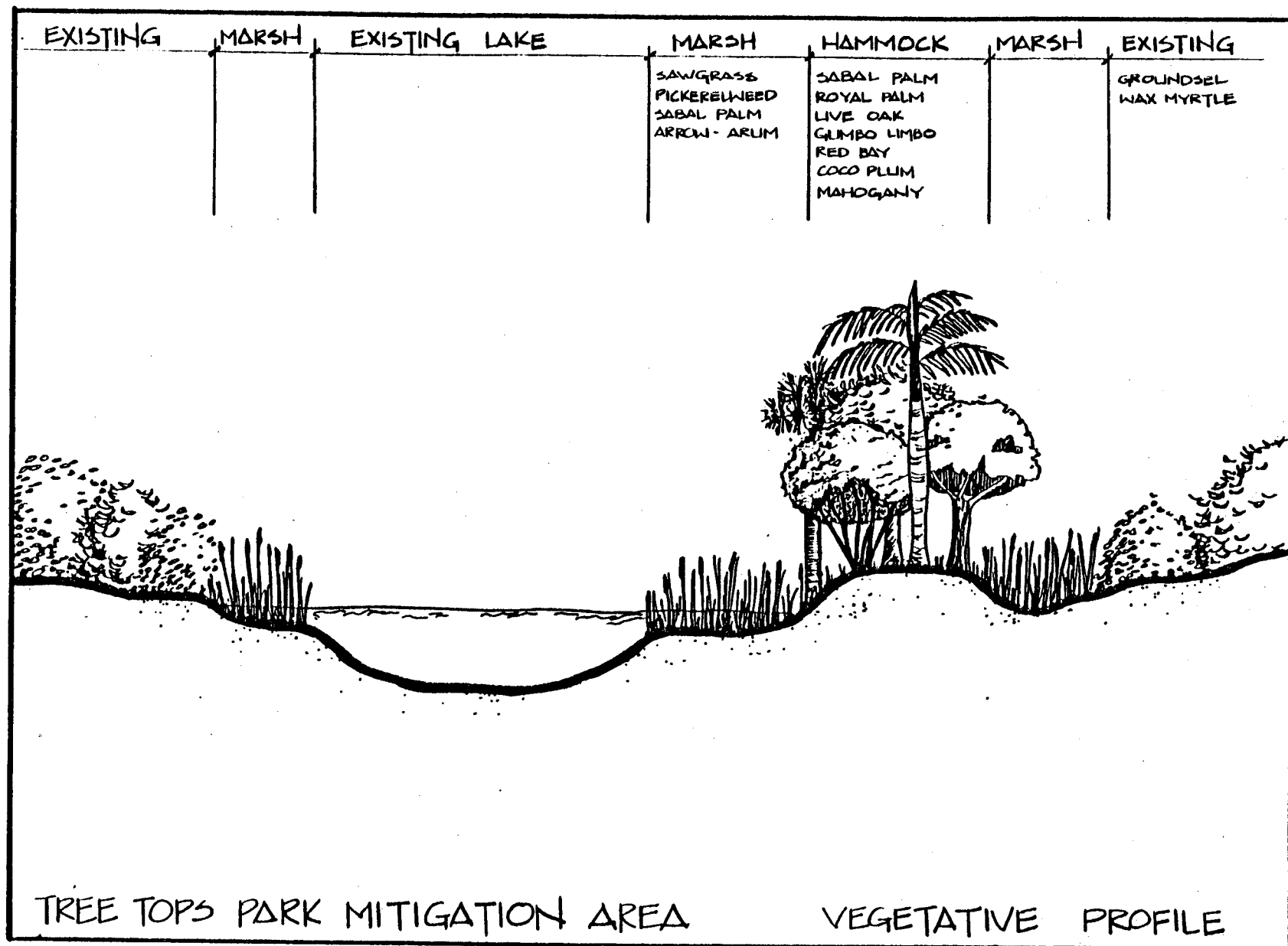


FIGURE 29

AREASPECIESDENSITY

MARSH

SAWGRASS
PICKEREL WEED
ARROW ARUMCLUMPS OF 3 CULMS ON 8'
CENTERS
COLONIES OF 5 PLANTS, 5
COLONIES / ACRE RANDOM
SPACING
3 / ACRE, RANDOM SPACING

HAMMOCK

SABAL PALMS

1 / 50 FEET OF PERIMETER
IN CLUMPS OF 3 AT
ELEVATION OF 3.0' OR 4.0'ROYAL PALM
LIVE OAK
GUMBO LIMBO
RED BAY
COCO PLUM
MAHOGANYEQUAL MIXTURE, RANDOM
SPACING, 1 TREE / 500 FT.²

TREE TOPS PARK MITIGATION AREA

PLANTING DENSITY

habitat will be created around the lake by lowering the surrounding area's elevation. Essentially, the edge of the lake will be a broad, shallow marsh with several tree islands (hammocks). The topography of the marsh area will range from +1.5 to +3.0. Hammocks will be at a slightly higher elevation (+5.0). Except on hammocks, the trail will be at (+4.0) and will incorporate culverts to insure water interchange throughout the marsh.

Creation of 15.5 acres of marsh and hammocks in Tree Tops Park provides mitigation to supplement on-site mitigation for the wetlands utilized in development of the Southern Residue/Unprocessible Waste Landfill.

The Tree Tops Park mitigation area will result in a high quality wetland/open water/hammock environment similar to the Everglades. Besides serving as a more valuable functioning wetland, the Tree Tops Park area will provide a valuable educational opportunity for the people of Broward County.



County Administrator's Office
Room 248, Broward County Courthouse
Fort Lauderdale, Florida 33301
(305) 765-5121

September 8, 1983

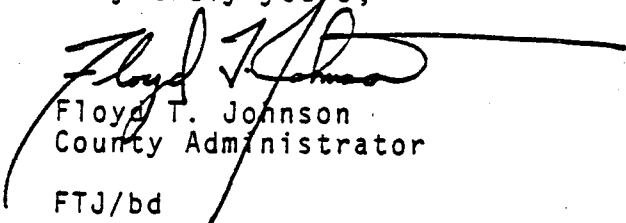
Attn: Mr. Jeremy Craft
State of Florida
Department of Environmental Regulation
2562 Executive Center Circle East
Montgomery Building
Tallahassee, Florida 32301

Re: Dredge and Fill Permit Application for Southern Broward
County Residue/Unprocessable Waste Landfill

Dear Mr. Craft:

I have designated Peter E. Robinson, P.E., Vice-President of Hazen and Sawyer, P.C., 5950 Washington Street, Hollywood, Florida, as the authorized agent for the dredge and fill permit application for the above referenced project. Mr. Robinson is authorized to negotiate modifications and revisions when necessary, and accept or assent to any stipulation on our behalf.

Very truly yours,


Floyd T. Johnson
County Administrator

FTJ/bd

BROWARD COUNTY BOARD OF COUNTY COMMISSIONERS

Marcia Beach Scott I. Cowan Howard Craft Howard Forman Jack Fried Nicki Englander Grossman Gerald Thompson
An Equal Opportunity Employer

ADJACENT LAND OWNERS

Bahamas Auto Club
3701 State Road 84, Ft. Lauderdale 33312

Company Six-O, Inc., 2230 SE 17th Street, Ft. Lauderdale 33326

Cotton, B. L. & Carmela
8203 SW 26 Place, Ft. Lauderdale 33328

Curry, R. H. & Deloris L.
4111 SW 53rd Avenue, Davie, FL 33314

Egan, Agnes B.
2500 E. Las Alas Blvd., Ft. Lauderdale 33301

84 Lumber Company
Box 98309, Atlanta, GA 30359

Florida Mobile Leasing, Inc.
3231 S. SR 7, Ft. Lauderdale 33314

Forman, Charles R.
3600 N. Federal Hwy., Apt. 301, Ft. Lauderdale 33308

Glantz, Gabriel
155 W. Congress, Suite 425, Detroit, MI 48226

Griffey, James T.
2945 State Road 84, Ft. Lauderdale 33312

Hacienda Flores, Inc.
3861 S.W. 31 Ct., Ft. Lauderdale 33312

Jackson, N. E., 3641 State Road 84, Ft. Lauderdale 33312

Kaufman, Lester & Alden
2501 Riverside Drive, Pompano 33062

Kaufman, Robert & Carlos, Thomas
1399 NW 17th Avenue, Suite 305, Miami 33175

Mighty Mite Race Trace
3101 South State Road 7, Ft. Lauderdale 33314

#810 Corp., Inc.
4601 Oaks Road, Ft. Lauderdale 33314

Powell Brothers, Inc.
P. O. Box 14550, Ft. Lauderdale 33302

ADJACENT LAND OWNERS

ATTACHMENT 2

-2-

Russo Assoc., Inc.

3195 South State Road 7, Ft. Lauderdale 33314

Russo, A. & Anne

3195 South State Road 7, Ft. Lauderdale 33314

Therrien, William

3581 South State Road 7, Ft. Lauderdale 33314

Thomas, Alberta

4736 Lake Worth Road, Lake Worth 33463

U-Haul of Central Florida

2721 N. Central Avenue, Suite 700, Phoenix, AZ 85004

West Dixie Farms Block 1 (contains 6 parcels)

1. Cramer, Hugh B. & Mauer, Kenneth, 3901 S. SR 7, Ft.
Lauderdale
33314

2. Florida Power & Light, P. O. Box 8248, Ft. Lauderdale 33310

3. Florida Power & Light, P. O. Box 8248, Ft. Lauderdale 33310

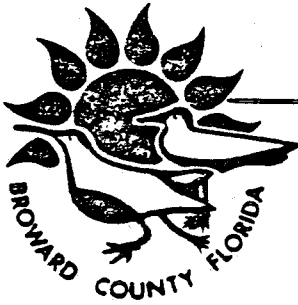
4. Manchao Landscape & Paving, 3911 1/2 S. SR 7, Ft. Lauderdale
33314

5. Serapigla, T. & Loretta, 5 Union Avenue, Johnston, RI 02919

6. Serapigla, T. & Loretta, 5 Union Avenue, Johnston, RI 02919

Zollmer, Mary

3621 State Road 84 33312



August 19, 1983

Property Division
521 S. Andrews Avenue
Fort Lauderdale, Florida 33301

Ref: 83/21

HAND DELIVERED

Patrick Davis, Environmental Engineer
Hazen and Sawyer, P. C.
5950 Washington Street
Hollywood, Florida 33023

Re: Broward County Resource Recovery -
Site Acquisition

Dear Mr. Davis:

Jim Hudgens of CZR, Inc. has requested that I furnish you with a brief overview that indicates the acquisition process that Broward County follows on projects.

Normally, the first process that takes place is site or route selection. In the case of resource recovery, both sites have now been identified. Having identified the site, we then request title information from an independent abstract company. Simultaneously, it is requested that survey work be performed that will give us the appropriate maps and sketches for negotiations, a legal description of each individual ownership involved, and the amount of acreage involved with each ownership. Other survey information is requested based on the individual needs concerned with each specific project.

As soon as survey and title information is received, we retain the services of one or more independent fee appraisers to establish fair market value of each property concerned. When these formal appraisals are received, they are reviewed by a staff review appraiser.

As soon as we have an approved appraisal work product, the appraisal is turned over to our professional negotiation team and an agent is assigned to make contact with the owner, and negotiations begin.

Should all negotiation attempts fail, property value data and suit information is forwarded to our Office of General Counsel for litigation under Florida Eminent Domain proceedings. Normally, our attorneys will file what is known as a "quick take action" under Florida statutes, which involves a hearing with the judge and condemnee. The judge then determines if we have shown sufficient proof of public necessity, whether our estimate of value is in good faith, the amount of monies to be deposited in the court registry, and the date that the county shall take physical possession of the property.

BROWARD COUNTY BOARD OF COUNTY COMMISSIONERS

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An Equal Opportunity Employer

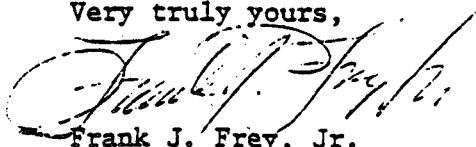
Patrick Davis, Environmental Engineer
Broward County Resource Recovery -
Site Acquisition

Page 2

In the case of "quick take" procedures, there would be a final adjudication by jury trial at some point after the Order of Taking, to determine the actual amount of compensation to be paid to the property owner. Any given project at this point would then proceed toward development and construction.

If I may be of further assistance, please advise.

Very truly yours,



Frank J. Frey, Jr.
Director

FJF:rf

CC: Tom Elliott, Asst. Director, Finance & Adm. Systems
Phyllis Korab, Coordinator

LEGAL DESCRIPTION

A parcel of land lying within Sections 24 and 25, Township 50 South, Range 41 East, and Sections 19 and 30, Township 50 South, Range 42 East, said parcel also being Tracts 1 and 2 and a portion of Tract 3, 15, and 16 in said Section 25 and a portion of Tracts 2, 3, 4 and 5 of Tier 1 in said Section 24 of the John W. Newman Survey as recorded in Plat Book 2, Page 26, of the Public Records of Dade County, Florida and a portion of Blocks 2 and 3, West Dixie Farms as recorded in Plat Book 24, Page 36, of the Public Records of Broward County, Florida, and a portion of Lots 3, 4 and 5 of the Florida East Coast Railway Subdivision as recorded in Plat Book "B," Page 142, of the Public Records of Dade County, Florida, being more particularly described as follows:

COMMENCING at the East Quarter (E 1/4) corner of said Section 25; thence South $88^{\circ} 34' 16''$ West, along the South line of the Northeast One Quarter (NE 1/4) of said Section 25, a distance of 491.85 feet to the easterly boundary of aforesaid Tract 16; thence North $20^{\circ} 05' 06''$ East, along said easterly boundary, 984.08 feet to the POINT OF BEGINNING; thence South $88^{\circ} 38' 08''$ West along a line 409.00 feet South of and parallel with the North line of said Tract 16 and aforesaid Tract 15 and West Dixie Farms, 1626.40 feet; thence South $01^{\circ} 42' 50''$ East along a line 433.00 feet West of and parallel with the East boundary of said West Dixie Farms 229.64 feet; thence South $88^{\circ} 34' 16''$ West along a line 8.83 feet North of and parallel with the North line of Lot 3 of aforesaid Block 2, a distance of 385.00 feet to the easterly right-of-way line of State Road No. 7 (100' wide right-of-way); thence North $14^{\circ} 51' 56''$ East along said right-of-way line 2,032.16 feet; thence continue along said right-of-way line, North $15^{\circ} 02' 23''$ East, 35.35 feet to a point of intersection with the North right-of-way line of Oaks Road; thence north $88^{\circ} 41' 58''$ East, along said North right-of-way line 71.72 feet to a point of intersection with the proposed limited access line as shown on Florida Department of Transportation right-of-way map for State Road No. 862. (I-595) sheet 6 of 9, dated November, 1981; thence along said limited access line the following nine (9) courses and distances; thence North $15^{\circ} 01' 35''$ east, 645.68 feet; thence North $43^{\circ} 15' 17''$ East, 109.67 feet; thence North $26^{\circ} 24' 46''$ East, 541.56 feet; thence North $22^{\circ} 49' 40''$ East, 98.27 feet; thence North $36^{\circ} 53' 09''$ East, 379.73 feet; thence North $62^{\circ} 27' 20''$ East, 178.19 feet; thence North $79^{\circ} 24' 18''$ East, 356.52; thence North $89^{\circ} 37' 32''$ East, 642.81 feet; thence North $77^{\circ} 33' 36''$ East, 1096.41 feet; thence South $03^{\circ} 32' 53''$ East, along a line 3,478.00 feet West of and parallel with the East line of aforesaid Section 19, a distance of 1,836 feet more or less to the northerly waters of the South New River Canal: thence westerly and southwesterly along the northerly and westerly waters of the said South New River Canal to a point of intersection with the East boundary of aforesaid range 41 East; thence North $01^{\circ} 46' 20''$ West along said East boundary 161.16 feet more or less to a point 95.31 feet South of the Northeast corner of aforesaid Tract 16; thence South $20^{\circ} 05' 06''$ West along the easterly boundary of said Tract 16, a distance of 337.04 feet to the point of beginning.

Said parcel lying within Broward County, Florida, containing 197.87 acres, more or less.

Subject to Rights-of-Way and Easements of Record.

Letter by William A. Feder relative
to landfill leachate.



UNIVERSITY OF MASSACHUSETTS
AMHERST · BOSTON · WORCESTER

SUBURBAN EXPERIMENT STATION
240 Beaver Street
Waltham, MA 02154

July 31, 1980.

Mr. John M. Kehoe, Jr.
Vice President and General Manager
Wheelabrator-Frye Inc.
Energy Systems Division
Liberty Lane,
Hampton, New Hampshire 03842

Dear Mr. Kehoe:

Ongoing research at the Suburban Experiment Station of the University of Massachusetts with RESCO incinerator bottom ash has produced data concerning heavy metals which I think you might find informative. I am therefore passing on to you a summary of these results updated to July 1980.

RESCO bottom ash contains large amounts of copper, zinc, cadmium, nickel, lead, and chromium. These metals, in a soluble form, could constitute a real threat to the environment. However, our studies have shown that these metals are tightly bound to the ash matrix and do not, therefore, enter the environment. Results of separate studies using the ash have led us to this conclusion.

Leaching columns were set up in October 1978 utilizing the RESCO bottom ash. Rainfall in Waltham, Massachusetts has an average annual pH value of 4.0. This is considered to be acid precipitation. In spite of the low rainfall pH, leachate pH values have consistently been above 7.0 for all rainfall events since October 1978--to date. This indicates the presence of a persistently high buffering capacity in the RESCO ash. The high pH of the leachate should minimize the movement of heavy metals out of the ash and the chemical analyses of this leachate over time by the University of Massachusetts Microanalysis Laboratory confirm that this is indeed the case. (See attached sheet).

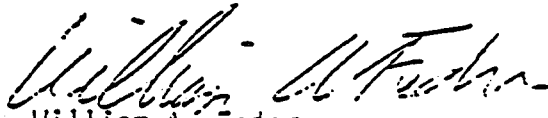
In addition, a second test was conducted in which RESCO bottom ash was placed next to a wetland and the heavy metal content of the groundwater monitored over time by the Lawrence Laboratory of the DEQE. These results, which are already in your possession, also confirm that there has been no ground water contaminated by heavy metals leaching from the RESCO bottom ash.

All the data to date indicate that the RESCO bottom ash will probably exert a minimal environmental impact and that heavy metal contamination of ground water

beneath this ash is highly unlikely. It is also clear, that since the heavy metals in the RESCO ash appear, to date, to be totally resistant to natural leaching under acid rainfall conditions, that they must be chemically altered in such a way as to tightly bind them to the ash and therefore unable to contaminate ground water and biological systems which come in contact with the ash. Since the heavy metals appear to be biologically unavailable RESCO bottom ash should, in my opinion, be considered a Non-Hazardous Waste.

Both these studies are being continued and new data will continue to be made available to your office. I trust that this information is of use to you?

Sincerely yours,


William A. Feder,
Professor

WAF:hr

encl.

Depositing of cinders in Vestskoven.

At the end of November 1972, I/S Vestforbranding received permission to dump combustion cinders for a four year period on an area in Vestskoven, in accordance with the special regulations.

The depositing of cinders was done in depots, shaped like big hollows with the under-side two to three metres below ground. The dug out earth is put up like a circular wall, so that the hollows are four to five metres deep. On the inside the hollows are lined with a heavy, coherent plastic diaphragm in order to prevent penetration of the percolate to the groundwater. The percolate runs to a centrally located pump well, from which it can be picked up and analysed.

With the object of shedding a light on the washing out process from an uncovered cinders depot, and to establish if there are traces of percolate in groundwater borings around the depositing site, tests of secondary groundwater and percolate of cinders from the locality in Vestskoven where the cinders are deposited, 171, 181, 191, have been taken in the period from June 1973 to October 1975.

No measurings or analyses of groundwater samples have evidenced any influence from the percolate of cinders in this period.

The concentration of macro ions (e.g. calcium, sodium, sulphate and chloride) in the percolate is of the same size as the concentrations in sea water.

Among the examined trace elements, hereunder also heavy metals, only the concentrations of arsenic are bigger than the concentration in the groundwater samples in the test period from June 1973 to March 1974; it is substantially smaller than the drinking water criterion for arsenic/10/11/, however.

The concentration level for trace elements has not changed essentially in the period 1974/75. In table 2 analytical values of trace elements in the percolate are compared with the values for river water, sea water as well as various drinking water criteria.

The main cause of the low concentrations of trace elements in the percolate is the high pH value (~ 10) of the cinders which gives the percolate a pH value of approx. 9. At this pH level all examined trace elements are thermo-dynamically stable in a solid form, as they are either immune (non-corrosive) or passive (coated with a dense skin of the corrosive product which prevents further corrosion) to attacks of water) 4/. The redox conditions in the depot (greatly reducing with hydrogen sulphide development), increases this tendency further, as possible dissolved trace elements from the top side of the depot will be tied up as very sparingly soluble sulphide deeper down in the depot. The presence of complexing ions (NH_4^+ , Cl^- , HCO_3^-) will only to a lesser extent be able to increase the solubility.

No bigger solubility of trace elements than the one observed up till now can be expected, as long as the present pH- and redox conditions are maintained in the cinders. A noticeable change will first occur if the pH value of the cinders falls to pH 7 or lower. The natural way, such a change can only be caused by a neutralization of the alkaline parts of the cinders with sour precipitation. The following calculation shows the magnitude of the period, such a neutralization will require:

Alkalinity of the cinders:	0,975 equiv./kg
Acidity of rain water:	10^{-4} equiv./l (pH 4)
Quantity of cinders in depot 1:	15.600 tons
Quantity of percolate per year:	452 m ³
"Neutralization time": $\frac{15.600 \times 0.975}{452 \times 10^{-4}}$	years = <u>336.500 years</u>

By the washing out from the depot some of the alkaline parts of the cinders are removed. This means that a neutralization of depot 1 would last less than the period indicated, but still a very long time (thousands of years).

Analysis variable	Percolate				Fresh- water median	Sea water	Drinking water cr. erions					
	1973-74		1974-75				WHO	Sweden	USA	USA		
	min.	max.	min.	max.			/12/	/12/	/10/	/10/	/10/	/11/
Al	<1	1080	2.5	108	240	10		150				
As	4,5	16,5	10,6	20,5	0,4	3	50	200	50	100		
Pb	2	<10	2	12	5	0,03	100	100	50	50		
Cd	<0,1	<20	<1	<10	<80	0.1	10	50	10	10		
Cr(tot)	10	<50	<5	50	0,2	0.05				50		
Fe	7	370	<100	300	670	10	300	200	300	300		
Cu	<1	80	<1	24	10	3	1000	50	1000	1000		
Hg	<0,05	0,29	<0.05	0.25	0,08	0,03				2		
Mn	29	300	30	50	12	2	100		50	50		
Zn	10	150	25	60	10	10	5000	1000	5000	5000		
B		<230	560	13	4600					(1000)		
Se			2	<20	0.09	10	50			10		
Ni		<50		10	5					-		
Co		<50		0,9	0,3					-		
Aq		40		0,1	0,3		50			-		

Table 2: Measured minimum and maximum concentrations of trace elements in percolate in the period June 1973 to March 1974, as well as March 1974 to October 1975, compared with the values for fresh water, sea water, as well as different drinking water criterions. All values are shown in ug/l.

RESOLUTION NO. R-82-19

A RESOLUTION OF THE TOWN OF DAVIE, FLORIDA
OPPOSING THE LOCATION OF ANY FUTURE BROWARD
COUNTY LANDFILL SITES WITHIN THE TOWN OF
DAVIE.

WHEREAS, an existing Broward County Landfill site
has been located within the Town of Davie for many years; and

WHEREAS, the existing Davie landfill site was to be
closed by 1982; and

WHEREAS, Broward County hired Malcolm Pirnie as
Consultant to conduct a study to identify and rank potential
future landfill sites in Broward County; and

WHEREAS, the Malcolm Pirnie study has identified
sites and has ranked as number one an area within the Town of
Davie adjacent to the existing landfill site; and

WHEREAS, the proposed new Davie landfill site would
create an adverse impact upon the health, safety and welfare of
the Town of Davie and its residents.

NOW, THEREFORE, BE IT RESOLVED BY THE TOWN COUNCIL OF THE TOWN OF
DAVIE, FLORIDA:

SECTION 1. The Town of Davie is hereby opposed to
the future landfill site within the Town as identified by the
Malcolm Pirnie study.

SECTION 2. The Town of Davie requests the Broward
County Commission remove from consideration the above mentioned
Davie site.

SECTION 3. The Town of Davie requests the Broward
County Commission closely examine alternatives to this site by
locating the landfill site in a location outside the Davie town
limits.

SECTION 4. This Resolution shall take effect
immediately upon its passage and adoption.

PASSED AND ADOPTED THIS 3rd DAY OF March, 1982.

[Signature]
MAYOR/COUNCILMAN

ATTEST:

[Signature]
TOWN CLERK

APPROVED THIS 4th DAY OF March, 1982.

LAW OFFICES
ARNSTEIN, GLUCK & LEHR
SUITE 904 FORUM III
1665 PALM BEACH LAKES BOULEVARD
WEST PALM BEACH, FLORIDA 33401
TELEPHONE (305) 689-3900
TELECOPIER (305) 686-8008

RESIDENT PARTNERS
GROVER C. HERRING
ANDREW FULTON, III
JAMES L. WATT

CHICAGO OFFICE
75TH FLOOR - SEARS TOWER
CHICAGO, ILLINOIS 60606
(312) 876-7100

April 20, 1982

Hon. Irving Rosenbaum
Town Administrator
Town of Davie
Town Hall
Davie, Florida 33314

RE: Lands of Imagination Farms and/or Henry B. Pownall, et ux,
located within the Town of Davie, as described in
Ordinance No. 74-44, enacted on September 18, 1974, by said
Town and validated by referendum held within said Town on
October 1, 1974.

Dear Mr. Rosenbaum:

This letter opinion is in response to your request for advice
as to the legal status of the aforesaid lands as concerns the
municipal jurisdiction of the Town of Davie of such lands.

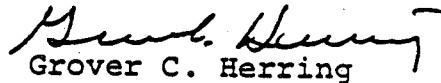
Please be advised that in 1974, said above described lands
were duly annexed to the Town of Davie by Ordinance No. 74-44
under the old annexation law of Florida, and such annexation was
validated by referendum on October 1, 1974, which effectively
completed the annexation of such lands to the Town, thereby giving
the said Town full municipal jurisdiction of said lands, including
zoning powers and taxation powers. The lands would have come into
the Town in 1974 as existing agricultural lands as the ordinance of
annexation retained the then existing zoning. Thereafter the land-
owner sought to be relieved of the municipal burdens incident to the
annexation, and instituted an appropriate suit which ultimately
resulted in the relief desired and in a stipulated settlement, which
was consented to by the Court. See Stipulation dated March 19, 1979,
and form of Consent Final Judgment dated May 3, 1979, in the case of
IMAGINATION FARMS, INC, ETC, ET AL, Plaintiff, vs. TOWN OF DAVIE,
Defendant, Case No. 74-14130, Broward County, Florida, judicial records.

Pursuant to the above mentioned agreement between the parties,
which was fully sanctioned by the court, these lands were judicially
reserved to the Town of Davie so that its municipal jurisdiction would
again be resumed or be reattached or be reactivated upon the lands
becoming "urban in character", at which time, of course, municipal
services would be needed and provided by the Town. Such steps as are

Hon. Irving Rosenbaum
Town Administrator
Town of Davie
April 20, 1982
page 2

necessary for the resumption of the Town's full municipal jurisdiction over said lands are now being taken. Naturally the present zoning of such property would remain on the property until such time as it may be thereafter changed or modified by the Town of Davie.

Yours very truly,


Grover C. Herring

GCH:1

Image Quality

As you review the next group of images, Please note that the original documents were of poor quality.

IN THE CIRCUIT COURT OF THE 17TH
JUDICIAL CIRCUIT IN AND FOR
BROWARD COUNTY, FLORIDA

CASE NO. 74-14130

IMAGINATION FARMS, INC., etc.,
et al.,

Plaintiffs,

vs.

STIPULATION

TOWN OF DAVIE, etc.,

Defendant.

Petitioners, Imagination Farms, Inc., Henry B. Pownall, and
Doris C. Pownall, by and through their undersigned attorneys, and
the Defendant, Town of Davie, a political sub-division of Broward
County, Florida, by and through its undersigned special counsel
having reached an amicable solution to dispose of this dispute, do
hereby stipulate and agree that the attached Consent Judgment may
be entered by the Court in its entirety and without alteration
without further notice or hearing. In the event any portion of
the Consent Judgment is altered or omitted or any additions are
made thereto, both parties reserve the right to withdraw from this
settlement stipulation. If either party elects to withdraw, the
agreement shall be void and may not be used in favor of or against
either party.

DATED this 17th day of March, 1974.

MERSHON, SAWYER, JOHNSTON,
DUNWODY & COLE
Attorneys for Plaintiffs
1600 S.E. First Natl. Bk. Bldg.
Miami, FL 33131 358-5100

STEPHEN W. TOOTHAKER
Attorney for Defendant
222 S. E. 10th Street
Fort Lauderdale, FL 33316
463-1461

By Robert T. Wright, Jr.
Robert T. Wright, Jr.

By Stephen W. Toothaker
Stephen W. Toothaker

IN THE CIRCUIT COURT OF THE 17TH
JUDICIAL CIRCUIT IN AND FOR
BROWARD COUNTY, FLORIDA

CASE NO. 74-14130

IMAGINATION FARMS, INC.,
et al.,

Plaintiffs,

vs.

TOWN OF DAVIE, INC.,

Defendant.

FINAL JUDGMENT

THIS CAUSE having come on to be heard upon the Stipulation of the parties to the entry of this Judgment, and the Court being otherwise fully advised in the premises, the Court finds and concludes as follows:

1. That the Town of Davie, pursuant to Florida Statutes, Chapter 171, did undertake to annex certain lands into the Town of Davie pursuant to a general election called for that purpose, which election was held on October 1, 1974.

2. That included in the lands which were to be annexed pursuant to an ordinance passed under the applicable provisions of Chapter 171 of Florida Statutes and adopted by the Town Council were the following lands (hereinafter the "Subject Property"):

Lands owned by Imagination Farms:

26-50-40 W 1/2 of Sec lying N of New River Canal
R/W less Beg NE cor of NW 1/4 Sec 26 run Sly
alg E/B 620, W670, N to N/L Sec, E alg N/L to POB.

26-50-40 Beg inter of E/L Sec 26 & N R/W L of
South New River Canal, N alg E/L 350 for POB, cont
N211, E para with N/L Sec 26 775, S to Pt on N R/W L
of S New River Canal, E 575, N 350, E 200 to POB.

Beg at Pt on E line of Sec 26 606 S of NE cor for
POB, S 1739, W to W line of NE 1/4, N to a Pt 620
S of N Sec line, E to POB.

26-50-40 E 1/2 lying N of canal less Beg at NE cor,
S 2345, W to cir sec line, N 2345, E to POB & less
Beg at intersec of E/L Sec 26 & N/R/W/L of S New
River Canal, N alg E/L 561, W 775, S to N/R/W/L of
S New River Canal, E alg said R/W/L to POB.

Fla Fruit Lands Co Sub No 1 2-17 D 27-50-40 Tracts
1 thru Tract 15.

Fla Fruit Lands Co Sub No 1 2-17 D 27-50-40 Tracts
53, 54 and 55 less Canal R/W.

Fla Fruit Lands Sub No 1 2-17 D 27-50-40 Tract 46
less Canal R/W and Tract 47.

Fla Fruit Lands Sub No 1 2-17 D 27-50-40 Tract 49,
50, 51 less Canal R/W.

Fla Fruit Lands Sub No 1 2-17 D 27-50-40 Tract 62
less Canal R/W, 63, & 64.

All N of Canal R/W less S 400 ft. of E 435 ft. of
E 1245 ft. of W 1/2 of N 3/4 and less W 80 ft. of
E 1/2 of part of Sec. 28 lying N of N/R/W/L of C-11
Canal.

Fla Fruit Lands Co Sub No 1 2-17 D 21-50-40 Tract
49 to 64.

Lands owned by Pownall:

26-50-40 Beg at intersec E/L Sec 26 & N/R/W/L S New
River Canal, N alg E/L 350, W 200, S to N/R/W/L S
New River Canal E alg said R/W/L to POB.

all of which lands were owned by the Petitioners in this
cause, Imagination Farms Incorporated, or Henry B. Pownall
and Dooris C. Pownall.

3. The annexation procedures undertaken by the Town of
Davie were in compliance with the applicable laws of the
State of Florida and the annexation procedure undertaken
therein was proper and correct.

4. Since the annexation election of October 1, 1974,
the Town of Davie has been collecting a municipal utilities
tax of ten percent from Petitioners in this case, as a part
of its exercise of jurisdiction over the subject property.

5. However, the subject property above described and
owned by the Petitioners herein was at all times material
hereto agrarian in nature and predominantly used for agricultural
purposes and said lands were not urban in character and do
not at the present time nor at any time material hereto need
or require or stand to benefit from municipal services which
could or would be supplied by the Town of Davie.

6. The said lands owned by the Petitioners herein are
on the outer boundaries of the property which was annexed
pursuant to the ordinance and election procedure undertaken
by the Town of Davie and the removal of said lands from the

jurisdiction of the Town of Davie would not in any way disturb the consanguinity of the overall annexation or void or otherwise disturb properties other than those owned by the Petitioners.

7. Should the circumstances change and these lands, in the future, become urban in character and require municipal services, Petitioners and the Respondent have agreed that the Town of Davie would be better suited to annex such property than any other municipality. Both parties have agreed, if that eventuality occurs, to use their best efforts to facilitate annexation of their lands by the Town of Davie, rather than some other municipality. Such efforts may include, but are not limited to, use of the procedure for voluntary annexation as provided in Florida Statute 171.044.

Whereupon, it is ORDERED AND ADJUDGED:

1. That the annexation by the Town of Davie of the subject property is null and void, and its jurisdiction over such lands be and the same is hereby ousted ab initio to the date of the annexation election of October 1, 1974. The Town of Davie shall have no further jurisdiction over the subject property.

2. That the annexation procedures as to the other lands annexed under the annexation of October 1, 1974, are hereby approved, ratified and confirmed.

3. That each party shall bear their own attorneys' fees and costs incidental to this matter.

DONE AND ORDERED in Chambers in Fort Lauderdale, Broward County, Florida, this 3rd day of May, 1979.

GEORGE RICHARDSON, JR.

CIRCUIT JUDGE

cc: Attorneys of Record

A TRUE COPY

PLANT SPECIES LIST

List of vascular plants identified during field reconnaissance, June, 1983, of the US 441 Resource Recovery Facility site, Broward County, Florida. Nomenclature follows that of Godfrey and Wooten (1979, 1981), Long and Lakela (1971), or Lakela and Long (1976).

<u>Scientific Name</u>	<u>Common Name</u>
<u>Acalypha setosa</u>	(Three-seeded mercury)
<u>Acer rubrum</u>	Red maple
<u>Acrostichum danaeifolium</u>	Giant leather fern
<u>Agalinis fasciculata</u>	(Gerardia)
<u>Albizia lebbek</u>	Woman's tongue
<u>Alternanthera philoxeroides</u>	Alligator weed
<u>Amaranthus spinosus</u>	Spiny pigweed
<u>Ambrosia artemisiifolia</u>	Ragweed
<u>Ampelopsis arborea</u>	Pepper-vine
<u>Andropogon glaucopsis</u>	(Broomsedge)
<u>Andropogon virginicus</u> var. <u>abbreviatus</u>	(Broomsedge)
<u>Anemia adiantifolia</u>	Pine fern
<u>Annona glabra</u>	Pond-apple
<u>Apios americana</u>	Potato-bean
<u>Asclepias incarnata</u>	Swamp milkweed
<u>Aster</u> sp.	(Aster)
<u>Axonopus furcatus</u>	(Carpet grass)
<u>Baccharis glomeruliflora</u>	(Groundsel-tree)
<u>Bacopa caroliniana</u>	Blue-hyssop
<u>Bidens pilosa</u>	(Beggar ticks)
<u>Blechnum serrulatum</u>	(Blechnum fern)
<u>Boehmeria cylindrica</u>	Bog-hemp
<u>Borreria terminalis</u>	n.c.n.
<u>Buchnera floridana</u>	(Bluehearts)
<u>Bulbostylis ciliatifolia</u> var. <u>ciliatifolia</u>	n.c.n.
<u>Capraria biflora</u>	n.c.n.
<u>Casuarina equisetifolia</u>	Australian pine
<u>Centella asiatica</u>	False pennywort
<u>Cephalanthus occidentalis</u>	Cotton buttonbush
<u>Cestrum diurnum</u>	Day jessamine
<u>Chenopodium ambrosioides</u>	Mexican tea
<u>Chloris glauca</u>	Fingergrass
<u>Chrysobalanus icaco</u>	Cocoa-plum
<u>Cladium jamaicense</u>	Saw-grass
<u>Coccoloba uvifera</u>	Sea-grapes
<u>Commelina</u> sp.	(Dayflower)
<u>Conoclinium coelestinum</u>	Mistflower
<u>Conyza canadensis</u>	Dwarf horseweed
<u>Crinum americanum</u>	Swamp-lily
<u>Crotalaria retusa</u>	(Rattlebox)
<u>Cynanchum angustifolium</u>	(Sand-vine)
<u>Cyperus compressus</u>	(Galingale)
<u>Cyperus elegans</u>	(Galingale)
<u>Cyperus globulosus</u>	(Galingale)
<u>Cyperus haspan</u>	(Galingale)
<u>Cyperus ligularis</u>	(Galingale)
<u>Cyperus polystachyos</u>	(Galingale)

<u>Cyperus rotundus</u>	Nut-grass
<u>Cyperus sesquiflorus</u>	(Galingale)
<u>Cyperus strigosus</u>	(Galingale)
<u>Cyperus surinamensis</u>	(Galingale)
<u>Desmodium canum</u>	(Tick trefoil)
<u>Dichromena colorata</u>	White-top sedge
<u>Digitaria serotina</u>	(Crabgrass)
<u>Echinochloa crusgalli</u>	Barnyard grass
<u>Eclipta alba</u>	n.c.n.
<u>Eleocharis atropurpurea</u>	(Spikerush)
<u>Eleocharis cellulosa</u>	(Spikerush)
<u>Eleocharis interstincta</u>	(Spikerush)
<u>Eragrostis sp.</u>	(Love grass)
<u>Erechtites hieracifolia</u>	Fireweed
<u>Eremochloa ophiuroides</u>	Centipede grass
<u>Erianthus giganteus</u>	Giant plume grass
<u>Erigeron vernus</u>	(Fleabane)
<u>Eupatorium capillifolium</u>	Dog-fennel
<u>Eupatorium mikanioides</u>	(Boneset)
<u>Eustoma exaltatum</u>	Catchfly-gentian
<u>Ficus aurea</u>	Strangler fig
<u>Fimbristylis spathacea</u>	n.c.n.
<u>Fuirena squarrosa</u>	(Umbrella-grass)
<u>Galium tinctorium var. tinctorium</u>	(Bedstraw)
<u>Gaura angustifolia</u>	Southern gaura
<u>Heliotropium polyphyllum</u>	(Heliotrope)
<u>Heterotheca subaxillaris</u>	(Golden aster)
<u>Hydrocotyle umbellata</u>	(Water pennywort)
<u>Hydrolea corymbosa</u>	(Waterleaf)
<u>Hypericum brachyphyllum</u>	(St.-John's-wort)
<u>Hypericum myrtifolium</u>	(St.-John's-wort)
<u>Hypericum tetrapetalum</u>	(St.-John's-wort)
<u>Hyptis alata</u>	(Bitter mint)
<u>Ilex cassine</u>	Dahoon holly
<u>Ipomoea sagittata</u>	(Morning-glory)
<u>Juncus marginatus</u>	(Rush)
<u>Juncus megacephalus</u>	(Rush)
<u>Juncus polycephalus</u>	(Rush)
<u>Justicia ovata</u>	n.c.n.
<u>Kosteletzkya virginica</u>	Seashore marsh-mallow
<u>Lachnanthes caroliniana</u>	Red-root
<u>Lactuca intybacea</u>	Wild lettuce
<u>Lantana camara</u>	Shrub verbena
<u>Lantana involucrata</u>	(Lantana)
<u>Lepidium virginicum</u>	Pepper grass
<u>Ludwigia alata</u>	n.c.n.
<u>Ludwigia microcarpa</u>	n.c.n.
<u>Ludwigia peruviana</u>	Primrose-willow
<u>Lythrum lineare</u>	(Loosestrife)
<u>Manisurus rugosa</u>	(Jointgrass)
<u>Melaleuca quinquenervia</u>	Cajeput
<u>Melanthera angustifolia</u>	n.c.n.
<u>Metopium toxiferum</u>	Poison-tree
<u>Mikania scandens</u>	Climbing hempweed

<u>Mitreola petiolata</u>	(Miterwort)
<u>Myrica cerifera</u>	Wax-myrtle
<u>Myrsine guianensis</u>	Myrsine
<u>Osmunda regalis</u> var. <u>spectabilis</u>	Royal fern
<u>Oxalis corniculata</u>	Lady's sorrel
<u>Panicum hemitomon</u>	Maidencane
<u>Panicum repens</u>	Torpedo grass
<u>Panicum</u> sp.	(Panic grass)
<u>Parthenocissus quinquefolia</u>	Virginia creeper
<u>Paspalum dilatatum</u>	Dallis grass
<u>Paspalum distichum</u>	Knot-grass
<u>Paspalum floridanum</u>	Florida paspalum
<u>Paspalum urvillei</u>	Vasey grass
<u>Passiflora suberosa</u>	Corky-stemmed passionflower
<u>Peltandra virginica</u>	Green arum
<u>Persea palustris</u>	Swamp-bay
<u>Phlebodium aureum</u>	Golden polypody
<u>Phragmites australis</u>	Common reed
<u>Phyla nodiflora</u>	(Frog-fruits)
<u>Phyllanthus caroliniensis</u>	(Leaf-flowers)
<u>Physalis viscosa</u> ssp. <u>maritima</u>	(Ground cherry)
<u>Phytolacca americana</u>	Pokeweed
<u>Plantago major</u>	Common plantain
<u>Pluchea rosea</u> var. <u>rosea</u>	(Marsh-fleabane)
<u>Poinciana regia</u>	Royal poinciana
<u>Poinsettia heterophylla</u>	Painted leaf
<u>Polygala grandiflora</u>	(Milkwort)
<u>Polygonum punctatum</u>	(Smartweed)
<u>Polypremum procumbens</u>	n.c.n.
<u>Pontederia cordata</u> var. <u>lancifolia</u>	Lance-leaved pickerelweed
<u>Proserpinaca palustris</u>	(Mermaid-weed)
<u>Proserpinaca pectinata</u>	(Mermaid-weed)
<u>Psidium guajava</u>	Guava
<u>Psilotum nudum</u>	Whisk fern
<u>Psychotria undata</u>	(Wild coffee)
<u>Rhynchelytrum roseum</u>	Natal grass
<u>Rhynchospora caduca</u>	(Beak-rush)
<u>Rhynchospora inundata</u>	(Beak-rush)
<u>Roystonea elata</u>	Royal palm
<u>Sabal palmetto</u>	Cabbage palmetto
<u>Sagittaria lancifolia</u>	(Arrowhead)
<u>Sagittaria latifolia</u> var. <u>latifolia</u>	Common arrowhead
<u>Salix caroliniana</u>	Carolina willow
<u>Sambucus canadensis</u>	Elderberry
<u>Sarcostemma clausum</u>	Milk withe
<u>Saururus cernuus</u>	Lizard's-tail
<u>Schinus terebinthifolius</u>	Brazilian pepper
<u>Scleria verticillata</u>	(Nut-rush)
<u>Setaria geniculata</u>	Knotroot bristlegrass
<u>Sida acuta</u>	n.c.n.
<u>Sida rhombifolia</u>	n.c.n.
<u>Smilax laurifolia</u>	Bamboo-vine
<u>Solanum americanum</u>	Common nightshade
<u>Sonchus oleraceus</u>	Common sow thistle

Sporobolus indicus
Sporobolus poiretii
Stachytarpheta jamaicensis
Taxodium ascendens
Teuchrium canadense
Thelypteris kunthii
Thelypteris palustris
Tillandsia fasciculata
Tillandsia polystachia
Tillandsia recurvata
Tillandsia setacea
Toxicodendron radicans
Trema micrantha
Trifolium repens
Typha angustifolia
Typha domingensis
Typha latifolia
Urena lobata
Verbesina virginica
Vitis aestivalis
Vitis rotundifolia
Wedelia trilobata
Xyris sp.
Zizaniopsis miliacea

Smutgrass
(Dropseed)
Blue porterweed
Cypress
Germander
Kunth's shield fern
Marsh-fern
n.c.n.
n.c.n.
Ball moss
n.c.n.
Poison ivy
Florida trema
White clover
Narrowleaf cat-tail
Southern cat-tail
Common cat-tail
Bur mallow
Frost-weed
Summer grape
Muscadine grape
n.c.n.
(Yellow-eyed grass)
Water millet

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Miami Airports District Office
Post Office Box 59-2014
Miami, Florida 33159

JAN 2 1983

1983 JAN 10 PM 2:25
SOLID WASTE DIVISION

Mr. Edward J. Jablonowski, Director
Broward County Solid Waste Division
Governor's Club - Room 526
236 S.E. First Avenue
Fort Lauderdale, Florida 33301

Dear Mr. Jablonowski:

This responds to your November 18, 1982, letter inquiring about Federal Aviation Administration comments regarding the establishment of a mass-burning resource recovery facility adjacent to U.S. Route 441 between State Road 84 and the south fork of the New River Canal.

At that location it is our understanding that the site would be at least 10,000 feet west from the nearest point of the nearest runway at Fort Lauderdale-Hollywood International Airport.

On December 17, 1982, Mr. Ron Mills of Malcolm Pirnie, the Environmental Engineer for this project, was called by Mr. Lee Guenther for clarification of your letter. He said there were about 25 mass burn technology facilities in operation in the U.S.A. One is in Saugus, Massachusetts, operated by Refuse Energy Systems Company. He provided the following information:

1. The unprocessable trash to be landfilled is non-combustible material such as construction debris, cans, etc. This material will contain less than .2% putrescible material. This landfill will be covered daily.
2. The tipping and sorting will be under cover and completely enclosed. The building will have doors which can be closed in the event of a temporary breakdown. In the event of a prolonged breakdown of the facility, the garbage will be trucked to the landfill in Pompano.
3. The ash goes through a quenching tank to cool it. When it leaves the tank it contains 30% moisture by weight, therefore it does not cause a dust problem and has no attraction to birds. It will be placed in lined pits. Periodically this will be covered. Rain water may cause these pits to pond. (However, with all the other bodies of water now existing near the site, this should not be a problem. Writer's note.)

Page No. 2

4. All the packers and trucks will be covered. The only uncovered material coming into the facility will be in private vehicles such as pick-up trucks.

Provided the operation is conducted as Mr. Mills outlined, this facility should not create a greater bird problem than now exists. The attraction of birds is our greatest concern in waste disposal operations.

A few suggestions are offered:

1. Any accidental spills outside the facility should be cleaned up immediately.
2. The sponsor should be prepared, when the facility starts operation, to scare away any birds. If birds are not permitted to develop a habit of flocking there, they will stay away.

The enclosed FAA Form 7460-1 should be completed so that all of the aeronautical impacts of the proposed facility can be determined. This review has been preliminary and concerns for the heights of building and structures or possible vision and other hazards were not considered.

Please let me know if you have any questions concerning this matter.

Sincerely,



Steve Nelson
Airport Planning and
Development Specialist

Enclosure

File

Broward Co RR Project

MALCOLM
PIRNIE

MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

June 24, 1982

FAA Southern Regional Office
P.O. Box 20636
Atlanta, GA 30320

Attention: Mr. Carl Stokoe,
Airspace Specialist/ASO-530

Re: Proposed Resource Recovery Facility to be
located in Broward County, Florida

Gentlemen:

This letter confirms our telephone conversations on April 21 and June 21, 1982, during which FAA limitations that may apply to the subject project were informally discussed.

Per our discussion, the proposed resource recovery facility site is within 3 nautical miles of the Hollywood/Ft. Lauderdale airport reference point. Therefore, the facility stack must be no higher than 200 feet above grade (Part 77.23(a)(2) of the DOT Federal Aviation Regulations).

Given the above 200 feet above grade limitation, the stack should also pose no problem with respect to any of the VOR approach patterns to runway 9L at the Ft. Lauderdale airport. This is based on preliminary calculations which indicate that a 260 foot stack height limitation would apply to the proposed site in order to provide the required 300 foot buffer beneath the minimum allowable aircraft altitude of 560 feet over the site.

-2-

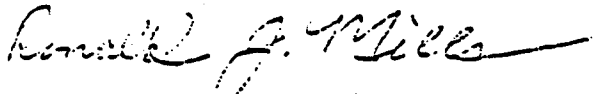
MALCOLM
PIRNIE

With respect to other air navigation obstruction standards specified in the FAA Regulations, such as height limitations to comply with Precision Instrument Approach Pattern imaginary surfaces, the proposed facility appears to meet applicable requirements.

If the above information is contrary to your understanding of the issues discussed, please contact me at your earliest convenience. We thank you for your assistance.

Sincerely,

MALCOLM PIRNIE, INC.



Ronald J. Mills
Project Scientist

RJM/pas

RECEIVED

AUG 11 1983

HAZEN & SAWYER, P.C.
Hollywood, Fla.



ATTACHMENT 11
Page 1 of 2

FLORIDA DEPARTMENT OF STATE

George Firestone
Secretary of State

DIVISION OF ARCHIVES,
HISTORY AND RECORDS MANAGEMENT
The Capitol, Tallahassee, Florida 32301
(904) 488-1480

July 22, 1983

In Reply Refer to:

Louis D. Tesar
Historic Preservationist
(904) 487-2333

Mr. Rhodes Robinson, Vice President
Coastal Zone Resources, Inc.
1001 U.S. Highway 1, Suite 305
Jupiter, Florida 33458

RE: Your Letter of June 28, 1983
Cultural Resource Assessment Request
Proposed Development of Two Resource Recovery Facilities and
Associated Landfills, Broward County, Florida

Dear Mr. Robinson:

In accordance with the procedures contained in 36 C.F.R., Part 800 ("Procedures for the Protection of Historic and Cultural Properties"), we have reviewed the above referenced project for possible impact to archaeological and historical sites or properties listed, or eligible for listing, in the National Register of Historic Places. The authorities for these procedures are the National Historic Preservation Act of 1966 (Public Law 89-665) as amended by P.L. 91-243, P.L. 93-54, P.L. 94-422, P.L. 94-458 and P.L. 96-515, and Presidential Executive Order 11593 ("Protection and Enhancement of the Cultural Environment").

A review of the Florida Master Site File indicates that no archaeological or historical sites are recorded for the project area. Furthermore, because of the location of the project, it is considered highly unlikely that any significant, unrecorded sites exist in the vicinity. Therefore, it is the opinion of this office that the proposed project will have no effect on any sites listed, or eligible for listing, in the National Register of Historic Places, or otherwise of national, state or local significance.

Mr. Rhodes Robinson
July 8, 1983
Page Two

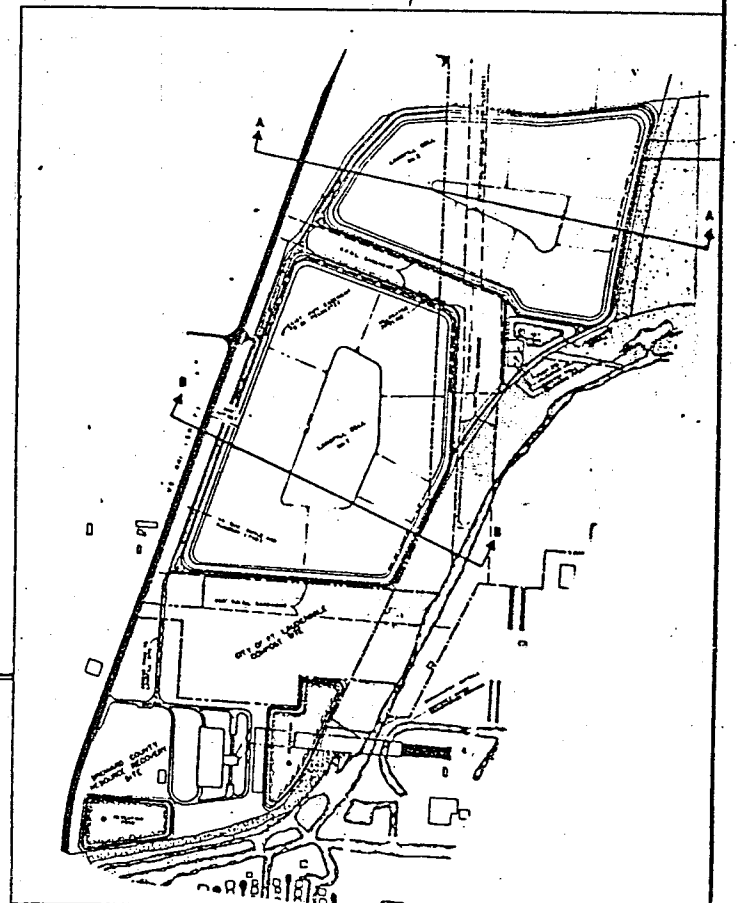
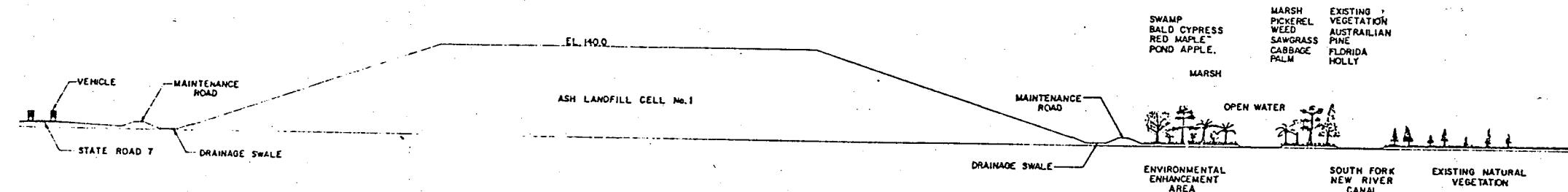
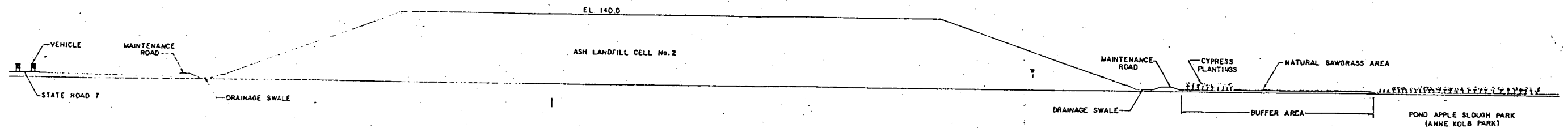
If you have any questions concerning our comments, please do not hesitate to contact us.

Your interest and cooperation in helping to protect Florida's archaeological and historical resources are appreciated.

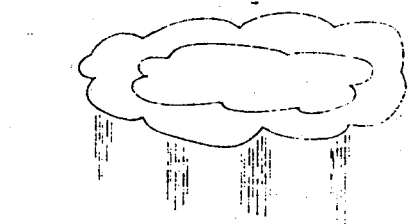
Sincerely,

George W. Percy
State Historic
Preservation Officer

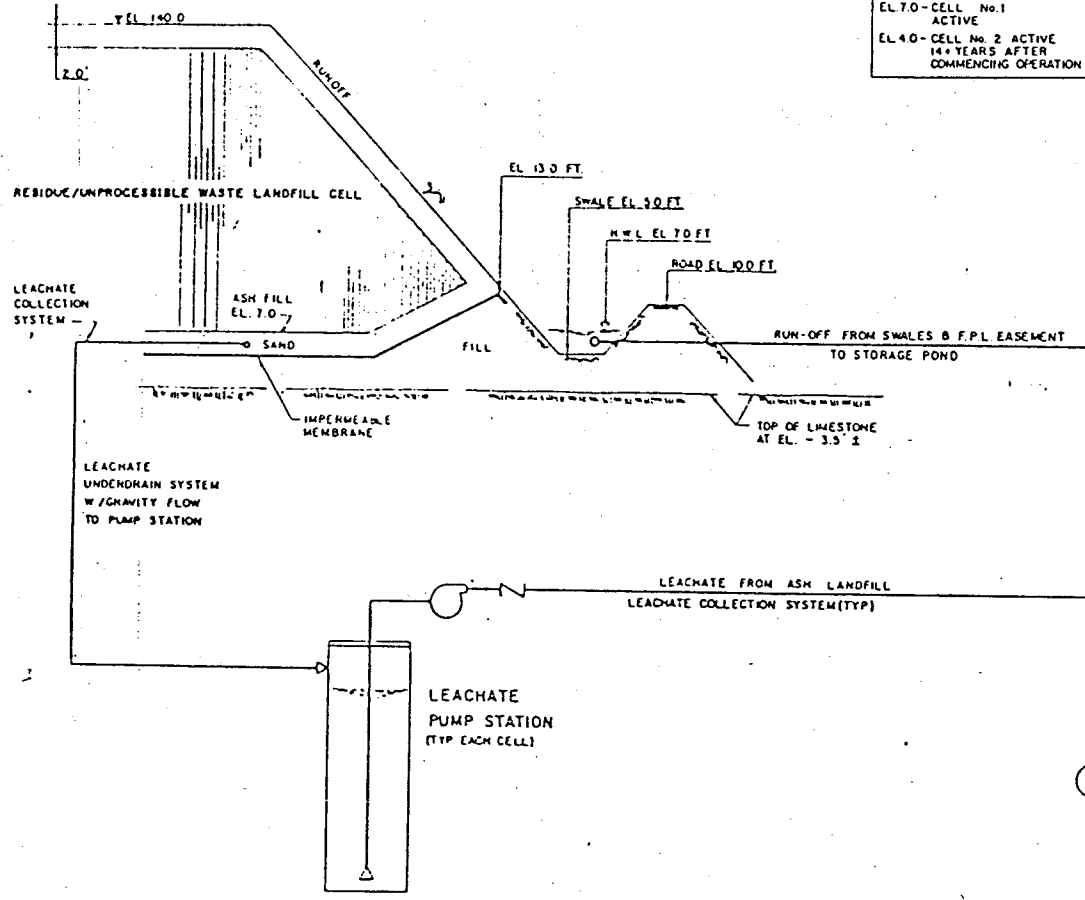
GWP:Teb



				DESIGNED <u>PAD</u>	HAZEN AND SAWYER ENGINEERS	SCALE <u>1" = 100'</u>	CONTRACT:	BOARD OF COUNTY COMMISSIONERS	SOLID WASTE DIVISION	PLATE 2
3	9-12-83	FDER/COE APPLICATION	PER	DRAWN <u>JMF</u>			CLIENTS PROJECT:	BROWARD COUNTY, FLORIDA	RESOURCE RECOVERY	DATE: <u>SEPT. 12, 1983</u>
2	7-15-83	OFFICE OF PLANNING	PER	CHECKED						SHEET: <u> </u> OF <u> </u>
1	2-10-83	BROWARD COUNTY REVIEW	PER	PROJ ENGR <u>PER</u>						DRAWING: <u>9154-01</u>
NO.	DATE	ISSUED FOR	BY							
				PETER E ROBINSON No 19277	P. E.	MIAMI - HOLLYWOOD - RALEIGH - NEW YORK - MOUNT KISCO	TRUE SCALE SECTIONS THROUGH PROJECT SITE			

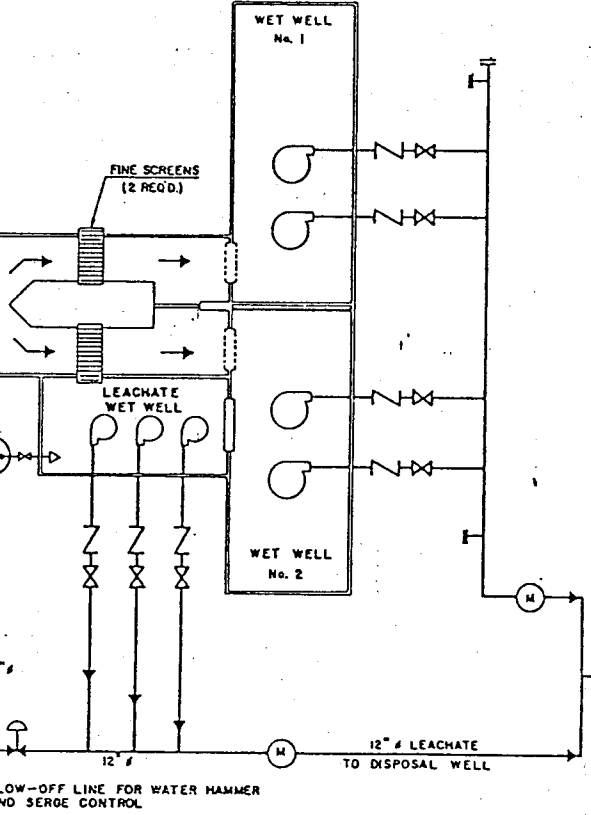
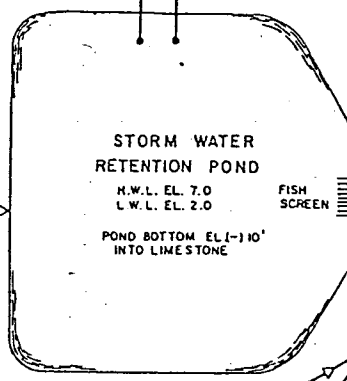
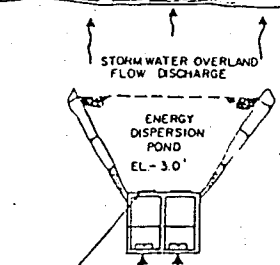


FINAL 2 FOOT COVER (CAPPING)
 - 12 INCHES PLANTING SOIL W/VEGETATIVE COVER
 - 6 INCHES BENTONITE SOIL MIXTURE (IMPERMEABLE)
 - 6 INCHES CRUSHED LIMESTONE



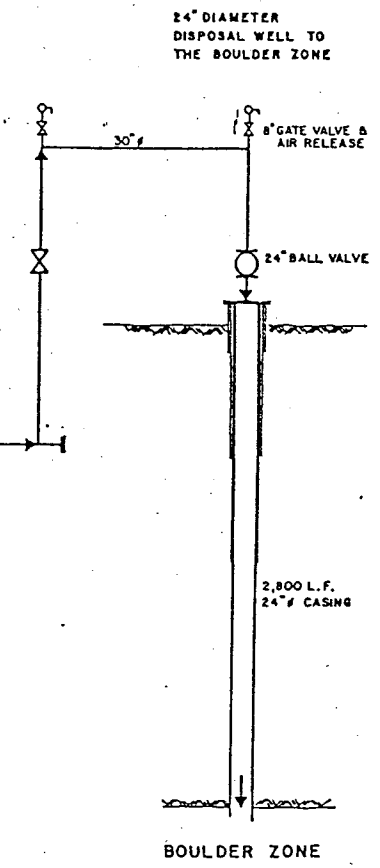
SOUTH FORK OF NEW RIVER CANAL
 TIDAL ELEVATIONS
 H.W.L. EL. + 1.65 FT
 L.W.L. EL. - 0.02 FT

DISCHARGE STRUCTURE WEIR SETTING
 EL 7.0 - CELL No. 1 ACTIVE
 EL 4.0 - CELL No. 2 ACTIVE 14+ YEARS AFTER COMMENCING OPERATION



- LEGEND
- SURGE RELIEF VALVE
 - BUTTERFLY VALVE NORMALLY OPEN
 - BUTTERFLY VALVE NORMALLY CLOSED
 - AIR RELEASE VALVE
 - CHECK VALVE
 - PUMP
 - SLIDE OR SLUICE GATE
 - FLOW METER

STORM WATER DISCHARGE
 FIRST 14+ YEARS ALL RUN-OFF CAPTURED ON SITE WILL BE RETAINED ON SITE OR PUMPED INTO THE DISPOSAL WELL.

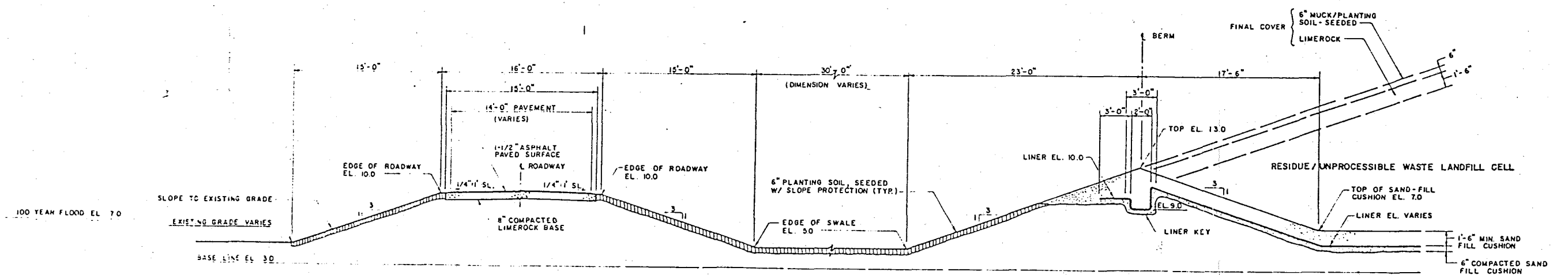


EL. 7.0 FT. - 100 YEAR FLOOD ELEVATION

SCREEN AND PUMP FACILITIES

NOTE: ALL ELEVATIONS AT NGVD

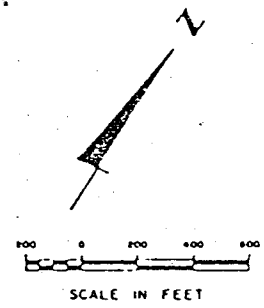
DESIGNED PER				HAZEN AND SAWYER, P.C. ENGINEERS				BOARD OF COUNTY COMMISSIONERS BROWARD COUNTY, FLORIDA				SOLID WASTE DIVISION RESOURCE RECOVERY		DATE: SEPT 12, 1983	
DRAWN JME				CHECKED PAD				ENGINEERS PROJECT: 9154				STORM WATER AND LEACHATE FLOW DIAGRAM		SHEET: OF	
7-15-83 OFFICE OF PLANNING				PETER E. ROBINSON P.E. 15277				MIAMI - HOLLYWOOD - DALEIGH - NEW YORK - MOUNT KISCO				DRAWING: 9154-01		PLATE 3	
7-15-83				BY											



TYPICAL SECTION THROUGH PERIMETER DIKE

PLATE 4
441 SITE

DESIGNED	PAD	HAZEN AND SAWYER, P.C. ENGINEERS	SCALE	CONTRACT	BOARD OF COUNTY COMMISSIONERS BROWARD COUNTY, FLORIDA	SOLID WASTE DIVISION RESOURCE RECOVERY	DATE: SEPT. 12, 1983
DRAWN	JMF		AS NOTED	CLIENTS PROJECT			SHEET: _____ OF _____
CHECKED	PER			ENGINEERS PROJECT: 9154	RESIDUE/UNPROCESSIBLE WASTE LANDFILL CELL - SECTION		DRAWING: 9154-01
NO	DATE	ISSUED FOR	BY				



COMPILATION FROM:
POWELL BROTHERS INDUSTRIAL
PARK PLAT, CITY OF FT.
LAUDERDALE, BLUDGE COMPOST
SITE TOPO, GRIFFEY TRACT
TOPO, FLORIDA D.O.I. TOPO
SECTIONS, U.S.G.S.

PLATE 5

				DESIGNED _____		HAZEN AND SAWYER ENGINEERS	SCALE 1" = 300'	CONTRACT: RESOURCE RECOVERY		BOARD OF COUNTY COMMISSIONERS BROWARD COUNTY, FLORIDA	SOLID WASTE DIVISION RESOURCE RECOVERY	DATE: SEPT 12, 1983 SHEET: 2 DRAWING: 9154-01
3	9-2-83	PERMIT APPLICATION	P.E.H.	DRWN								
2	7-15-83	OFFICE OF PLANNING	P.E.H.	CHECKED				EPA PROJECT				
1	2-22-83	BROWARD COUNTY REVIEW	P.E.H.	PROJ. ENGR				ENGINEERS PROJECT 9154				
NO	DATE	PAID FOR	BY			MIAMI HOLLYWOOD PALM BEACH NEW YORK MOUNT KISCO		PRELIMINARY TOPOGRAPHY OF ROUTE 441 SITE				

SCIENTIFIC NAME	1		2		3		4		5		6		7		8	
	T	MA	T	MA	T	MA	T	MA	T	MA	T	MA	T	MA	T	MA
<i>Acacia robusta</i>	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
<i>Adiantum quercifolium</i>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<i>Cestrum diurnum</i>																
<i>Chrysobalanus icaco</i>			2	2			1	1					1	1		
<i>Coccoloba uvifera</i>					1	1	1									
<i>Ficus aurea</i>			20	20	1	1	22	22					6	5	9	4
<i>Ficus elastica</i>					1	1										
<i>Ficus sp.</i>					1	1										
<i>Ilex cassine</i>			13	8	33		5	2	4						2	0
<i>Mangifera indica</i>									1							
<i>Metopium toxiferum</i>			43	43			5	2								
<i>Myrica cerifera</i>			22	18	27		79	40	110	41	19	206	87	111	0	
<i>Myrsine guianensis</i>			17	16	65		57	15	98	14	13			8	2	
<i>Persea palustris</i>			206	153	144		42	18	148	23	21	22	10	15	1	
<i>Prunus caroliniana</i>			2	7												
<i>Psidium guajava</i>															1	1
<i>Roystonia elata</i>							12	10	1	1	1	12	4	1	1	
<i>Sabal palmetto</i>	201	77	20	20	28		38	12	9	2	1	2	2			
<i>Salix caroliniana</i>			7	7	3		24	5	29	20	2	43	14	45	2	
<i>Taxodium ascendens</i>			16	16	4		41	8		5	5	1	1			
<i>Terminalia catappa</i>							1	1								
<i>Thespesia populnea</i>																
<i>Trema micrantha</i>	1														4	0
<i>Washingtonia robusta</i>															4	1
T = Total MA = Mitigation area (Trees preserved)																

NOTE:
CIRCLES INDICATE LOCATIONS OF TREES AND CLUMPS OF TREES
TABLE INDICATES TOTAL NUMBER OF TREES PER COMPARTMENT
AND TOTAL NUMBER OF TREES IN THE MITIGATION AREA WHICH
WILL BE SAVED.

DESIGNED _____		HAZEN AND SAWYER, P.C. ENGINEERS		SCALE 1" = 300'		CONTRACT: CLIENTS PROJECT:		BOARD OF COUNTY COMMISSIONERS BROWARD COUNTY, FLORIDA		SOLID WASTE DIVISION RESOURCE RECOVERY		DATE: SEPT. 12, 1983 SHEET: _____ OF _____	
DRAWN _____												9154-01	
CHECKED _____													
PROJ. ENGR. _____													

PLATE 6



DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232

SKB → RJM

REPLY TO
ATTENTION OF

Regulatory Division
Permits Branch
83B-3304 & 83B-3305

FEB 16 1984

Ms. Phyllis A. Korab
Broward County
236 Southeast First Avenue, Room 526
Fort Lauderdale, Florida 33301

Dear Ms. Korab:

This letter refers to your Department of the Army permit applications for placing fill material in waters of the United States, wetlands adjacent to the South Fork New River Canal east of U.S. Highway 441, Broward County, Florida, associated with construction of the county's Southern Resource Recovery Facility.

A list of the comments received during the public notice is enclosed. The U.S. Fish and Wildlife Service, Environmental Protection Agency, National Marine Fisheries Service, Florida Game and Freshwater Fish Commission, Broward County Audubon Society, Mr. S. T. Hogg, and Mr. Wilfred A. Bost have recommended the permit be denied. Please review and provide a written response to the comments.

These representatives of the general public have indicated a desire to further explore the practicability of available alternatives and/or mitigative measures and, in the case of local groups and citizens, to express their concerns in public hearing; therefore:

In addition to your response to the comments, please provide a discussion of the following items:

- a. The public and private need for the project and the benefits to be derived.

b. Why the proposed fill and the activity associated with it must be located in the wetland resource.

c. Alternate sites and site plans that have been considered and why alternatives are not feasible. Among the alternatives which could be discussed in response to this item is whether Broward County would be willing to defer construction of that portion of landfill cell number 2/3, east of the Florida Power and Light Company easement for approximately ten years while the potential of alternatives thereto may be explored and considered.

All the above information must be provided for us to complete our public interest review. Any other information you feel may be helpful in order to fully justify the project should also be submitted at this time. Your application will be held in abeyance for 20 days pending receipt of your response. If we do not hear from you within 20 days, we will initiate final action without your response. Final action may be issuance, denial, or deactivation of your Department of the Army permit application. Any questions concerning the application should be directed to Mr. Vic Anderson at the letterhead address or by telephone at (904) 791-1664.

Sincerely,

Bertil A. Heimer
Chief, Permits Branch

Enclosure

Copy Furnished:

✓ Mr. Peter E. Robinson, Vice President
Hazel and Sawyer, P.C.
5950 Washington Street
Hollywood, Florida 33023



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

JAN 23 1984

4PM-EA/EHH

Colonel Alfred B. Devereaux, Jr.
District Engineer
U.S. Army Corps of Engineers, Jacksonville
P.O. Box 4970
Jacksonville, Florida 32232

ATTENTION: Vic Anderson

SUBJECT: Broward County
(Permit Application Nos. 83B-3304 & 83B-3305)

Dear Colonel Devereaux:

This is in response to the above referenced public notices regarding proposed construction of solid waste recovery and landfill facilities in wetlands adjacent to the South New River Canal, Broward County, Florida. The applicant proposes to fill 15.6 acres of wetlands at the 18.4 acre County Southern Resource Recovery site to construct a mass-burn incinerator complex designed to process 1,300 tons per day of municipal solid waste. The applicant proposes to mitigate for onsite wetland filling by creating 15 acres of tidal wetlands adjacent to the South New River Canal.

The proposed County Southern Residue/Unprocessable Waste Landfill facility will be constructed by placing 1,570,000 cubic yards of limestone and sand fill over 133 acres of wetlands at the 152 acre site. This diked incinerator residue and disposal cell and retention pond complex would receive 710-965 tons per day of ash residue and unprocessable waste from the Resource Recovery Facility incinerator. Each landfill cell will be lined with an impermeable membrane and surrounded by +9' MSL berms and roadways and internal stormwater swales. To compensate for the proposed 133 acres of wetland filling, the applicant proposes to preserve and enhance 14 acres of adjacent marsh, create 18 acres of tidal wetland adjacent to the South New River Canal and create an additional 15.5 acres of wetlands offsite.

Based on information provided to us by Federal, State and County biologists, environmental engineers and planners familiar with the proposal and the project site, and our review of the reports concerning the proposed project prepared by the applicant's environmental consultant, EPA has serious surface and groundwater

quality and wetland concerns with the proposed project. A member of my staff inspected the adjacent City of Fort Lauderdale regional sewage sludge composting facility site in December 1982, so we are somewhat familiar with the wetland habitat types at the resource recovery site.

Section 404(b) Guidelines state that from a national perspective, the degradation or destruction of aquatic resources by filling operations in wetlands is considered the most severe environmental impact covered by the guidelines. Filling in wetlands may be permitted only when it can be demonstrated that the site selected is the least environmentally damaging alternative or if the applicant can demonstrate that other alternatives are not practicable and that wetland filling will not have an unacceptable adverse impact on the aquatic resource. The proposed project involves filling approximately 148 acres of wetlands adjacent to the South New River Canal, a riverine system which has been seriously degraded by numerous man-related filling, drainage, channelization and effluent impacts. The wetland habitat types proposed for filling vary considerably in quality across the site, ranging from stressed at the southern incinerator area to highly productive at the northeastern proposed landfill portion of the project site.

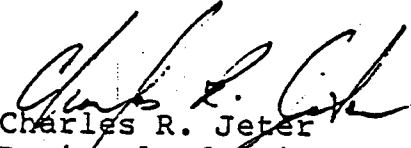
Since the proposed project is not water dependent, in order for the proposed project to be in compliance with Section 404(b) Guidelines, the applicant must convincingly show that alternative upland site locations are not practicable for project construction and that project construction will not result in unacceptable adverse impacts to the aquatic resource. EPA feels that the applicant has failed to convincingly demonstrate that the proposed project is in compliance with the 404(b) Guidelines on either of these crucial tests. The short and long-term environmental impacts of construction, operation and maintenance of solid waste landfills in wetlands are not preferable to siting of such landfills at upland locations. However, if you concur with the applicant's determination that practicable upland locations are not available, EPA would not object to the issuance of a permit for the resource recovery facility (83B-3304) provided that stringent erosion/turbidity control measures are installed and maintained during project construction and the proposed mitigation plan is installed concurrently with project construction.

Regardless of your practicable alternatives evaluation, EPA strongly feels that the direct wetland impacts and potential long-term surface and groundwater degradation associated with construction and operation of the landfill facility (83B-3305), as it is currently proposed, are unacceptable. The existing sawgrass marsh-hardwood swamp wetland systems east of the Florida Power and Light Company (FPL) north-south powerline at the proposed landfill site are highly productive and very valuable. This 45-50 acre wetland area is one of the last remaining functional wetland systems adjacent

to the South New River Canal in the highly urbanized Ft. Lauderdale region. These wetlands serve many beneficial ecological functions: including providing fish and wildlife habitat; hydrological buffering; groundwater exchange; water purification; pollution and erosion traps; and, food chain production. Wetlands are a valuable public resource and this Agency takes a strong stand against unnecessary filling, dredging or otherwise altering of this already diminishing habitat. Therefore, EPA recommends for the denial of any filling east of the FP&L north-south powerline at the proposed landfill (83B-3305) site. We also feel that the currently proposed mitigation plan for the landfill site is inadequate and that any permitted wetland filling should be mitigated by at least 1:1 wetland creation, preferably at the project site. An acceptable mitigation plan should be coordinated with and approved by this office and the U.S. Fish and Wildlife Service.

A member of my staff will be inspecting the landfill and resource recovery sites during the week of January 30th in the company of the applicant's environmental consultant. We will provide you with any additional comments concerning this project in early February. Thank you for providing us with this opportunity to comment on these projects.

Sincerely yours,


Charles R. Jeter
Regional Administrator

*degraded
damaged
condition* 74/ acres - *Everglades Restoration Area*
- restored - *upland site restored to wetlands*
1 1/2 mi east of

15.5
74
89.5

cc: Ms. Victoria J. Tschinkel, Secretary
Florida Department of Environmental Regulation
Attn: Jeremy Craft, Dan Garlick

Mr. Joe Carroll, Field Supervisor
U.S. Fish and Wildlife Service
Vero Beach, Florida
Attn: Joe Johnston

Dr. Edward Keppner, Field Supervisor
National Marine Fisheries Service
Panama City, Florida

Mr. J.T. Brawner, Regional Director
National Marine fisheries Service
St. Petersburg, Florida

Mr. John Guidry
DER
3301 Gun Club Rd.
P.O. Box 3858
W. Palm Beach, Florida 33402
Attn: Larry O'Donnell

Ms. Phyllis Korab
Resource Recovery Office
Board of County Commissioners
Room 526
236 S.E. First Avenue
Ft. Lauderdale, Florida 33301
Attn: Diane Moore, Jim Elias

Peter Robinson, P.E.
Hazen and Sawyer, P.C.
5950 Washington St.
Suite 301
Hollywood, Florida 33023
Attn: Jim Hudgens, Rhodes Robinson

Dick Rogers
South Florida Water Management District
P. O. Box V
West Palm Beach, FLA 33402



United States Department of the Interior
FISH AND WILDLIFE SERVICE

P.O. Box 2676
Vero Beach, Florida 32961-2676

January 23, 1984

District Engineer
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232

Dear Sir:

By notice, 83B-3305, dated December 15, 1983, you requested our comments on a Department of the Army permit application. The applicant, Broward County, proposes to fill wetlands with ash residue from a Resource Recovery Facility. The project is located adjacent to the South New River Canal, Broward County, Florida. This report is submitted in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

This project site is adjacent to Public Notice 83B-3304 (to which we registered no objection) a site which is to be used for the construction of the Resource Recovery Facility. The byproduct of this neighboring facility will be placed on the area of this application. The landfill site totals 152 acres and is bordered on the southeast by the South New River Canal, on the west by U.S. Highway 441, on the north by State Road 84, and on the east by "Anne Kolb Park". This project calls for the construction of dikes to contain the ash from the incinerator. The ash would be stacked to an elevation of about 140 feet above mean sea level providing capacity until the year 2007.

The purpose of the project is to provide an area for the disposal of ash from incineration of municipal garbage from Broward County.

Habitat types on the site, according to the applicant's consultant, include 132 acres of wetlands and 20 acres of uplands. The wetlands are predominantly shrub wetlands (Palustrine shrub/scrub broadleaf evergreen), about 80 acres. The remainder is sawgrass/cattail marsh (Palustrine emergent persistent).

A Fish and Wildlife Service biologist conducted an onsite inspection of the project site on January 10, 1984. The majority of the site is upland and wax myrtle thicket with about 40 acres of the proposed fill area a sawgrass/cattail marsh. Land elevation in the sawgrass area is about 1.2 feet mean sea level and there is no direct surface water connection to the South New River canal to the south. This canal is tidally influenced at this point with high water about 1.1 feet mean sea level. Vegetation in the sawgrass area includes some Andropogon and Melaleuca invasion at the slightly higher land elevations. There was some standing water in the cattails and depressions in the sawgrass but the majority of the site had no surface water at the time of the inspection. Land crabs, and herons and egrets were observed in the sawgrass.

This project will result in the destruction of about 40 acres of functional, sawgrass wetlands. These areas provide valuable services to man in the storage of runoff, removal of nutrients from the water, and production of fish and wildlife resources. The elimination of this area carries more significance because there are few wetlands remaining in urban Broward County, and they provide valuable educational and aesthetic as well as functional benefits.

The mitigation proposed for this project does not adequately offset project damages. The creation of the 15.5 acres of marsh in the Tree Tops Park area is acceptable but the work to be done in the landfill area needs to be evaluated in more detail to assure that the removal of the berm along the South New River Canal will not adversely impact or cause drainage of the wetland that is to be preserved. If the water levels and the land elevations are compatible to maintain a long enough hydroperiod for the preserved wetlands, then this portion of mitigation would be acceptable, otherwise it is not. Overall, we believe the mitigation proposal does not compensate for the loss of the wetlands proposed. We have talked with the applicant's consultant and they are willing to work with the agencies in developing adequate mitigation for the proposed loss of wetlands.

We believe that more adequate mitigation is possible for this project but that additional time is required to work out appropriate mitigation plans. Therefore, we recommend that the permit be denied unless adequate mitigation is proposed.

This report represents the views of the Department of the Interior. Please keep us advised as to your actions on this project.

Sincerely yours,

Joseph D. Carroly, Jr.
Field Supervisor

Army.

excavation
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el. 1.5
at mean high water
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cc:

EPA, Atlanta, Ga.

NMFS, St. Petersburg, Fla.

NMFS, Panama City, Fla.

FG&FWFC, Tallahassee, Fla.

FG&FWFC, Vero Beach, Fla.

DER, Tallahassee, Fla.

CE, Miami, Fla.

ARD-HP, FWS, Atlanta, Ga.

Comments received on Public Notice
Permit Application Numbers 83B-3304 and 83B-3305 (copies attached)

Environmental Protection Agency letter dated January 23, 1984
Fish and Wildlife Service letter dated January 23, 1984
National Marine Fisheries Service letter dated January 4, 1984
Mr. S. T. Hogg letter dated December 23, 1983
Florida Gas Transmission Company letter dated December 21, 1983
Florida State Historic Preservation Office letter dated
December 28, 1983
Wilfred A. Bost letter dated January 10, 1984
South Florida Regional Planning Council letters dated January 10,
19, and 27, 1984
Broward County Audubon Society letter dated January 11, 1984
Florida Game and Fresh Water Fish Commission letter dated
January 23, 1984

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Region
9450 Koger Boulevard
St. Petersburg, FL 33702

January 4, 1984

F/SER113/GLN
904 234-5061

Colonel Alfred B. Devereaux, Jr.
District Engineer, Jacksonville District
Department of the Army, Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232

Dear Colonel Devereaux:

The National Marine Fisheries Service has reviewed Public Notice No. 83B-3304 and 83B-3305 dated December 15, 1983. Broward County proposes to fill wetlands adjacent to the South New River for a non-water dependent resource recovery facility in Broward County, Florida.

Based on an October 18-19, 1983, on-site survey and information provided by the applicant's consultant regarding site, it appears that about 150 acres of marsh and wooded swamp flood plain of the South New River will be filled by project construction and the subsequent placement of ash. These wetlands provide seasonal feeding and nursery areas for important migratory commercial and recreational fish and shellfish, detritus for estuarine food chains, and promote good water quality by filtering upland runoff.

The proposed project is not water dependent and could be constructed on an upland site. Since several upland sites are available in the area, the project does not appear to conform with Section 404b guidelines for wetland fill. The project could be better constructed on uplands which could require no additional fill. The site 4 (Davie site) provides a suitable alternative in an upland cattle pasture. In addition, areas west of the Davie site in sections 17, 18, 19, 20, 29 and 30 are cattle pastures that could be used as an upland site (NMFS map I).

Therefore, we recommend that this permit be denied and that the applicant construct the facility on the uplands which are currently available.

Sincerely yours,

Edward J. Hoogland

for Richard J. Hoogland
Chief, Environmental Assessment Branch



NME'S MAP I 10/24/83
BROWARD COUNTY LANDFILL PERMIT
(UPDATE 1/3/87)

CONSERVATION AREA NO. 2B

LAUDERHILL Pop. 8,005

TAMARAC Pop. 1,076

LAUDERDALE LAKES Pop. 10,570

SUNRISE Pop. 7,403

PLANTATION Pop. 23,373

COOPER CITY Pop. 2,335

DAVIE Pop. 2,856

PEBROKE PINES Pop. 10,820

HOLLYWOOD Pop. 106,871

Site 4 DAVIE

NME'S PROPOSED ALTERNATIVE SITE

North New River Canal

Middle River Canal

South New River Canal

Plantation Acres

SEE INSET A: Melancon Isles

FERN CREST VILLAGE

ST. LAUDERDALE DELIMITED URBAN COMPACT AREA

DAVIE SEMINOLE INDIAN RESERVATION

MIAMI SPEEDWAY PARK

HOLLYWOOD INTERCHANGE

SEABOARD

US 95

US 82

US 817

US 818

US 848

US 820

US 822

US 816

US 441

US 7

US 9

US 14

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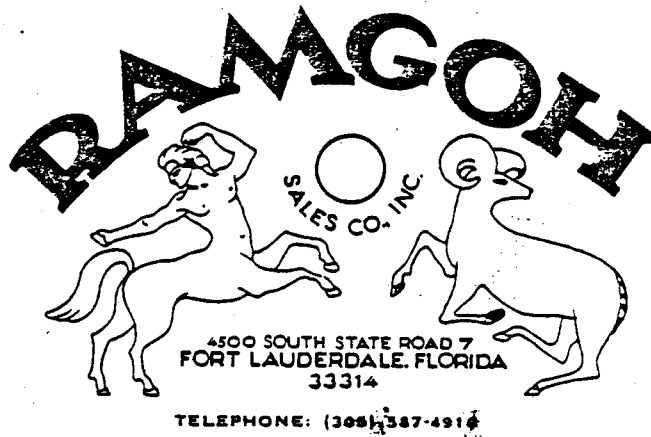
US 321

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NMFS
PROPOSED
ALTERNATIVE
SITE



December 23, 1983

Department of the Army
Jacksonville District
Corps of Engineers
P.O. Box 4970
Jacksonville, Fla. 33232

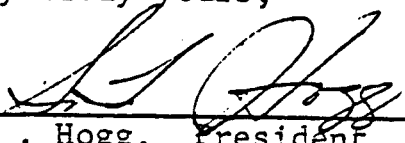
Ref: Permit # 83B-3304 & 83B-3305

Att: Mr. Vic Anderson,

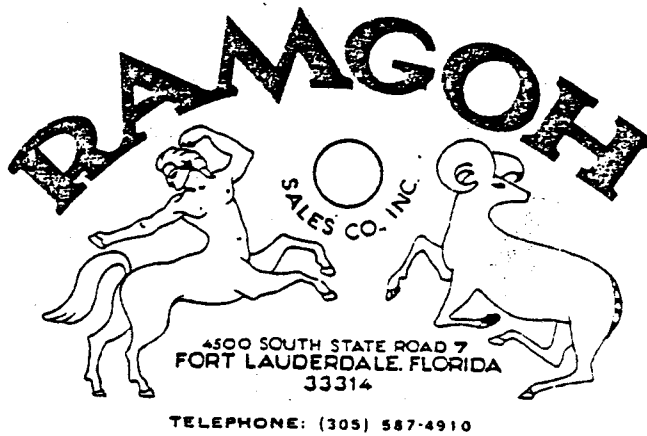
Dear Sir:

Pursuant to our telecon of 12/21/83, I am herewith requesting a Public Hearing in Broward County on the aforementioned permit applications. Attached hereto is a copy of my letter to the Broward County Commissioners Office which outlines only a few of the potential problems which require answers.

Very truly yours,



S.T. Hogg, President



December 23, 1983

Broward County Board of Commissioners
201 South East 6th Street
Ft. Lauderdale, Fla. 33301

Ladies & Gentlemen:

Ref:83B 3304 Section 25 Township 50 So Range
41 East

On December 15th, 1983 we received public notice from the Department of the Army outligning Broward County's request for permits from the Core of Army Engineers and the State Department of Enviornmental Regulation, regarding the installation of a mass burn incenerator complex designed to process 1,300 tons per day of solid waste. This would amount to approximately 130 fully loaded garbage compacted trucks per day.

We can appreciate the complexity of the problem in establishing a site for such a facility and the vast study required in locating it on State Road # 7, directly in front of the anticipated entrance and exit to the new I-595 now under construction and directly in the flight pattern of the new three hundred and fifty million dollar (\$350,000,000.) expansion of the Fort Lauderdale Airport. It would appear that the agriculturally zoned wetland on the No. bank of the New River Canal and East of Rd. 441 will have to be rezoned to an unprecedented level of heavy industrial on State Rd #7, which the Broward County Building Zoning Department will unquestionably approve. The thing we can't appreciate is that the duly elected officers of Broward County have decided that this is to be their facility site, regardless of the devaluation of every waterfront home on the Dania Canal or the New River Canal including our Marina & Mobil Home Park, without so much as a post card notice advising that you are in high gear during the Holiday Season. Naturally we will receive "Public Notice" once the permits are issued by the Department of the Army and the State Enviornmental Regulation. It would appear that I am paying Taxes to allow South Florida Water Management to build a Dam one thousand feet West of 441 Across the North Fork of New River, to block my ocean access from my waterfront Home in Plantation Isles, while Broward County Builds a "Garbage Dump", directly adjacent to my "Mobile Home Park". So much for Progress.

I am requesting as a major Tax Payer and Landowner in Broward County a positive written assurance from the Broward County Building and Zoning Department that the rezoning of property in question for the purpose outlined by Broward County will not emit a foul odor or ash residue from smoke stacks that will cause unpleasant odors at my home in Plantation Isles located in direct path of the South Easternly prevailing winds nor will they effect my Mobile Home occupants located on the South Bank of New River and State Rd. # 7 at the Orange Drive intersection.

I am also requesting positive written assurance from Broward County Public Health Unit and the Broward County Environmental Control Dep't that the environmental living conditions of 170 residents of our Mobile Home Park be protected from the scavengers and insects that are inherent with garbage ie: field mice, rats, mass concentrations of flies and disease bearing insects in addition to the continuous excretion of mass hords of flying bird such as seguls; another resident of garbage concentration.

The last positive assurance requested is that at no time before, during or upon completion of this complex will the waterways of the South Fork of New River or the Dania Cut Off Canal be unnavigatable.

We surely hope that an intensive study has been made regarding the impact on fish life and Manatee concentration which is very heavy throughout his area. One cannot wonder about the effect of Heavy Concentrations of Birds in direct flight approach by Jet Aircraft enroute to the Airport.

If written assurance is not received prior to the issuance of Permits from the State Department of Environmental Control it will be self evident that the Lambs in the Unincorporated Section of Fort Lauderdale are destined to be Sheered by some members of their own Commission.



S. T. HOGG, President

cc: Messrs: Vic Anderson
Jerame Craft
Myra Lentz
Patric Meli/Thomas Mc Pherson
Dick Moran
Frank Veltri
Joseph Webber



Florida Gas Transmission

Packaging
Forest Products
Insurance
Energy

December 21, 1983

Department of the Army
Corps of Engineers
Jacksonville District
Post Office Box 4970
Jacksonville, FL 32232Attention: Regulatory Division
Permits Branch

Re: Permit Application Numbers 83B-3304 and 83B-3305

Gentlemen:

Florida Gas Transmission Company operates a natural gas pipeline across the property on which Broward County proposes to construct an incinerator complex.

We hereby object to the issuance of this permit until an agreement to relocate our pipeline has been obtained from Broward County.

Please contact me at (305) 646-1219 if any further information is needed.

Very truly yours,

Thomas L. Nestor II, Manager
Right-of-Way Department

TLN:jf

cc: J. Harp
D. Inbody
S. Davenport



FLORIDA DEPARTMENT OF STATE

George Firestone
Secretary of State

DIVISION OF ARCHIVES,
HISTORY AND RECORDS MANAGEMENT
The Capitol, Tallahassee, Florida 32301
(904) 488-1480

December 28, 1983

In Reply Refer to:

Mr. Frederick P. Gaske
Historic Sites Specialist
(904) 487-2333

Mr. John F. Adams, Chief
Regulatory Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232

RE: Public Notice of December 15, 1983
Cultural Resource Assessment Request
Permit Application No. 83B-3304 and 3305; Proposed Construction of
County Southern Resource Recovery Facility and Southern Residue/Ur
processable Waste Landfill, Secs. 24 and 25, T50S-R41E and Secs.
19 and 30, T50S-R42E, Broward County, Florida

Dear Mr. Adams:

In accordance with the procedures contained in 36 C.F.R., Part 800 ("Procedures for the Protection of Historic and Cultural Properties"), we have reviewed the above referenced project for possible impact to archaeological and historical sites or properties listed, or eligible for listing, in the National Register of Historic Places. The authorities for these procedures are the National Historic Preservation Act of 1966 (Public Law 89-665) as amended by P.L. 91-243, P.L. 93-54, P.L. 94-422, P.L. 94-458 and P.L. 96-515, and Presidential Executive Order 11593 ("Protection and Enhancement of the Cultural Environment").

A review of the Florida Master Site File indicates that no archaeological or historical sites are recorded for the project area. Furthermore, because of the location of the project, it is considered highly unlikely that any significant, unrecorded sites exist in the vicinity. Therefore, it is the opinion of this office that the proposed project will have no effect on any sites listed, or eligible for listing, in the National Register of Historic Places, or otherwise of national, state or local significance.

Mr. John F. Adams
December 28, 1983
Page Two

If you have any questions concerning our comments, please do not hesitate to contact us.

Your interest and cooperation in helping to protect Florida's archaeological and historical resources are appreciated.

Sincerely,


for George W. Percy
State Historic
Preservation Officer

GWP:Geb

PARKHURST & CARLSON
ATTORNEYS
1107 SOUTHEAST FOURTH AVENUE
FORT LAUDERDALE, FLORIDA 33316

ARTHUR S. PARKHURST, P.A.
GRAFTON N. CARLSON, P.A.

January 10, 1984

TELEPHONE (305) 761-1400

Certified Mail
Return Receipt Requested

District Engineer
Corps of Engineers
Department of the Army
Post Office Box 4970
Jacksonville, FL 32232

Re: Permit Applications Nos. 83B-3304 and 83B-3305

Dear Sir:

I represent Wilfred A. Bost, owner of Boatarama, Inc., a retail marine sales and service center located at 4301 South State Road 7, directly across from the proposed landfill and resource recovery facility. Mr. Bost wishes to express his opposition to the project for the reasons stated below.

✓ The location of the proposed landfill and resource recovery is in the middle of a heavily traveled and congested area and the facility will add to that congestion more than other permitted uses. The constant heavy truck traffic will be an added danger to the many commuters who use State Road 7 as well as to the survival of the businesses located in the area.

The proposed facility will substantially reduce the value of Mr. Bost's property and business as well as other businesses in the area. There are many plans to provide buffering and other protection devices to mitigate against harmful effects but these are doomed to failure because the site is too small to utilize as a landfill and to provide adequate setbacks and buffering.

The site is too small and chopped up for the long term use needed by Broward County. The Florida Power & Light easements which crisscross the property further limit its usefulness. There is no possibility of expansion at a later date.

The facility is proposed to be located on environmentally sensitive lands which requires expensive and land-consuming mitigating measures. With the availability of other more suitable sites it makes little sense to put this type of facility in such an area. The western sites contain few environmental problems and there is enough land available to properly buffer surrounding uses.

District Engineer
Page Two
January 10, 1984

Because of its location the proposed facility will be horrendously expensive. The land will cost four to five times what the western sites will cost on a per acre basis and the mitigating environmental measures will be very expensive. In addition, because of the lack of available land, an expensive deep-well injection system will have to be used to dispose of run-off.

There are several suitable sites for the location of a landfill resource recovery facility but the proposed site is not one of them. The petition should be denied for all the reasons briefly discussed in this letter. Please advise my office of the time, date and location of any public hearing to be held on this matter.

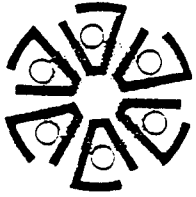
Very truly yours,



Arthur B. Parkhurst
For the Firm

ABP:pdg

cc: Mr. Wilfred A. Bost



south florida regional planning council

3440 hollywood blvd, suite 140, hollywood, florida 33021

broward: (305) 961-2999

dade: (305) 620-4266

January 27, 1984

Mr. John F. Adams
Chief, Regulatory Division
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232

Attn: Vic Anderson

RE: SFRPC #83-1226, USACE #83B-3304 & #83B-3305
Broward County Board of County Commissioners

Dear Mr. Adams:

The attached staff evaluation and recommendations on the above permit applications will be presented to the Council at its meeting on February 6, 1984 at the Howard Johnson's, 16500 N.W. 2nd Avenue, Miami, at 9:30 a.m.

Please call if you have any questions.

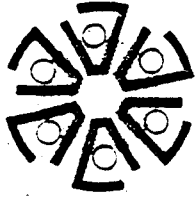
Sincerely,

M. Barry Peterson, AICP
Executive Director

MBP/bh

Enclosures

cc: Honorable Nicki Grossman
Chuck Schnepel
Phyllis Korab
Diane Moore



south florida regional planning council

3440 hollywood blvd., suite 140, hollywood, florida 33021

broward: (305) 961-2999

dade: (305) 620-4266

AGENDA ITEM #8b

February 6, 1984

TO: COUNCIL MEMBERS

FROM: STAFF

SUBJECT: SFRPC #83-1226, USACE #83B-3304 & 83B-3305
BROWARD COUNTY SOUTHERN RESOURCE RECOVERY FACILITY
AND RESIDUE/UNPROCESSIBLE WASTE LANDFILL

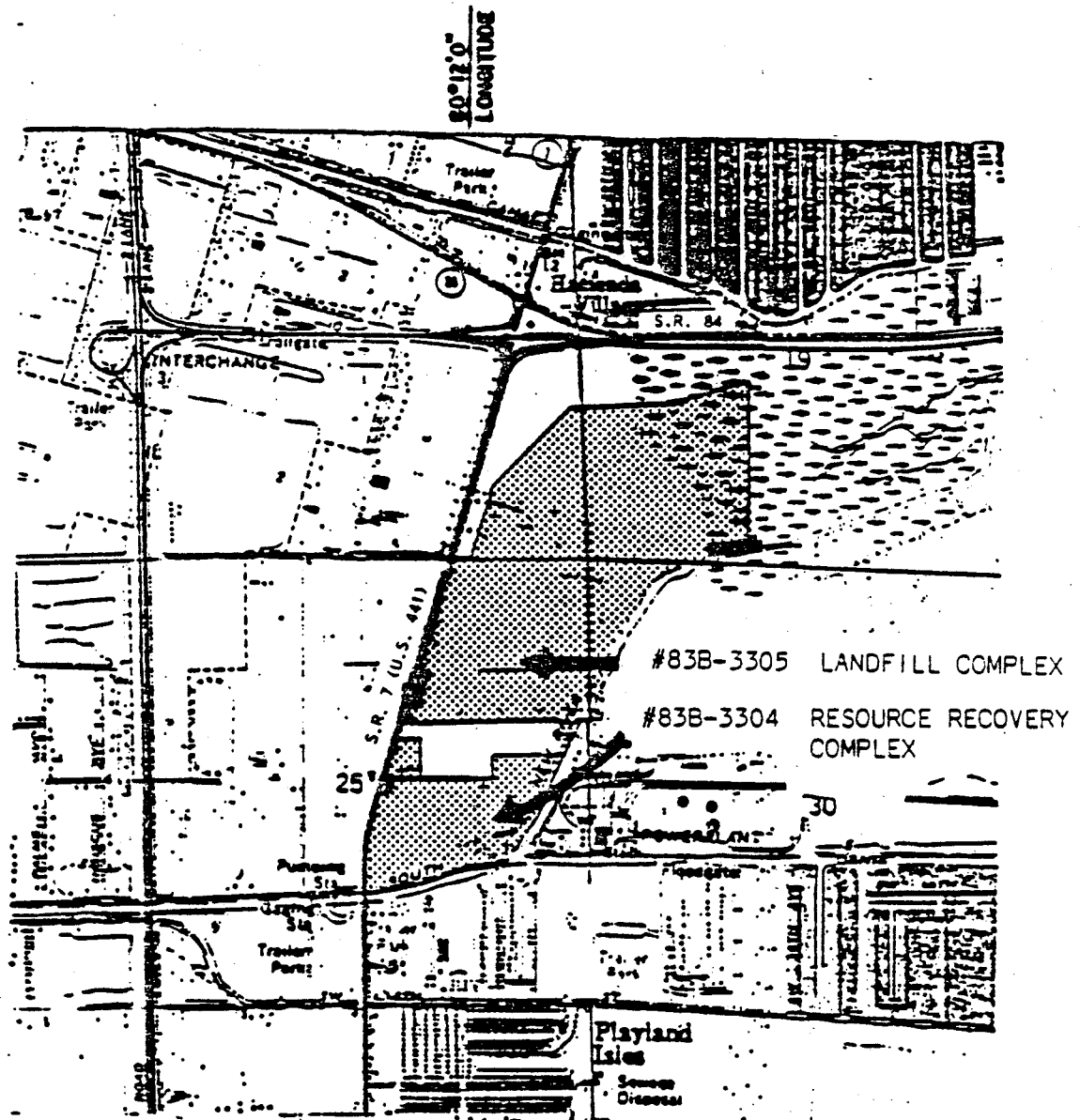
Background

We have received U.S. Army Corps of Engineers (USACE) permit applications (83B-3304 and 83B-3305) for review and comment. The permits involve dredge and fill of two sites south of State Road 84 and east of State Road 7 (US 441) for the purpose of constructing a Southern Resource Recovery Facility (Incinerator complex) and Southern Residue/Unprocessable Waste Landfill (Figure 1). The two proposed actions involve the development of 170 acres, of which 149 acres are wetlands.

Permit Application 83B-3304 involves the placement of 260,000 cubic yards of fill over 16 acres of wetlands on an 18-acre site to construct an Incinerator complex. Primary by-products of the 1,300 tons-per-day capacity, 1,600°F solid waste incinerator will include electrical energy (35 megawatts), produced for sale to Florida Power and Light, and ash residue/unprocessable wastes requiring disposal at the associated landfill to the north (Permit Application 83B-3305). In addition to the Incinerator complex, two retention ponds are proposed to provide for upland runoff discharge from the site to the South Fork New River Canal (Figure 2). Incinerator process blow-down water will be disposed by deep well injection. The 16-acre wetland plant community impacted by the proposed fill supports numerous species, including willow, red maple, red bay, wax myrtle, and Florida holly. As mitigation, the Applicant proposes creation of tidal wetlands on a 15-acre strip, excavated immediately adjacent to the South Fork New River Canal (C-11).

Permit Application 83B-3305 involves the placement of 1,570,000 cubic yards of fill over 133 acres of wetlands on a 157-acre site for the construction of a diked incinerator residue/unprocessable waste landfill and retention pond complex (Figure 3). The landfill will receive from 710 to 965 tons per day from the Resource Recovery Incinerator for a

Figure 1
LOCATION MAP



Source: Application

SCALE: 1000' 0' 1000' 2000'

SOUTHERN RESOURCE RECOVERY FACILITY
SITE PLAN

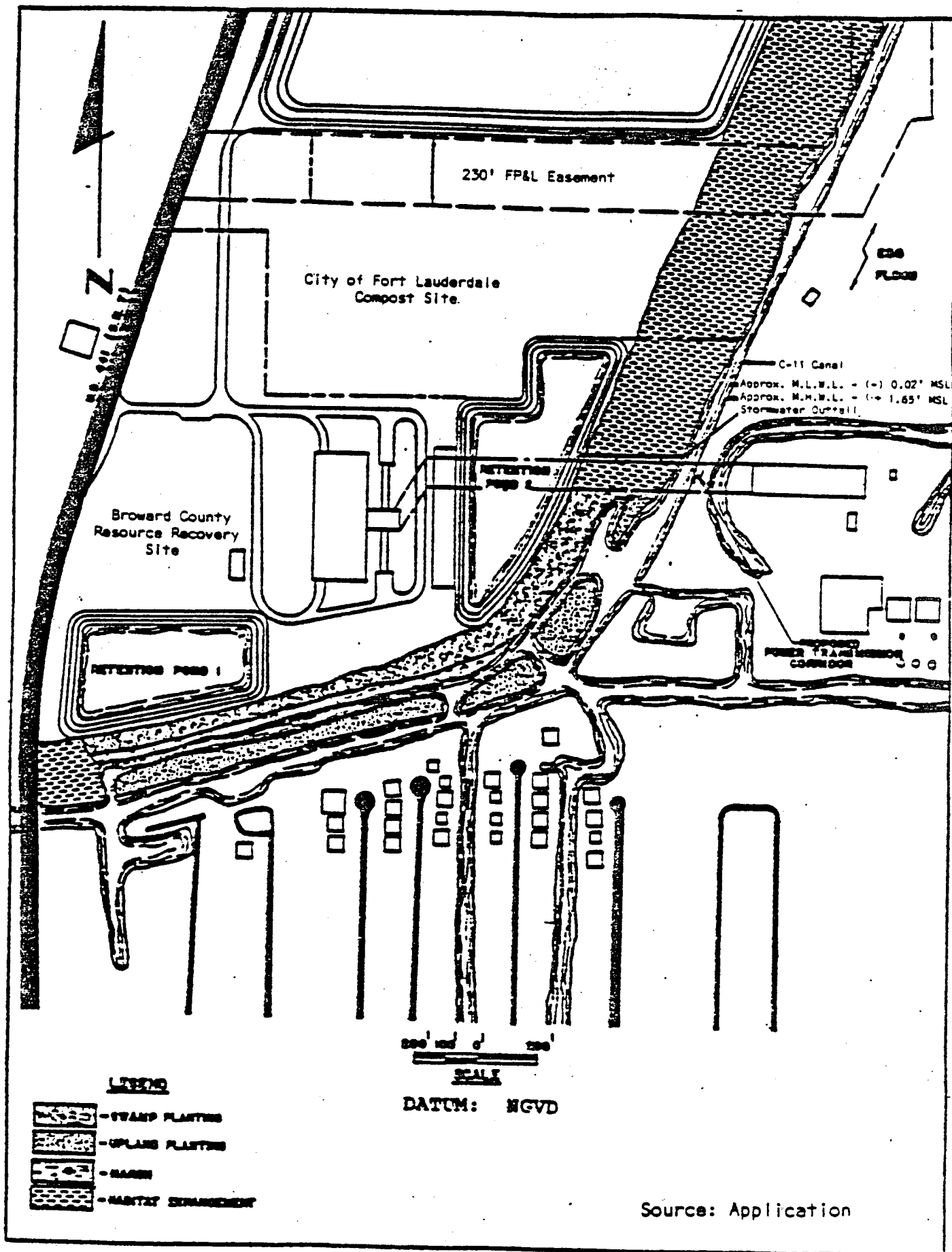
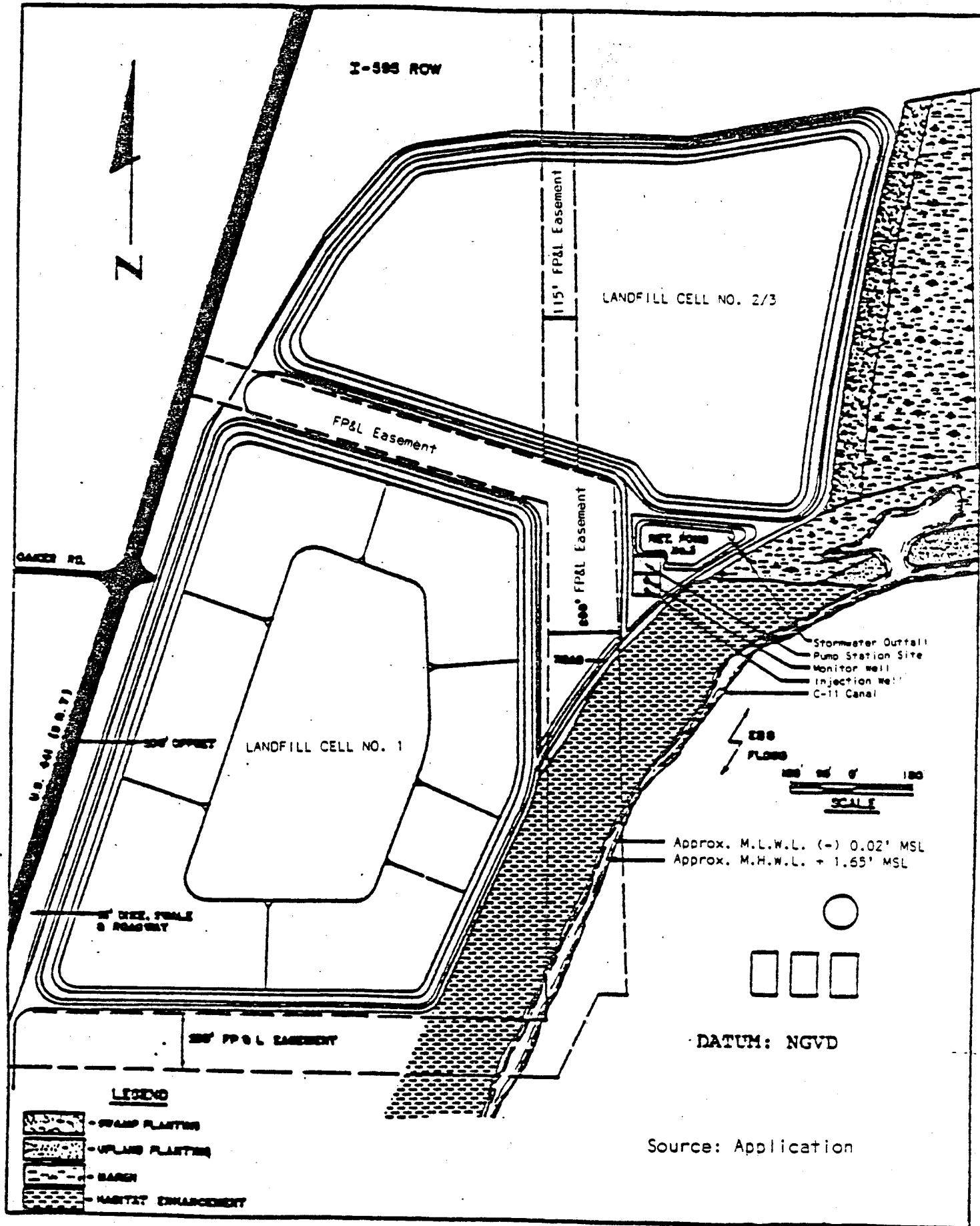


Figure 3
SOUTHERN RESIDUE/UNPROCESSABLE WASTE LANDFILL



total of 12 million cubic yards of ash residue and unprocessable waste over the 20-year life expectancy of the facility. The expected composition of filled material will be 60 percent ash residue, 40 percent unprocessable waste, and less than .3 percent putrescible (organic matter subject to decay) waste. The site will be demucked by excavating 530,000 cubic yards of peat, quartz sand, and limestone substrate and filled to 5 feet above mean sea level (MSL) elevation at the bottom of each cell (above 100-year flood elevation). Each cell will be lined with an impermeable membrane (projected 50-year life) over six feet of underlying fill (including 18 inches of bentonite clay), and surrounded by berm, stormwater swale, and roadway. The elevation of each cell at buildout will be 140 feet above MSL, including a cover of 18-inch bentonite clay and 12-18 inch soil vegetated cover. Initially, all runoff and landfill leachates (contaminated water that has passed through disposed solid waste) will be directed to retention area (25-year, 72-hour design storm) before disposal via deep well injection. An overflow structure to the South Fork New River Canal will be constructed to handle progressively greater overflow discharges as disposal areas are filled with incinerator residue, with retention pond capacity expected to be exceeded after the year 2007. At this time, a minimum of 1.4 inches of runoff will be retained on-site, and overflows will be slowed and filtered by a riprapped dispersion pond, separated from the Canal by 200 feet of created marsh wetlands.

The wetlands portion of the site includes a wax myrtle dominated marsh in most of proposed landfill cell No. 1; mixed cypress, red maple, button bush, willow, wax myrtle, and Florida holly scrub swamp in the western half of proposed landfill cell 2/3; and sawgrass, cattail, water millet, galingales, swamp lily, arrowhead, pickerel weed, and cabbage palm in the eastern half of proposed cell 2/3. The Applicant proposes to preserve 14 acres of sawgrass/cattail marsh bordering the Pond Apple Slough (proposed Anne Kolb Park). To compensate for the loss of 133 acres of wetlands, the Applicant proposes to enhance the westernmost 50 feet of the Pond Apple Slough adjacent to the cell 2/3 landfill berm with planted cypress trees. In addition, 18 acres of tidal wetlands will be created in a strip excavated immediately adjacent to the South Fork New River Canal (C-11), for a total on-site mitigation of 32 acres, plus 15 acres off-site at Tree Tops Park. Other mitigation measures are still being evaluated, including creating a non-tidal wetland area in western Broward and enhancing two small areas (four and twenty acres) north of State Road 84.

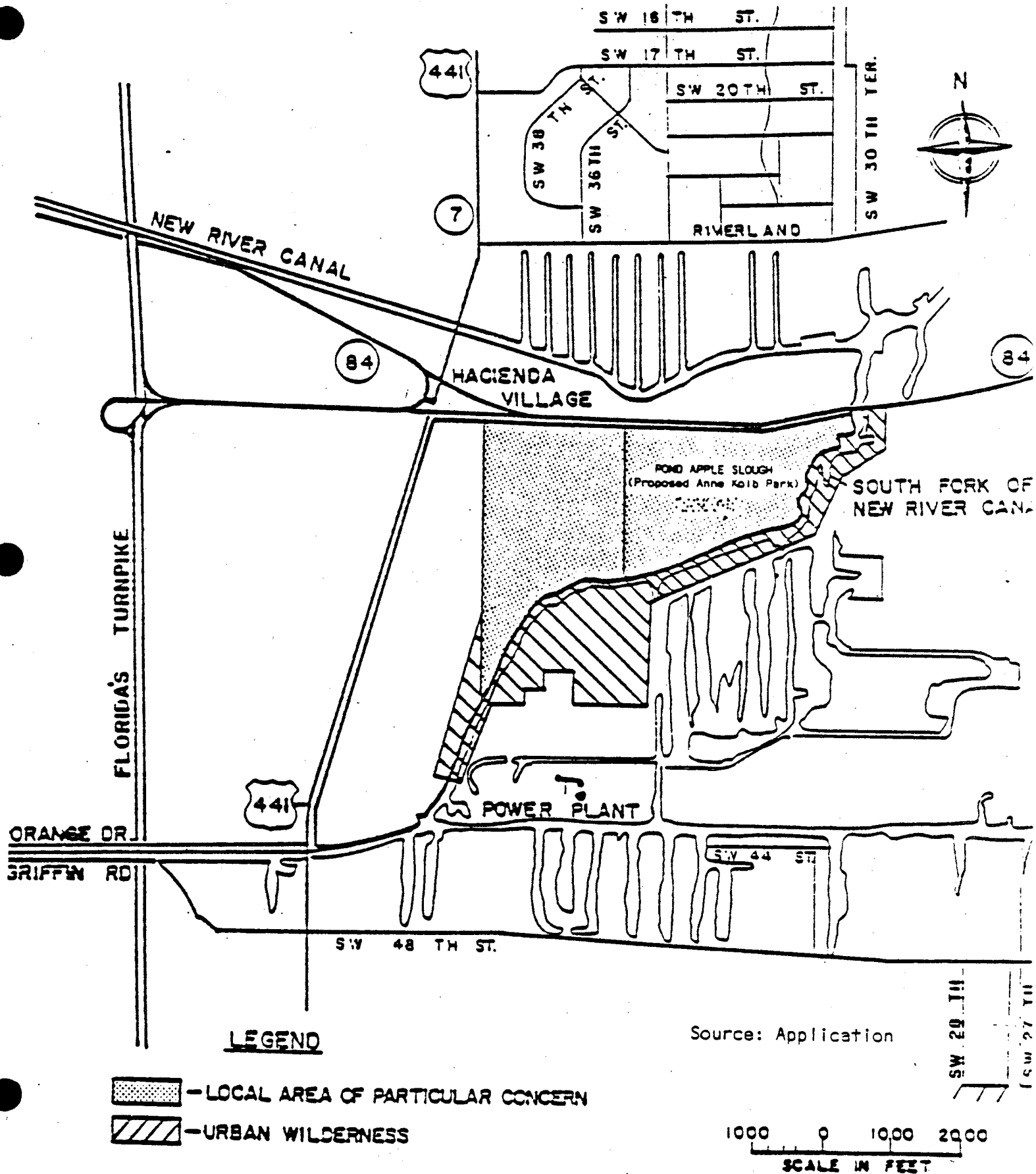
Issues

The proposed actions raise the following issues:

- A portion of the site is located within the County-designated South Fork New River Local Area of Particular Concern (LAPC) and Urban Wilderness Area (Figure 4). The proposed actions will destroy approximately 149 acres of wetlands, including 51 acres (21 percent)

Figure 4

SOUTH FORK NEW RIVER LOCAL AREA OF PARTICULAR CONCERN AND
URBAN WILDERNESS AREA



Source: Application

of the LAPC described in the Coastal Zone Protection and Conservation Element of the Broward County Comprehensive Plan as containing "the lone remaining example of a forested, non-tidal wetlands system in the eastern regions of Broward County."

- The project site is known to contain several endangered or threatened plant species, including Florida Royal Palm, Wild Pine Bromeliads, other Bromeliads, and Leather Fern. The endangered and threatened plant species located within the project boundaries will be destroyed.
- The proposed actions conflict with the two wetlands policy guidelines of the Broward County Coastal Element:

"Protect and, where possible, preserve wetland areas of sufficient size to maintain a productive biological and hydrological system; and

Wetlands are valuable as water recharge and purification areas; therefore, development within these areas should be designed to maximize natural water storage potential."

- Discharge of contaminated water from stormwater runoff in excess of the design storm and from potential leaks from the landfill cells may significantly affect the water quality of the South Fork New River Canal. While the landfill lining is designed to contain leachate for up to 50 years, indefinite containment cannot be assured. Pollutants entering the South Fork New River Canal could seriously degrade water quality, harm marine life, and negatively impact the local marine-oriented economy. In addition, the 25-year design storm has a 4 percent chance of occurring each year, and could be exceeded many times in a 25-year period, forcing runoff and leachate to overflow into the Canal.
- Wastewater disposal will involve deep well injection of approximately 700,000 gallons per day (gpd) from the Incinerator and 500,000 gpd from runoff and leachate.
- The filling of 149 acres of wetlands will reduce groundwater recharge of the Biscayne Aquifer and displace flood waters, which now cover the site, to adjacent areas.
- The area east of the proposed cell 2/3 is known as the Pond Apple Slough (proposed Anne Kolb Park), a forested, tidally-connected wetland area. Stormwater runoff, contamination of river water adjacent to the project, and possibly underground leachate, could negatively affect the water quality of the proposed park posing a hazard to humans, vegetation, and wildlife.

- Appropriate measures for treating landfill leachate before deep well injection are presently being evaluated by the South Florida Water Management District (SFWMD) and the Florida Department of Environmental Regulation (DER). In addition, the feasibility of using deep well injection for this project will be evaluated by the two permitting agencies before granting surface water (SFWMD) or well injection (DER) permits. Treatment of leachate before deep well injection may or may not be required.
- Mitigation efforts proposed by the County include the following:
 - Creation of a 15-acre tidally-connected wetland strip to compensate for the loss of 16 acres of tidally-connected wetlands (Permit Application 83B-2204: Resource Recovery Incinerator Complex).
 - Creation of 18 on-site and 15 off-site acres of tidally-connected wetlands, or a total of 33 acres, to compensate for the loss of 133 wetland acres (Permit Application 83B-3305: Landfill Complex).

Recreation of 48 acres of wetlands is far less than the 149 acres of wetlands being destroyed. The creation of tidally-connected wetlands does not compensate for the loss of a non-tidal, sawgrass/cattail marsh wetland system, and there are no non-tidal mitigation proposals included in the permit application. In addition, no schedule for mitigation has been proposed, making it possible for cost overruns to reduce the quantity or quality of mitigation.

- Due to its proximity to the Fort Lauderdale/Hollywood International Airport, the site is within regulated airspace. The stack height of the proposed incinerator will have to conform to Federal Aviation Administration (FAA) criteria (220 feet maximum). Also, Florida State regulations prohibit the siting of landfills within 10,000 feet of a public airport to avoid the safety hazard due to birds congregating near airports. The eastern portion of landfill cell 2/3 is just at the 10,000-foot line. Congregations of birds at the landfill may, however, still adversely impact air traffic. The landfill will be clearly visible to aircraft passengers approaching the airport from the west.

Evaluation

There is an urgent need for a new incinerator complex and landfill disposal area in southern Broward County. The solid waste generated in Broward County is 2,400 to 3,000 tons per day (tpd), disposed of either at the Davie (1,200 tpd) or Pompano Beach landfill (1,200 to 1,800 tpd). The Davie landfill reaches capacity this year. In order to evaluate possible sites for a new landfill, several site selection studies were done by Broward County or its consultants. Three final sites, Davie (next to existing landfill), Broward Correctional Institute, and US 441/SR 84 were chosen by Broward County for the incinerator/landfill

complex from 97 potential, 16 probable, and 7 candidate sites. Although the Initial February, 1982 County site selection study showed that the Davie site was the best choice for the Incinerator/landfill complex, it was withdrawn from consideration because of litigation; and the Broward Correctional Institute site has more severe environmental limitations than the proposed US 441/SR 84 site. The proposed actions at the US 441/SR 84 will destroy a large non-tidal wetland area located within the South Fork New River LAPC, which contains "the lone remaining example of a forested, non-tidal wetlands system in the eastern regions of Broward County." In order to satisfy the public need for an additional solid waste disposal site and protect, to the greatest extent possible, valuable tidal and non-tidal wetlands, the following should be imposed by the U.S. Army Corps of Engineers as conditions to granting the two permits:

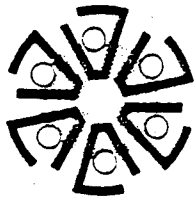
- The portion of landfill cell 2/3 east of the Florida Power and Light easement should be deleted from the plan and preserved in its present condition, and retention pond No. 3 should be moved to under (or west of) the FP&L easement. The area east of the easement contains a healthy wetlands system that can:
 - serve to filter and cleanse any overflow runoff from the remainder of cell 2/3, thereby protecting the South Fork New River Canal from water quality degradation;
 - continue to recharge the Biscayne Aquifer so salt water intrusion will not be unnecessarily increased; and
 - If undisturbed, preserve a majority of the South Fork New River Local Area of Particular Concern in its present condition, thereby conforming to the intent of the Broward County Comprehensive Plan.

Deleting the portion of cell 2/3 east of the FPL easement will also:

- eliminate that portion of the landfill closest to the Fort Lauderdale/Hollywood International Airport, reducing the potential for bird strikes in the airport approach zone; and
- reduce the amount of landfill visible to motorists travelling on I-595 when complete. Site selection criteria adopted by Florida DER for sanitary landfills include the following:

"Landfills are specifically prohibited...in any area open to public view from any major public thoroughfare without proper screening where it can practically be avoided."

- All proposed mitigation should start when site preparation for the incinerator complex and landfill begins, and be completed within one year of the starting date. Preserved and created wetland areas should be maintained to prevent infestation by exotic plants.



south florida regional planning council

3440 hollywood blvd., suite 140, hollywood, florida 33021

broward: (305) 961-2999

code: (305) 620-4266

January 19, 1984

Mr. Vic Anderson
U.S. Army Corps of Engineers
P. O. Box 4970
Jacksonville, Florida 32232

RE: SFRPC #83-1226, USACE #83B-3304 & 83B-3305
Broward County Board of County Commissioners

Dear Mr. Anderson:

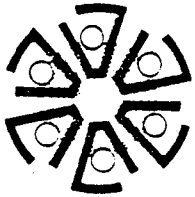
This will confirm your telephone conversation today with Rod Arroyo of Council staff where you agreed to an extension of our review period of the above-referenced permit application until February 8, 1984.

We appreciate your cooperation.

Sincerely,

M. Barry Peterson, AICP
Executive Director

MBP/bh



south florida regional planning council

3440 hollywood blvd., suite 140, hollywood, florida 33021

broward: (305) 961-2999

dade: (305) 620-4266

January 10, 1984

Mr. John F. Adams
Chief, Regulatory Division
U.S. Army Corps of Engineers
P. O. Box 4970
Jacksonville, Florida 32232

RE: SFRPC #83-1226, USACE #83B-3304 & 83B-3305, DER #060781738 & 060781749
Broward County Board of County Commissioners

Dear Mr. Adams:

We are requesting an extension of the due date for comments on the above-referenced permit applications until February 8, 1984. Because of the following environmental issues associated with the proposed actions, it is necessary for our Board to take official action on the permit applications:

- The proposed actions conflict with the two wetlands policy guidelines in the Coastal Zone Protection and Conservation Element of the Broward County Comprehensive Plan (Broward Coastal Element, pg. 1-32):

"Protect and, where possible, preserve wetland areas of sufficient size to maintain a productive biological and hydrological system; and

Wetlands are valuable as water recharge and purification areas; therefore, development within these areas should be designed to maximize natural water storage potential."

- The sites are located within the South Fork New River Local Area of Particular Concern (LAPC) and Urban Wilderness Areas. The proposed action will destroy approximately 149 acres of wetlands, including 51 acres of the LAPC described in the Broward Coastal Element as containing "the lone remaining example of a forested, non-tidal wetlands system in the eastern regions of Broward County" (pg. 2-23).
- The discharge of contaminated water from stormwater runoff in excess of the design storm and from potential leaks through the liner of the landfill cell will adversely affect water quality in the South Fork New River (a navigable river).

Mr. John F. Adams
Page 2
January 10, 1984

- The area east of proposed cell 2/3 is designated as the Ann Kolb Park. Stormwater runoff, river water contaminated adjacent to the project, and possibly underground leachate, could negatively affect the water quality of the park area posing a hazard to humans, vegetation, and wildlife.
- The proposed mitigation measures of 32 on-site and 15.5 off-site acres is inadequate because the large wetland acreage associated with this area serves as a productive system that cannot be replaced by efforts such as "creating 18 acres of tidal wetlands in a strip excavated immediately adjacent to the South New River Canal" and other such piecemeal efforts. In addition, most of the wetlands being destroyed are non-tidally connected, while mitigation proposals involve the creation or preservation of tidally-connected wetlands.

The Council Board is scheduled to meet on February 6. A meeting notice and agenda item will be forwarded to you so that a representative of your office may attend. We appreciate your assistance in this matter. If you have any questions or comments, please call.

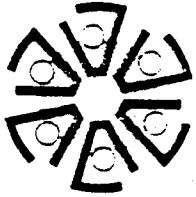
Sincerely,



M. Barry Peterson, AICP
Executive Director

MBP/bh

cc: The Honorable Scott Cowan
The Honorable Howard Craft
The Honorable Howard Forman
Mr. Vic Anderson
Ms. Diane Moore



south florida regional planning council

3440 hollywood blvd., suite 140, hollywood, florida 33021

broward (305) 961-2999
dade (305) 620-4256

January 10, 1984

Mr. John F. Adams
Chief, Regulatory Division
U.S. Army Corps of Engineers
P. O. Box 4970
Jacksonville, Florida 32232

RE: SFRPC #83-1226, USACE #83B-3304 & 83B-3305, DER #060781738 & 060781749
Broward County Board of County Commissioners

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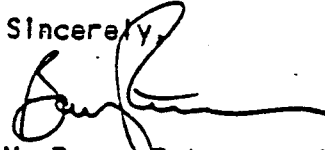
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Mr. John F. Adams
Page 2
January 10, 1984

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- The proposed mitigation measures of 32 on-site and 15.5 off-site acres is inadequate because the large wetland acreage associated with this area serves as a productive system that cannot be replaced by efforts such as "creating 18 acres of tidal wetlands in a strip excavated immediately adjacent to the South New River Canal" and other such piecemeal efforts. In addition, most of the wetlands being destroyed are non-tidally connected, while mitigation proposals involve the creation or preservation of tidally-connected wetlands.

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Sincerely,



M. Barry Peterson, AICP
Executive Director

MBP/bh

cc: The Honorable Scott Cowan
The Honorable Howard Craft
The Honorable Howard Forman
Mr. Vic Anderson
Ms. Diane Moore

**BROWARD
COUNTY
AUDUBON SOCIETY**

MEMBER
National Audubon Society
Florida Audubon Society

1/11/84

District Engineer
Department of the Army
Jacksonville District, Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232

Re: Permit Application Numbers 83B-3304 and 83B-3305

Dear Sir;

Broward County Audubon Society is opposed to the construction of the proposed resource recovery facility and ash landfill in the wetlands of South New River Canal and requests a public hearing.

It is an incompatible land use destroying valuable marshland, threatening endangered manatees in the manatee sanctuary of South New River Canal, and negatively impacting an Urban Wilderness area and a Local Area of Particular Concern which is designated to be a county park. Mitigation is token and in no way cures the environmental problems or makes up for the loss of this ecosystem.

Seepage or planned overflow from containment areas or leakage from the leachate collection system would contaminate South New River Canal and a leak in the deep well could contaminate Broward County Wellfield 3A or the Floridan Aquifer.

It is not in the public interest to destroy these wetlands and impact others to create an ash landfill that will last less than 20 years. It is a damaging short term solution. According to Dr. George Fitzpatrick of the University of Florida, there are better alternatives, such as composting. "No other resource recovery methods were seriously considered."

The Broward County Environmental Quality Control Board states, "Landfills should not be located on, an, or adjacent to any major surface water resources such as wetlands, lakes, or streams.

Landuse effects landfill site evaluation in two ways. First, the landfill must be compatible to existing, surrounding land uses; and second, its end use (once capacity has been reached) must conform to long-term land use patterns.

Avoiding environmentally sensitive areas is needed to mitigate the impact that any landfill may have on fragile ecosystems or unique sites."

The Environmental Quality Control Board, the Broward County Office of Planning, and two county commissioners advised the county commission to have staff do an environmental impact study. Ms. Bernstein from the Office of Planning told the commission, "in order to evaluate impact on Anne Kolb Park (a Local Area of Particular Concern) there would need to be a detailed hydrological impact study made." Five of the seven commissioners voted not to investigate the unanswered environmental questions.

✓ A hydrological impact study should be required by the Corps of Engineers.

up to
COE ← Experts from U.S. Fish and Wildlife and the Florida Department of Natural Resources should be asked for their comments, as it involves the habitat of endangered species.

up to
COE ← The Dade County Department of Environmental Resource Management should be asked for comments as they have been investigating water and air pollution at a similar facility in North Dade County.

IE ← The Florida Game and Freshwater Fish Commission should be asked to comment the bird problems they recently investigated at the same facility and the problems they foresee with a facility and retention ponds along South New River Canal.

COE ← The Broward County Native Plant Society is now doing a plant survey of the area and should be asked to comment on endangered and threatened plant species that will be impacted.

2 (We have found contradictions in the report done by Hazen and Sawyer, Inc. and Malcolm Pirnie, Inc. and many questions are left unanswered.

This site with this form of resource recovery was not picked because it is environmentally sound. Again, we ask that you deny these permit applications or call for a public hearing.

Sincerely,

Sandra Kokernoot

Sandra Kokernoot, Chairman
Conservation Committee

FLORIDA GAME AND FRESH WATER FISH COMMISSION

WILLIAM G. BOSTICK, JR.
Chairman, Winter Haven

CECIL C. BAILEY
Vice Chairman, Jacksonville

C. TOM RAINEY D.V.M.
Miami

THOMAS L. HIRES SR
Tampa

J.H. BAROCO
Pensacola

ROBERT M. BRANTLY, Executive Director
F. G. BANKS, Assistant Executive Director



FARRIS BRYANT BUILDING
620 South Meridian Street
Tallahassee, Florida 32301

January 23, 1984

Colonel Alfred B. Devereaux, Jr.
District Engineer
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32201

Re: COE 83B-3304 and 83B-3305
Broward County

Dear Colonel Devereaux:

The Office of Environmental Services of the Florida Game and Fresh Water Fish Commission has reviewed this permit application received from the United States Army Corps of Engineers, dated December 15, 1983. Our comments are submitted in compliance with the Fish and Wildlife Coordination Act.

The applicant proposes to construct a resource recovery facility (COE 83B-3304) including a mass-burn incinerator complex designed to process 1,300 tons per day of municipal solid waste. The ash and unprocessable waste would be placed in an adjacent landfill (COE 83B-3305). The incinerator portion of the project would require filling 15.6 acres of wetlands, and creation of 15 acres of wetlands along the South New River Canal as mitigation. The landfill portion of the project involves filling 133 acres of wetlands. As mitigation, the applicant proposes to create 18 acres of tidal wetlands along the South New River Canal and 15.5 acres of wetlands offsite, around a county park lake (Tree Tops Park). An additional 14 acres of wetlands would be preserved on site, but this should not be classified as mitigation.

The proposed incinerator site is located within disturbed wetlands dominated primarily by wax myrtle. We believe that the applicant's mitigation proposal adequately compensates for the filling of these wetlands, and we offer no objection to the issuance of this permit (COE 83B-3304).

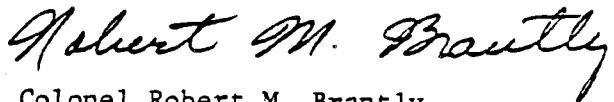
Colonel Devereaux, Jr.

Page 2

The proposed landfill site (COE 83B-3305) contains approximately 91 acres of disturbed wetlands dominated by wax myrtle, and approximately 42 acres of undisturbed wetlands dominated by sawgrass and cattail. The 33.5 acres of mitigation proposed for this site is inadequate compensation for the wetland destruction associated with this permit. We have discussed this problem with the applicant's consultant, CZR, Inc. They agree that more mitigation is needed and are in the process of developing additional mitigation sites that would be acceptable to all parties. We have inspected several potential sites with the consultant, but firm commitments and plans for these and any other sites need to be provided before we can make final recommendations on the suitability of this additional mitigation. Therefore, we recommend against issuance of this permit (COE 83B-3305) until additional mitigation is assured.

Please call me if we can be of further assistance.

Sincerely yours,



Colonel Robert M. Brantly
Executive Director .

RMB/SL/rs

March 1, 1984

Department of the Army
Jacksonville District, Corps of Engineers
Regulatory Division, Permit Branch
P.O. Box 4970
Jacksonville, Florida 32232

Attn: Mr. Bertil A. Heimer
Chief, Permits Branch

Re: Broward County Permit Applications
Nos. 83B-3304 & 83B-3305

Gentlemen:

We are herein responding to your letter of February 16, 1984 regarding our Department of the Army permit applications for placing fill material in waters of the United States wetlands, adjacent to the South Fork New River Canal, associated with construction of the County's Southern Resource Recovery Facility and associated Residue/Unprocessable Waste Landfill.

The resource recovery facility and residue/unprocessable waste landfill project is part of Broward County's solid waste management plan. The project will serve the public by providing the county with an effective, reliable and environmentally sound municipal solid waste management system.

Our permit application submittals have generated certain issues which have been the focus of comments forwarded to your office by representatives of the general public and other permit review agencies. By attachment to this letter, we are providing detailed responses to these comments and issues as well as to the three topical issues specifically addressed in your letter. Hence, Attachment No. 1 responds to comments received during the public notice period while Attachment No. 2 responds to the three specific areas for which you are requesting further clarification.

We wish to expeditiously resolve outstanding concerns impeding final approval of the dredge and fill permits to the satisfaction of the U.S. Army Corps of Engineers. Toward this goal, we wish to make you aware of our pending meeting with representatives of the USEPA and other involved agencies now scheduled for March 12, 1984 in Atlanta, Georgia. Preliminary discussions with EPA and other agency representatives indicate

March 1, 1984

that several issues addressed in your February 16, 1984 letter and attached comments will be discussed at this meeting. Our objective is to resolve the remaining issues of concern to the mutual satisfaction of Broward County and the U.S. Army Corps of Engineers. Your continuing cooperation with Broward County on this matter is greatly appreciated.

Should you have any further questions or require additional clarification please contact us at your convenience.

Very truly yours,

Phyllis A. Korab
Project Direct

PAK/lfc

RESPONSE TO DEPARTMENT OF ARMY LETTER DATED FEBRUARY 16, 1984
BROWARD COUNTY PERMIT APPLICATION NOS. 83B-3304 AND 83B-8305

ATTACHMENT NO. 1

1. Response to Letter from U.S. Environmental Protection
Agency dated January 23, 1984

- a. Demonstrate compliance of resource recovery facility (83B-3304) with Section 404(b) guidelines - Refer to Attachment No. 2, Item Nos. 2 and 3. In addition, stringent erosion/turbidity control measures will be installed and maintained during project construction as well as throughout the life of the project. The stormwater management system will be designed after vendor selection for the project. A construction timetable for the proposed mitigation plan has not been developed at this time. However, we do not object to scheduling the proposed mitigation plan concurrently with project construction, as proposed by EPA.
- b. Demonstrate compliance of landfill (83B-3305) with Section 404(b) guidelines - We believe that we can convincingly show that alternative upland site locations are not practicable for project construction (Refer to Attachment No. 2, Item Nos. 2 and 3).

We agree that the existing 45-50 acre sawgrass marsh-hardwood swamp wetland system east of the FP&L north-south powerline at the proposed landfill site (proposed landfill cell No. 3) is productive and valuable.

As compensation for the proposed landfill areas, the proposed mitigation plan will create on-site and off-site wetlands of greater value per unit than those which will be lost.

The off-site 15.5 acre Tree Tops Park mitigation area will result in a high quality wetland/open water/hammock environment similar to the Everglades. In addition to serving as a valuable functioning wetland, the Tree Tops Park area will provide a valuable educational opportunity for citizens of Broward County.

Sixteen acres of wooded swamp, approximately one half mile east of the project site at the intersection of State Route 84 and the North Fork New River Canal, will be restored to wetlands.

The 74 acre Everglades Restoration Area is an upland degraded site in western Broward County which will be restored to its original wetlands environment.

On-site mitigation entails preservation and enhancement of 35 acres. A small lagoon connecting with South Fork New River Canal will be excavated in the extreme northeastern corner of the site to provide shallow open water habitat from a dredged material berm. The lagoon will be excavated to enhance the adjacent wetlands by providing the opportunity for natural shallow flooding of adjacent wetlands on an intermittent basis. Flooding, a natural phenomenon which is part of floodplain wetland ecology, has been prevented by the berm of spoil which was placed beside the river when it was dredged.

Every effort will be made to preserve the wetland system in proposed landfill cell No. 3. As previously stated, development of landfill cell No. 3 will be postponed until all other cells are fully utilized. Upland sites will be reevaluated during project construction and operation. In the event that a more suitable site with landfill volume comparable to landfill cell No. 3 is located, landfill cell No.3 will not be developed.

- c. Permitted wetland filling should be mitigated by at least 1:1 wetland creation, preferably at the project site (83B-3305) - The revised mitigation plan proposed in item No. 7b satisfies this comment. Development of the landfill requires that 133 acres of wetland be filled. On-site, 35 acres of wetland will be preserved and enhanced. Off-site, a total of 105 acres of semi-permanently flooded sawgrass marsh and hardwood hammock will be created. The project will result in the restoration or preservation of 140 acres of highly productive and very valuable wetlands which will otherwise likely never be realized by Broward County.
- d. EPA and U.S. Fish and Wildlife coordination and approval of an acceptable mitigation plan - We are meeting with EPA officials on March 12, 1984. Joint development of an acceptable mitigation plan is an item on the agenda.

2. Response to Letter from U.S. Department of the Interior,
Fish and Wildlife Service dated January 23, 1984

- a. Recommend permit denial unless adequate mitigation is proposed - Refer to Attachment No. 1, Item Nos. 1b, 1c, and 1d, and Attachment No. 2, Item No. 2.
- b. Compatible water levels and land elevations to maintain a long enough hydroperiod for the preservation of wetlands which may be impacted by removal of the berm along the South Fork New River Canal - This item has been clarified in discussions held subsequent to February 16, 1984, and has been resolved to the satisfaction of the Department of the Interior.

Briefly, the existing berm area will be excavated to Elevation (El) + 1.50, which is below mean high water Elevation + 1.64. Since the wetland to be preserved is below El. 1.5, water will flow into the wetland during the tidal cycle and a sufficient hydroperiod will be maintained.

3. Response to letter from U.S. Department of Commerce,
National Marine Fisheries Services dated January 4, 1984

- a. Recommend facility construction on the uplands which are currently available - Refer to Attachment No. 2, Item No. 3 regarding areas west of the Davie site.

The National Marine Fisheries Service (NMFS) suggests use of cattle pastures in sections 17, 18, 19, 20, 29 and 30 as a suitable upland site for this resource recovery project (NMFS Map I). Section 18 is included in the Davie landfill site and is therefore unavailable as a viable alternative site. The remaining tracts are included in the Arvida Corporation development project. The Arvida project has received Development of Regional Impact approval and has been platted for development as a residential community. As a result, these properties, for all practical purposes, are unavailable for implementation of the resource recovery project.

Furthermore, even if these properties were available, total project waste transport costs associated with their use would be approximately double the costs associated with use of the Route 441 site. Over the life of the project, total waste transport costs for sites in the Davie vicinity would be approximately \$91.8 million versus \$46.8 million for

the Route 441 site, based on 1983 dollars (presented in permit application 83B-3305, Section III.D, Table 5).

Also, the Route 441 site is adjacent to an FP&L electric substation. Use of the Davie sites, even if available, would require additional project costs for power grid interconnection.

We conclude that the unavailability of the sites referenced in the NMFS comment, in conjunction with the significantly higher project costs associated with use of these sites, renders them infeasible as alternative project sites.

4. Response to Letter from Mr. S.T. Hogg dated December 23, 1983

Refer to Exhibit A.

5. Response to Letter from Florida Gas Transmission Company dated December 21, 1983

We recognize the need to reach a mutually satisfactory agreement with Florida Gas Transmission Company (FGT) with regard to FGT's natural gas pipeline operating across the Southern landfill property. The issue of location and potential relocation of FGT's pipeline will be addressed during subsequent detailed project development and design. Therefore, we would not object to issuance of the final permit being conditional on the resolution of pipeline location between FGT and Broward County.

6. Response to letter from Wilfred A. Bost dated January 10, 1984

- a. Facility will add heavy truck traffic - The projected impact of project-generated traffic is discussed in Section IV.E of the facility permit application (83B-3304). According to the TRIPS model, the projected traffic increase will have an insignificant impact on existing traffic patterns. In final site evaluation, the Route 441 site had the lowest annual waste transport costs. The impact of the exhaust emissions from the solid waste transport vehicles is expected to be minimal. In addition, the solid waste transport vehicles would largely replace the vehicles used for the existing solid waste transport pattern.

- b. "The proposed facility will substantially reduce the value of Mr. Bost's property and business as well as other businesses in the area." - The proposed project is consistent with existing and proposed land use and zoning in the area. Existing land use in the area includes several small businesses and one residence around the periphery of the site. A large industrial park is currently proposed for the area immediately north of the compost facility. Without the project, much of the area might be developed in a piecemeal fashion by private entrepreneurs.
- c. "...the site is too small to utilize as a landfill and to provide adequate setbacks and buffering." - Project setbacks and buffers are discussed in the permit applications (83B-3304 and 83B-3305).

Acceptability of the project site with regard to size, setback, and buffer adequacy is under the jurisdiction of the Florida State Department of Environmental Regulation (DER) Solid Waste Facility Permit and the Broward County Environmental Quality Control Board (BCEQCB) Construction/Operation License for Solid Waste Pollution Sources. The DER and BCEQCB have performed site inspections to verify the acceptability of the project site. Both agencies have made a preliminary determination that, assuming all their respective regulatory requirements are satisfied, permit approval will be forthcoming.

- d. "The site is too small and chopped up for the long term use needed by Broward County...no possibility of [site] expansion..." - This item is addressed in Section III.C, Site Evaluation and Selection on page 28, of the facility permit application submittal (83B-3304) and Section III.D, Final Site Selection, of the landfill permit application submittal (83B-3305).
- e. FP&L easements limit the project's usefulness - The landfill cells abut the FP&L easements. The easements do not significantly affect the project design; in fact, the proximity of the project to the FP&L substation is a positive factor.
- f. Project site environmental sensitivity - Refer to Attachment No. 1, Item Nos. 1a and 1b above, and Attachment No. 2, Item No. 2.

- g. Siting the project at other more suitable western sites - Refer to Attachment No. 1, Item Nos. 3a above, and Attachment No. 2, Item No. 3.
 - h. Project cost at the Route 441 site - Estimated annual site acquisition and preparation costs for the Route 441 site are the highest of the evaluated final sites. However, when all project costs are considered, the Route 441 site is the most cost-effective of the evaluated final sites. Refer to Section III.D, Final Site Selection of the landfill permit application (83B-3305), for the discussion summarizing project cost analysis for the alternative sites.
7. Response to Letters from South Florida Regional Planning Council dated January 10, 19, and 27, 1984
- The South Florida Regional Planning Council has not, in fact, adopted the aforementioned letters as forwarded by Council staff. These letters do not present the comments and recommendations of the Council regarding the project. Attached to this response as Exhibit B is a copy of the letter, dated February 16, 1984, which has been ratified by the Council and states the Council's position regarding issuance of the dredge and fill permit. Summarizing the letters' content, the Council supports the project and inclusion of landfill cell No. 3, as proposed in the dredge and fill permit application submittal.
8. Response to Letter from Broward County Audubon Society dated January 11, 1984
- a. "...destroying valuable marshland..." - Refer to Attachment No. 1, Item No. 1b above.
 - b. "...threatening endangered manatees in the manatee sanctuary of the South New River Canal..." - We have no knowledge of an area designated as a manatee sanctuary in the vicinity of the project site. We have reviewed the definition of critical habitat as determined by the U.S. Department of the Interior, Fish and Wildlife Service. The project area is not within critical habitat for the manatee. The site has been reviewed by the Fish and Wildlife Service and development is not expected to negatively impact endangered or threatened species in any significant manner.

- c. "Mitigation is token and in no way cures the environmental problems or makes up for the loss of this ecosystem." - Refer to Item Nos. 1c and 1d of Attachment No. 1. Curing the environmental problems of the Route 441 site has never been an objective of this project.
- d. Potential contamination of South Fork New River Canal, Broward County Wellfield 3A, or the Floridan Aquifer from project.

Each landfill cell will be surrounded by a perimeter dike to contain all surface runoff on-site. During the first 14 + years of landfill operations all design surface runoff will be disposed via an injection well. After this period, runoff will be disposed of via deep well injection supplemented by controlled surface discharge to the C-11 canal.

The management of surface waters on the landfill site is subject to approval from the South Florida Water Management District (SFWMD). Permit approval for a surface water management system based on SFWMD criteria is anticipated.

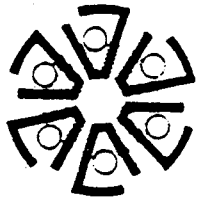
- e. Project is short-term solution - Refer to Attachment No. 1, Item No. 6d.
- f. "No other resource recovery methods were seriously considered." - A number of disposal technologies, including composting, were evaluated by Broward County. This resulted in the determination by the Board of County Commissioners of Broward County that mass burn incineration best meets the public need for the southern facility. Refer to facility permit application (83B-3304), Section I.B, Need.
- g. Landfill site evaluation - The selection of a landfill site is a complex process involving careful consideration of the environmental, economic and social factors. The Route 441 site meets environmental siting criteria of the state and county regulatory agencies. For a discussion of land use patterns in the vicinity of the Route 441 site and compatibility of the landfill with those land use trends, refer to Attachment No. 1, Item No. 6b.
- h. Avoidance of environmentally sensitive areas - Every effort will be made to mitigate the impact of the project on environmentally sensitive areas on site. Refer to Attachment No. 1, Item Nos. 1a, 1b, and 2a.

- i. Hydrological impact study - To provide subsurface information for the Route 441 site, a proposed hydrogeologic program has been developed and submitted to the DER with the southern landfill's Application for Permit to Construct a Solid Waste Resource Recovery and Management Facility.

Briefly, the program comprises field investigative elements that comply with the State's requirements and provide for a definition of shallow geologic, hydrogeologic and water quality conditions at the southern site. The principal study components include:

- 1) Definition of site specific geologic and hydrogeologic characteristics:
 - Installation of soil borings/piezometers/monitoring wells (for background water quality)
 - Review of available published/unpublished site and area specific hydrogeologic studies
 - Development of site and area specific geologic cross sections
- 2) Definition of site specific ground water flow direction and rates (shallow system) as well as an assessment (from existing reports and data) of regional ground water flow conditions:
 - Measurements of water levels in shallow piezometers and nearby existing wells
 - Permeability tests on shallow piezometers/monitoring wells
- 3) Definition of background water quality conditions:
 - Analysis of existing water quality data in the vicinity of the sites
 - Analysis of samples from background monitoring wells
- 4) • Inventory of active production wells and monitoring wells within a one-mile radius of the southern site:

- The inventory will include depth, construction details (if possible), and cones of depression from well fields (if data are available)
- 5) Inventory of present and expected future pollution sources within a one-mile radius of the southern site.
- 6) Recommendation for a permanent monitoring system:
 - Well locations, construction details, and depths
- 7) Recommendation for sampling, testing, and quality assurance/quality control:
 - Establishment of sampling/testing parameters and frequency as well as the development of a definitive quality assurance/quality control program
- 8) Proper abandonment of borings as per DER requirements.
- 9) Definition of depth of ground water, seasonal fluctuations, and thickness of the unsaturated zone using existing historical data and site specific water level measurements.



south florida regional planning council

3440 hollywood blvd., suite 140, hollywood florida 33021

broward (305) 961-2999
dade (305) 620-4266

February 6, 1984

Mr. John F. Adams
Chief, Regulatory Division
U.S. Army Corps of Engineers
P. O. Box 4970
Jacksonville, Florida 32232

Attn: Mr. Vic Anderson

RE: SFRPC #83-1226, USACE #83B-3304 & 83B-3305, DER #060781738 & 060781749
Broward County Southern Resource Recovery Facility
and Residue/Unprocessable Waste Landfill

Dear Mr. Adams:

At its February 6, 1984 meeting, the Council voted unanimously to forward the following official comments to your department.

Background

We have received U.S. Army Corps of Engineers (USACE) permit applications (83B-3304 and 83B-3305) for review and comment. The permits involve dredge and fill of two sites south of State Road 84 and east of State Road 7 (US 441) for the purpose of constructing a Southern Resource Recovery Facility (Incinerator complex) and Southern Residue/Unprocessable Waste Landfill (Figure 1). The two proposed actions involve the development of 170 acres, of which 149 acres are wetlands.

Permit Application 83B-3304 involves the placement of 260,000 cubic yards of fill over 16 acres of wetlands on an 18-acre site to construct an Incinerator complex. Primary by-products of the 1,300 tons-per-day capacity, 1,600°F solid waste incinerator will include electrical energy (35 megawatts), produced for sale to Florida Power and Light, and ash residue/unprocessable wastes requiring disposal at the associated landfill to the north (Permit Application 83B-3305). In addition to the incinerator complex, two retention ponds are proposed to provide for upland runoff discharge from the site to the South Fork New River Canal (Figure 2). Incinerator process blow-down water will be disposed by deep well injection. The 16-acre wetland plant community impacted by the proposed fill supports numerous species, including willow, red maple, red bay, wax myrtle, and Florida holly. As mitigation, the Applicant proposes creation of tidal wetlands on a 15-acre strip, excavated immediately adjacent to the South Fork New River Canal (C-11).

Permit Application 83B-3305 involves the placement of 1,570,000 cubic yards of fill over 133 acres of wetlands on a 157-acre site for the construction of a diked incinerator residue/unprocessible waste landfill and retention pond complex (Figure 3). The landfill will receive from 710 to 965 tons per day from the Resource Recovery Incinerator for a total of 12 million cubic yards of ash residue and unprocessible waste over the 20-year life expectancy of the facility. The expected composition of filled material will be 60 percent ash residue, 40 percent unprocessible waste, and less than .3 percent putrescible (organic matter subject to decay) waste. The site will be demucked by excavating 530,000 cubic yards of peat, quartz sand, and limestone substrate and filled to 5 feet above mean sea level (MSL) elevation at the bottom of each cell (above 100-year flood elevation). Each cell will be lined with an impermeable membrane (projected 50-year life) over six feet of underlying fill, and surrounded by berm, stormwater swale, and roadway. The elevation of each cell at buildout will be 140 feet above MSL, including a cover of 18-inch bentonite clay and 12-18 inch soil vegetated cover. Initially, all runoff and landfill leachates (contaminated water that has passed through disposed solid waste) will be directed to retention area (25-year, 72-hour design storm) before disposal via deep well injection. An overflow structure to the South Fork New River Canal will be constructed to handle progressively greater overflow discharges as disposal areas are filled with incinerator residue, with retention pond capacity expected to be exceeded after the year 2007. At this time, a minimum of 1.4 inches of runoff will be retained on-site, and overflows will be slowed and filtered by a riprapped dispersion pond, separated from the Canal by 200 feet of created marsh wetlands.

The wetlands portion of the site includes a wax myrtle dominated marsh in most of proposed landfill cell No. 1; mixed cypress, red maple, button bush, willow, wax myrtle, and Florida holly scrub swamp in the western half of proposed landfill cell 2/3; and sawgrass, cattail, water millet, galingales, swamp lily, arrowhead, pickerel weed, and cabbage palm in the eastern half of proposed cell 2/3. The Applicant proposes to preserve 14 acres of sawgrass/cattail marsh bordering the Pond Apple Slough (proposed Anne Kolb Park). To compensate for the loss of 133 acres of wetlands, the Applicant proposes to enhance the westernmost 50 feet of the Pond Apple Slough adjacent to the cell 2/3 landfill berm with planted cypress trees. Eighteen acres of tidal wetlands will be created in a strip excavated immediately adjacent to the South Fork New River Canal (C-11), and 15 acres will be created off-site at Tree Tops Park. Other mitigation measures are still being evaluated, including creating a non-tidal wetland area in western Broward and enhancing two small areas (four and twenty acres) north of State Road 84.

Issues

The proposed actions raise the following issues:

- A portion of the site is located within the County-designated South Fork New River Local Area of Particular Concern (LAPC) and Urban Wilderness Area (Figure 4). The proposed actions will destroy approximately 149 acres of wetlands, including 51 acres (21 percent) of the LAPC described in the Coastal Zone Protection and Conservation Element of the Broward County Comprehensive Plan as containing "the lone remaining example of a forested, non-tidal wetlands system in the eastern regions of Broward County."
- The project site is known to contain several endangered or threatened plant species, including Florida Royal Palm, Wild Pine Bromeliads, other Bromeliads, and Leather Fern. The endangered and threatened plant species located within the project boundaries will be destroyed.
- The proposed actions conflict with the two wetlands policy guidelines of the Broward County Coastal Element:

"Protect and, where possible, preserve wetland areas of sufficient size to maintain a productive biological and hydrological system; and

Wetlands are valuable as water recharge and purification areas; therefore, development within these areas should be designed to maximize natural water storage potential."

County staff note that these policies are not solely intended to ensure preservation of wetlands, but rather that, where development occurs in wetlands, it should be designed for maximum protection of these natural systems, whether by preservation or mitigation. The County Office of Planning position is that the proposed mitigation is adequate to demonstrate compliance with these coastal protection policies. However, 149 acres of wetlands will be destroyed and only 49 acres are proposed for mitigation.

Council practice, as well as that of State and Federal agencies, is to require acre for acre mitigation. Thus, the proposed mitigation plan does not appear to be adequate (See Evaluation below).

- Discharge of contaminated water from stormwater runoff in excess of the design storm and from potential leaks from the landfill cells may significantly affect the water quality of the South Fork New River Canal (the landfill lining is designed to contain leachate for up to 50 years). Pollutants entering the South Fork New River Canal could seriously degrade water quality, harm marine life, and negatively impact the local marine-oriented economy. In addition, the 25-year design storm has a 4 percent chance of occurring each year, and could

February 6, 1984

be exceeded many times in a 25-year period, forcing runoff to overflow into the Canal.

- Wastewater disposal will involve deep well injection of approximately 700,000 gallons per day (gpd) from the incinerator and 500,000 gpd from runoff and leachate.
- The filling of 149 acres of wetlands will reduce groundwater recharge of the Biscayne Aquifer and displace flood waters, which now cover the site, to adjacent areas.
- The area east of the proposed cell 2/3 is known as the Pond Apple Slough (proposed Anne Kolb Park), a forested, tidally-connected wetland area. Stormwater runoff, contamination of river water adjacent to the project, and possibly underground leachate, could negatively affect the water quality of the proposed park posing a hazard to humans, vegetation, and wildlife.
- Appropriate measures for treating landfill leachate before deep well injection are presently being evaluated by the South Florida Water Management District (SFWMD) and the Florida Department of Environmental Regulation (DER). In addition, the feasibility of using deep well injection for this project will be evaluated by the two permitting agencies before granting surface water (SFWMD) or well injection (DER) permits. Treatment of leachate before deep well injection may or may not be required.
- Mitigation efforts proposed by the County include the following:
 - Creation of a 15-acre tidally-connected wetland strip to compensate for the loss of 16 acres of tidally-connected wetlands (Permit Application 83B-2204: Resource Recovery Incinerator Complex).
 - Creation of 18 on-site and 15 off-site acres of tidally-connected wetlands, or a total of 33 acres, to compensate for the loss of 133 wetland acres (Permit Application 83B-3305: Landfill Complex).

Recreation of 48 acres of wetlands is far less than the 149 acres of wetlands being destroyed. The creation of tidally-connected wetlands does not compensate for the loss of a non-tidal, sawgrass/cattail marsh wetland system, and there are no non-tidal mitigation proposals included in the permit application. In addition, no schedule for mitigation has been proposed, making it possible for cost overruns to reduce the quantity or quality of mitigation.

- Due to its proximity to the Fort Lauderdale/Hollywood International Airport, the site is within regulated airspace. The stack height of the proposed incinerator will have to conform to Federal Aviation Administration (FAA) criteria (220 feet maximum). Also, Florida State regulations prohibit the siting of landfills within 10,000 feet

of a public airport to avoid the safety hazard due to birds congregating near airports. The eastern portion of landfill cell 2/3 is just at the 10,000-foot line. Congregations of birds at the landfill may, however, still adversely impact air traffic. The landfill will be clearly visible to aircraft passengers approaching the airport from the west.

Evaluation

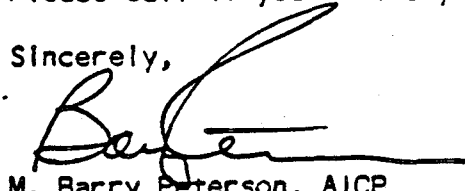
There is an urgent need for a new incinerator complex and landfill disposal area in southern Broward County. The solid waste generated in Broward County is 2,400 to 3,000 tons per day (tpd), disposed of either at the Davie (1,200 tpd) or Pompano Beach landfill (1,200 to 1,800 tpd). The Davie landfill reaches capacity this year. In order to evaluate possible sites for a new landfill, several site selection studies were done by Broward County or its consultants. Three final sites, Davie (next to existing landfill), Broward Correctional Institute, and US 441/SR 84 were chosen by Broward County for the incinerator/landfill complex from 97 potential, 16 probable, and 7 candidate sites. Although the initial February, 1982 County site selection study showed that the Davie site was the best choice for the landfill complex, it was withdrawn from consideration because of litigation; and the Broward Correctional Institute site has more severe environmental limitations than the proposed US 441/SR 84 site. The proposed actions at the US 441/SR 84 will destroy a large non-tidal wetland area located within the South Fork New River LAPC, which contains "the lone remaining example of a forested, non-tidal wetlands system in the eastern regions of Broward County." In order to satisfy the public need for an additional solid waste disposal site and protect, to the greatest extent possible, valuable tidal and non-tidal wetlands, the following should be imposed by the U.S. Army Corps of Engineers as conditions to granting the two permits:

- All proposed mitigation should start when site preparation for the incinerator complex and landfill begins, and be completed within one year of the starting date. Preserved and created wetland areas should be maintained to prevent infestation by exotic plants.
- The County should evaluate other areas adjacent to the Canal to create additional tidal and non-tidal wetlands. Priority should be placed on creating wetlands in the same drainage basin and replacing, to the maximum extent feasible, an acre of wetlands lost with an acre of newly created wetlands.

Mr. John F. Adams
Page 6
February 6, 1984

Please call if you have any questions.

Sincerely,

A handwritten signature in black ink, appearing to read 'M. Barry Peterson', with a long horizontal stroke extending to the right.

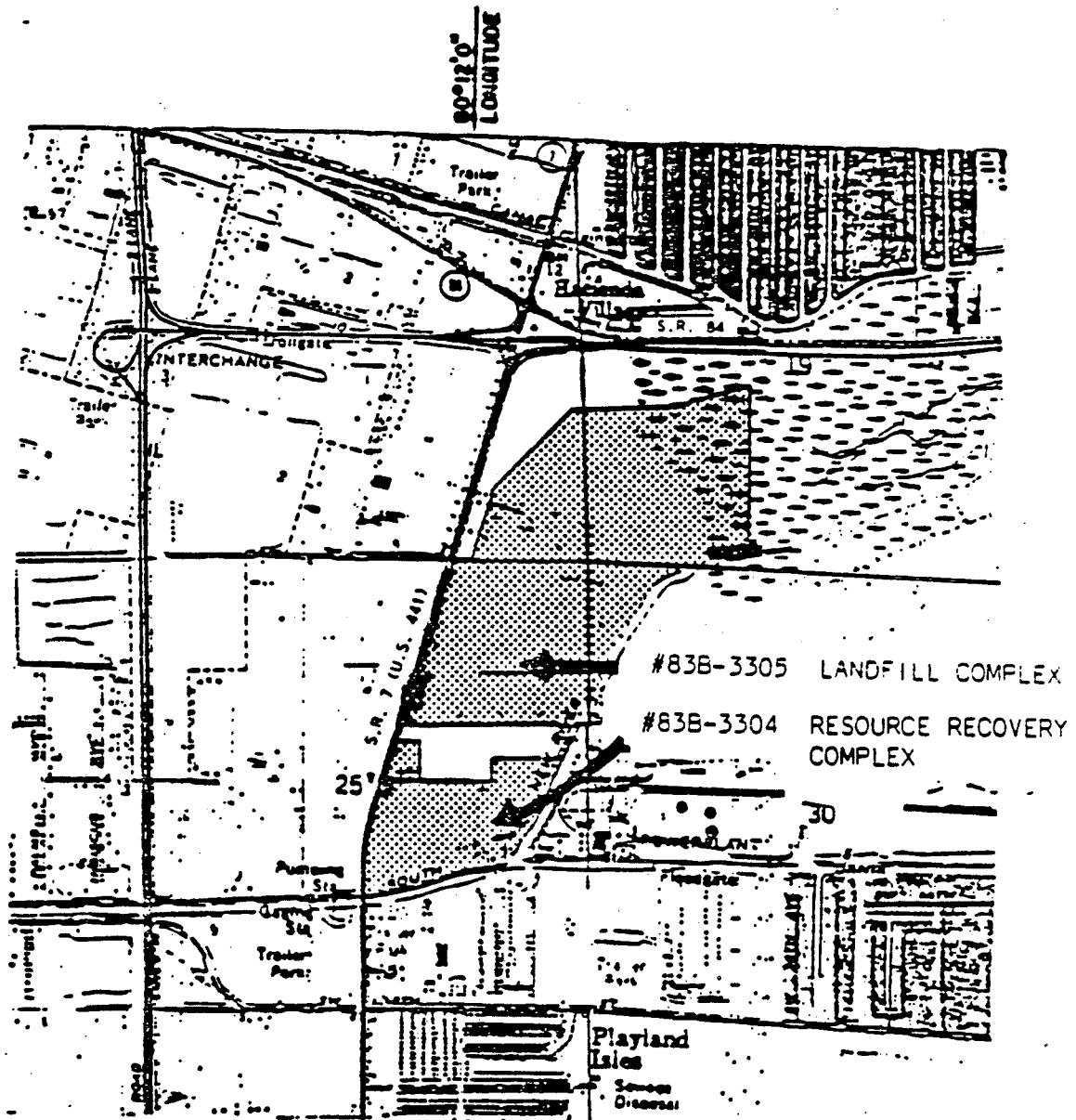
M. Barry Peterson, AICP
Executive Director

MBP/bh

Attachments

cc: Honorable Nicki Grossman
Chuck Schnepel
Phyllis Korab
Diane Moore
Jim Hudgens
Betty Gregg

Figure 1
LOCATION MAP



Source: Application

SCALE: 1000' 0' 1000' 2000'

Figure 2
SOUTHERN RESOURCE RECOVERY FACILITY
SITE PLAN

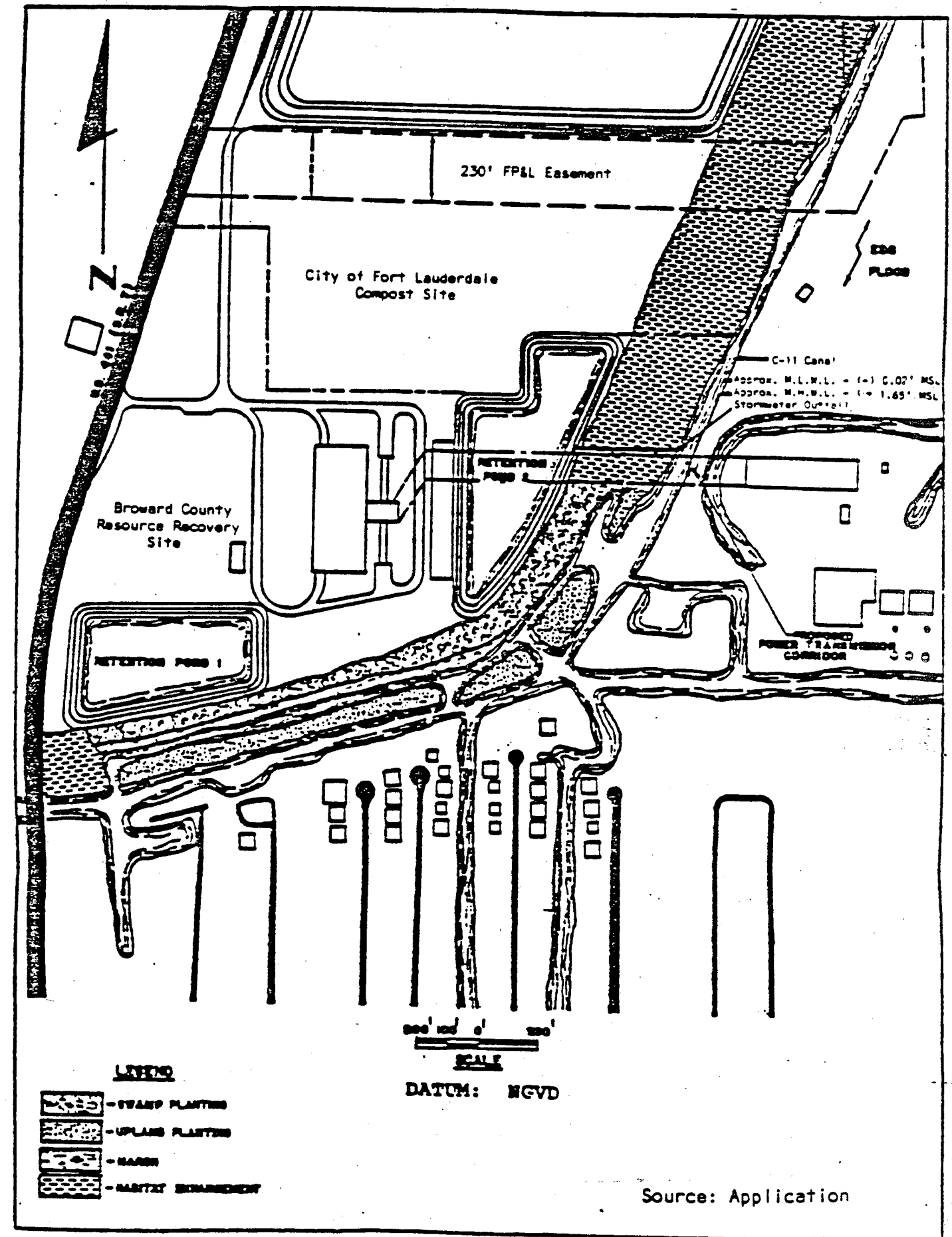
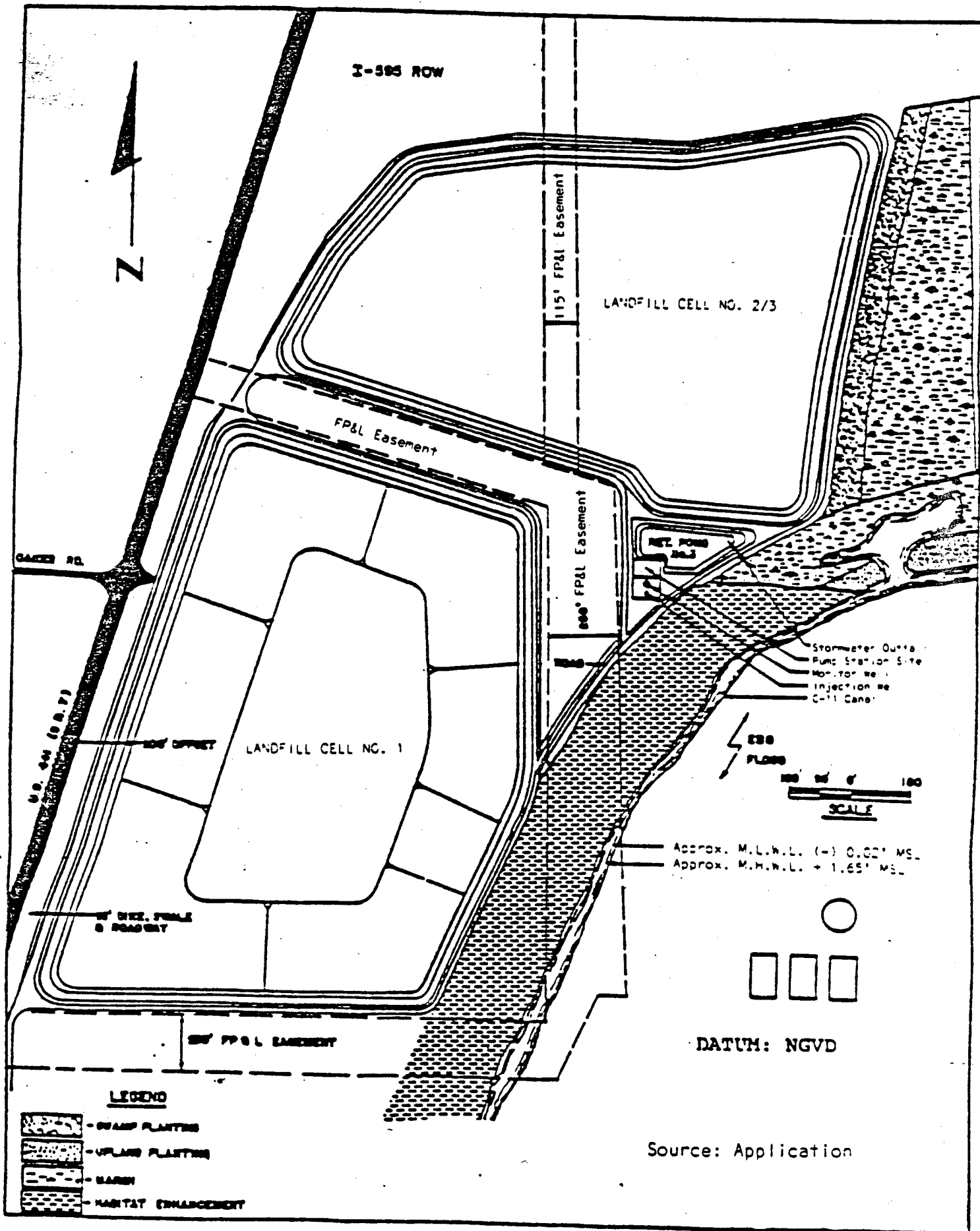
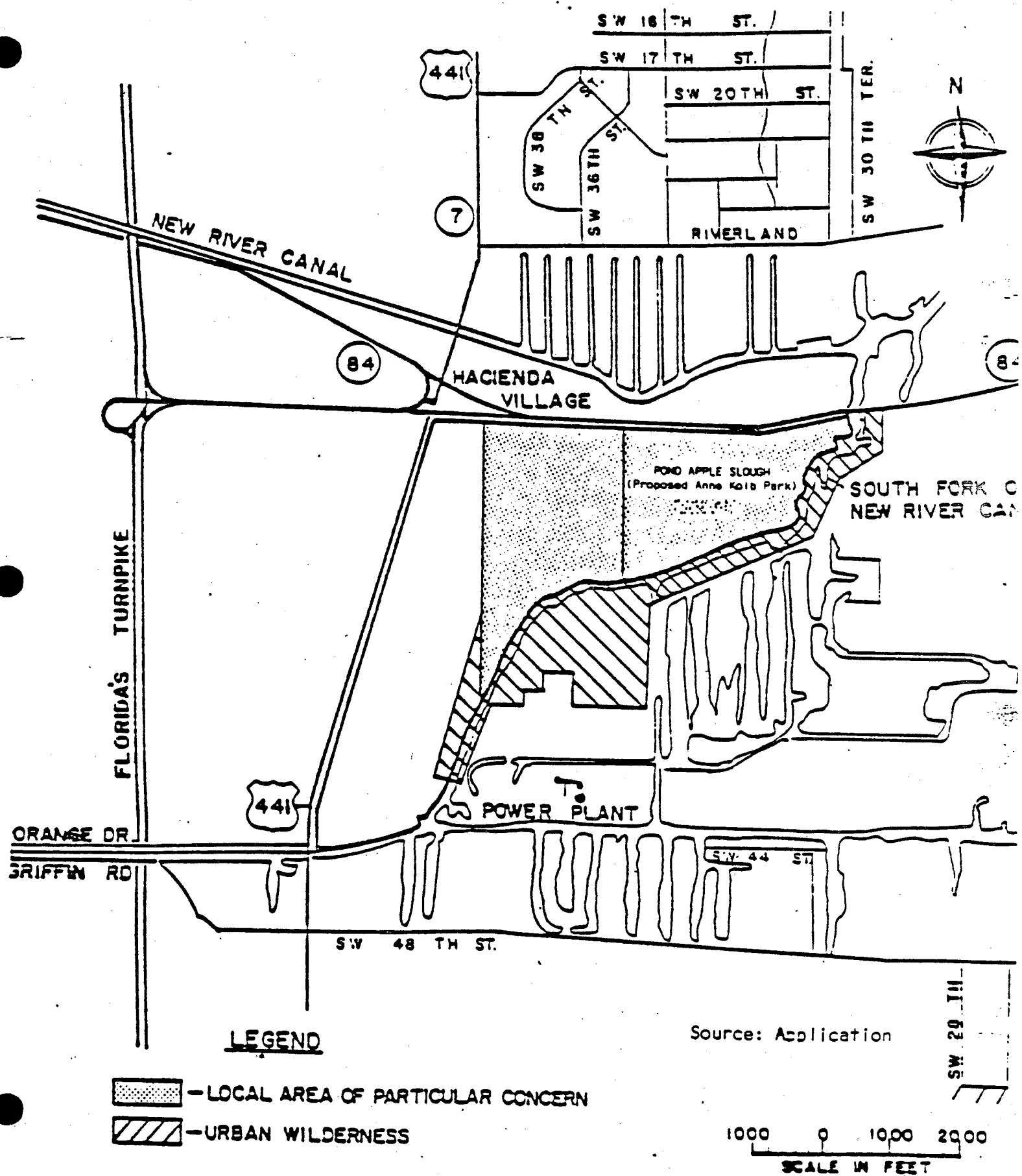


Figure 3
SOUTHERN RESIDUE/UNPROCESSIBLE WASTE LANDFILL



SOUTH FORK NEW RIVER LOCAL AREA OF PARTICULAR CONCERN AND
URBAN WILDERNESS AREA



RESPONSE TO DEPARTMENT OF ARMY LETTER DATED FEBRUARY 16, 1984
BROWARD COUNTY PERMIT APPLICATION NOS. 83B-3304 and 83B-3305

ATTACHMENT NO. 2

1. The public and private need for the project and the benefits to be derived

In 1981, Broward County generated approximately 2,700 tons per day of solid waste. It is projected that the County's waste generation will increase to 3,200 tons per day by 1987. At present, the County's waste is disposed of at two landfills. One of these landfills, the County landfill at Davie, is projected to reach capacity in mid-1986. The other landfill, the Central Disposal landfill located at Pompano Beach is estimated to reach capacity in the early 1990's. Once this occurs, there are no long term arrangements for the disposal of municipal solid waste generated in Broward County.

The capacity limitations of these landfills necessitated development of a long-term county-wide disposal plan. To address this situation, the County established a conceptual project approach which involves the recovery of materials and/or energy. Specifically, mass-burning waterwall incineration was selected as the resource recovery technology to be employed with a residue/unprocessable waste landfill accompanying each facility, thereby providing the County with a complete disposal program.

The exact population to be served by the Southern facility will be determined by the number of municipalities that commit their waste to the County and the location and transportation preferences of these municipalities. At present, Broward County is in the process of negotiating an Interlocal Agreement for waste commitments from the Broward County municipalities. Preliminary results from these negotiations indicate that approximately 60 percent of the county-wide population, or an estimated population of 631,000 in 1981 (as reported by the League of Cities, Broward County and the Broward County Office of Planning), will be served by the southern project.

There are many benefits associated with construction of the Southern facility and landfill. First, the project is a long term environmentally sound, county-wide solution to the municipal solid waste (MSW) problem. The selected incineration technology will reduce the MSW volume to be landfilled by approximately 90 percent.

This corresponds roughly to 10 landfills with the volume of the Southern landfill which will not need to be constructed over the operating life of the Southern landfill.

In addition, the facility will generate electric power which will be sold to Florida Power & Light. The project site has ready access to the FP&L electric grid, which simplifies interconnection arrangements. The revenue generated by selling electricity to FP&L will substantially reduce the facility and landfill operating cost burden on the County's taxpayers.

2. Why the proposed fill and the activity associated with it must be located in the wetland resource

The project site which has been selected through a lengthy and complex series of studies comprises a total of 248 acres. The Resource Recovery Facility is 50.46 acres and the Residue/Unprocessable Waste Landfill is 197.87 acres. Project development requires a twenty year landfill capacity, and design of the facility and landfill cells at the selected site fulfills that minimum need requirement.

This need will be met by consumptive use of existing natural communities on the project site. Development will require the purchase of approximately 148 acres of wetlands along with 100 acres of uplands to meet the land requirements. Project buildout at the required capacity is not feasible without use of the wetlands. As described below, use of the more viable wetlands will be delayed for 10 - 12 years through phased development.

Relative to wetland use, it is important to consider project mitigation. Total on-site mitigation comprises 41 acres; 15 at the Resource Recovery Facility, and 35 at the Landfill. Off-site mitigation comprises three parcels totaling 105 acres (15 acres, 26 acres, and 74 acres). Revised mitigation drawings are being forwarded to the U.S. Army Corps of Engineers under separate cover.

3. Alternative sites and site plans that have been considered and why alternatives are not feasible

To identify the most appropriate site for development of the Southern Resource Recovery Facility and associated Residue/Unprocessable Landfill, Broward County has undertaken a comprehensive site selection process which was initiated in 1981 and completed in 1983. The analy-

ses and evaluation procedures utilized in performing the site selection is documented in the following materials, which are enclosed for your review:

- o "Site Evaluation for Solid Waste Management Alternatives for Broward County," February 1982
- o Letter report to Dr. Edward J. Jablonowski regarding additional site investigations dated April 22, 1982
- o Letter report to Dr. Edward J. Jablonowski regarding additional site investigations dated August 10, 1982
- o "Site Evaluation for the Broward County Solid Waste Management Program," March, 1983
- o "Landfill Site Selection Study," prepared by the Broward Office of Planning, June, 1982
- o Correspondence from Frederick J. Danski, Broward County Assistant General Counsel to John F. Adams, Chief Regulatory Division Department of the Army Jacksonville District Corps of Engineers. Re: legal opinion regarding feasibility of utilizing Davie site for southern resource recovery facility.

We recognize that this is a great deal of material to be reviewed. Therefore, the highlights of the aforementioned materials are summarized below.

Initially, the site evaluation process for the Broward County resource recovery program involved the identification of one site for the construction of a resource recovery facility and a second site for the development of a new sanitary landfill. In February, 1982 a report was prepared which examined the technical, environmental and regulatory aspects of three potential resource recovery sites and five potential landfill sites. The results of this analysis indicated that the Route 441 site was the most suitable site for the development of a resource recovery facility.

Subsequent to the submission of the February 1982 site evaluation report, additional investigations were performed regarding the feasibility of the above mentioned resource recovery and landfill sites. A report summarizing the results of these investigations was prepared in April 1982.

To verify the results of these initial studies, supplemental investigations were undertaken, which involved the identification of major undeveloped areas in the County through a review of current aerial photographs. This resulted in the identification of 97 locations. These sites were then evaluated based upon development status, size, extent of on-site water bodies, location with regard to unincorporated areas, and involvement with Development of Regional Impact.

The results of this review indicated 16 potential sites requiring further investigation. In an initial screening of these 16 sites which is summarized in the June 1982 site evaluation report, nine of the sixteen sites were eliminated from further consideration for a variety of reasons including LAPC status, size, parkland status and the presence of a hospital on-site. The remaining seven sites were then evaluated in the August, 1982 report.

As a result of a policy decision, adopted by Broward County on October 12, 1982, not to rely on landfill as a primary long-term disposal solution, the County decided to reevaluate the three top ranked southern sites; the Broward Correctional Institute (BCI) site, the Davie site and the Route 441 site.

The results of this evaluation, which are presented in the March 1983 report, indicate that the Route 441 site is the most suitable for development of the southern resource recovery facility and residue/unprocessable landfill.

There are several problems associated with using either the BCI or Davie site. The BCI site contains substantial wetlands areas and is located just east of the conservation areas indicating that this site may be an important ground-water recharge area. The Davie site is not feasible for development of the southern resource recovery facility as a result of the uncertainty regarding jurisdictional authority over the site, as indicated in the enclosed letter from the Broward County Assistant General Counsel to the Corps of Engineers.

Based upon environmental, regulatory and technical considerations, the Route 441 site represents the most appropriate for development of the southern facilities.

Recognizing the various concerns expressed by some reviewing agencies over the consumptive use of existing wetlands east of the FP&L easement (a portion of landfill cell number 2/3), Broward County is willing to defer

construction of this portion of the landfill for a period of up to ten years following issuance of the required permit. During this period, Broward County will make every reasonable effort to explore and consider viable alternatives to development and use of this portion of the landfill site. Such deferral, in conjunction with the on-site and off-site mitigation measures already proposed, represents a rational approach to planned use of the facility site and provides for maximum potential mitigation of impacts on resources currently present on the site. In the event viable alternatives to use of this portion of the site are not found during the intervening ten-year period, development of the remainder of cell number 2/3 would proceed in the best interest of the Broward County citizenry.

March 14, 1984

United States Environmental Protection
Agency, Region IV
345 Courtland Street
Atlanta, Georgia 30365

Attention: Mr. Charles R. Jeter
Regional Administrator

Re: Broward County Southern Resource Recovery Landfill

Gentlemen:

We thank you for the opportunity of meeting with you on March 12, 1984 to discuss our proposal to construct a resource recovery facility and associated landfill adjacent to the South Fork of the New River Canal.

Included in the meeting agenda were the questions and issues raised in your letter of February 28, 1984. As agreed, we are herein submitting written responses to these items.

We wish to expeditiously resolve outstanding issues of concern to the mutual satisfaction of Broward County and the U.S. Environmental Protection Agency. Your continued cooperation on this matter is of great significance to the continued vitality of Broward County and is greatly appreciated.

Should you have any further questions or require additional clarification please contact us at your convenience.

Very truly yours,

Phyllis A. Korab
Project Director

PAK/lfc

RESPONSE TO U.S. ENVIRONMENTAL PROTECTION AGENCY
LETTER DATED FEBRUARY 28, 1984

BROWARD COUNTY PERMIT APPLICATION
NOS. 83B-3304 AND 83B-8305

ATTACHMENT NO. 1

1. "Provide a brief overview of the alternative site analysis. Why must the facility be located at the proposed site? Reference the current situation at Davie."

To identify the most appropriate site for development of the Southern Resource Recovery Facility and associated Residue/Unprocessable Landfill, Broward County has undertaken a comprehensive site selection process which was initiated in 1981 and completed in 1983.

Initially, the site evaluation process for the Broward County resource recovery program involved the identification of one site for the construction of a resource recovery facility and a second site for the development of a new sanitary landfill. In February, 1982 a report was prepared which examined the technical, environmental and regulatory aspects of three potential resource recovery sites and five potential landfill sites. The results of this analysis indicated that the Route 441 site was the most suitable site for the development of a resource recovery facility.

Subsequent to the submission of the February 1982 site evaluation report, additional investigations were performed regarding the feasibility of the above mentioned resource recovery and landfill sites. A report summarizing the results of these investigations was prepared in April 1982.

To verify the results of these initial studies, supplemental investigations were undertaken, which involved the identification of major undeveloped areas in the County through a review of current aerial photographs. This resulted in the identification of 97 locations. These sites were then evaluated based upon development status, size, extent of on-site water bodies, location with regard to unincorporated areas, and involvement with Development of Regional Impact.

The results of this review indicated 16 potential sites requiring further investigation. In an initial screening of these 16 sites which is summarized in the June 1982

site evaluation report, nine of the sixteen sites were eliminated from further consideration for a variety of reasons including LAPC status, size, parkland status and the presence of a hospital on-site. The remaining seven sites were then evaluated in the August, 1982 report.

As a result of a policy decision, adopted by Broward County on October 12, 1982, not to rely on landfill as a primary long-term disposal solution, the County decided to reevaluate the three top ranked southern sites; the Broward Correctional Institute (BCI) site, the Davie site and the Route 441 site.

The results of this evaluation, which are presented in the March 1983 report, indicate that the Route 441 site is the most suitable for development of the southern resource recovery facility and residue/unprocessable landfill.

There are several problems associated with using either the BCI or Davie sites. The BCI site contains substantial wetlands areas and is located just east of the conservation areas indicating that this site may be an important ground-water recharge area. The Davie site is not feasible for development of the southern resource recovery facility as a result of the uncertainty regarding jurisdictional authority over the site, as indicated in the enclosed letter from the Broward County Assistant General Counsel to the Corps of Engineers.

Based upon environmental, regulatory and technical considerations, the Route 441 site represents the only site available for the required development of the southern facilities.

2. "Outline the environmental amenities of the proposed facility relative to standard solid waste disposal facilities."

The technology proposed for the Broward County facility is the state-of-the-art mass burning waterwall incineration that has been demonstrated through successful operation at over 400 facilities worldwide with some operating as long as 30 years. The proposed facility is designed to minimize environmental impact in these important areas:

- Air Quality
- Traffic

- Noise
- Odor
- Dust

These environmental impacts can be summarized as follows:

- a. Air Quality - Modeling results indicate that emissions from the proposed resource recovery facility would not cause any significant deterioration of existing air quality. Table 1 summarizes the modeling results and provides a comparison of ambient air quality, predicted air quality, and regulatory standards. As indicated, the predicted increase above ambient levels for all constituents tested will be minimal and all projected air quality levels are well within regulatory standards. This preliminary modeling will be demonstrated conclusively as part of the federal, state and local permitting process and through the required facility emissions testing.
- b. Traffic - Estimates of the additional truck traffic that would be associated with the proposed facility were utilized to project traffic impacts on the local access roads. Table 2 presents the results of these estimates by listing the additional vehicle trips expected on each of the roadways and the percentage increase these additional trips represent. As the figures in this table indicate, all of the increases in average daily traffic volumes should have an insignificant impact on existing traffic conditions.

In addition, since both the resource recovery facility and the landfill can be located on the same site, there will be no need to haul ash residue over public roads, thus further reducing traffic impact.

- c. Noise Impacts - The design and selection of equipment and construction materials shall be made to minimize noise generation and to conform to all requirements of the Broward County Noise Regulations established under Chapter 27-7 of the Code of Regulations of the Broward County Environmental Control Board. Noise testing will be performed during the Acceptance Test Period and acceptable levels must be demonstrated for obtaining the County noise permit which is necessary for facility operation.

ROUTE 441 SITE AIR QUALITY IMPACTS¹

<u>PARAMETER</u>	<u>REGULATORY STANDARDS</u>	<u>AMBIENT LEVELS</u>	<u>FACILITY EMISSIONS</u>	<u>PERCENT INCREASE</u>
TSP	60	38.0	0.1	<1
CO	10,000	9,500.0	1.4	<1
NO _x	100	36.0	0.3	<1
SO ₂	60	3.0	0.3	10

TABLE 1

1 - ALL VALUES IN $\mu\text{g}/\text{m}^3$

ROUTE 441 SITE TRAFFIC IMPACTS

	<u>AVERAGE DAILY TRAFFIC</u>	<u>APPROXIMATE ADDITIONAL VEHICLE TRIPS</u>	<u>PERCENT INCREASE</u>
RT 441 (SOUTH TO RT 84)	35,930	82	0.2
RT 441 (RT 84 TO SITE)	30,059	383	1.3
RT 441 (NORTH TO RT 84)	26,174	298	1.1
RT 84 (EAST TO RT 441)	37,480	32	0.1
RT 84 (WEST TO RT 441)	41,200	132	0.3
FLORIDA TURNPIKE EXIT	11,678	32	0.3

TABLE 2

- d. Odor - Solid waste handling facilities and landfills are perceived to generate offensive odors which impact people in adjacent areas.

The resource recovery facility (RRF) will be completely enclosed, and malodorous gas generated by incoming solid waste will be controlled by negative air pressure in the facility. The air will be fed into the furnaces where destruction of odor-causing compounds will occur.

The material placed on the landfill will consist of inorganic, nonprocessable waste and residue ash that must meet the specification of containing not greater than 4 percent combustibles and 0.3 percent putrescibles. As a result, the landfilled materials will be odorless, will not attract insects, rodents or birds, and will not have an olfactory impact on nearby residents.

- e. Dust - Dust will be generated in the RRF as solid waste is processed. All dust will be contained within the enclosed facility. The residue ash product of the RRF will have approximately a 30 percent moisture content. Accordingly, there will be no dust impact on the surrounding community.

3. "Outline the proposed safeguards to onsite surface and groundwater quality at the proposed facility."

and

4. "What is the current proposal for landfill leachate and facility stormwater runoff disposal and treatment?"

Water resource impacts are an important concern of this project. A thorough discussion of the control procedures for on-site water was provided in Sections II.A.3 and Section IV.L of the Joint Application for Activities in the Waters of the State of Florida, September 1983, submitted to the U.S. Department of the Army and the Florida Department of Environmental Regulation for the Southern Resource Recovery Facility, and in Sections II.A.3 and IV.K of the Southern Residue/Unprocessable Waste Landfill Application concurrently submitted to the same agencies.

The proposed development is expected to have an insignificant impact on water quality. The materials to be landfilled (inert residue and unprocessable materials) will be essentially non-putrescible and non-combustible.

The available data indicate that, typically, leachate generated at this type of landfill does not contain the pollutants usually associated with a processable waste landfill. Nevertheless, the County is taking the additional precaution of requiring vendors to install an impermeable liner to prevent leachate percolation to the underlying aquifer. A leachate collection system is to be installed atop the liner. Typical details of the proposed liner and collection system are shown in Figure 1. The collected leachate will be pumped to the Hollywood Regional Wastewater Treatment Plant for treatment prior to final disposal.

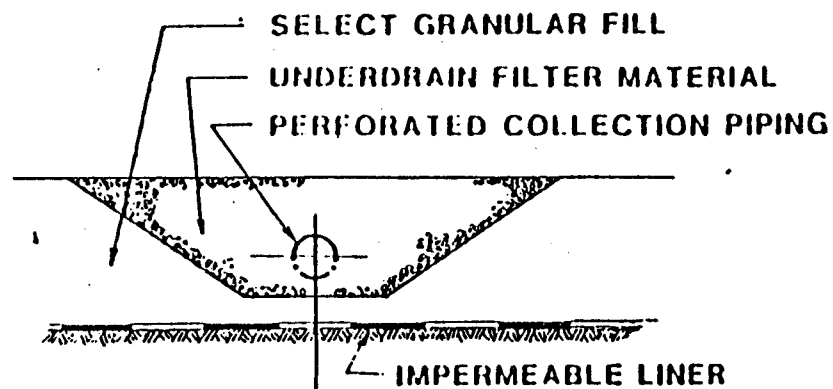
In addition, once a landfill cell reaches completion, an impermeable cover system will be installed to prevent future percolation, and a perimeter swale system will be constructed to control stormwater runoff. A groundwater monitoring well system will also be installed to ensure the integrity of the leachate collection and stormwater runoff systems, and to serve as a potential additional precaution to protect the quality of the underlying aquifer.

5. "Why does the County feel that it must fill the 45-50 acre landcell #3, sawgrass marsh, for the total project to be viable, i.e., expected volumetric and economic bond requirements?"

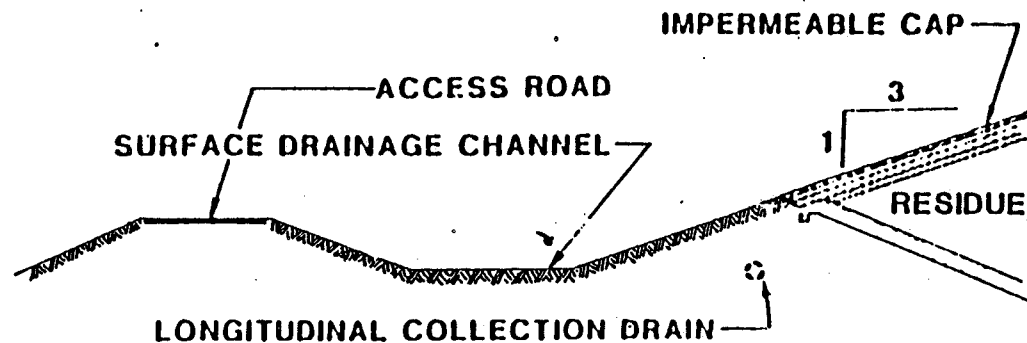
The estimated volume requirements for the proposed southern landfill during the 20 year planning period are shown in Table 3.

As this table indicates, approximately 12 million cubic yards of landfill volume are required at the southern facility to accommodate the residue and unprocessable waste projected to require disposal at the southern residue/unprocessable waste landfill over the life of the project.

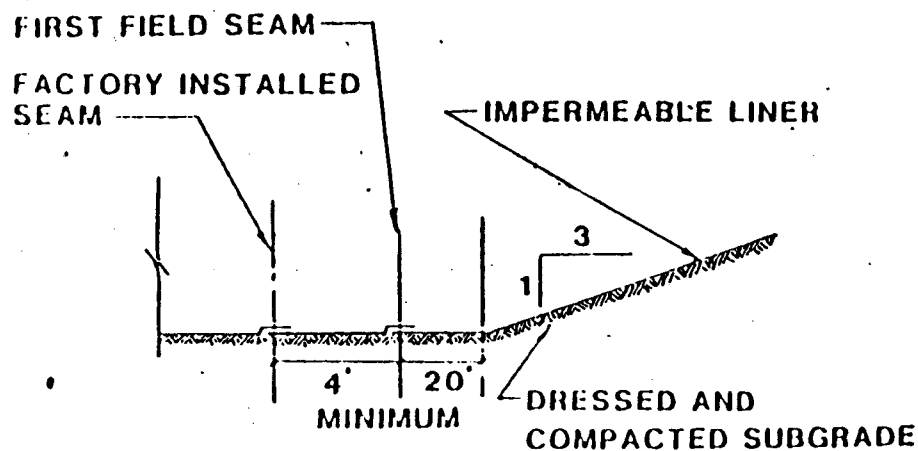
There are approximately 198 acres available at the Route 441 site for development of the southern residue/unprocessable waste landfill, including buffer areas and stormwater retention ponds. Preliminary calculations, utilizing 116 acres for landfill development, indicate that the capacity of this landfill would be approximately 12 million cubic yards. The remaining 82 acres are sufficient for development of the stormwater retention ponds, buffer areas, and environmental enhancement areas.



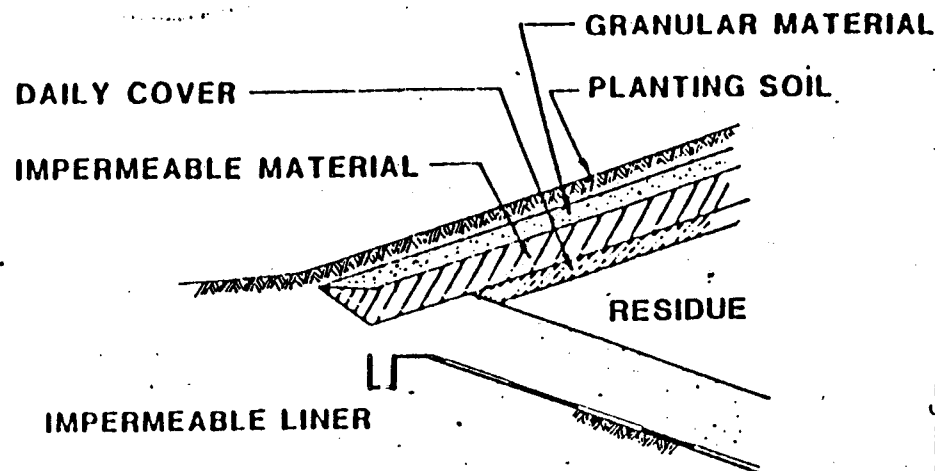
TYPICAL UNDERDRAIN SECTION



TYPICAL SECTION THROUGH TOE OF SLOPE



TYPICAL BOTTOM LINER INSTALLATION



TYPICAL CAP DETAIL

TABLE 3

ESTIMATED VOLUME REQUIREMENTS FOR RESIDUE/UNPROCESSABLE WASTE
LANDFILL TO BE LOCATED AT THE SOUTHERN SITE

Year	Estimated Residue ¹ to Southern Landfill (TPY)	Estimated Unprocessable Waste ² to Southern Landfill		Cumulative Total ³ of Residue & Unprocessable Waste to Southern Landfill (Cubic Yards)
		Tons Per Year	Cubic Yards Per Year	
1987	142,000	117,000	292,000	471,000
1988	146,000	119,000	298,000	954,000
1989	149,000	124,000	310,000	1,453,000
1990	153,000	128,000	320,000	1,967,000
1991	156,000	130,000	325,000	2,490,000
1992	159,000	131,000	328,000	3,020,000
1993	162,000	133,000	332,000	3,557,000
1994	165,000	135,000	338,000	4,103,000
1995	168,000	137,000	342,000	4,658,000
1996	170,000	141,000	352,000	5,225,000
1997	173,000	142,000	355,000	5,799,000
1998	176,000	144,000	360,000	6,382,000
1999	178,000	146,000	365,000	6,971,000
2000	181,000	148,000	370,000	7,571,000
2001	183,000	150,000	375,000	8,177,000
2002	185,000	151,000	378,000	8,789,000
2003	187,000	153,000	382,000	9,409,000
2004	188,000	155,000	388,000	10,034,000
2005	191,000	155,000	388,000	10,663,000
2006	192,000	159,000	398,000	11,304,000
2007	194,000	159,000	398,000	11,948,000
	3,598,000	2,957,000	7,394,000	

NOTES:

1. Calculated as follows: for 1987 (from p. 42 of draft RFP) 2,600 tpd x 0.60 (percentage of total processable waste available to southern resource recovery facility) x 0.25 (percentage of waste by weight remaining as residue after incineration) x 365 day/yr = 142,000 tons year. Density of Residue is assumed to be 2000 lbs/cubic yard.
2. Assumes that 50 percent of all unprocessable waste will be landfilled at the southern facility's residue/unprocessable landfill and that such waste will have a landfilled density of 800 lbs/cubic yard: i.e. for 1987 (from p. 42 of draft RFP) 640 tpd x 0.50 x 365 day/yr = 116,800 or 117,000 tpy.

$$117,000 \text{ tons} \times \frac{2000 \text{ lbs}}{\text{ton}} \times \frac{1 \text{ cu.yd.}}{800 \text{ lbs.}} \times 292,000 \text{ cubic yards/year}$$

3. Includes an allowance of 8 percent of total volume for cover materials.

Reducing the landfill acreage approximately 42 acres by eliminating the wetland parcel on the South Fork New River Canal east of the FP&L easement (landfill cell No. 3) would reduce the lifetime capacity of the residue/unprocessable waste landfill to approximately 16 to 18 years.

Since this is two to four years less than the originally proposed life of the project, the gap in capacity will make the site inadequate for the planning period, and would adversely affect the financing of the project. Refer to the attached correspondence to Ms. Phyllis A. Korab, Broward County Resource Recovery Office from Lazard Freres & Company, dated February 28, 1984, regarding a discussion of the impact on financing of reduced landfill capacity.

6. "Can stormwater runoff retention/treatment requirements from landcell #1 operation be met by landcell #2 retention capacity alone?"

Yes, the stormwater runoff retention/treatment requirements from landfill cell No. 1 operation can be met without entire use of landfill cell No. 3 retention capacity.

In preliminary discussions held with the South Florida Water Management District, this agency has indicated that retention capacity of landfill cell No. 2 (the area west of the north-south FP&L easement) plus the east-west FP&L easement separating landfill cell Nos. 1 and 2 is sufficient to meet the stormwater runoff retention/treatment requirements.

7. "Is phasing of construction at the landcell #3 sawgrass marsh area so as to avoid any filling of landcell #3 until all other on-site disposal/runoff retention capacity is exhausted, engineeringly feasible? If so, at what future date would dike construction around landcell #3 be anticipated?"

Phased development of the landfill cells is feasible from an engineering standpoint. As originally conceived, the development plan involves ash disposal in subcells of a landfill cell until capacity of that cell is exhausted. The order of development is landfill cell No. 1 followed by landfill cell No. 2/3.

Before material is deposited within a given landfill cell, it is surrounded by a dike and perimeter swale system. Dike construction around landfill cell No. 2/3

is anticipated to commence between 10 to 14 years (i.e., between 1997 and 2001) from the start of landfill operations.

8. "Is the County willing to actively seek other off-site landfill sites, other technologies or other techniques to extend landcell #1 and #2 capacity (i.e. selling disposal residue, etc.) prior to filling the landcell #3 sawgrass marsh?"

Recognizing the various concerns expressed by some reviewing agencies over the consumptive use of existing wetlands east of the FP&L easement (a portion of landfill cell number 2/3), Broward County is willing to defer construction of this portion of the landfill for a period of up to ten years following issuance of the required permit. During this period, Broward County will make every reasonable effort to explore and consider viable alternatives to development and use of this portion of the landfill site. In addition, efforts will also be made to market the process residue so as to minimize landfill capacity requirements and extend the life of the landfill site. Such deferral, in conjunction with the on-site and off-site mitigation measures already proposed, represents a rational approach to planned use of the facility site and provides for maximum potential mitigation of impacts on resources currently present on the site. In the event viable alternatives to use of this portion of the site are not found during the intervening ten-year period, development of the remainder of cell number 2/3 would proceed in the best interest of the Broward County citizenry.



General Counsel's Office
Room 248, Broward County Courthouse
Fort Lauderdale, Florida 33301
(305) 765-5105

November 9, 1983

Our File: 83-148

Department of the Army
Jacksonville District
Corps of Engineers
P. O. Box 4970
Jacksonville, Florida 32232

Attention: Mr. John F. Adams, Chief
Regulatory Division

Re: Broward County Resource Recovery Project

Gentlemen:

We are in receipt of your inquiry concerning the potential use of the Davie site for development of the referenced project. Since the jurisdictional location of this site is a critical factor in determining its acceptability, our office has been involved in investigating this matter. The legal background regarding the proposed Davie site is as follows.

On September 19, 1974, Ordinance No. 74-44 which called for a referendum election to annex the proposed site into the Town of Davie pursuant to Florida Statute 171.04 was passed. The subsequent referendum election, held October 1, 1974, resulted in the annexation of the proposed site into the Town of Davie.

The owner of the proposed site, Imagination Farms, Inc., subsequently brought suit against the Town of Davie requesting that the annexation be declared null and void. This case (Case 74-14130) resulted in a final judgment for the plaintiff since the subject lands were predominantly used for agricultural purposes and were not urban in character as required by Florida Statute 171.043. Included was the stipulation that in the event of any alteration, omission or addition to the consent judgment, both parties reserve the right to withdraw from the settlement, and the agreement shall become void. Section 171.031 of the Florida Statutes defines "urban purposes" to include land used for governmental purposes.

Department of the Army
Page Two
November 9, 1983

The Town of Davie has informed the County that it believes the agreement between the Town and Imagination Farms, Inc., is illegal and unenforceable since:

- Proper contraction (deannexation) procedures were not followed under F.S. Chp. 171.051, and the Judgment Order cannot substitute for these procedures.
- The Town counsel, who was party to the agreement, did not have the authority to override the ordinance and referendum which annexed the land originally; and,
- The contraction of the property out of the Town of Davie would violate F.S. Chp. 171.052, because it would create out parcels and areas not contiguous to the Town which is prohibited.

In addition, the Town of Davie has engaged legal counsel to defend its jurisdiction over the proposed site for the purpose of preventing the development of a resource recovery facility and/or landfill at this site.

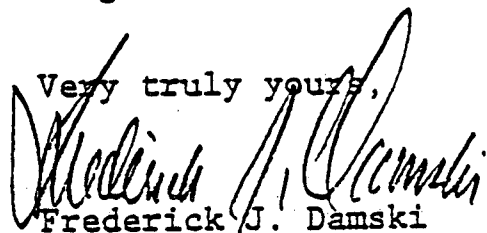
In summary, the information obtained during our investigation, indicates that there is considerable uncertainty as to whether the Davie site will ultimately be held to be within the corporate boundaries of the Town of Davie or in an unincorporated area. It is apparent that this issue will only be resolved through litigation. Should this litigation result in a confirmation of the Town of Davie's claim to jurisdictional authority, then the Town can prevent the County from developing this site for resource recovery. Regardless of the outcome of this litigation, the time required to complete this process will delay the implementation of the project beyond the exhaustion of the County's current waste disposal capabilities.

Based on the foregoing, implementation of the proposed project at the Davie site cannot be considered as an acceptable solution to the County's waste disposal needs. It is our opinion, therefore, that the Davie site is not feasible for development of the referenced project.

Department of the Army
Page Three
November 9, 1983

Should you have any questions regarding this matter, please do not hesitate to contact us.

Very truly yours,


Frederick J. Damski
Assistant General Counsel

FJD:1b1

LAZARD FRÈRES & CO.

ONE ROCKEFELLER PLAZA
NEW YORK, N.Y. 10020

CABLE ADDRESS "LAZARD NEW YORK"
TELEPHONE (212) 489-6800

NEW YORK

February 28, 1984

Ms. Phyllis Korab
Project Director
Resource Recovery Office
236 S.E. First Avenue - Room 526
Fort Lauderdale, Florida 33301

Re: Corps of Engineer Dredge & Fill Permit
Impact on Financing of Reduced Residue
Landfill Capacity in the Southern Site

Dear Ms. Korab:

This letter is in response to your request that Lazard Freres & Co. render its opinion as to the effect certain permitting alternatives may have on the marketability and credit quality of bonds to be issued to finance the Broward County, Florida, Solid Waste Resource Recovery Project.

Lazard Freres & Co. serves as Financial Advisor to Broward County relating to its resource recovery activities. Lazard Freres is a major New York investment banking firm well known for its financial advisory activities for municipal organizations, corporations and governments. We have accomplished and are working on a wide variety of resource recovery projects for more than 15 governmental jurisdictions throughout the nation. We also have extensive experience in other sectors of municipal finance such as municipal utilities and corporate-related industrial development bonds.

As currently formulated, the financing plan for the Broward County project contemplates the issuance of long-term revenue bonds to pay up to 80% of the design, construction, and startup costs, net interim financing costs, bond issuance expenses and contingency reserves. Security provisions on the bonds are expected to include a pledge of electric energy and tipping fee revenues received in connection with the operation of the facility. Receipt of such revenues from Broward County and other entities will require the processing and disposal of solid waste, including the ultimate disposal of the residue produced therefrom. Continued operation of the facility so as to generate

sufficient revenues to pay its operating expenses and debt service will therefore depend on, among other things, the existence of one or more properly designed and permitted residue landfills accessible by the facility owner/operator on economically reasonable terms and within economic hauling distances from the facility.

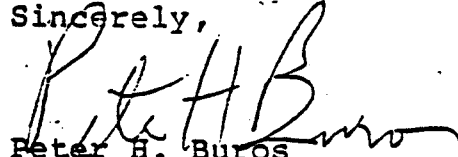
Broward County has proposed the construction of a 1600 ton-per-day or larger resource recovery facility and accompanying residue/unprocessable waste landfill cells encompassing an area of approximately 250 acres at the Route 441 site in southern Broward County. The County and its consulting engineers, Malcolm Pirnie, have calculated that such accompanying landfills have sufficient acreage to handle 21 years of residue generated from the facility - a time period in excess of the final maturity contemplated on the long-term revenue bonds. We understand that the United States Corps of Engineers, in its review of the of the County's application for a Dredge & Fill Permit, has suggested that the County consider reducing its landfill acreage approximately 42 acres by eliminating the wetland parcels on the South Fork New River east of the Florida Power & Light easement. The County and its consulting engineers, Malcolm Pirnie, estimate such a reduction in acreage would reduce the lifetime capacity of the residue/unprocessable waste landfill to handle resource recovery residue to approximately 16 to 18 years, three to six years less than the contemplated final maturity on the long-term revenue bonds.

You have asked Lazard Freres & Co. as to the impact such a change would have on the financing plan contemplated by the County. As you know, sufficient residue landfill capacity is a concern of the investing public and, to the extent there is a gap in the capacity, bondholders will be concerned that such a gap might ultimately cause a default on the bonds. Any gap in capacity would therefore adversely affect the credit quality and marketability of the long-term revenue bonds and might require the bonds to be marketed with higher yields and net interest costs to the County, resulting in higher tipping fees to the residents of Broward County. Such a gap may also require the County and the owner/operator to provide additional assurances and undertakings to the bondholders with respect to the timely provision of a new residue landfill.

As you can appreciate, this is just one of many inter-related elements affecting bond security, some of which are still in the conceptual stage. The willingness of the investing public to accept the risk associated with all the elements of the financing at reasonable interest costs may vary over time. We have no way of accurately determining the exact quantitative effect on the

financing of changes in the residue landfill capacity. However, as a matter of financial prudence and in order to achieve the lowest possible net interest cost, we believe the County would be best served by obtaining permits for a residue/unprocessable waste landfill to handle all residue expected to be generated during the life of the bonds.

Sincerely,

A handwritten signature in dark ink, appearing to read "Peter H. Buros". The signature is fluid and cursive, with the first name "Peter" and last name "Buros" being the most legible parts.

Peter H. Buros
Vice President

PHB:gg



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

APR - 6 1984

4PM-EA/EH

Colonel Alfred B. Devereaux, Jr.
District Engineer
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232

ATTENTION: John Adams
Vic Anderson

SUBJECT: Broward County
(Permit Application Nos. 83B-3304 & 83B-3305)

Dear Colonel Devereaux:

This is in regard to additional information that this office has received relating to the above referenced public notices proposing construction of solid waste recovery and landfill facilities in wetlands adjacent to the South New River Canal, Broward County, Florida. EPA provided comments to you relative to the proposed project in a letter dated January 23, 1984. Due to our concerns with various direct and indirect environmental impacts associated with project construction and operation, my staff requested additional information from the applicant relating to the proposed project in a February 28, 1984, memorandum, a copy of which was provided to the Chief of your Regulatory Division. On March 12, 1984, I conducted a meeting in our EPA Regional Office with representatives of the applicant, its environmental and engineering consultants, and Florida Department of Environmental Regulation, and Corps South Atlantic Division personnel to further discuss our concerns with the proposed project. We recently have received a written response dated March 26, 1984, from the applicant addressing issues discussed at the March 12th meeting. A copy of the applicant's response has been forwarded to your Regulatory Division.

Based on the additional information that has been provided to us by the applicant, as well as additional mitigation, project design changes, restrictive easement agreements, and the phased construction agreement that the applicant has committed to, EPA would have no objections to the issuance of permits for construction of the proposed facilities. Major project components in addition to the original permit application that must be clearly reflected in the authorization or design plans of this project for EPA to support permit issuance include:

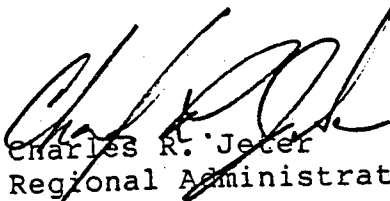
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APR 09 1984
COASTAL ZONE
RESOURCES

1. Implementation and maintenance of on and off site wetland mitigation/enhancement work totaling 103 acres, as specified in the applicant's March 26, 1984, correspondence. The applicant has committed to providing restrictive easements on all mitigation/enhancement acreages to assure that these areas will be maintained as functional wetlands in perpetuity. The applicant has also committed to completing all mitigation work prior to the commencement of any landfill operation.
2. Stormwater runoff retention/treatment at the landfill facility will be segregated from landfill leachate collection/retention with all leachate being pumped to and treated at a nearby municipal sewage treatment plant.
3. To phase landcell #3 construction by deferring diking and filling of the sawgrass marsh until cells #1 and #2 have been completed. The applicant anticipates that dike construction of cell #3 will occur between 1997 and 2001, or at least 10 years after initiation of landfilling at landcell #1. Stormwater retention/treatment for landcell #1 will be accomplished at landcell #2 and adjacent easements. The applicant has committed to making all practicable efforts to extend the project life at landcells #1 & #2, as well as pursuing alternatives to developing the sawgrass marsh area to protect this valuable wetland resource.

It is my understanding, after discussions with your staff, that the phased construction schedule mentioned above can be authorized under your permitting regulations.

If we can be of any further assistance to you on this project, please contact our project officer, Eric Hughes, at 404 881-7901 or FTS 257-7901. Thank you for providing us with this opportunity to comment on this matter.

Sincerely yours,


Charles R. Jeter
Regional Administrator

cc: See attached

cc: Ms. Victoria J. Tschinkel, Secretary
Florida Department of Environmental Regulation
Attention: Jeremy Craft

Mr. Joe Carroll, Field Supervisor
U.S. Fish and Wildlife Service
Vero Beach, Florida

Dr. Edward Keppner, Field Supervisor
National Marine Fisheries Service
Panama City, Florida

Mr. J.T. Brawner, Regional Director
National Marine Fisheries Service
St. Petersburg, Florida

Jim Kelly
Corps South Atlantic Division
Atlanta, Georgia

John Guidry
FDER
P.O. Box 3858
West Palm Beach, Florida 33402

Floyd T. Johnson
Broward County Commissioner
Rm. 248, Broward County Courthouse
Ft. Lauderdale, FL 33301

Nicki E. Grossman, Chairman
Board of County Commissioners
Broward County
201 S.E. 6th Street
Ft. Lauderdale, Florida 33301

Phyllis Korab
Project Director
Resource Recovery Office
236 S.E. First Avenue, Rm. 526
Ft. Lauderdale, Florida 33301

Jim Hudgens, President
CZR, Incorporation
1001 U.S. highway
Suite 305
Jupiter, Florida 33458

CANNON HOUSE OFFICE BUILDING
ROOM 131
WASHINGTON, D.C. 20515

ADMINISTRATIVE ASSISTANT
RICHARD MCBRIDE

LEGISLATIVE ASSISTANT
JAMES E. LAMBLE

DANIEL A. MICA
14TH DISTRICT, FLORIDA

Congress of the United States
House of Representatives
Washington, D.C. 20515

FOREIGN AFFAIRS
VETERANS' AFFAIRS
SELECT COMMITTEE ON
AGING

May 15, 1984

Phyllis A. Korab, Director
Resource Recovery Project
Governor's Club, Room 526
236 S.E. First Avenue
Fort Lauderdale, Florida 33301

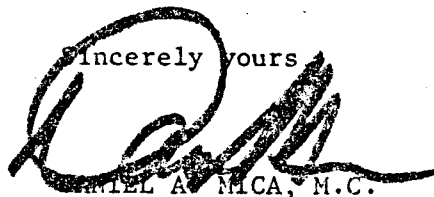
Dear Ms. Korab:

The Army Corps of Engineers has sent my office the attached additional report regarding your case. I am sending this to you for your information and records and trust that this is helpful to you.

In the event that you should ever be in need of my further service, please feel free to contact my office. Again, thank you for contacting me on this matter.

Kind regards.

Sincerely yours



DANIEL A. MICA, M.C.

DM:vp
Enclosure

RECEIVED
M P I

R. F. BONNER
R. P. BROWNELL
P. L. BUSCH
J. H. FOSTER
K. W. HENDERSON
J. C. HENNINGSON
A. C. LEONARD
R. L. PILLSBURY
M. PIRNIE
D. R. SHEVCHIK
A. H. STEVENSON
G. P. WESTERHOFF
J. B. ZONDORAK

RETURN TO
ANS. BY
FILE

PLEASE REPLY:
☐ CANNON HOUSE OFFICE BUILDING
ROOM 131
WASHINGTON, D.C. 20515

☐ 639 EAST OCEAN AVENUE
SUITE 303
BOYNTON BEACH, FLORIDA 33435

THIS STATIONERY PRINTED ON PAPER MADE WITH RECYCLED FIBERS



DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232
May 1, 1984

REPLY TO
ATTENTION OF

Regulatory Division
Permits Branch

Honorable Daniel A. Mica
House of Representatives
Washington, D. C. 20515

Dear Mr. Mica:

Reference is made to our previous correspondence and your recent letter of April 9, 1984 (128737-VP) on behalf of Broward County regarding Department of the Army permit applications 83B-3304 and 83B-3305 for fill associated with siting of the Southern Resource Recovery Facility and Incinerator Residue - Unprocessable Waste Disposal Cell Complex.

This office has received the referenced items of correspondence from Broward County, as well as the April 6, 1984 letter of the U.S. Environmental Protection Agency (EPA) pursuant to its March 12, 1984 meeting with the county. Subject to certain conditions acceptable to the county, EPA advised it would have no objection to issuance of the subject permits.

However, the Florida Department of Environmental Regulation (DER) has yet to issue its water quality certification and has requested that this office not take final action until it has done so. Otherwise, this office is prepared for permit decisions and is in the process of preparing final action documents in support thereof.

I will keep you informed of progress in this matter as it develops. If I can provide additional information, please contact me.

Sincerely,

Alfred B. Devereaux, Jr.
Colonel, Corps of Engineers
District Engineer

DAVID B. WATSON
Lt. Colonel, Corps of Engineers
Acting District Engineer

Copy Furnished:

Commander, U.S. Army Corps of Engineers (DAEN-CWO-N)
Commander, South Atlantic (SADCO-0)



DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232

July 13, 1984

REPLY TO
ATTENTION OF

Regulatory Division
Permits Branch

Ms. Phyllis A. Korab
Broward County
236 Southeast First Avenue,
Room 526
Ft. Lauderdale, Florida 33301

Dear Ms. Korab:

This letter refers to Department of the Army permit applications numbered 83B-3304 and 83B-3305.

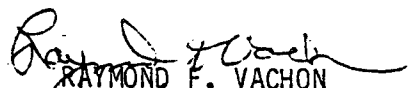
The Corps has completed the evaluation of your proposals and is in a position to issue your Department of the Army permits, but by law cannot do so until the State has certified water quality pursuant to Section 401 of the Clean Water Act.

You must notify us in writing when you receive a State permit/certification or resolve local objections and enclose a copy of the State permit/certification as well as any revised drawings illustrating project modifications. Upon receipt of State approval, the Department of the Army permits will be issued unless significant modification has occurred.

You are cautioned that commencement of the proposed work prior to Department of the Army authorization would constitute a violation of Federal laws and subject you to possible enforcement action. Receipt of a permit from the Department of Environmental Regulation does not obviate the requirement for obtaining a Department of the Army permit prior to commencing the proposed work.

Any questions concerning your applications should be directed to Mr. John Hall at the letterhead address or by telephone at (904) 791-1664.

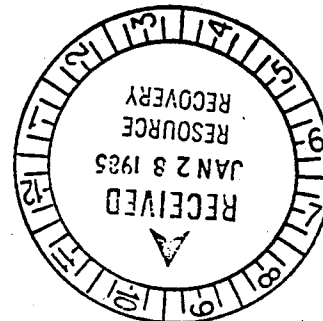
Sincerely,


RAYMOND F. VACHON
LTC, Corps of Engineers
Deputy Commander



85-58 14

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019
JAN 22 1985



REPLY TO
ATTENTION OF

Regulatory Division
Permits Branch
838-3304
838-3305

Mr. Steve Simmons
South Broward Citizens for
a Better Environment
2390 SW. 34th Way
Ft. Lauderdale, Florida 33312

Dear Mr. Simmons:

This is in response to your October 17, 1984, letter further expressing concerns with Broward County's proposed Southern Resource Recovery Facility. Your letter was a followup to a meeting between members of your organization and Jacksonville District regulatory staff.

At that meeting you requested copies of all pertinent information in our file. These copies are provided. We will try to address each point in your letter to us, based on information in the file, the permit application package submitted by the county dated November 1983, and inquiries we have made subsequent to your letter.

The first two points you raised deal with potential contamination of groundwater which may provide a source of municipal or industrial water to Broward County. Although we recognize your concerns, they could probably be applied to to any landfill site selected in South Florida. We have consulted with agencies with expertise in these areas, notably the Environmental Protection Agency, and considered those agency opinions in our decision making process. We have checked with Broward County about the liner seam problem you raised. They indicate the drawings are conceptual only. The liner would be polyethylene at least 40 mils thick, and all seams would be heat welded and pressure tested before use.

We have also checked with the county about their treatment and disposal plans for stormwater runoff and landfill leachate. As originally proposed leachate was to be disposed by deep well injection. Runoff from active landfill areas was to be directed to empty landfill subcells of the project and then conveyed along with leachate to a common sump for disposal by deep well injection. These systems were to be entirely separate from stormwater management facilities.

In reviewing the project, the Environmental Protection Agency (EPA) requested (letter dated April 6, 1984) that Broward County modify this proposed stormwater and leachate handling plan. The applicant agreed and so EPA requested that the Corps add a special condition to its permit to require segregation of stormwater and leachate systems, with all leachate being pumped to and treated at a nearby municipal sewage treatment facility. Such a condition would be added when and if a Department of the Army permit is issued.

Next you raised concerns over the project's potential effects on two endangered species, the West Indian (Florida) manatee and the American crocodile. We have taken a second look at the information we have on these species and continue to feel that the project is not likely to jeopardize either species or cause destruction or adverse modification of their habitat.

We are aware that the South New River Canal is a State designated manatee sanctuary with regulated slow speed zone, and that manatees are found in the vicinity throughout the year. We have requested Section 7 consultation with the U.S. Fish and Wildlife Service (FWS) on several projects in the area where we felt the project might affect the manatee. We are aware of the latest published public information on known sources of manatee mortality. That information shows that for the period between April 1976 and March 1982, manatee deaths were caused by collisions with boats/barges (87); perinatal/early juvenile with open diagnosis (58); entrapment in gates of locks and dams (35); other human-related causes (e.g. poaching, vandalism, and discarding of fishing gear)(20); and natural causes (19). Given the nature of this project we do not feel it represents a danger to the manatees from demonstrated human-caused mortalities.

The hypothesis that contaminants in stormwater runoff from the facility may jeopardize the species is highly speculative given the extent of the area's high level of urban and industrial development in the general area.

As for the American crocodile, information available from the the FWS indicates that there were three crocodiles in the Dania Cut-Off Canal, but that one was shot, another killed by a car, and the third captured and moved to Florida's West Coast. Thus, for both species we can only conclude that the project would not jeopardize their continued existence.

We have read the portion of the Florida Department of Environmental Regulation (DER) field report you provided and talked with that agency regarding the status of the State permitting process. We do not feel we can comment on one individual State employee's opinion, but rather must await DER's final determination concerning the issues raised in that agency's permit process.

In summary, we feel that although you may have legitimate concerns with some aspects of the project, our review of these concerns, and of information in our files does not indicate there is sufficient justification to reopen our decisionmaking process. We learned in our discussions with DER, however, that your organization has requested an administrative hearing on the State dredge and fill permit. If the hearing process results in significant modification of the project, we will need to reevaluate our decision process. If the hearing results in denial of the State permit, we will be required by law to deny the Department of the Army permit.

Thank you for providing information on your concerns about the project.

Sincerely,

John F. Adams
Chief, Regulatory Division

Enclosures

Copy Furnished:

✓ Ms. Phyllis Korab (with copy incoming corresp.)

South Broward Citizens for a Better Environment

October 17, 1984

Col. John Hall, District Engineer
Department of the Army
Jacksonville District, Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232

Dear Col. Hall:

Thank you for taking time from your schedule to meet with us last Thursday. As you know, we continue to strongly oppose the "Resource Recovery" projects in Broward County. Enclosed you will find copies of some of the material that supports our viewpoint.

I will address our concerns on water quality at the southern site. Let me begin by questioning the County's assumption that the site lies east of the isochlor line. As we discussed, the study used to determine the assumption was done in 1981 during a severe multi-year drought (see Attachment 1). Naturally, salt water took the place of fresh water in many parts of our aquifer during these years. However, Dennis Nealon, a hydrologist with the South Florida Water Management District, has informed me that it was very likely with the return of normal rainfall in the last few years that the isochlor line has moved east of the 84-441 site. We, as a group, feel it is important to determine exactly where the isochlor line lies at present, during normal rainfall, rather than basing assumptions on data from periods of drought.

Secondly, it is assumed by the County, but can be believed by only the most naive, that a 40 mil plastic liner will prevent the landfill from polluting the groundwater. Please find the copies from Technologies for Hazardous Waste Management (Attachment 2), a federal study that states that there is no material known to man that can withstand the hydraulic pressure without leaking. Also, find the copy of the proposed seaming diagram (Attachment 3) and see if that makes sense to you. I don't believe you would want the County's engineer to plan the roof of your house!

During our meeting you expressed a belief that stormwater runoff, as well as leachate, would be disposed of by deepwell injection. Attachment 4 reflects pages from the September 1983 "Joint Application for Activities in Waters of the State of Florida". In these you will find that at that time it intention of the County to do as you said. However, the more recent description of the project calls for no deepwell injection at all.

Attachment 5 is a page from the Sept. 4, 1983 "Joint Application" that states that "... field studies during site analysis have not identified any endangered or threatened species

on the site and the probability of occurrence is low." Since the waters bordering the project are designated by the State of Florida as an official Manatee Sanctuary, and since manatees can be and have been observed there 365 days a year, I think the probability that they really looked very hard for endangered species is low. Perhaps the key to this obvious deception is the phrase "... on the site ...". While manatees are not likely to crawl out of the water onto the actual plant site, they do now reside in apparent peace in the vicinity of Ramgoh Marine, which is directly across the New River Canal (C-11) from the site. As many as 40 manatees reside there during the winter and several reside there year-round. The photograph enclosed is of a cow and calf as seen from Ramgoh Marine on August 29, 1984. Although my photography is not professional and the picture lacks clarity, the date is very significant since this was the day DER officials were taken on a tour of the site by the County. I informed Phyllis Korab of the manatees presence before the tour but she did not see fit to include Ramgoh Marine as a stop. A simple telephone call by your office to Ramgoh Marine ((305) 587-4910) would confirm the year-round presence of manatees. The main point, however, is that the impact of the construction and pollution on the manatees has not yet been considered since their existence has been denied.

The manatee, however, is not the only endangered species known to inhabit this area. Pat Rose of the Florida Audubon Society participated in locating and monitoring several American Crocodiles along this stretch of C-11. Please feel free to call his office for verification.

Attachment 6 is the cover page and conclusion of the DER's own Water Quality Biological Assessment dated May 4, 1984. Here, the DER's own field biologist concludes that this project will have a "... high probability of some short and/or long term negative impacts to water quality." The complete study can be made available to you by calling Dan Garlick of DER.

The above represents only a sampling of information that we have available. In summary, let me put you on notice that this group is prepared to seek judicial relief in this matter. We hope, however, to gain your office's cooperation as we offer to cooperate with your office. Consider the above: a case where water quality will certainly be negatively impacted; a site in a wetland, directly adjacent to the South New River Canal; a site alongside a manatee sanctuary and known to have not only manatees but also American Crocodiles; and yet the Army Corps of Engineers concludes that no threatened or endangered species are present or will be affected, and therefore no biological assessment or impact statement is necessary?

This letter reflects some of our arguments on the subject of water quality. Upon receipt of the information your office used in making their permitting decision, we will be happy to notify you of the changes that have taken place but have apparently not been reported to you by the County. We also have strongly documented arguments concerning air quality, dioxins, noise, traffic, and odor which we can gladly send to you.

Once again, let me thank you for taking time to hear our

concerns. Forgive my tardiness in sending this information to you, but we've been fighting the bonding validation of this project in court this week and that has kept all of us very busy. As you can see, we are very sincere in our opposition to the County on this issue and are expending great effort to hopefully prevent this mistake. Thank you again for your help.

Sincerely,



Steve Simmons
South Broward Citizens for a Better Environment
2390 SW 34 Way
Ft. Lauderdale, Fla. 33312
(305) 792-5186

H-6

The geotechnical studies indicate that the soils are unsuitable for construction and that site development will require removal of the surface soils (peat) and replacement by crushed limestone fill prior to construction.

J. Dust

Dust will be generated in the RRF as solid waste is processed. All dust will be contained in the enclosed facility. The residue ash product of the RRF will have 30 percent moisture content. Hence it will be dustless.

K. Water Resources

Water resource impacts are an important concern of this project, and thorough discussion of the control procedures for on-site water was provided in Section II.A.3. This section provides a recapitulation of Section II.A.3, a description of a 100-year flood consideration, and groundwater.

1. Water Management

a. Runoff

The landfill will ultimately consist of two landfill cells. Each cell will be surrounded by a perimeter access road which will serve as a dike in order to insure all surface runoff is contained on site.

A grassed perimeter swale will be located between the toe of each landfill cell and the cell's perimeter access road. During periods of rainfall, stormwater will run off the landfill and be captured in the perimeter swale system. The perimeter swale systems will discharge to a retention pond where final stormwater disposal will take place.

During the first 14+ years of landfill operations all design surface runoff will be disposed via an injection well. After this period, runoff will be disposed of via deep well injection supplemented by

controlled surface discharge to the C-11 canal. Drainage facilities for the landfill will meet South Florida Water Management District criteria for surface water management.

b. Leachate

An impermeable bottom liner will be placed at the base of each landfill. Leachate which is generated within the ash landfill due to intrusion of rainfall will be collected and disposed of in an injection well. The leachate collection and disposal system will be entirely separate from the stormwater management facilities. Disposal of leachate in the injection well will occur first, before any surface runoff is disposed of via the injection well. All ash will be deposited in the landfill above the 100 year flood elevation. Leachate will not enter the surficial aquifer as it will be disposed of by deep well injection.

2. Flood Zone

Project design criteria for the 100-year flood in the development area is elevation 7.0 feet MSL in accordance with Broward County standards. The resource recovery facility site will be filled to a minimum of 7.0 feet during development; therefore, this portion of the project will be at or above the established 100-year flood elevation (Figure 21). Similarly, all materials deposited in the landfill cells will be placed at or above elevation 7.0 feet MSL.

3. Ground Water

The Biscayne Aquifer underlies the entire eastern and central portion of Broward County and is the sole source of municipal water supply in the County. The aquifer is composed of limestone, sandstone and sand, and ranges in thickness from 200 feet along the coastline to a thin edge in the

2. Urban Wilderness

The second biological concern is that portion of the project area which has been designated Urban Wilderness Area, i.e. a 300 foot-wide strip of waterfront and the marsh in the northwestern corner of the site (Figure 16). The area was designated Urban Wilderness because it is the last vestige of natural vegetation along South Fork New River. The 300 foot-wide strip of urban wilderness adjacent to the river will be preserved and enhanced (Chapter V). Much of the area identified as the Griffey Tract (Figure 16), will be utilized as the location for landfill cell 2 which is critical to the project. This area is currently a sawgrass marsh of which up to an 800 foot swath fronting SR 84 will be required for I-595 right of way (Figure 16). Cypress stumps throughout the marsh indicated that it was previously part of the swamp forest adjacent to the west, and that the area regenerated to sawgrass after it was cut over.

3. Threatened and Endangered Species

The project area is within the theoretical range of several species classified as threatened or endangered by U. S. Department of the Interior and Florida Game and Freshwater Fish Commission. Field studies during site analysis have not identified any threatened or endangered species on the site, and the probability of occurrence is low. The site has been reviewed by the U. S. Fish and Wildlife Service (Jacksonville, FL) and development is not expected to impact any endangered or threatened species (Personal Communication, 12 July 1983, Don Palmer, Endangered Species Specialist, U. S. Fish and Wildlife Service).

D. Sedimentation and Siltation

A potential impact of dredging and filling during construction is siltation and sedimentation. Berms will be constructed to contain water during

Attachment 8

DEPARTMENT OF ENVIRONMENTAL REGULATION
PERMIT APPLICATION APPRAISAL

File No.: 060781739 County: Broward Date: 05/04/84
Applicant Name: Broward County, s/o Phyllis Korab
Address: 236 S.E. First Avenue, Room 526
Agent (if applicable): Peter Robinson, P.E., Vice President
Address: Hazen & Sawyer, P.C., 5950 Washington St. Hollywood, FL 33023
Location of Project: Section(s) 25 Township 50S Range 41E
24, 25 41E &
Section(s) 19, 30 Township 50S Range 42E
Local Reference: Intersection of U.S. 441 (SR 7) & S. Fork New River
Water Body: South Fork New River Canal
Water Classification of Project Area: III Adjacent Waters: III
Aquatic Preserve: N/A
Outstanding Florida Waters: N/A
On site inspection by: Steven K. Burian
Date of Inspection: 03/06/84 Original Application: Yes XX No
Revised Application: Yes No Date: Date of 2nd Insp.

Biological and Water Quality Assessment

- A. Description of proposed project and construction techniques. Quantify area of project which extends into waters of the state (including the submerged lands of those waters and the transitional zone of the submerged land) as defined in Section 17-4.02 and Section 17-4.28, Florida Administrative Code.
- B. Biophysical features of general area. Include comments concerning extent of development of adjoining properties as well as relevant historical facts about the area.
- C. Biophysical features of specific project site and spoil site if applicable. Include identification of bottom types and any relevant historical facts about the area of the project.
- D. Potential impact of project on biological resources and water quality. Address long-term impact as well as immediate impact for all aspects of the project.
- E. Suggestions, where appropriate, for modifications that may reduce or minimize the potential impact of project.

Leatler fern	(<u>Acrostichum</u> sp.)
Fern	(<u>Petris</u> sp.)
Swamp fern	(<u>Blechnum</u> sp.)
Sedges	(<u>Cyperus</u> sp.)
Sawgrass	(<u>Cladrum jamaicense</u>)
Pondapple	(<u>Annona glabra</u>)
Royal fern	(<u>Osmunda regalis</u>)
Cattails	(<u>Typha</u> sp.)
Rushes	(<u>Juncus</u> sp.)
Spike rush	(<u>Eleocharis</u> sp.)
Beak rush	(<u>Rhynchospora</u> sp.)
Marsh fern	(<u>Thelypteris</u> sp.)

For a more complete listing of plant species found on site see Fig. (prepared by CZR, Inc. 1983).

★ { D. Potential impacts of the project (both construction of the plant and disposal landfill) on the biological resource and water quality are difficult to assess. The filling of productive marsh habitats which provides benefits to water quality of the south branch of the New River constitutes a negative impact which may not easily be mitigated. In addition, many other short-term impacts are possible and stem from a series of hypothetical scenarios, where impacts are the result of mechanical failure or human error. The potential mismanagement of wastes, failure of the leachate collection/containment system, cross contamination of the stormwater and leachate system and a multitude of other problems which could occur at this facility and have occurred at other resource recovery projects, suggest a high probability of some short and/or long-term negative impacts to water quality.

E. No Comment

Steven K. Burian
Completed by: Steven K. Burian

5-17-84
Date

SKB:my:29



United States Department of the Interior

FISH AND WILDLIFE SERVICE

P.O. Box 2676

Vero Beach, Florida 32961-2676

15-5

November 23, 1984

RECEIVED

Mr. James M. Hudgens
Coastal Zone Resources, Incorporated
1001 US Highway 1
Suite 305
Jupiter, Fl 33458

NOV 27 1984

COASTAL ZONE
RESOURCES

Dear Jim:

This responds to your request of October 26, 1984, for information relative to the occurrence of the Florida manatee and the American crocodile in the New River System in Broward County, Florida, and your request for copies of correspondence from the Fish and Wildlife Service regarding these two species in this river system.

Your summary of the distribution of the American crocodile contained in your letter is essentially accurate. Although individual crocodiles may make occasional excursions out of the area, they are essentially restricted to South Dade and upper Monroe County on either side of Florida Bay.

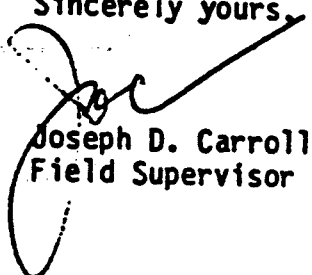
Enclosed for your information are excerpts from several references which document the occurrence of manatees in the New River. These include Hartman (Hartman, D. 1974. Distribution status and conservation of the manatee in the United States. U.S. Fish and Wildlife Service, National Fish and Wildlife Lab. Contract Report 14-16-0008-748. NTIS Publication No. PB81-140725. 246 pg.), Rose and McCutcheon (Rose, P.N. and S.P. McCutcheon. 1980. Manatees (*Trichechus manatus*): Abundance and distribution around several Florida power plant effluents. Report prepared for Florida Power and Light Company. Contract No. 31534-86626.) and Reynolds (Reynolds, John E. 1984. Distribution and abundance of West Indian Manatees (*Trichechus manatus*) Around selected Florida power plants following winter cold fronts: 1983-1984. Report prepared for Florida Power & Light Company. Order No. 01249-83562.) You may wish to consult these reports for more specific information. In general, manatees may occur throughout the New River at any season of the year, but appear to be seasonally influenced and attracted to some of the deeper canal systems and the power plant discharge when operating during winter months. While we have no information on the distribution of food resources in the New River System, it is generally thought to provide a poor food base due to the almost total destruction of previously existing submerged vascular aquatic vegetation in the area.

Based on the history of recorded manatee mortality in the New River, the species in this locale is most threatened by water control structures and boat and barge collisions.

Also attached for your information is a letter dated September 21, 1984, relating to a letter received by the Fish and Wildlife Service regarding the proposed Broward County Resource Recovery Facility to be located adjacent to New River, as requested under the Freedom of Information Act.

I trust that this information will be helpful to you. Should you require additional information, please contact the Jacksonville Endangered Species Field Station, 2747 Art Museum Drive, Jacksonville, Florida, 32207.

Sincerely yours,



Joseph D. Carroll, Jr.
Field Supervisor

att.

cc:

SE, Jacksonville, FL

SE, Vero Beach, FL

ARD-HR, FWS, Atlanta, GA

Donald W. Pfitzer, PAO, Atlanta, GA



United States Department of the Interior

FISH AND WILDLIFE SERVICE

ENDANGERED SPECIES FIELD STATION

2747 ART MUSEUM DRIVE

JACKSONVILLE, FLORIDA 32207

September 21, 1984

Mr. Laurence D. Gore
Sunrise Bay Building, Suite 212
2701 East Sunrise Boulevard
Fort Lauderdale, Florida 33304

Dear Mr. Gore:

This responds to your letter of August 27, requesting that a Biological Assessment be prepared in accordance with Section 7 of the Endangered Species Act of 1973, as amended, for the proposed Resource Recovery Facility in Broward County. We have reviewed the information provided in your letter and the copy of the letter from the Corps.

We believe that it is important to understand that it is the action agency's responsibility in this case, the Corps, to prepare the necessary documentation required under Section 7, not the Fish and Wildlife Service. As stated in Section 7(a)(2):

"...Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency (hereinafter in the section referred to as an "agency action") is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical, unless such agency has been granted an exemption for such action by the Committee pursuant to subsection (h) of this section. In fulfilling the requirements of this paragraph each agency shall use the best scientific and commercial data available..."

The Corps did not initiate formal consultation with the Service on this proposed action. The statement in the Corps' letter regarding our request for consultation is not germane to this issue however. The responsibility to initiate rests with the Corps, and again, it is their responsibility to prepare the biological assessment. If it is a major Federal action, that is one that requires an Environmental Impact Statement, an assessment is necessary. If it is not a major Federal action, but the Federal agency determines that the proposed project "may

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effect" a listed species a biological assessment is required. If an agency's decision is "no effect", then consultation is not required, however we do request that we have the opportunity to review the assessment and concur with the agency's determination.

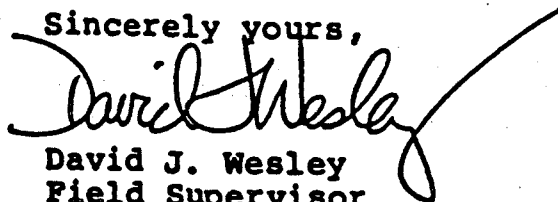
In this case, the Corps did not request our concurrence. We suggest, therefore, that you request from the Corps the information they used to reach the decision that consultation was not necessary.

Our regulations give the Fish and Wildlife Service the authority to request Section 7 consultation regardless of the agency's response. As we stated in our August 16 letter, our initial assessment of this project did not warrant us to request consultation, because we did not feel that this action would adversely affect the manatees. We have contacted the manatee coordinator for the Florida Department of Natural Resources and he concurs in our assessment. Therefore, our initial position remains unchanged.

The overall impact of the project is the destruction of about 40 acres of functional sawgrass wetlands. We realize that there are very few of these areas remaining in Broward County, however, the loss of this area in our estimation would not significantly affect the manatee. Our primary concern within this area is related to boat/manatee conflicts. We are aware that these wetlands provide nutrients to the waterway, but as a food source for manatees it is not critical.

For your information, we have enclosed copies of the Act and our proposed Section 7 Regulations. We suggest that you familiarize yourself with them, and if you have any questions, please contact my office.

Sincerely yours,



David J. Wesley
Field Supervisor
Endangered Species Field Station

cc: ES, Vero Beach, FL ✓

*F - Bureau to
Resource records
present*

**DISTRIBUTION, STATUS, AND CONSERVATION OF THE MANATEE
IN THE UNITED STATES**

by

Daniel S. Hartman

Broward County

Manatees range the length of the Intracoastal Waterway in Broward County from Deerfield Beach to Hallandale. Drawbridge tenders and dockmasters report an average of one sighting per month. Weekly sightings were reported at Lauderdale-by-the-Sea and Dania. Manatees are also seen up to six times a year in passage along the Atlantic beaches. One lifeguard reported monthly sightings off Hollywood Beach. Passage between the ocean and Intracoastal Waterway is effected at Boca Raton Inlet (Palm Beach County), Hillsboro Inlet, and Port Everglades. Animals are observed heading north and south during all seasons in both inland and ocean waters.

In addition to the Intracoastal Waterway, manatees regularly visit such tributaries as the Hillsboro Canal (Deerfield Beach); Cypress Creek (Pompano Beach); the lower reaches of the Middle River (Ft. Lauderdale); the New River (Ft. Lauderdale); and the Dania Cut-off Canal (Dania). Animals also turn up occasionally in the labyrinth of small canals and lakes that feed the Intracoastal Waterway along the entire coast of Broward County. No animals were reported in Ft. Lauderdale from the upper reaches of the Middle River, the Tarpon River, or the North Fork of the New River. During the winter, manatees seek sanctuary in the warm-water discharges of the Ft. Lauderdale Power Plant off the South Fork of the New River and the Port Everglades Power Plant off the Intracoastal Waterway (page 25).

... was unable to confirm reported sightings of manatees
... on the perimeter of Water Conservation Area No. 3
... County).

The relative scarcity of sightings in Broward County suggests
that manatees are not common and may largely be migrants in transit
between more bountiful habitats to the north and south. The inland
waters of the county are turbid and manatee food resources in short
supply. Interviewees reported that manatees had been seen feeding
on bank grass (Distichlis) in the Dania Cut-off Canal. It was
also claimed that animals fed on bank growth in the New River
(Ft. Lauderdale) until this source of food was eliminated by the
construction of sea walls. During the rainy season, manatees are
believed to intercept water hyacinth and other fresh-water
vegetation sluiced through the flood gates on the North and South
New River Canals and possibly on the Hillsboro and Pompano Canals.
It is known that fresh water attracts manatees to the flood gates
at all times of year.

Salinity dams, locks, or pumping stations block the flood
control canals of Broward County at varying distances from the
Intracoastal Waterway. Distances on the respective canals are as
follows, from north to south: 6 kilometers (Hillsboro Canal); 3
kilometers (Pompano Canal); 4 kilometers (Cypress Creek Canal); 11
kilometers (Middle River); 13 kilometers (North New River Canal);
12 kilometers (South New River Canal via South Fork of New River);
and 10 kilometers (South New River Canal via Dania Cut-off Canal).
Apparently manatees were found many kilometers up the Hillsboro

before the spillway was built. A few manatees are reported
blocked above the salinity dam on the North New River Canal
(pages 39 and 40).

Over 50 per cent of the older residents interviewed were of
the opinion that manatees are on the wane in Broward County. An
increase in boat traffic and decline in aquatic vegetation are
thought to be the causative factors.

MANATEES (TRICHECHUS MANATUS):
ABUNDANCE AND DISTRIBUTION
IN AND AROUND SEVERAL FLORIDA POWER PLANT EFFLUENTS

FINAL REPORT
1 MAY 1980

Prepared for the
Florida Power and Light Company
P.O. Box 529100
Miami, Florida 33152
Contract No. 31534-86626

by
Patrick H. Rose
Susan P. McCutcheon
Florida Audubon Society
P.O. Drawer 7
Maitland, Florida 32751

TABLE OF CONTENTS

PREFACE.....	ii
LIST OF TABLES.....	v
LIST OF FIGURES.....	vi
LIST OF PHOTOGRAPHS.....	viii
INTRODUCTION.....	1
THE STUDY AREA.....	4
METHODS.....	5
RESULTS AND DISCUSSION.....	8
Abundance and Distribution.....	8
Seasonal Variation.....	8
Individual Sites.....	11
Riviera Beach (and Hobe Sound Region of Indian River).....	11
Cape Canaveral and Orlando Utilities.....	23
Ft. Lauderdale.....	41
Port Everglades.....	50
Fort Myers.....	60
Vero Beach.....	69
Hutchinson Island.....	70
Putnam-Palatka.....	72
Sanford.....	72
CONCLUSIONS AND RECOMMENDATIONS.....	76
SUMMARY.....	80
BOAT SPEED REGULATIONS.....	82
APPENDIX.....	84 a
LITERATURE CITED.....	127

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during the warmer months, several winter sightings were also made. Manatees showed strong preference for certain locations within the intake canals but the reasons for these selections are unknown (see appendix, photographs 4-5).

Even though the manatees within the intake canals were probably in no immediate danger from direct power plant operations, they were subjected to repeated dangers from the fuel barges that make regular deliveries using the intake canals. Within the study period, at least one nearly full-time pregnant manatee and its fetus were killed by a tug during maneuvering operations (USFWS: pers. comm.) at the PCC intake and several badly scarred animals are regularly observed in the immediate area, suggesting that this problem should be investigated further.

The chances of such an accident happening again should be investigated since it appears that both manatees and fuel barges will continue to frequent these intakes. There is some evidence that manatees may be attracted to the turbulence created by the tugs during docking (personal observation); if this is true, the chances are very high for another accident.

Some remedial courses of action available might be: 1) find alternate mode of fuel delivery (i.e. overland); 2) require the use of propeller guards; 3) insure that sufficient clearance is maintained so that a fully loaded barge can pass safely over or by a manatee on the bottom even in times of lowest water levels; and 4) require use of manatee detection/warning devices.

Ft. Lauderdale.

Manatees were sighted on 59 occasions or on 76% of the 78 aerial surveys conducted at the Ft. Lauderdale Inland (PFL) site. Air traffic in this area was particularly heavy and on some days permission to survey in this area was denied by the air traffic controller, while on many other days survey time was often restricted.

The maximum number of manatees seen within the PFL effluent zone during each winter was 36 in 1977-78, 22 in 1978-79 and 36 again in 1979-80. As with most of the other study areas, manatee use of this effluent zone during the study period was heaviest during the winter months, with most of each year's sightings occurring between December and March (see Figure 8; see also Table 6 for the dates of each survey and for the number of manatees sighted during each year). Changes in manatee abundance within the effluent zone correlated significantly with changes in air temperature ($r = -.75, p < .01$): as the temperature decreased the number of manatees increased and as the temperature increased the number of manatees decreased (see also Figures 9a-c).

Although the power units here are used for peaking only and due to the relatively high ambient water temperatures in this area, it does not appear that the manatees using this effluent are in any immediate danger from cold. It is possible, however, that an unseasonably cold winter could pose problems for the manatees using this system. Consideration should be given to insuring that the future power consumption demand projections take into account the times peaking units are likely to be used and more importantly, not used during critically low temperatures.

No manatees were sighted in the effluent zone between 1 April and 6 December. However, regular sightings were recorded from the adjoining "non-discharge" canal systems throughout the remainder of the study period. The presence of these animals within the study area may be considered incidental to the existence of the power plant, as their presence was probably influenced by the abundance of floating vegetation growing in the canals. Many manatees

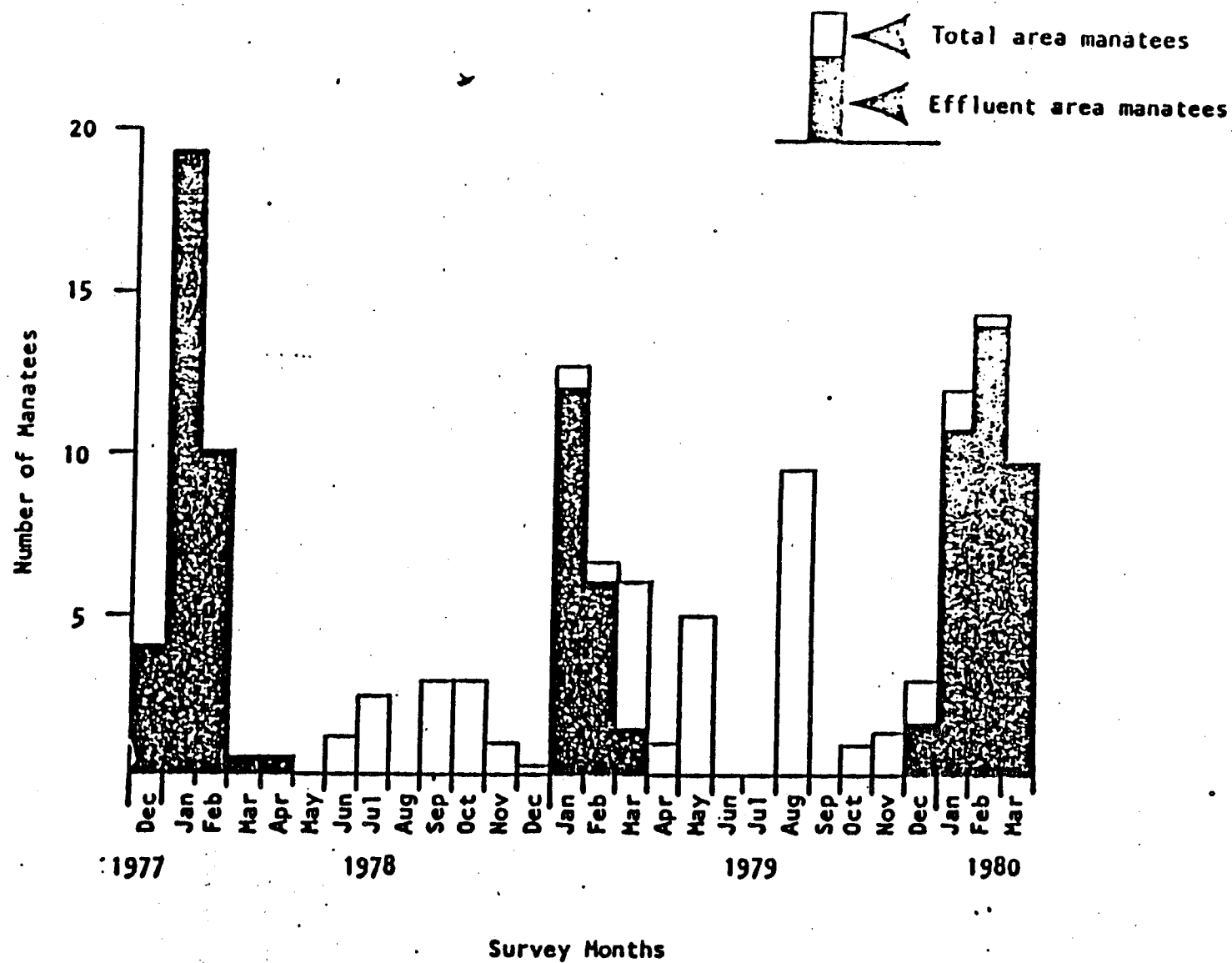


Figure 8 . Mean monthly number of manatees sighted at the Ft. Lauderdale Power Plant.

Table 6

Total number of manatees sighted per aerial survey of the Ft. Lauderdale Power Plant and adjacent waters within approximately 5 miles thereof from 12-12-77 through 3-20-80.

<u>DATE</u>	<u>TOTAL AREA</u>	<u>EFFLUENT ZONE</u>	<u>INTAKE ZONE</u>	<u>SURVEY CONDITIONS</u>
<u>1977</u>				
13 Dec	-	-	-	
20 Dec	4(1)*	4(1)	0	+ - **
28 Dec	-	-	-	
<u>1978</u>				
3 Jan	-	-	-	
11 Jan	-	-	-	
17 Jan	13	13	0	-
25 Jan	9	9	0	-
31 Jan	36(3)	36(3)	0	-
7 Feb	23(3)	23(3)	0	+ -
21 Feb	-	-	-	
22 Feb	6	6	0	+ -
28 Feb	1	1	0	+ -
6 Mar	-	-	-	
14 Mar	0	0	0	-
23 Mar	1	1	0	-
1 Apr	1	1	0	-
18 Apr	0	0	0	
2 May	0	0	0	
18 May	-	-	-	
1 June	0	0	0	
14 June	3(1)	0	0	
27 June	1	0	0	
11 July	3	0	0	
25 July	2	0	0	
7 Aug	0	0	0	
22 Aug	0	0	0	
5 Sept	2(1)	0	0	
18 Sept	4	0	0	
2 Oct	5(1)	0	0	
19 Oct	1	0	0	
2 Nov	0	0	0	
16 Nov	1	0	0	+ -
21 Nov	2(1)	0	0	-
29 Nov	1	0	0	+ -
6 Dec	1	0	0	+ -
15 Dec	0	0	0	+
19 Dec	0	0	0	+ -
27 Dec	0	0	0	- -
<u>1979</u>				
3 Jan	4	4	0	-
8 Jan	6(1)	6(1)	0	-
9 Jan	-	-	-	
15 Jan	4	4	0	-
22 Jan	27(2)	24(2)	0	-

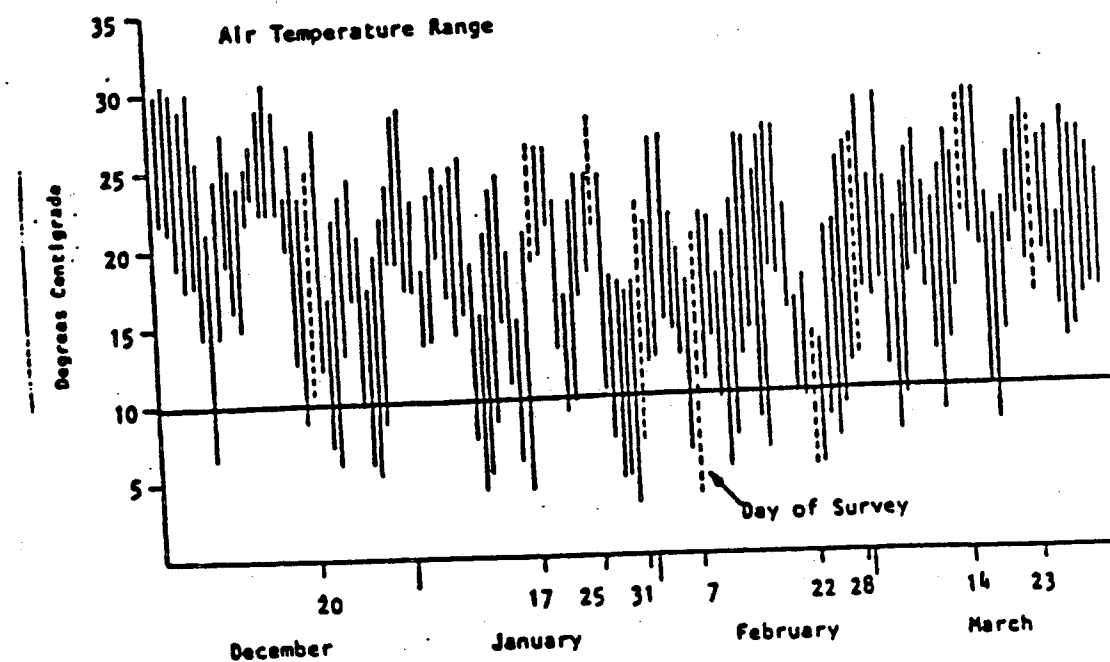
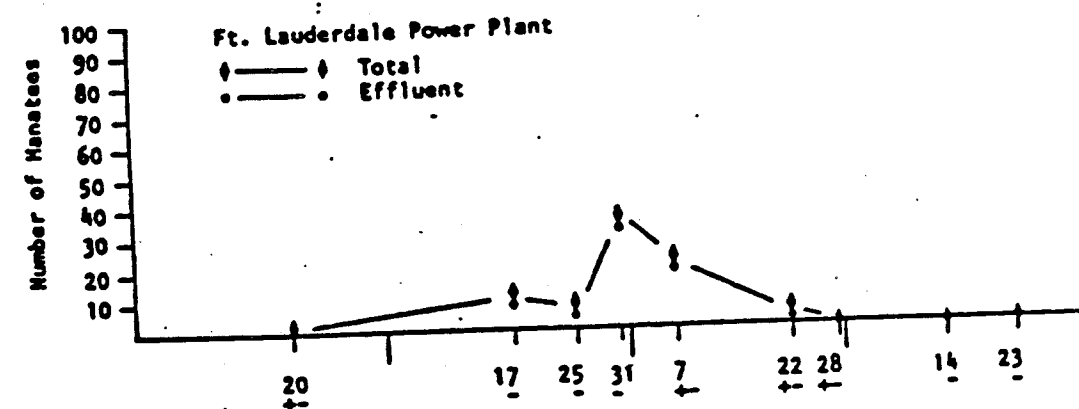
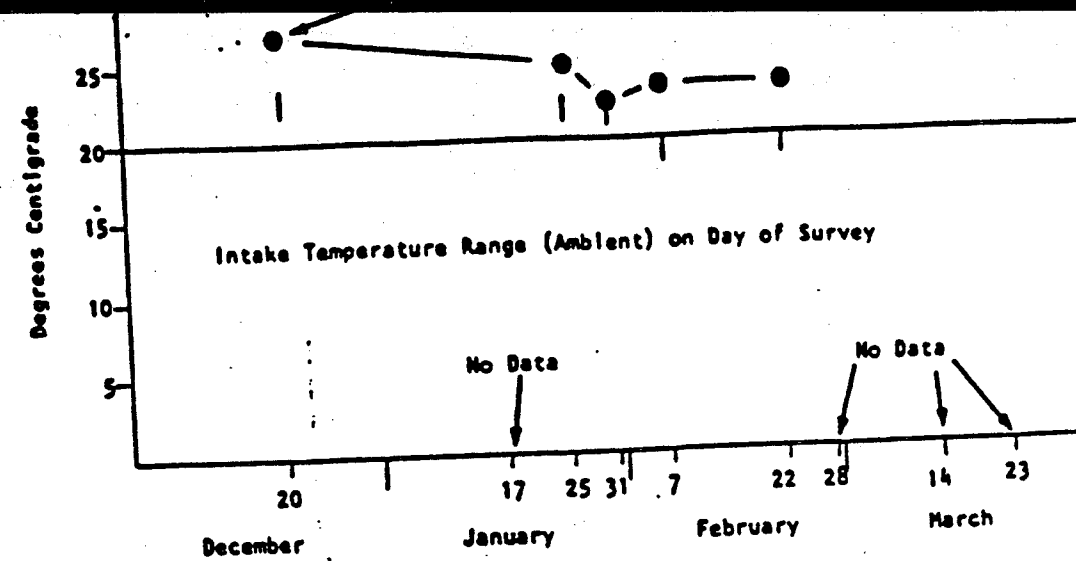
* The number of calves is enclosed in parentheses.

** Relative survey conditions are defined on page 12.

Table 6 continued.

<u>DATE</u>	<u>TOTAL AREA</u>	<u>EFFLUENT ZONE</u>	<u>INTAKE ZONE</u>	<u>SURVEY CONDITIONS</u>
29 Jan	22(2)	22(2)	0	-
1 Feb	12	12	0	-
7 Feb	3(1)	2(1)	0	- -
16 Feb	11	10	0	-
20 Feb	3	2	0	-
27 Feb	4	4	0	- -
9 Mar	3	0	0	-
15 Mar	2(1)	2(1)	0	-
22 Mar	6	4	0	+ -
27 Mar	13(2)	0	0	+ -
12 Apr	1	0	0	
9 May	5(1)	0	0	
23 May	5	0	0	
5 June	0	0	0	
21 June	0	0	0	
2 July	1	0	0	
18 July	4	0	0	
30 July	6(1)	0	0	
17 Aug	12(1)	0	0	
29 Aug	7(1)	0	0	
10 Sept	-	-	-	
24 Sept	0	0	0	
10 Oct	2	0	0	
23 Oct	0	0	0	
5 Nov	1	0	0	
20 Nov	0	0	0	- -
30 Nov	3	0	0	- -
6 Dec	7(1)	5(1)	0	-
12 Dec	1	0	0	-
18 Dec	4	2	0	- -
27 Dec	0	0	0	-
<u>1980</u>				
2 Jan	13(1)	13(1)	0	+ -
7 Jan	17(1)	17(1)	0	+ -
11 Jan	7	4	0	-
20 Jan	22(2)	19(2)	0	-
30 Jan	1	1	0	-
2 Feb	20(4)	20(4)	0	+ -
7 Feb	6	6	0	+ -
14 Feb	0	0	0	-
21 Feb	36(8)	35(8)	0	- -
27 Feb	9	9	0	+ -
4 Mar	29(2)	29(2)	0	+ -
12 Mar	0	0	0	+ -
20 Mar	0	0	0	+ -

Figures 9a-c. Congregations of manatees at the Ft. Lauderdale Power Plant in relation to the daily air temperature, minimum effluent water temperature and water temperature on day of survey in 1977-78 (Figure 9a), 1978-79 (Figure 9b), and 1979-80 (Figure 9c). A 10° air and 20° water temperature reference line is indicated on the graphs. The air temperature range on each day of survey is depicted with a dashed line for easy reference. The relative survey conditions for November through March of each year are: ++ (very good); + (good); +- (fair); - (poor); and -- (extremely poor). Water temperatures were recorded by the individual power plants. Air temperatures were provided by the National Climatic Center with some additional temperatures from Ft. Lauderdale International Airport.



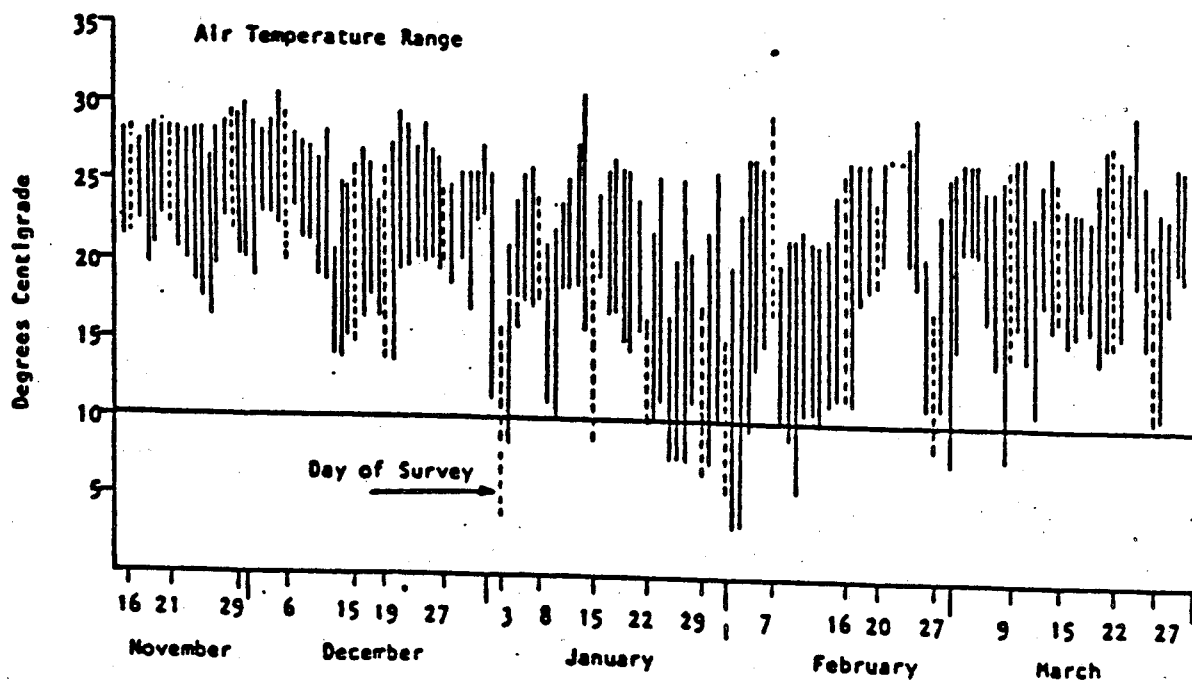
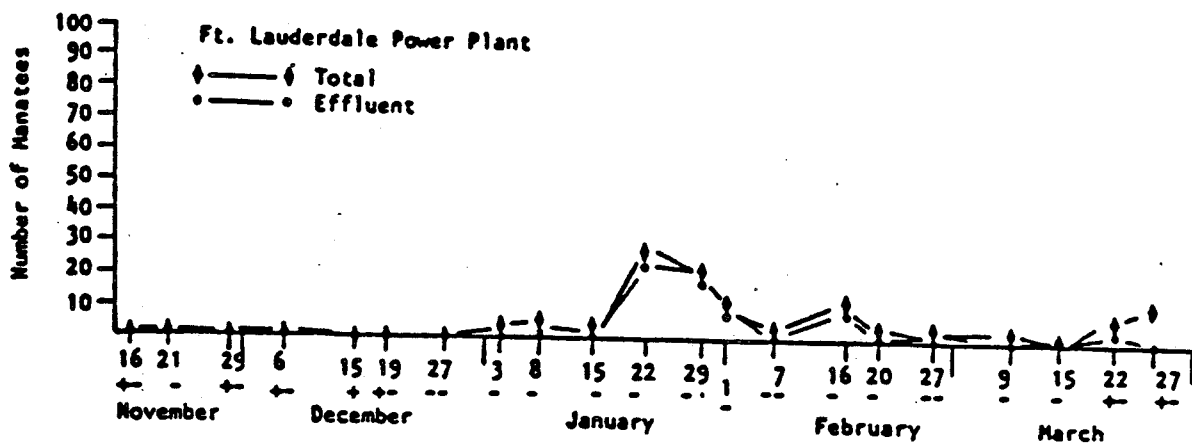
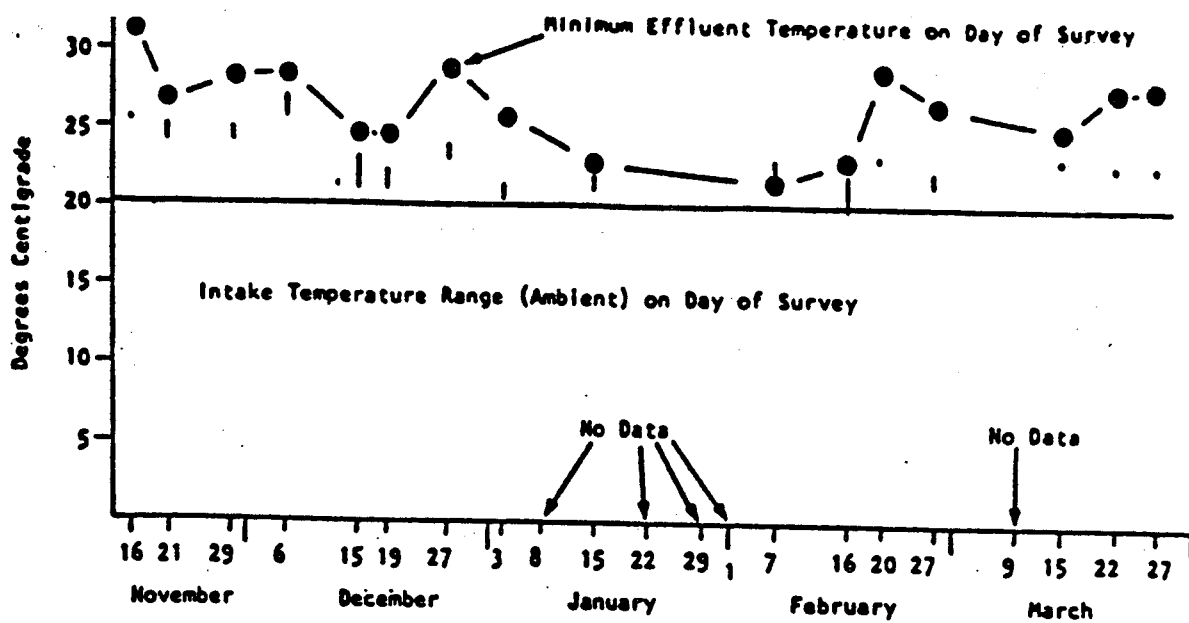
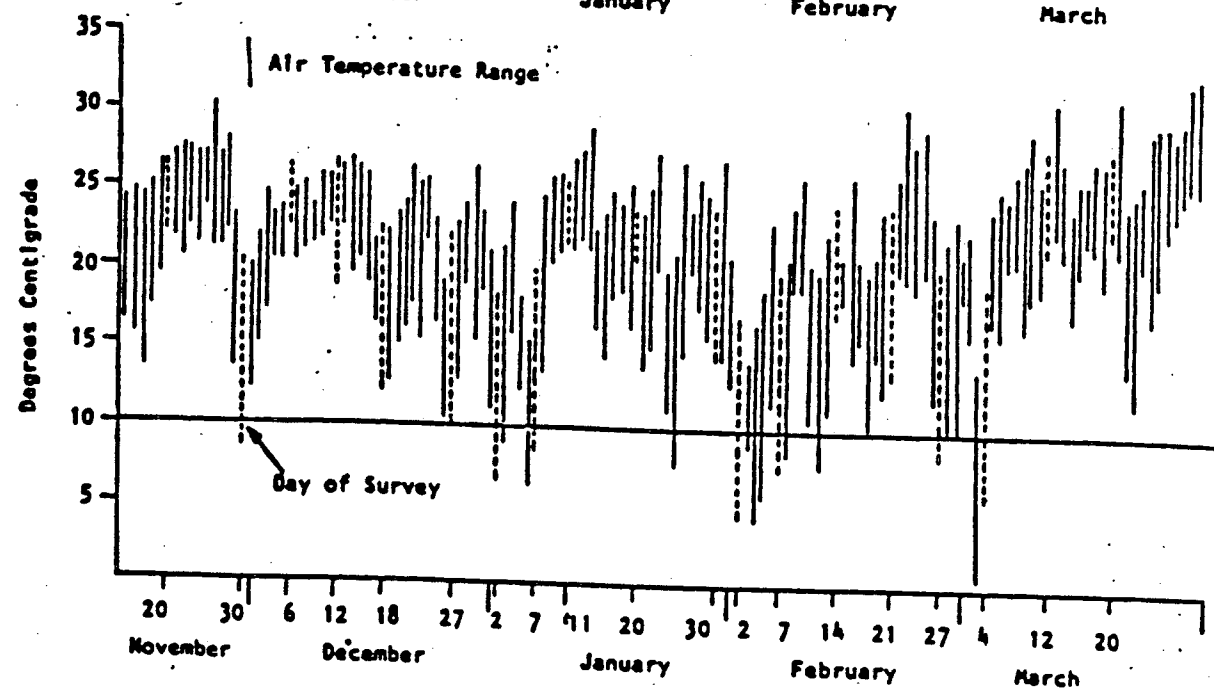
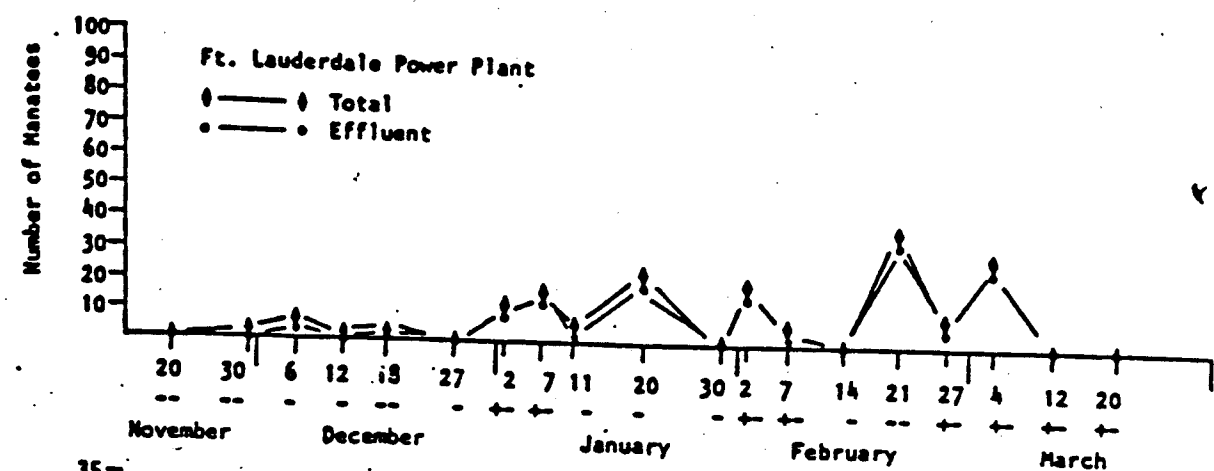
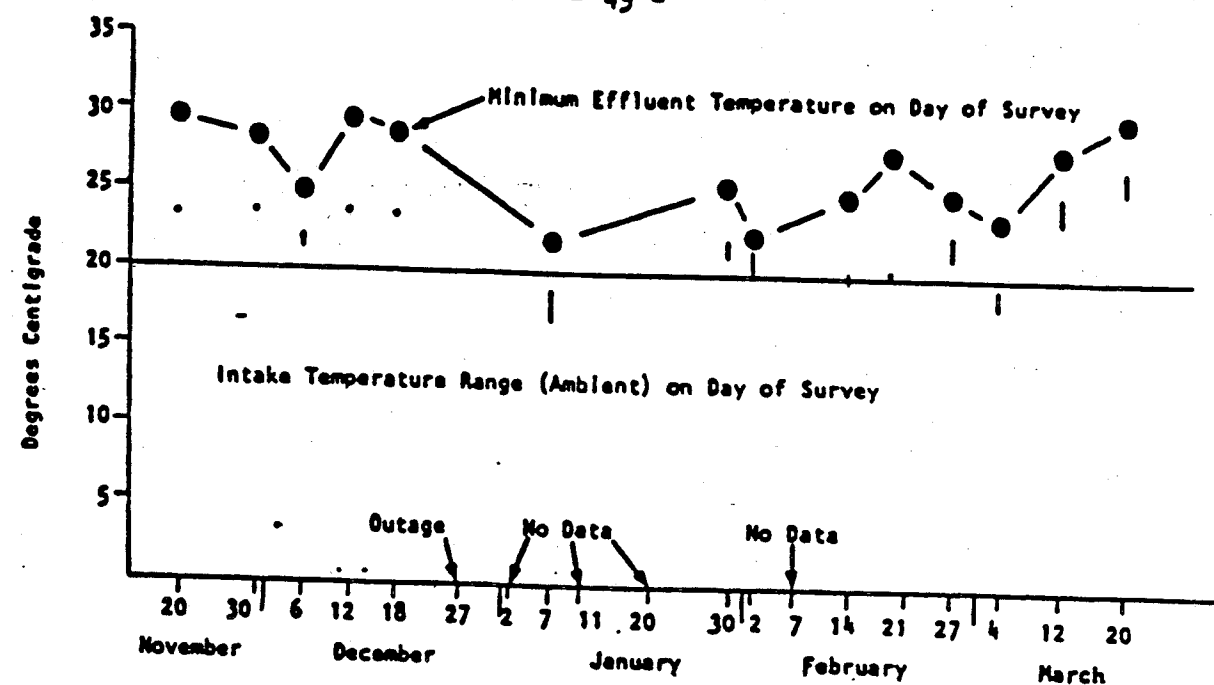


Figure 9c.

- 49 -



were seen feeding on this vegetation, particularly upstream of a nearby water control structure. It was presumed that these animals were also traveling through the control gate since the number of animals found in the canal varied from survey to survey. Upon further checking, it was found that the control gate remains in an open position and, therefore, should not present a serious threat to the manatees that use this canal. Dredging activity, however, in the discharge canal should be examined more closely to insure that this is not now a problem for the manatees and that it does not become a problem. It is conceivable that changes in techniques without considering the potential impact on manatees could pose a threat to the manatees that use this canal system in the winter.

Port Everglades.

Manatees were sighted on 59 occasions or on 70% of the 84 aerial surveys conducted at the Port Everglades (PPE) site. The number of manatees peaked strongly in the winter months. The majority of the sightings were made between 6 December and 27 March during all three years (see Table 7 for the dates of each survey and for the number of animals sighted).

The maximum numbers of manatees found within the PPE effluent for 1977-78, 1978-79 and 1979-80, respectively were: 112, 125 and 86. All of these counts were made on days when the minimum air temperature fell below 10°C and occurred during or immediately following each winter's most prolonged cold spell (Figures 10 a-c). These figures were considerably higher than the estimated 30 manatees reported by Hartman (1974) to be using the effluent canal during the winter and can probably be attributed at least in part to improved survey techniques. Another contributing factor may have been the closing of the Miami River Plant in 1973 which historically had estimated

Ft. Lauderdale

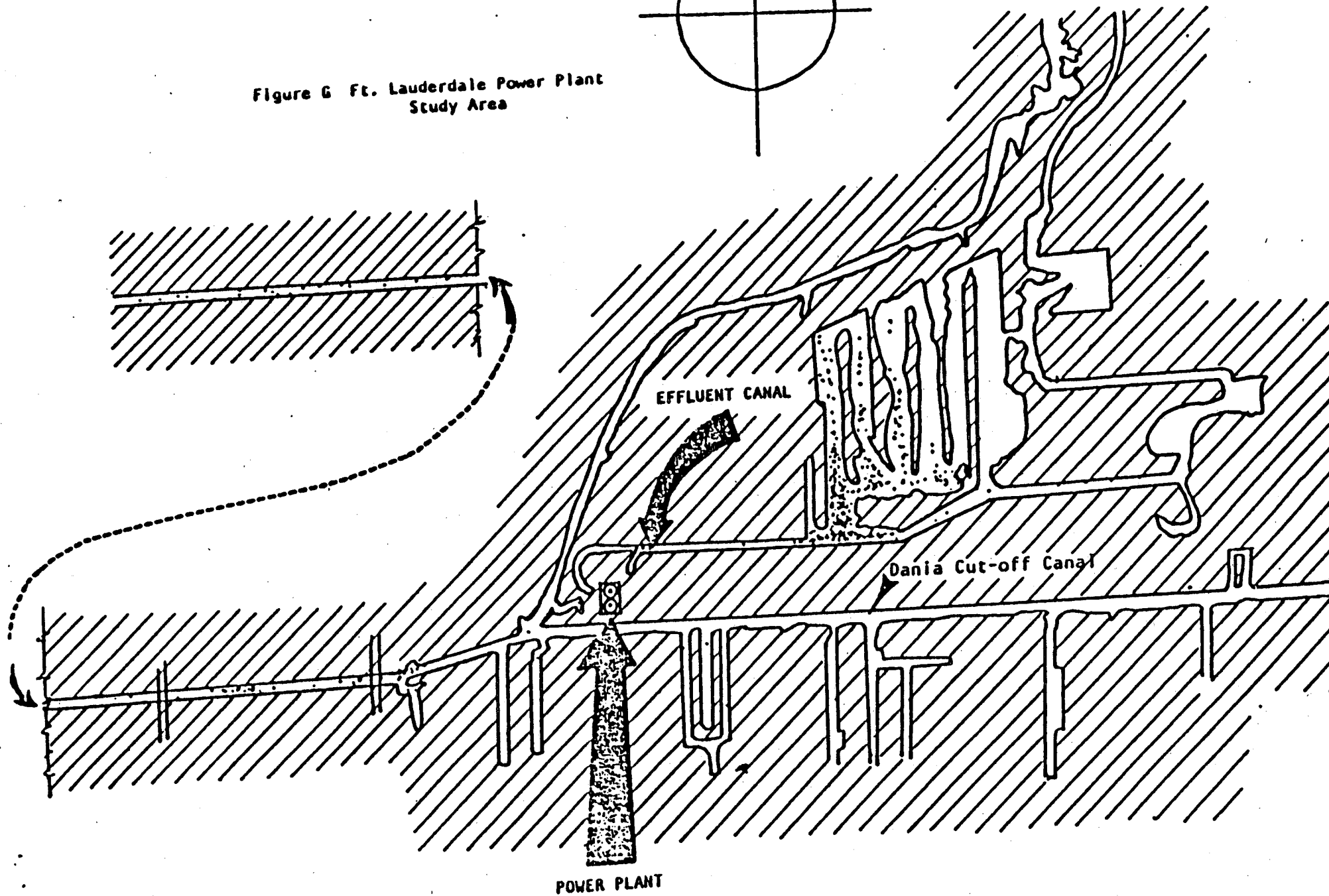
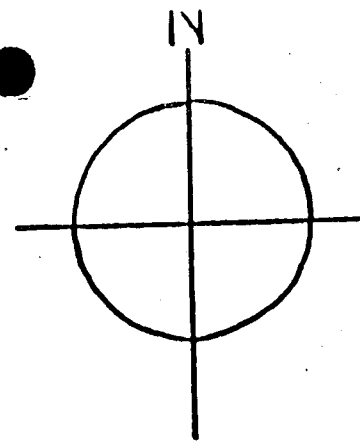
The Ft. Lauderdale Florida Power and Light Power Plant (PFL) is located in the southwestern area of Ft. Lauderdale, 2 miles west of the Ft. Lauderdale International Airport. The Plant is located on the north bank of the Dania Cut-Off Canal. Of the five originally constructed steam generating units, only units 4 and 5 are still in operation. Unit 4 began operating in 1957 and Unit 5 in 1958. Each unit has a 30-year retirement date. Both units are presently working in a peaking mode and thus all four pumps are not in operation continuously, 24 hours a day. When dropping the units down to hot standby in the evening, one circulating pump at each unit is turned off. Six hours later, the second pump at each unit may be turned off. The pumps are restarted the following day as the load demands.

The cooling water for the steam generating units is pumped from the Dania Cut-off Canal through a short intake canal. The two intake structures extend 3' above and 15' below the water line. There are chain link fences across the intake canals extending 2' into the water to minimize river trash from accumulating in the canal.

The water is discharged at a flow rate of 167.04 MGD per unit into a 2,400 foot long canal that leads into a canal/lake system. Extensive dredging in the area has changed the pattern of flow. The partially cooled water flows from the cooling system into the south fork of the New River. The estimated time for a parcel of water to flow through the cooling system is 2½ days.

(Site description taken from Lyerly and Associates 1976).

Figure G Ft. Lauderdale Power Plant
Study Area



DISTRIBUTION AND ABUNDANCE OF WEST INDIAN MANATEES
(TRICHECHUS MANATUS) AROUND SELECTED FLORIDA
POWER PLANTS FOLLOWING WINTER COLD FRONTS: 1983-1984

John E. Reynolds, III
Assistant Professor of Biology
Eckerd College
St. Petersburg, Florida 33733

Final Report: 31 August 1984

Prepared for:

Florida Power and Light Company
P.O. Box 14000
Juno Beach, Florida 33408

Order Number: 01249-83562

from "normal" temperature for December, 1983-March, 1984 was 0.9°C warmer. Four air temperatures below 5°C and one below 0°C were recorded for winter, 1983-1984 (Anon., 1983; 1984a; 1984b; 1984c). At least one unit of the PPE Plant was on line during each aerial survey.

Lauderdale Plant and Vicinity:

Manatees were observed at PFL during four of five aerial surveys (Table 7). Only 8.7% of the animals sighted were calves. The survey area and the distribution of all animals for all surveys are presented in Figure 5. Behaviorally, the animals were usually resting or feeding in the finger channels to the east of the effluent (Figure 5).

Survey conditions were fair to good. Turbidity and limitations on circling due to Flight Control were both detrimental to survey conditions.

Comparisons of water temperatures, air temperatures, and number of manatees were made via regressions (Table 6). Regression coefficients were not significant for any comparisons.

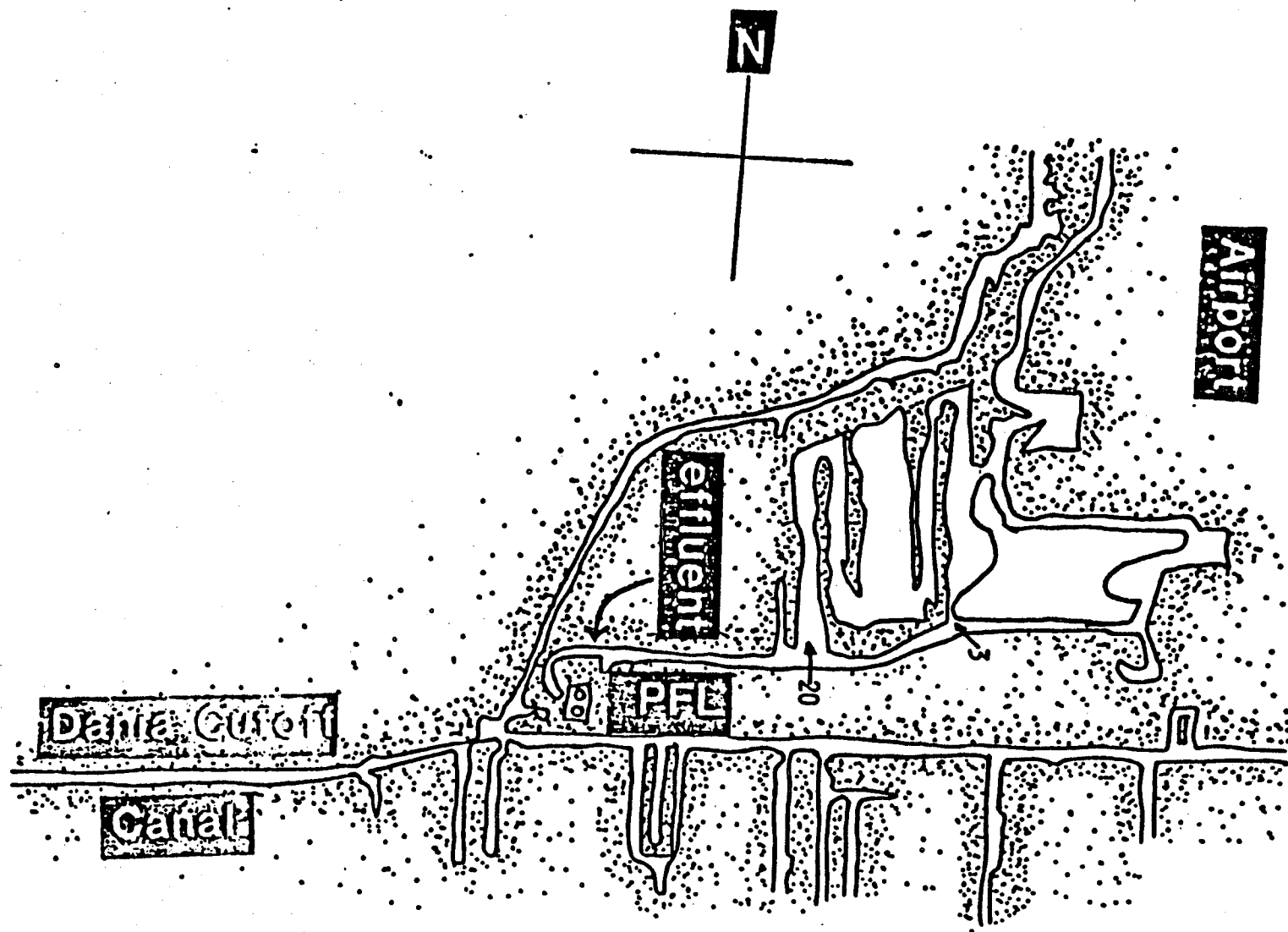
Mean monthly air temperatures were 21.7°C for December (1.8°C warmer than "normal" since 1950), 19.5°C for January (0.6°C warmer than "normal" since 1950), 20.4°C for February (1.2°C warmer than "normal" since 1950), and 21.5°C for March (0.0°C warmer than "normal" since 1950). The average monthly departure from "normal" air temperature for December, 1983-March, 1984 was 0.9°C warmer. Four air temperatures colder than 5°C and one below 0°C were recorded for winter, 1983-1984.

Table 7: Number of manatees observed during each aerial survey in the vicinity of the Lauderdale Plant (PFL): winter, 1983-1984. Distribution of animals appears in Figure 5. The number of calves is enclosed in parentheses and included in the total number of animals. The percentage of calves represents the percent of the total manatees. All temperatures are reported in °C. (Key: atemp: mean air temperature on the day of a flight; atemp3: mean air temperature on the day of a flight plus the two previous days; wtemp: mean intake water temperature for the day of a flight; wtemp3: mean intake water temperature for the day of a flight plus the two previous days)

<u>Survey Date</u>	<u>Total Manatees</u>	<u>Percent Calves</u>	<u>Survey Conditions</u>	<u>atemp</u>	<u>atemp3</u>	<u>wtemp</u>	<u>wtemp3</u>
27 Dec.	0 (0)	-	Good	13.9	11.2	18.4	18.7
30 Jan.	2 (0)	-	Good	18.3	19.2	N/A	N/A
1 Feb.	8 (1)	12.5	Good	15.0	16.7	20.0	N/A
7 Feb.	11 (1)	9.1	Fair	12.5	13.5	N/A	N/A
1 Mar.	<u>2 (0)</u>	<u>-</u>	Good	11.7	15.2	20.7	N/A
Total	23 (2)	8.7					

N/A: Means that the units were on standby and that water temperatures were, therefore, not recorded.

Figure 5: The location of the Lauderdale Plant (PFL) is indicated, together with the total number of manatees observed in each location during all surveys of this area. The total count was 23 animals.



HAZEN AND SAWYER, P.C.

ENGINEERS



5950 WASHINGTON STREET - HOLLYWOOD, FLORIDA 33023 - (305) 987-0066
(305) 625-4101

July 16, 1984

MEMORANDUM

TO: Thomas M. Henderson
✓ Phyllis A. Korab
Carlton A. Miller
James Hudgens
Stephen C. Schwarz
Ronald J. Mills
Robert J. Schneider
Clifford A. Schulman, Esq.

- Resource Recovery Office
- Resource Recovery Office
- Resource Recovery Office
- Coastal Zone Resources
- Malcolm Pirnie, Inc.
- Malcolm Pirnie, Inc.
- Malcolm Pirnie, Inc.

FROM: P.E. Robinson

SUBJECT: Department of the Army
Dredge and Fill Permit at the
Southern (Route 441) Site

Attached is COE correspondence dated July 13, 1984 which indicates they have completed their evaluation of the Broward County Dredge and Fill Permit Application. The Department of the Army will issue the DOE Permit once the State of Florida issues their Dredge and Fill Permit. In other words, the COE will go along with the State DER. No EIS is required for the Southern Site.

/rw
attachment

PREVENTION OF SIGNIFICANT DETERIORATION

ESE ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.

AN **RSH** COMPANY

TECHNICAL SUPPORT DOCUMENT FOR
THE PREVENTION OF SIGNIFICANT DETERIORATION
(PSD) PERMITS FOR TWO RESOURCE RECOVERY
FACILITIES IN BROWARD COUNTY, FLORIDA

Prepared for:

MALCOLM PIRNIE, INC.

Prepared by:

ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
Gainesville, Florida

March 1985

ESE No. 85-110-0100

TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
1.0	<u>INTRODUCTION</u>	1-1
2.0	<u>AIR QUALITY REVIEW REQUIREMENTS AND APPLICABILITY</u>	2-1
2.1	PROJECT DESCRIPTION	2-1
2.2	NATIONAL AND STATE AAQS	2-2
2.3	PSD REQUIREMENTS	2-6
	2.3.1 <u>General Requirements</u>	2-6
	2.3.2 <u>Increments/Classifications</u>	2-10
	2.3.3 <u>Control Technology Review</u>	2-11
	2.3.4 <u>Air Quality Analysis</u>	2-13
	2.3.5 <u>Source Impact Analysis</u>	2-14
	2.3.6 <u>Additional Impact Analysis</u>	2-16
2.4	NONATTAINMENT RULES	2-16
2.5	SOURCE APPLICABILITY	2-17
3.0	<u>FACILITY DESIGN</u>	3-1
3.1	PROCESS DESCRIPTION	3-1
3.2	EMISSION AND STACK OPERATING PARAMETERS	3-3
4.0	<u>BEST AVAILABLE CONTROL TECHNOLOGY EVALUATION</u>	4-1
4.1	DESCRIPTION OF PROPOSED CONTROL TECHNOLOGY	4-1
	4.1.1 <u>Particulate Matter</u>	4-2
	4.1.2 <u>Sulfur Dioxide</u>	4-5
	4.1.3 <u>Nitrogen Oxides and Carbon Monoxide</u>	4-5
	4.1.4 <u>Other Pollutants</u>	4-6
	4.1.5 <u>Test Methods to Demonstrate Compliance</u>	4-7
4.2	COMPARISON OF ALTERNATIVE CONTROL TECHNOLOGIES	4-8
	4.2.1 <u>Particulate Matter</u>	4-8
	4.2.2 <u>Sulfur Dioxide</u>	4-11
	4.2.3 <u>Nitrogen Oxides and Carbon Monoxide</u>	4-14
	4.2.4 <u>Other Pollutants</u>	4-14
5.0	<u>AIR QUALITY MODELING APPROACH</u>	5-1
5.1	MODEL SELECTION	5-1
5.2	METEOROLOGICAL DATA	5-2
5.3	RECEPTOR GRID	5-3
5.4	REVIEW OF EXISTING AMBIENT MONITORING DATA	5-4

TABLE OF CONTENTS
(Continued, Page 2 of 2)

<u>Section</u>		<u>Page</u>
6.0	<u>AIR QUALITY MODELING RESULTS</u>	6-1
7.0	<u>IMPACT ON VEGETATION, SOILS, AND VISIBILITY</u>	7-1
7.1	IMPACTS ON VEGETATION AND SOILS	7-1
7.2	VISIBILITY IMPACTS	7-4
7.3	INDIRECT AIR QUALITY IMPACTS	7-5
8.0	<u>SUMMARY AND CONCLUSIONS</u>	8-1

REFERENCES

LIST OF TABLES

<u>Table</u>		<u>Page</u>
2-1	National and Florida AAQS	2-7
2-2	PSD Significant Emission Rates and <u>De Minimis</u> Impact Levels	2-9
2-3	Significant Impact Levels for Criteria Pollutants	2-15
2-4	Maximum Hourly and Annual Average Emission Rates for South BCRR Facility	2-18
2-5	Maximum Hourly and Annual Average Emission Rates for North BCRR Facility	2-19
2-6	Predicted Impacts for Each Proposed BCRR Facility Compared to <u>De Minimis</u> Air Quality Impacts	2-21
3-1	MSW Charging Rate and Location of North BCRR Facility	3-4
3-2	MSW Charging Rate and Location of South BCRR Facility	3-5
3-3	Stack and Operating Parameters for the Projected Capacities of the BCRR Facility Considered in the Air Quality Modeling	3-6
3-4	Pollutant Emission Factors for the Proposed BCRR Facility	3-8
5-1	Ambient Air Monitoring Sites in Broward County During 1983	5-5
5-2	1983 Ambient Air Quality Data for Monitoring Stations Within 10 km of the North BCRR Facility	5-7
5-3	1983 Ambient Air Quality Data for Monitoring Stations Within 10 km of the South BCRR Facility	5-8
6-1	Predicted Maximum Concentrations for Each Proposed BCRR Facility at Initial Projected Operation (115 Percent of Nameplate Capacity) Using Screening Modeling Methods	6-2

LIST OF TABLES
(Continued, Page 2 of 2)

<u>Table</u>		<u>Page</u>
6-2	Predicted Maximum Concentrations for Each Proposed BCRR Facility at Initial Projected Operation (115 Percent of Nameplate Capacity) Using Refined Modeling Methods	6-3
6-3	Predicted Maximum Concentrations for Each Proposed BCRR Facility at Maximum Projected Operation (115 Percent of Nameplate Capacity) Using Screening Modeling Methods	6-4
6-4	Predicted Maximum Concentrations for Each Proposed BCRR Facility at Maximum Projected Operation (115 Percent of Nameplate Capacity) Using Refined Modeling Methods	6-5
6-5	Predicted Maximum Concentrations at the PSD Class I Area Due to the Proposed South BCRR Facility at Initial Projected Load (115 Percent of Nameplate Capacity)	6-7
6-6	Predicted Maximum Concentrations at the PSD Class I Area Due to the Proposed South BCRR Facility at Maximum Projected Load (115 Percent of Nameplate Capacity)	6-8
6-7	Predicted Maximum Concentrations at the PSD Class I Area Due to the Proposed North BCRR Facility at Initial Projected Load (115 Percent of Nameplate Capacity)	6-9
6-8	Predicted Maximum Concentrations at the PSD Class I Area Due to the Proposed North BCRR Facility at Maximum Projected Load (115 Percent of Nameplate Capacity)	6-10
7-1	Maximum Predicted Concentrations Due to Each Proposed BCRR Facility Compared to Concentrations Known to Adversely Impact Vegetation	7-3

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
2-1	Locations of the Proposed North and South Resource Recovery Facilities in Broward County	2-3
2-2	Location of Proposed North Resource Recovery Facility	2-4
2-3	Location of Proposed South Resource Recovery Facility	2-6

1.0 INTRODUCTION

This report presents the results of an air quality analysis and study performed by Environmental Science and Engineering, Inc. (ESE) for the proposed Broward County Resource Recovery (BCRR) facilities. The proposed plants will be located in the north and south portions of Broward County and, therefore, are referred to as the north and south BCRR facility, respectively. They will be owned by Broward County and operated by a vendor selected by Broward County. Because a vendor has not yet been selected, a conceptual design has been specified by Malcolm Pirnie, Inc. based on conservative, or worst-case, assumptions from a potential air quality impact viewpoint. Once a vendor is selected and the conceptual design is finalized, the predicted impacts are not expected to be significantly different (i.e., not significantly higher) than those presented in this report. Solid waste will fuel steam generation boilers at each facility for the purpose of reducing waste volume and generating electricity.

The north BCRR facility will have initial and maximum (or ultimate) nameplate operating capacities of charging 2,200 and 3,300 tons per day (TPD), respectively, of municipal solid waste (MSW). The south BCRR facility will have initial and maximum nameplate operating capacities of charging 2,352 and 3,300 TPD, respectively. For modeling purposes, each facility is assumed to operate at 115 percent of its initial and maximum nameplate capacity at a 100-percent annual availability factor. Since the initial and maximum operating capacities for the two facilities are nearly identical, the air quality modeling analyses were performed to address impacts from a facility that is capable of charging 2,705 TPD for initial conditions and 3,795 TPD for maximum conditions. These modeling assumptions will produce conservative (i.e., higher-than-expected) concentrations because each facility is not likely to operate at 115 percent of its nameplate capacity, and the actual annual availability factor will be approximately 80 to 85 percent.

In accordance with the Clean Air Act (CAA) Amendments of 1977, this report addresses the requirements of the Prevention of Significant Deterioration (PSD) review which will be submitted to the Florida Department of Environmental Regulation (DER) and the United States Environmental Protection Agency (EPA) Region IV for their approval. This review includes an emission control technology evaluation, an air quality modeling and monitoring assessment of expected air pollutant emissions and background sources, and an assessment of the impact of the proposed facilities on soils, vegetation, and visibility.

As part of the air quality modeling assessment, incremental and total ambient pollutant concentrations were simulated for comparison to the national and Florida Ambient Air Quality Standards (AAQS) and PSD increments in the area surrounding the proposed plants. Air quality dispersion modeling was conducted using the EPA Industrial Source Complex (ISC) model for estimating concentrations.

The air quality regulatory requirements pertaining to the proposed BCRR facilities are presented in Section 2.0. The facility design description and control technology review are presented in Sections 3.0 and 4.0, respectively. The air quality modeling procedures and assumptions are presented in Section 5.0. The results of the modeling analyses that compare the predicted impacts of the BCRR facilities to the national and Florida AAQS and the PSD Class I and II increments are discussed in Section 6.0. An evaluation of the predicted impacts on soils, vegetation, and visibility is presented in Section 7.0. A summary of the results of this analysis and the conclusions are presented in Section 8.0.

2.0 AIR QUALITY REVIEW REQUIREMENTS AND APPLICABILITY

The following discussions pertain to the general project description and regulatory requirements that must be met for the construction and operation of the proposed resource recovery facilities, as required by federal and state PSD regulations and other air quality regulations.

2.1 PROJECT DESCRIPTION

Broward County occupies an area of approximately 1,200 square miles (mi²) and is located in the southeastern portion of the State of Florida.

Broward County is bounded on the north by Palm Beach County, on the east by the Atlantic Ocean, on the south by Dade County, and on the west by Hendry and Collier Counties.

In 1981, Broward County generated approximately 2,700 TPD of solid waste (Malcolm Pirnie, Inc., 1983). Currently, the County's waste is disposed of at two landfills. One of these landfills, the county landfill at Davie, is projected to reach capacity in 1986. The other landfill, the central disposal landfill located at Pompano Beach, is owned and operated by Waste Management, Inc. It is estimated that this landfill will reach capacity in the early 1990's.

The capacity limitations of these landfills necessitate the development of a long-term countywide disposal plan. Recognizing this need, Broward County authorized the investigation of solid waste management alternatives. A policy decision was made by Broward County not to rely on landfill as a primary long-term disposal solution and to concentrate on alternatives that involve the recovery of materials and/or energy as valuable resources. The engineering firm of Malcolm Pirnie, Inc., in association with W.F. Cosulich and Associates, Inc., and Hazen and Sawyer, Inc., was retained by the County to assist representatives from applicable county agencies in developing a long-term, full-service waste disposal system.

The BCRR project will utilize two sites to locate the necessary facilities. Figure 2-1 illustrates the general locations of the northern and southern sites. A resource recovery facility and landfill area will be located at each site. Broward County is currently in the process of acquiring and rezoning these sites. Negotiations have been initiated with the appropriate property owners, and the rezoning applications have been submitted.

The northern site location is shown in Figure 2-2. This site is accessible by Powerline Road to Copans Road. Powerline Road is a 4-lane paved roadway with current development in the vicinity of the site limited to industrial activity. Copans Road is a 2-lane paved roadway extending westward from Powerline Road to Blount Road.

At the northern site, approximately 130 acres will be available for siting the resource recovery facility and accompanying landfill and to provide buffer and stormwater retention ponds. Acreage requirements for the resource recovery facility, stormwater retention ponds, and buffer areas are estimated to be approximately 50 acres. Approximately 80 acres will be available at this site for landfill development.

The southern site, shown in Figure 2-3, will be located about 1.5 kilometers (km) southeast of the intersection of US Route 441 (State Road 7) and State Road 84. The southern and eastern site boundaries are formed by the South New River Canal. This site is accessible from an easement off US Route 441, which is a 4-lane undivided highway and a major roadway in the area.

2.2 NATIONAL AND STATE AAQS

As a result of the requirements of the 1970 CAA Amendments, EPA enacted primary and secondary national AAQS (Federal Register, 1971) for six air pollutants. Primary national AAQS are required to protect the public health, and secondary national AAQS are required to protect the

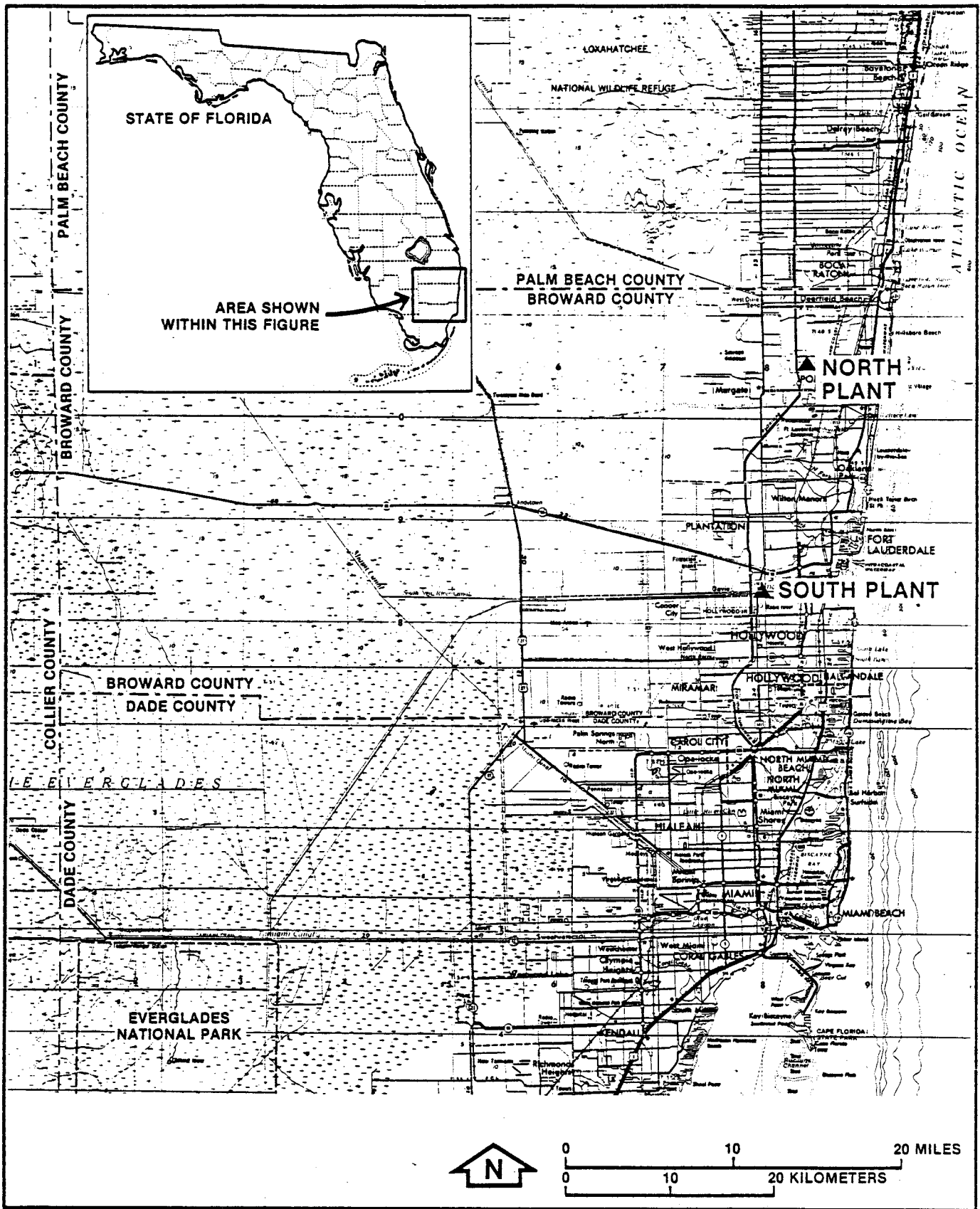


Figure 2-1
LOCATIONS OF THE PROPOSED NORTH AND
SOUTH RESOURCE RECOVERY FACILITIES IN
BROWARD COUNTY

SOURCE: ESE, 1985.

MALCOLM PIRNIE, INC.

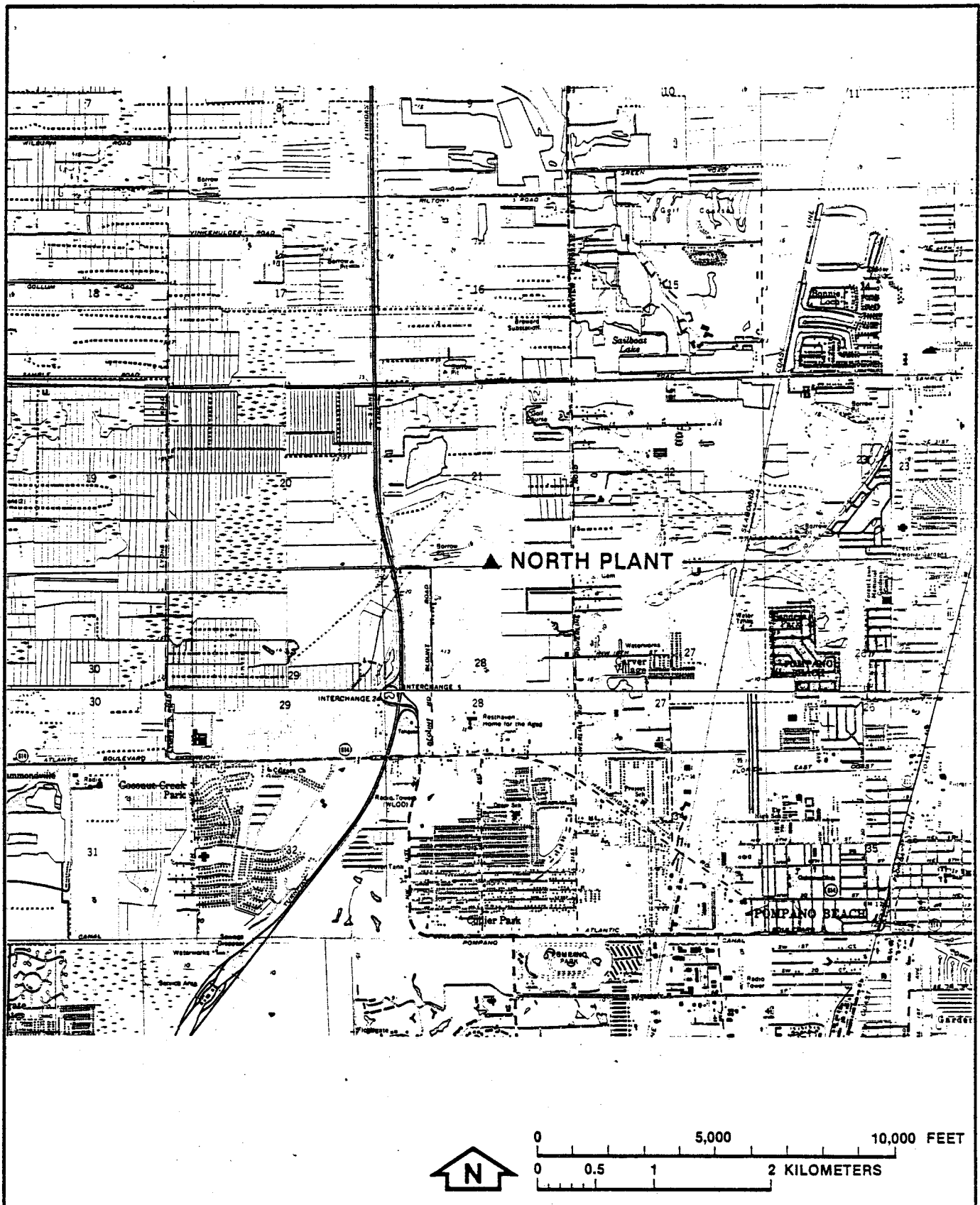


Figure 2-2
LOCATION OF PROPOSED NORTH RESOURCE
RECOVERY FACILITY

SOURCE: ESE, 1985.

MALCOLM PIRNIE, INC.



Figure 2-3
LOCATION OF PROPOSED SOUTH RESOURCE
RECOVERY FACILITY

SOURCE: ESE, 1985.

MALCOLM PIRNIE, INC.

public welfare from any known or anticipated adverse effects associated with the presence of pollutants in the ambient air.

The existing applicable national and Florida AAQS are presented in Table 2-1. Since the original standards were issued in 1971, the following changes have been made to national AAQS:

1. EPA eliminated the 24-hour and annual secondary AAQS for sulfur dioxide (SO₂);
2. AAQS for photochemical oxidants was redesignated as ozone, the concentration limit was increased, and the method for determining compliance was changed;
3. A new national AAQS for lead was promulgated; and
4. AAQS for hydrocarbons, used as a guide in achieving the AAQS for photochemical oxidants, was eliminated.

Prior to these changes, the State of Florida promulgated the secondary national AAQS for SO₂ as the state AAQS. Since states have the authority to adopt AAQS more stringent than those established by EPA, the State of Florida has chosen to retain the secondary AAQS for SO₂ which were eliminated by EPA. Pollutants for which AAQS have been established are called "criteria" pollutants.

Areas of the country in violation of AAQS are designated as nonattainment areas, and new sources to be located in or near these areas may be subject to more stringent air permitting requirements. Broward County is currently designated an ozone nonattainment area. There are no other designated nonattainment areas for other pollutants within 100 km of the proposed plant sites.

2.3 PSD REQUIREMENTS

2.3.1 General Requirements

Under federal PSD review requirements, all major new sources of air pollutants regulated under CAA must be reviewed and approved by EPA (in

Table 2-1. National and Florida AAQS.

Pollutant	Averaging Time	National AAQS* (ug/m ³)		PSD Increments (ug/m ³)	
		Primary	Secondary	Class I	Class II
Suspended Particulate Matter	Annual Geometric Mean	75	60	5	19
	24-Hour Maximum†	260	150	10	37
Sulfur Dioxide	Annual Arithmetic Mean	80	NA	2	20
	24-Hour Maximum†	365	NA	5	91
	3-Hour Maximum†	NA	1,300	25	512
Carbon Monoxide	8-Hour Maximum†	10,000	10,000	NA	NA
	1-Hour Maximum†	40,000	40,000	NA	NA
Nitrogen Dioxide	Annual Arithmetic Mean	100	100	NA	NA
Ozone	1-Hour Maximum**	235	235	NA	NA
Lead	Calendar Quarter	1.5	1.5	NA	NA

* Florida AAQS are identical to the secondary national AAQS except for the following sulfur dioxide concentrations: 60 ug/m³, annual average, and 260 ug/m³, 24-hour average.

† Maximum concentration not to be exceeded more than once per year.

** Maximum concentration not to be exceeded more than an average of 1 calendar day per year.

ug/m³ = micrograms per cubic meter.

NA = Not applicable.

Source: 40 CFR, Parts 50 and 52.

this case, reviewed and approved by DER since PSD review authority has been delegated to the state). A "major stationary source" is defined as any one of 28 named source categories which has the potential to emit 100 tons per year (TPY) or more, or any other stationary source which has the potential to emit 250 TPY or more, of any pollutant regulated under CAA. "Potential to emit" means the capability at maximum design capacity to emit a pollutant after the application of control equipment.

PSD review is used to determine whether significant air quality deterioration will result from the new or modified source. PSD requirements are contained in 40 CFR 52.21, Prevention of Significant Deterioration of Air Quality. Major sources are required to undergo the following reviews related to PSD for each pollutant emitted in significant amounts:

1. Control technology review,
2. Source impact analysis,
3. Air quality analysis (monitoring),
4. Source information, and
5. Additional impact analyses.

"Significant" is defined as any increase in emissions in excess of specified levels (Table 2-2).

The control technology review includes determination of Best Available Control Technology (BACT) for each applicable pollutant. BACT emission limits cannot exceed applicable emission standards (e.g., NSPS or state emission limits) promulgated under 40 CFR 60. The source impact analysis requires demonstration of compliance with federal and state AAQS and allowable PSD increment limitations. Projected ambient impacts on designated nonattainment areas and federally promulgated Class I PSD areas must also be addressed. The air quality analysis (monitoring) portion of PSD review requires an analysis of continuous ambient air monitoring data to be performed for the impact area of the proposed source. Source information, including process design parameters and

Table 2-2. PSD Significant Emission Rates and De Minimis Impact Levels

Pollutant	Regulated Under	Significant Emission Rate (TPY)	<u>De Minimis</u> Air Quality Impact (ug/m ³)
Sulfur Dioxide	NAAQS, NSPS	40	13, 24-hour
Particulate Matter	NAAQS, NSPS	25	10, 24-hour
Nitrogen Oxides	NAAQS, NSPS	40	14, Annual
Carbon Monoxide	NAAQS, NSPS	100	575, 8-hour
Volatile Organic Compounds (Ozone)	NAAQS, NSPS	40	100 TPY*
Lead	NAAQS	0.6	0.1, 24-hour
Sulfuric Acid Mist	NSPS	7	†
Total Fluorides	NSPS	3	0.25, 24-hour
Total Reduced Sulfur	NSPS	10	10, 1-hour
Reduced Sulfur Compounds	NSPS	10	10, 1-hour
Hydrogen Sulfide	NSPS	10	0.04, 1-hour
Asbestos	NESHAP	0.007	†
Beryllium	NESHAP	0.0004	0.0005, 24-hour
Mercury	NESHAP	0.1	0.25, 24-hour
Vinyl Chloride	NESHAP	1	15, 24-hour
Benzene	NESHAP	0	†
Radionuclides	NESHAP	0	†
Inorganic Arsenic	NESHAP	0	†
Any Regulated Pollutant	—	Class I Impact**	

* Increase in volatile organic compounds (VOC) emissions.

† No ambient measurement method.

** Any emission rate for a source located within 10 km of a Class I area which causes impacts of 1 ug/m³, 24-hour average, or greater.

Notes: Ambient monitoring requirements for subject pollutants may be exempted if the impact of the increase in emissions is below air quality impact de minimis levels.

NAAQS = National Ambient Air Quality Standards.

NSPS = New Source Performance Standards.

NESHAP = National Emission Standards for Hazardous Air Pollutants.

In February 1981, the Ambient Monitoring Guidelines for PSD (EPA-450/4-80-012) were revised to reflect the following changes in the de minimis levels: lead—0.1 ug/m³, calendar quarter; hydrogen sulfide—0.2 ug/m³, 1-hour; and beryllium—0.001 ug/m³, 24-hour. These revisions have not been published in the Federal Register or incorporated into the Code of Federal Regulations.

Sources: 40 CFR 52.21.
Lutz, 1981.

control equipment information, must be submitted to the reviewing agencies. Additional analysis of the proposed source's impact on soils, vegetation, and visibility, especially pertaining to Class I PSD areas, must be performed, as well as analysis of impacts due to growth in the area associated with the proposed source.

2.3.2 Increments/Classifications

In promulgating the 1977 CAA Amendments, Congress specified that certain increases above an air quality "baseline concentration" level of SO₂ and total suspended particulate (TSP) concentrations would constitute significant deterioration. The magnitude of the increment that cannot be exceeded depends on the classification of the area in which a new source (or modification) will have an impact. Three classifications were designated based on criteria established in the CAA Amendments. Initially, Congress promulgated areas as Class I [international parks, national wilderness areas, and memorial parks larger than 2,024 hectares (ha) (5,000 acres), and national parks larger than 2,428 ha (6,000 acres)] or Class II (all other areas not designated as Class I). No Class III areas, which would be allowed greater deterioration than Class II areas, were designated. However, the states were given the authority to redesignate any Class II area to Class III status, provided certain requirements were met. EPA then promulgated as regulations the requirements for classifications and area designations. The State of Florida has adopted the EPA class designations and allowable PSD increments (Table 2-2). The nearest Class I area is the Everglades National Park, located about 75 and 57 km from the north and south BCRR facility, respectively.

The term "baseline concentration" evolved from federal and state PSD regulations and denotes a fictitious concentration level corresponding to a specified baseline date and certain additional baseline sources. By definition in the PSD regulations, as amended August 7, 1980, baseline concentration means the ambient concentration level which exists in the

baseline area at the time of the applicable baseline date. A baseline concentration is determined for each pollutant for which a baseline date is established and shall include:

1. The actual emissions representative of sources in existence on the applicable baseline date; and
2. The allowable emissions of major stationary sources which commenced construction before January 6, 1975, but were not in operation by the applicable baseline date.

The following will not be included in the baseline concentration and will affect the applicable maximum allowable increase(s) (allowed increment consumption):

1. Actual emissions from any major stationary source on which construction commenced after January 6, 1975; and
2. Actual emissions increases and decreases at any stationary source occurring after the baseline date.

"Baseline date" means the earliest date after August 7, 1977, on which the first complete application under 40 CFR 52.21 is submitted by a major stationary source or major modification subject to the requirements of 40 CFR 52.21.

2.3.3 Control Technology Review

CAA mandated that EPA promulgate NSPS, which are a set of national emission standards for stationary sources of air pollution. These standards are applicable to specific categories of sources and apply not only to new sources, but also to modified or reconstructed existing sources of air pollution. Consequently, EPA promulgated NSPS for incinerators in June 1974 (40 CFR 60, Subpart E). NSPS for incinerators impose an emission limitation on particulate matter (PM) only. Specifically, incinerators with a charging rate in excess of 50 TPD of solid waste may not discharge to the atmosphere flue gases that contain PM in excess of 0.08 grain per standard cubic foot dry gas (gr/dscf), corrected to 12-percent carbon dioxide (CO₂).

DER has promulgated pollutant emission limitations to attain and preserve ambient air quality. The only emission regulation that applies to the proposed BCRR facilities is a PM standard. Particulate emissions from a new incinerator with a charging rate equal to or greater than 50 TPD are limited to 0.08 gr/dscf corrected to 50-percent excess air. Opacity is limited to 20 percent.

On June 19, 1984, EPA proposed a revision to NSPS for fossil-fuel-fired steam generators (Subpart D of 40 CFR Part 60) capable of combusting more than 250×10^6 Btu/hr heat input. The revision would include PM and NO_x emission limits for industrial-commercial-institutional steam generating units capable of combusting more than 100×10^6 Btu/hr heat input. For units that are capable of burning municipal-type solid waste, the PM emission standard is 0.10 lb/ 10^6 Btu. No NO_x emission limits are proposed for this source type at this time. Based on discussions with EPA (ESE, 1985), the proposed revisions are expected to be implemented in late 1985.

Under EPA's implementation of the CAA Amendments, the basic control technology requirement is the application and evaluation of BACT. BACT is defined as follows [40 CFR 52.21(b)(12)]:

An emission limitation...based on the maximum degree of reduction for each pollutant...which would be emitted from any proposed major stationary source or major modification which the Administrator, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable...for control of such pollutant.

In December 1978, EPA's Office of Air, Noise, and Radiation published Guidelines for the Evaluation of BACT to assist states and EPA Regional Offices in making BACT determinations. The BACT requirements are intended to ensure that the control systems incorporated in the design of a proposed facility reflect the latest in control technologies used in a particular industry and take into consideration existing and future air

quality in the vicinity of the proposed facility. BACT must, as a minimum, demonstrate compliance with NSPS for this source, if applicable. An evaluation of the air pollution control techniques and systems, including a cost-benefit analysis of alternative control technologies capable of achieving a higher degree of emission reduction than the proposed control technology, is also required. The cost-benefit analysis requires the documentation of the materials, energy, and economic penalties associated with the proposed and alternative control systems as well as the environmental benefits derived from these systems.

2.3.4 Air Quality Analysis

In accordance with requirements of 40 CFR 52.21(m), any application for a PSD permit must contain, for each pollutant regulated under CAA, an analysis of continuous ambient air quality data in the area affected by the proposed major stationary source or major modification. For a new major source, the affected pollutants are those that the source would potentially emit in a significant amount.

According to CAA, ambient air monitoring for a period of up to 1 year generally is appropriate to complete the PSD requirements of CAA. Existing data from the vicinity of the proposed source may be utilized if the data meet certain quality assurance requirements; otherwise, additional data may need to be gathered. Guidance in designing a PSD monitoring network is provided in EPA's Ambient Monitoring Guidelines for Prevention of Significant Deterioration (EPA, November 1980).

The regulations include an exemption which excludes or limits the pollutants for which an air quality analysis is conducted. This exemption states that the Administrator may exempt a proposed major stationary source or major modification from the monitoring requirements of 40 CFR 52.21(m) with respect to a particular pollutant if the emissions increase of the pollutant from the source or modification would cause, in any area, air quality impacts less than the de minimis levels presented in Table 2-2.

The State of Florida has passed similar PSD air quality analysis requirements. EPA and State of Florida de minimis air quality impact levels are currently identical. In February 1981, EPA revised the de minimis levels and averaging times for three of the pollutants (Lutz, 1981). The averaging period for the de minimis level for lead was changed to 3 months, and the de minimis impact levels for beryllium and hydrogen sulfide were changed to 0.001 ug/m³ and 0.2 ug/m³, respectively.

2.3.5 Source Impact Analysis

A source impact analysis must be performed by a proposed major source subject to PSD for each pollutant for which the increase in emissions exceeds the significant emission rates (Table 2-2). The PSD regulations specifically require the use of atmospheric dispersion models in performing impact analysis, estimating baseline and future air quality levels, and determining compliance with AAQS and allowable PSD increments. Designated EPA models must normally be used in performing the impact analysis. Specific applications for other than EPA-approved models require EPA's consultation and prior approval. Guidance for the use and application of dispersion models is presented in the EPA publications, "Guideline on Air Quality Models" (EPA, 1984) and "Regional Workshops on Air Quality Modeling: A Summary Report" (EPA, 1982a). Criteria pollutants may be exempt from the source impact analysis if the net increase in impacts due to the proposed source is below significant impact levels, as presented in Table 2-3.

Various lengths of record for meteorological data can be utilized for impact analysis. A 5-year period can be used with corresponding evaluation of highest, second-highest short-term concentrations for comparison to AAQS or PSD increments. The term "highest, second-highest" refers to the highest of the second-highest concentrations at all receptors (i.e., the highest concentration at each receptor is discarded). The second-highest concentration is significant because short-term AAQS specify that the standard should not be exceeded at any

Table 2-3. Significant Impact Levels for Criteria Pollutants

Pollutant	Averaging Period	Concentration (ug/m ³)
Sulfur Dioxide	3-Hour	25
	24-Hour	5
	Annual	1
Particulate Matter	24-Hour	5
	Annual	1
Nitrogen Dioxide	Annual	1
Carbon Monoxide	1-Hour	2,000
	8-Hour	500

Source: 40 CFR 52.

location more than once a year. If less than 5 years of meteorological data are used, the highest concentration at each receptor must be used.

2.3.6 Additional Impact Analysis

In addition to air quality impact analyses, federal PSD regulations require analyses of the impairment to visibility and the impacts on soils and vegetation that would occur as a result of the proposed source. These analyses are to be conducted primarily for PSD Class I areas. Impacts due to general commercial, residential, industrial, and other growth associated with the source must also be addressed. These analyses are required for each pollutant emitted in significant amounts.

2.4 NONATTAINMENT RULES

On August 7, 1980, EPA promulgated rules for review of major new sources and major modifications in areas where air quality does not meet federal standards (i.e., nonattainment areas). Those rules defined source as either an entire plant or an individual piece of process equipment within the plant (i.e., dual definition). On October 14, 1981, EPA deleted the dual definition and defined a source as an entire industrial plant (i.e., plant-wide or bubble definition). In an opinion on Natural Resources Defense Council versus Gorsuch on August 17, 1982, the Washington, D.C. Circuit Court vacated the plant-wide definition and apparently reinstated the dual definition of source. Although no final decision has been reached, EPA's guidance to regional offices concerning the court decision is to reinstate the dual definition of a source. This ruling not only affects the new source review (NSR) permit program as specified in 40 CFR 51.18(j), but also the Emission Offset Interpretative Ruling (40 CFR 51, Appendix S), which applies to new and modified major sources affecting nonattainment areas. Under Section IV.A of the Ruling, such sources are required to: (1) meet an emission limitation which specifies the lowest achievable emission rate for such sources, (2) certify that all existing major sources owned or operated by the applicant in the same state are in compliance with all applicable emission limitations and

standards under the Act, (3) obtain emission offsets such that there will be reasonable progress toward attainment of the applicable national AAQS, and (4) demonstrate that the emission offsets would provide a positive net air quality benefit in the affected area [not applicable for VOC or nitrogen oxides (NO_x)].

Based on these current nonattainment provisions, all major new sources and modifications to existing major sources locating in the nonattainment area must undergo the nonattainment review procedures if the proposed pieces of equipment have the potential to emit 100 TPY or more of the nonattainment pollutant, or the major modification results in a significant net emission increase at the facility of the nonattainment pollutant. For major sources or major modifications which locate in an attainment or unclassifiable area, the nonattainment review procedures apply if the source or modification exceeds the significant impact levels presented in Table 2-3 at any locality that does not meet AAQS.

2.5 SOURCE APPLICABILITY

The estimated emissions of regulated pollutants from the south and north BCRR facilities are presented in Tables 2-4 and 2-5, respectively. These emissions are based on 115 percent of initial and maximum nameplate capacities. The proposed facilities will be located in Broward County, which is designated by EPA and DER as an attainment area for all criteria pollutants except ozone, and a PSD Class II area for SO₂ and TSP.

Because VOC emissions from the proposed facilities will be less than 100 TPY, nonattainment review is not required. The nearest nonattainment area for any other criteria pollutant is located more than 100 km from either of the proposed BCRR facilities. Because impacts from the proposed plant's emissions are not expected to be significant at such distances, potential impacts on the nearest nonattainment areas were not addressed in the analysis.

03/03/85

Table 2-4. Maximum Hourly and Annual Average Emission Rates for South BCRR Facility

Pollutant	Initial Capacity = 2,705 TPD*		Maximum Capacity = 3,795 TPD*		PSD Significant Emission Rate (TPY)
	lb/hr	TPY	lb/hr	TPY	
Particulate Matter	75.1	328.8	105.3	461.3	25
Sulfur Dioxide	557.9	2,443.6	782.7	3,428.3	40
Nitrogen Dioxide	568.1	2,488.1	796.9	3,490.6	40
Carbon Monoxide	90.3	395.4	126.7	554.8	100
Volatile Organic Compounds	13.2	57.8	18.5	81.0	40
Lead	30.4	133.3	42.7	187.0	0.6
Fluorides	25.4	111.1	35.6	155.8	3
Sulfuric Acid Mist	2.8	12.3	4.0	17.3	7
Beryllium	0.00094	0.0041	0.0013	0.0058	0.0004
Mercury	0.26	1.4	0.36	1.6	0.1
Arsenic	0.032	0.14	0.044	0.19	0

*These capacities are 115 percent of nameplate capacities which are 2,352 TPD (initial) and 3,300 TPD (maximum).

Source: Malcolm Pirnie, Inc., 1985.

Table 2-5. Maximum Hourly and Annual Average Emission Rates for North BCRR Facility

Pollutant	Initial Capacity = 2,530 TPD*		Maximum Capacity = 3,795 TPD*		PSD Significant Emission Rate (TPY)
	lb/hr	TPY	lb/hr	TPY	
Particulate Matter	70.2	307.5	105.3	461.3	25
Sulfur Dioxide	521.8	2,285.7	782.7	3,428.3	40
Nitrogen Dioxide	531.3	2,327.1	796.9	3,490.6	40
Carbon Monoxide	84.4	369.8	126.7	554.8	100
Volatile Organic Compounds	12.3	54.0	18.5	81.0	40
Lead	28.5	124.7	42.7	187.0	0.6
Fluorides	23.7	103.9	35.6	155.8	3
Sulfuric Acid Mist	2.6	11.5	4.0	17.3	7
Beryllium	0.00088	0.0039	0.0013	0.0058	0.0004
Mercury	0.24	1.1	0.36	1.6	0.1
Arsenic	0.030	0.13	0.044	0.19	0

*These capacities are 115 percent of nameplate capacities which are 2,200 TPD (initial) and 3,300 TPD (maximum).

Source: Malcolm Pirnie, Inc., 1985.

The proposed north and south BCRR facilities will be located about 57 and 75 km, respectively, from the PSD Class I area of the Everglades National Park. As a result, potential impacts on the Class I area were addressed in the analysis.

Under PSD regulations, the proposed project will be a major source because it is one of the 28 named "major stationary sources" (i.e., municipal incinerator capable of charging more than 250 tons of refuse per day) which has the potential to emit more than 100 TPY of PM, SO₂, nitrogen dioxide (NO₂), carbon monoxide (CO), lead (Pb), and fluorides. As a result, any regulated pollutant emitted from the BCRR facilities above the significant emission rates presented in Tables 2-4 and 2-5 is subject to PSD review.

Emissions of the following pollutants from the proposed sources will be in excess of the appropriate significant emission levels: PM, SO₂, NO₂, CO, lead, fluorides, beryllium, mercury, sulfuric acid mist, and arsenic. It should be noted that no significant emission rate has been established for arsenic, and, therefore, any emissions are considered significant. The methods used to estimate the emissions of the regulated pollutants are presented in Section 3.2.

As discussed in Section 2.3.4, a new major source may be exempt from preconstruction air quality monitoring requirements of the PSD regulations for those pollutants which have air quality impacts less than the de minimis levels presented in Table 2-2. The maximum predicted impacts due to emissions from each of the proposed BCRR facilities for regulated pollutants subject to PSD review are presented in Table 2-6. The methods used to predict the proposed facilities' impacts are described in Section 5.0. Based on these results, the impacts from the proposed facilities are expected to be below the de minimis impact levels for all pollutants except lead and fluorides. Currently, there are no de minimis levels designated for inorganic arsenic and sulfuric acid mist

Table 2-6. Predicted Impacts for Each Proposed BCRR Facility Compared to De Minimis Air Quality Impacts

Pollutant	Averaging Period	Impacts (ug/m ³)*	
		Maximum Predicted Due to Each Facility	<u>De Minimis</u> Level
Particulate Matter	24-hour	0.8	10
Sulfur Dioxide	24-hour	5.9	13
Nitrogen Dioxide	Annual	0.6	14
Carbon Monoxide	8-hour	2.6	575
Lead	24-hour (Quarterly)†	0.3 (0.03)	0.1 (0.1)
Fluorides	24-hour	0.27**	0.25
Beryllium	24-hour	0.00001	0.0005 (0.001)
Mercury	24-hour	0.0028	0.25

*Values in parentheses represent results associated with revised de minimis monitoring levels.

†Based on annual average concentrations.

**Based on emissions at 115 percent of maximum nameplate capacity. At 115 percent of initial nameplate capacity, maximum 24-hour concentration is predicted to be 0.25 ug/m³.

Source: ESE, 1985.

because an appropriate monitoring method has not yet been developed for these pollutants. Therefore, no monitoring is required, and no modeling has been performed for these pollutants in this analysis.

For lead, the impacts from the proposed facilities are expected to be slightly above the de minimis impact level promulgated by the State of Florida. Based on a review of existing monitoring data in the county (see Section 5.4), there is at least one lead monitor within 8 km of each of the proposed facilities' locations. These monitoring sites, which are expected to measure general population-created pollution in the county, have measured maximum concentrations that are less than 50 percent of AAQS. Because the maximum lead impacts from the proposed facilities are expected to be low and existing ambient lead concentrations are well below AAQS, existing monitoring data should be suitable for determining preconstruction monitoring lead levels and acceptable as part of the PSD permit application. Therefore, preconstruction monitoring for lead is not considered necessary for the BCRR facilities. It should be noted that EPA has revised the de minimis level for lead from a 24-hour to calendar-quarter averaging time. Based on this revision, the maximum predicted lead concentration is well below the calendar-quarter average de minimis level and, therefore, monitoring would not be required as part of the PSD permit application.

For fluorides, the 24-hour impacts from the proposed facilities operating at 115 percent of initial capacity are expected to equal the de minimis impact level of 0.25 ug/m^3 . At 115 percent of maximum capacity, the plants' operations are expected to slightly exceed the de minimis impact level. Because the predicted impacts are low and conservative (i.e., emissions are based on 115 percent of nameplate capacity) and there are no national or state AAQS for fluorides, monitoring is not considered necessary before each facility operates at maximum capacity.

3.0 FACILITY DESIGN

3.1 PROCESS DESCRIPTION

The BCRR facilities will be designed such that MSW will be delivered to each facility by collection trucks that are either municipally or privately operated. MSW will be dumped from these vehicles into a totally enclosed tipping area which will be kept under negative pressure. The drawn air will be used as combustion air in the boilers. MSW will be moved from the storage pit and fed or charged into the furnaces by means of an overhead crane-and-grapple system. The cranes and grapples will also be used to mix processible waste in the pit to produce a homogeneous mass. This system will also be capable of removing large, bulky, combustibile trash items from the storage pit and feeding them to the crusher and shears process. The crusher and shears, located at one end of the storage pit, will be used for size reduction of the oversized, processible trash prior to charging them into the furnaces. Provisions will also be made for removal of salvageable, oversized, noncombustible trash from the storage pit, using the overhead crane-and-grapple system.

The furnace design will be of the mass-burn stoker-fired or stoker/rotary kiln tandem type, capable of firing as-received processible waste, without auxiliary fuel burning, on a continuous-feed basis. Each combustion system will be equipped with an individual multiple-pass, waterwall-type boiler. This system will convert feed water to steam by the heat released during combustion of the solid waste. The steam will be used to drive a steam turbine which, in turn, drives an electric generator for the production of electricity.

The combustion air systems for the furnace will be designed to control automatically the furnace temperature within ± 50 degrees Fahrenheit ($^{\circ}\text{F}$) of the set-point temperature selected by the vendor while firing processible waste with higher heating values (HHV) varying from 3,500 to 6,000 British thermal units per pound (Btu/lb). Sampling conducted on Broward County's processible waste (Malcolm Pirnie, Inc., 1983) indicates

that the minimum and maximum extremes of the range may be realized on a sustained seasonal basis (e.g., November through April at the upper range) as a result of significant variation in moisture content associated with extremes in rainfall.

The combustion air will be vented from the refuse storage area, tipping area, and/or the outside atmosphere. This procedure will maintain negative pressure in the refuse storage and tipping areas and thereby provide odor and dust control.

Gases exiting the furnaces and boilers will enter an electrostatic precipitator for removal of particulate matter prior to release of the gases to the atmosphere.

The proposed facilities will also have a residue handling system to collect the postincineration bottom ash and fly ash while separating any recyclable materials in a dust-free manner. The systems will have ash conveyors to transport the ash to the handling areas at each facility. Provisions for an enclosed tractor-trailer loading area with ventilation and dust control will be incorporated into the design. A clamshell-type bucket for loading ash onto trucks from an ash storage pit may be provided. The residue ash will contain less than 4.0 percent combustibles and less than 0.2 percent putrescibles.

The bottom ash or residue will be water-cooled by spray or quenched in tanks or sumps before it is handled by the conveyors. The cooled bottom ash handling system will consist of drag or vibrating conveyors designed to handle the total plant load. The fly ash may be combined with the quenched bottom ash or collected separately by the vendor to market the fly ash for reuse. The fly ash handling system will include, but not be limited to, screw conveyors inside the precipitator hoppers, rotary or double-flap airlock valves, and dry drag-type transfer conveyors.

3.2 EMISSION AND STACK OPERATING PARAMETERS

The proposed project consists of two resource recovery facilities to be located in Broward County. The data presented in this report are based on preliminary or conceptual design of the proposed facilities. The design will be subject to certain refinements following selection of a full-service vendor. However, the conceptual design is based on conservative or worst-case assumptions from a potential air quality impact viewpoint, particularly in minimizing the exit gas flow rate. The assumptions used in estimating the exit gas flow rate for modeling purposes were conservative because:

1. A lower percent of carbon (29 percent) was used in the calculations rather than higher percentages obtained from ultimate analysis tests, and
2. Only 60 percent excess air was considered (excess air for normal operation is between 80 and 120 percent).

The north and south BCRR facilities are assumed to have initial nameplate capacities of 2,200 and 2,352 TPD, respectively. Each BCRR facility is assumed to have a maximum (or ultimate) nameplate capacity of 3,300 TPD of MSW. One of the facilities is to be located in north Broward County, approximately 22 km north-northeast of the other facility, located in south Broward County. The MSW charging rate and location of the north and south BCRR facilities are presented in Tables 3-1 and 3-2, respectively. The stack and operating parameters for the projected initial and maximum capacities (i.e., 115 percent of nameplate) of each facility considered in the air quality modeling are presented in Table 3-3. Because the initial capacities of the two facilities are nearly the same (i.e., approximately 7 percent difference), only the initial capacity of the proposed south facility was considered in the modeling analysis. The model results for the north facility at initial capacity are expected to be lower than those for the south facility. The proposed stack heights for each facility will be at a Good Engineering

Table 3-1. MSW Charging Rate and Location of North BCRR Facility

Parameter	Value
<u>MSW Charging Rate</u>	
Nameplate Capacity--Initial	2,200 TPD (91.7 tph)
Maximum	3,300 TPD (137.5 tph)
Projected Capacity--Initial	2,530 TPD (112.7 tph)
Maximum	3,795 TPD (158.1 tph)
<u>Heat Input Rate*</u>	
Nameplate Capacity--Initial	825.0 x 10 ⁶ Btu/hr
Maximum	1,237.5 x 10 ⁶ Btu/hr
Projected Capacity--Initial	948.8 x 10 ⁶ Btu/hr
Maximum	1,422.9 x 10 ⁶ Btu/hr
<u>Location</u>	
Latitude, Longitude	26.26°, 80.16°
UTM Zone	17
UTM East, North Coordinate	584.0, 2,904.7 km

*Based on average heating value of MSW of 4,500 Btu/lb.

Source: Malcolm Pirnie, Inc., 1985.

Table 3-2. MSW Charging Rate and Location of South BCRR Facility

Parameter	Value
<u>MSW Charging Rate</u>	
Nameplate Capacity--Initial	2,352 TPD (98.0 tph)
Maximum	3,300 TPD (137.5 tph)
Projected Capacity--Initial	2,705 TPD (112.7 tph)
Maximum	3,795 TPD (158.1 tph)
<u>Heat Input Rate*</u>	
Nameplate Capacity--Initial	882.0 x 10 ⁶ Btu/hr
Maximum	1,237.5 x 10 ⁶ Btu/hr
Projected Capacity--Initial	1,014.3 x 10 ⁶ Btu/hr
Maximum	1,422.9 x 10 ⁶ Btu/hr
<u>Location</u>	
Latitude, Longitude	26.07°, 80.20°
UTM Zone	17
UTM East, North Coordinate	579.6, 2,883.3 km

*Based on average heating value of MSW of 4,500 Btu/lb.

Source: Malcolm Pirnie, Inc., 1985.

Table 3-3. Stack and Operating Parameters for the Projected Capacities* of the BCRR Facility Considered in the Air Quality Modeling

Parameter	Value
<u>MSW Charging Rate</u>	
Initial	2,705 TPD
Maximum	3,795 TPD
<u>Heat Input Rate</u>	
Initial	1,014.3 x 10 ⁶ Btu/hr
Maximum	1,422.9 x 10 ⁶ Btu/hr
Stack Height	195 ft (59.4 m)
Stack Diameter	16.5 ft (5.03 m)
<u>Exit Gas Temperature</u>	
Initial	450°F (505°K)
Maximum	450°F (505°K)
<u>Exit Gas Flow Rate</u>	
Initial	691,493 acfm
	355,558 dscfm†
Maximum	970,134 acfm
	498,832 dscfm†
Initial (used in model)	594,767 acfm
Maximum (used in model)	834,433 acfm
<u>Exit Gas Velocity</u>	
Initial (used in model)	42.6 ft/s (14.1 m/s)
Maximum (used in model)	65.0 ft/s (19.8 m/s)

*Based on 115 percent of nameplate capacity.

†At 10-percent CO₂

Note: acfm = actual cubic feet per minute.

dscfm = dry standard cubic feet per minute.

Source: Malcolm Pirnie, Inc., 1985.

Practice (GEP) height; therefore, building downwash conditions are not considered in this analysis.

The emission factors for the regulated pollutants that will be emitted from the proposed BCRR facilities are presented in Table 3-4. For most of the regulated pollutants, the emission factors are based on estimates derived for resource recovery facilities similar in size to the proposed facilities. The emission factors are given as a function of the heat content and amount of MSW burned. These emission factors were obtained from Malcom Pirnie, Inc. and are based on a review of the literature, such as EPA AP-42 emission factors and A.D. Little reports, or manufacturer's design specification. The maximum hourly and annual average emission rates for the south and north facilities are presented in Tables 2-4 and 2-5, respectively, and are 115 percent of nameplate capacity.

Table 3-4. Pollutant Emission Factors for the Proposed BCRR Facility

Pollutant	Emission Factor	
	lb/10 ⁶ Btu	lb/ton*
Particulate Matter	0.074	0.67
Sulfur Dioxide	0.55	4.91
Nitrogen Dioxide	0.56	5.0
Carbon Monoxide	0.089	0.80
Volatile Organic Compounds	0.013	0.12
Lead	0.03	0.27
Fluorides	0.025	0.23
Sulfuric Acid Mist	0.0028	0.025
Hydrogen Sulfide	NA	NA
Total Reduced Sulfur	NA	NA
Reduced Sulfur Compounds	NA	NA
Asbestos	NA	NA
Beryllium	9.3 x 10 ⁻⁷	8.4 x 10 ⁻⁶
Mercury	0.00026	0.0023
Vinyl Chloride	NA	NA
Benzene	NA	NA
Radionuclides	NA	NA
Inorganic Arsenic	0.000031	0.00028

NA = Not applicable.

*Based on average heating value of MSW of 4,500 Btu/lb.

Source: Malcolm Pirnie, Inc., 1985.

4.0 BEST AVAILABLE CONTROL TECHNOLOGY EVALUATION

4.1 DESCRIPTION OF PROPOSED CONTROL TECHNOLOGY

The source applicability analysis for the proposed BCRR facilities, presented in Section 2.0, identified the following emitted air pollutants as requiring a BACT review under federal and state PSD regulations:

Particulate Matter (PM)

Sulfur Dioxide (SO₂)

Nitrogen Oxides (NO_x)

Carbon Monoxide (CO)

Lead (Pb)

Fluorides (F⁻)

Beryllium (Be)

Mercury (Hg)

Arsenic (As)

Sulfuric Acid Mist

The State of Florida has received administrative and technical review authority for the federal PSD program. In addition, Florida has passed PSD regulations and BACT requirements similar to EPA. DER defines BACT as follows [Ch 17-2.100(22), FAC]:

An emission limitation, including a visible emissions standard, based on the maximum degree of reduction of each pollutant emitted which the Department, on a case by case basis, taking into account energy, environmental and economic impacts, and other costs, determines is achievable through application of production processes and available methods, systems, and techniques (including fuel cleaning or treatment or innovative fuel combustion techniques) for control of each such pollutant . . . Each BACT determination shall include applicable test methods or shall provide for determining compliance with the standard(s) by means which achieve equivalent results.

The remainder of this section describes the proposed BACT, emission limit, visible emission (opacity) standard, and compliance test methods for each pollutant subject to BACT. An analysis of alternative control technologies, including economic, energy, and environmental considerations, is presented in Section 4.2.

4.1.1 Particulate Matter

PM generated by the combustion of MSW will be minimized through combustion controls and boiler design. PM exiting the boilers in the exhaust gases will be controlled by use of electrostatic precipitators (ESPs). The combustion boiler design will be of the mass-burn stoker-fired, or stoker/rotary kiln tandem, type and capable of firing as-received MSW on a continuous-feed basis without auxiliary fuel firing. The combustion efficiency of the stokers will yield a residue, or ash, containing not more than 4-percent combustibles or 0.2-percent noncombustibles. This boiler design requirement will serve to minimize the generation of ash and, therefore, PM in the furnace.

Each facility will have a maximum nameplate capacity of charging 3,300 TPD of MSW, based on a 100-percent annual availability factor. The exhaust gases of each boiler will pass through an ESP prior to discharge to the atmosphere through a common stack. Design details for the ESP are not known at this time. Design details will be supplied to DER as they become available for regulatory review. However, the following minimum criteria will have to be met by the selected manufacturer: Each ESP will be capable of reducing the exhaust gas PM concentration to 0.03 gr/dscf, corrected to 12-percent CO₂, over the range of boiler operating conditions. Opacity of the emissions will not exceed 20 percent.

The ESP will be complete with all appurtenances, structural supports, foundations, external and internal walkways, platforms, access stairways, fly ash hoppers with discharge air lock valves, power and control wiring, induced-draft fan, and other accessories for a complete operation system. Each ESP will be a multi-field type with the output of each ESP flowing into a single flue. The fields will be sized adequately considering both the volume of gases and amount of excess air. The temperature of flue gases entering the ESP will be below 600°F and at least 40°F above the

dew point temperature. The maximum ESP inlet temperature is based on operating experience from ESPs at incinerator installations (EPA, 1979). The ESP design will have been successfully operated in a facility firing MSW for a minimum of 3 years.

ESP gas distribution will be accomplished via a low-velocity, multiple-vane system or a perforated-plate system. ESP collecting surface rapping will be by shaft-driven rotary hammers. Solenoid impact or vibration rapping is not acceptable. ESP high-voltage systems will have star-shaped, spiked, stainless-steel electrodes, with rigid mast mounting and high-alumina refractory-type insulators. Weighted wire systems are not acceptable. ESP discharge electrode rapping will be accomplished by shaft-mounted rotary hammers; solenoid impact or vibrating rapping is not acceptable.

ESP fly ash hopper heaters will be resistance type, extending two thirds of the ash hopper height from the bottom of the hopper (to prevent blockage). The fly ash handling systems include, but are not limited to, screw conveyors inside precipitator hoppers, rotary or double flap air lock valves, and dry drag type transfer conveyors.

Each furnace-boiler will be equipped with an induced-draft fan, an induced-draft fan drive, an induced-fan inlet damper, and appropriate breechings. Induced-draft fans will be centrifugal, backward-curved, inclined blade, treated radial-tip-type, designed for continuous operation at 600°F in a dusty environment.

An ESP with an outlet grain loading of 0.03 gr/dscf is considered to represent BACT for the proposed BCRR facilities, based on economic, energy, environmental, and plant operating considerations. NSPS for new incinerators charging more than 50 TPD of solid waste are applicable to

this proposed project (40 CFR 60, Subpart E). The NSPS emission standard limits PM emissions to 0.08 gr/dscf, corrected to 12-percent CO₂. The proposed ESP emission rate is well below this allowable level.

The MSW boilers will be used to generate steam which will drive turbine electrical generators. The boilers will not be subject to the provisions of Subpart D or D(a) of 40 CFR 60, which are the NSPS for fossil-fuel-fired steam generators and electric utility steam generating units, respectively, because MSW is not a fossil fuel.

State of Florida PM emission-limiting standards require new incinerators with a charging rate of greater than 50 TPD to meet 0.08 gr/dscf, corrected to 50-percent excess air. This standard is similar to the federal NSPS, and the proposed facilities will emit PM at a significantly lower rate. State of Florida emission regulations also require an opacity limit of 20 percent, which the proposed facilities will not exceed.

At 115 percent of maximum nameplate capacity (i.e., 3,795 TPD = 115 percent of 3,300 TPD), the proposed ESP maximum PM emission rate will result in a maximum PM emission rate of 105.3 pounds per hour (lb/hr). Based on EPA emission factors for municipal incinerators (EPA, 1983), uncontrolled PM emissions are estimated at 30 pounds per ton (lb/ton) of solid waste fired. EPA's review of NSPS for incinerators (EPA, 1979) cites uncontrolled PM emissions in the range of 10 to 70 lb/ton. However, it is noted that these values are for municipal incinerators and may not be applicable to resource recovery units. Nevertheless, if an average value of 30 lb/ton is assumed, the proposed facilities would generate 4,744 lb/hr of PM. The ESP would then have a PM removal efficiency of at least 97 percent. Assuming an average MSW heating value of 4,500 Btu/lb, the facilities would emit 0.074 lb/10⁶ Btu of PM. This emission rate is even less than EPA's proposed revision to NSPS for fossil-fuel-fired steam generating units which would limit PM emissions to 0.1 lb/10⁶ Btu for units firing MSW and capable of combusting more than 100 x 10⁶ Btu/hr heat input.

4.1.2 Sulfur Dioxide

The control technology of firing low-sulfur fuel in the mass-burn resource recovery facility is proposed as BACT. The proposed BACT emission limit of 4.9 lb SO₂/ton of MSW fired is equivalent to 782.7 lb/hr or 0.55 lb/10⁶ Btu heat input. By comparison, NSPS for fossil-fuel-fired boilers and electric utility steam generators firing solid fuel [40 CFR 60, Subparts D and D(a)] would allow up to 1.2 lb SO₂/10⁶ Btu. No SO₂ emission-limiting standard currently exists or are proposed for incinerators or MSW-fired boilers.

4.1.3 Nitrogen Oxides and Carbon Monoxide

The proposed BACT for NO_x and CO emissions is boiler design and good combustion practices. The proposed BACT emission limits are 5.0 lb/ton of MSW fired for NO_x (as NO₂), and 0.8 lb/ton for CO. These emission factors are equivalent to 796.9 lb/hr or 0.56 lb/10⁶ Btu for NO_x (as NO₂) and 126.7 lb/hr or 0.089 lb/10⁶ Btu for CO.

By comparison, NSPS for fossil-fuel-fired boilers [40 CFR 60, Subparts D and D(a)] limit NO_x (as NO₂) emissions to between 0.5 and 0.7 lb/10⁶ Btu for solid fuel. No NO_x or CO emission-limiting standard currently exist or are proposed for incinerators or MSW-fired boilers.

Factors that influence NO_x emissions from MSW boilers consist of boiler design, excess air, and peak combustion temperatures. NO_x emissions are derived from either the fuel-bound nitrogen being reduced and subsequently oxidized, or thermal oxidation of nitrogen in the combustion air. The latter source of NO_x is much greater than the former source. The primary factors affecting combustion air NO_x is the amount of oxygen in the combustion zone (i.e., related to excess air) and the peak combustion temperature. MSW boilers are typically designed for low-temperature operation, about 1,800°F (EPA, 1979).

For the proposed facilities, the combustion temperature will be maintained between 1,500°F and 1,800°F. The combustion air system will be designed to automatically control the boiler temperature within 50°F of the set-point temperature selected by the operator, while firing MSW over varying moisture compositions and heating values. Consequently, NO_x formation will be suppressed, with expected emissions of 5.0 lb/ton or 0.56 lb/10⁶ Btu.

CO is produced when carbon-containing fuel is burned in an oxygen-deficient atmosphere, resulting in the carbon atoms being oxidized partially to CO instead of totally to CO₂. An oxygen-deficient atmosphere may result from deficient amounts of combustion air or incomplete air/fuel mixing. High excess air, proper primary and secondary air distribution, and proper air/fuel mixing all tend to minimize unburned carbon and CO emissions.

4.1.4 Other Pollutants

Other pollutants emitted from the proposed source requiring BACT review are lead, fluorides, beryllium, mercury, sulfuric acid mist, and inorganic arsenic. These are all trace elements contained in MSW in very minor quantities. The proposed BACT for lead, beryllium, and inorganic arsenic is the ESP selected in Section 4.1.1 for the control of PM emissions. These pollutants are emitted in the solid phase; therefore, control of PM emissions will also control these pollutants. The BACT emission limits are the emission rates presented in Tables 2-4 and 2-5 for each pollutant.

Fluorides, sulfuric acid mist, and mercury are emitted primarily in the gaseous phase and are not susceptible to collection by ESP. No additional control technology is proposed for these pollutants since such controls would be costly and would not provide significant environmental benefits.

4.1.5 Test Methods to Demonstrate Compliance

Compliance with NSPS for PM will be demonstrated by source emission tests conducted in accordance with the Federal Reference Methods specified in 40 CFR 60, Appendix A. Reference Method 1 will be used in sampling point determination for sample traverses. Reference Method 5 will be used in determination of PM emissions, grain loading, and moisture content.

4.2 COMPARISON OF ALTERNATIVE CONTROL TECHNOLOGIES

Federal and state PSD/BACT regulations and guidelines require that an analysis of alternative control technologies be conducted (EPA, 1980; EPA, 1978). The only alternatives that need be addressed are those "which have greater control capabilities than the system proposed as BACT and which have been used or proposed for the same or similar operations" (EPA, 1978). If no better control technology than the proposed technology exists, no further analysis is necessary. Other equipment with similar control potential need not be evaluated.

The BACT analysis must support that the identified alternative control techniques would cause unreasonably adverse energy, environmental, or economic impacts. The following sections present the alternatives analysis required under BACT review and justify selection of the proposed control equipment described in Section 4.1:

4.2.1 Particulate Matter

In March 1979, EPA conducted a survey of all existing and proposed incinerators in the United States (EPA, 1979). The study identified three types of control devices as potentially applicable to incinerators: ESPs, fabric filters, and venturi scrubbers. Test results for PM were compiled for 14 municipal incinerators where the federal reference method (Method 5) was known to be used for testing. MSW charging rates varied from 30 to 600 TPD. Of these installations, only one used a fabric filter for PM control, while nine used ESPs and four utilized venturi scrubbers. Test results were as follows (corrected to 12-percent CO₂):

Fabric filter:	0.024 gr/dscf
ESP:	0.018 to 0.060 gr/dscf, average of 0.041 gr/dscf
Venturi scrubber:	0.046 to 0.416 gr/dscf, average of 0.14 gr/dscf

These data indicate that fabric filter technology for incinerators is not well proven. Operational problems with filter bags were noted with the

test results. However, the 0.024 gr/dscf emission rate was the second lowest of all test results; one ESP test was lower, with an emission rate of 0.018 gr/dscf.

ESPs are by far the most prevalent type of control and provide much better emission reduction than do venturi scrubbers. The venturi scrubber test results not only indicate much higher average emissions than the ESP, but scrubber deterioration due to wearing of scrubber parts has been noted on several installations. In addition, high scrubber pressure drops are required to meet the 0.08 gr/dscf NSPS, resulting in a significant energy penalty. Those venturi scrubbers meeting NSPS operated with pressure drops of 15 inches of water (in. H₂O) or greater, whereas an ESP typically operates at 1 to 2 in. H₂O.

Test data from eight additional municipal incinerator installations where the test method was not specified were also presented. MSW charging rates varied from 120 to 360 TPD, and ESPs were used at all of these installations. The PM emissions ranged from 0.013 to 0.108 gr/dscf and averaged 0.059 gr/dscf (excluding two facilities where test results were reported in gr/acf).

In March 1982, EPA issued a background information document for non-fossil-fuel-fired industrial boilers (EPA, 1982b). The study included a survey of MSW boilers as well as refuse-derived fuel (RDF). This study stated:

No successful scrubber applications to MSW or RDF boilers exist: the fine particulate in these boiler exhausts can be removed only by very high-energy scrubbers which must be constructed of expensive corrosion resistant materials. The only MSW boiler that used a wet scrubber replaced the scrubber with an electrostatic precipitator.

Few full-scale baghouses have been applied to nonfossil fuel fired boilers . . . no baghouse installations exist on bagasse, MSW or RDF boilers. However, one baghouse operates successfully on an MSW incinerator. The principal drawback to fabric filtration, as perceived by potential users, is a fire danger arising from the collection of a combustible carbonaceous fly ash.

Electrostatic precipitators are currently used on boilers fired with wood, MSW or RDF.

The data from the EPA study show that ESP is highly proven for municipal incinerator applications and is capable of achieving PM emission levels well below NSPS and State of Florida emission standards. In addition, this technology has low energy requirements (i.e., pressure drop of 1 to 2 in. H₂O) and no liquid waste disposal problem. On the other hand, a high pressure drop is required across a venturi scrubber to achieve levels as low as the proposed emission rate of 0.03 gr/dscf. This requirement would increase maintenance costs because of the severe wear on the venturi and increase energy costs significantly. The fabric filter is relatively unproven on municipal incinerators; although fabric filters potentially could achieve PM levels below 0.03 gr/dscf, they have experienced maintenance and operational problems which must be overcome before they are deemed reliable. For these reasons, venturi scrubbers and fabric filters were not considered further as viable control technologies.

Test data presented in the EPA non-fossil-fuel boiler study consisted of ESP data only for MSW-fired boilers. PM emissions ranged from 0.2 to 0.05 lb/10⁶ Btu at average specific collection areas (SCA) of 140 to 570 ft²/1,000 acfm, respectively. Data for the most efficient control device for PM emissions from MSW boilers were also presented (obviously for an ESP, since no other test data were available). These data were for ESPs with SCAs of 240 ft²/1,000 acfm or more, and emissions averaged less than 0.1 lb/10⁶ Btu in each of the four cases presented. Emissions in lb/10⁶ Btu were shown to decrease as the SCA increased, the lowest test case yielding about 0.05 lb/10⁶ Btu with an SCA of 573 ft²/1,000 acfm. The proposed BCRR facilities will achieve a PM emission level of approximately 0.074 lb/10⁶ Btu.

A resource recovery facility similar to the BCRR facilities is now operating in Dade County, Florida. The facility fires a maximum of

3,456 TPD of RDF. The PM emission rate determined as BACT for this facility was 0.037 gr/dscf and 94.05 lb/hr, or 0.65 lb/ton of RDF fired in the boilers. By comparison, the proposed BCRR facilities emission limit is 0.03 gr/dscf, which is equivalent to 105.3 lb/hr and 0.67 lb/ton.

The environmental impact of the selected control technology is considered to be minimal. The predicted maximum 24-hour average PM impact due solely to the proposed facilities will be less than 10 percent of the de minimis air quality impact level (i.e., for monitoring exemption), less than 20 percent of the significant impact level (i.e., for modeling exemption), less than 3 percent of the PSD Class II increment, and less than 1 percent of Florida AAQS. Predicted annual average PM impacts due to the facilities are 8 percent of the significant impact level (for modeling exemption), less than 1 percent of the PSD Class II increment, and less than 1 percent of Florida AAQS. These minimal environmental impacts do not justify a lower BACT emission level.

4.2.2 Sulfur Dioxide

Sulfur is contained in MSW in very small quantities, typically about 0.12 percent on an as-fired basis. For the proposed facilities, the resulting SO₂ emissions are 4.9 lb/ton or 0.55 lb/10⁶ Btu heat input. Precombustion and postcombustion SO₂ control technologies have been developed for boilers firing fossil fuels. However, SO₂ control technologies have not been applied to boilers burning non-fossil fuels, such as MSW, due to the low SO₂ emissions.

Precombustion control technologies consist of: (1) using naturally occurring low-sulfur fuels, and (2) physically or chemically cleaning the fuel. The MSW fired in the proposed facility falls into this first category, with a sulfur content of 0.12 percent (i.e., 0.30 lb/10⁶ Btu).

By comparison, low-sulfur coal typically contains 0.5-percent sulfur (i.e., about 0.8 lb/10⁶ Btu), and No. 2 distillate oil typically is as low as 0.35-percent sulfur by weight (i.e., about 0.4 lb/10⁶ Btu).

No method of physically or chemically cleaning MSW to lower its sulfur content is known to have been developed. The naturally low sulfur content of MSW has not required such a process to be developed. Therefore, precombustion sulfur removal from MSW is deemed technologically unfeasible.

Postcombustion SO₂ removal techniques for boilers consist of the implementation of flue gas desulfurization (FGD) technology. Several different FGD systems have been developed, primarily for use on high-sulfur-fuel-fired boilers. These consist of sodium scrubbing, dual-alkali scrubbing, lime and limestone scrubbing, and dry scrubbing. These systems use calcium- or sodium-based scrubbing solutions which react with SO₂ to form sulfite and sulfate salts.

The major drawbacks to all of these systems are:

1. They produce large amounts of solid and/or liquid wastes, which must be disposed of properly. Disposal may cause other environmental effects (i.e., ground water contamination).
2. Energy requirements to operate the FGD system are high. Typical FGD installations on electric utility boilers use 10 percent or more of the energy output of the boiler.
3. FGD systems have not been applied to incinerators where SO₂ concentrations are low and highly variable due to the variable nature of MSW.
4. FGD systems are costly to install and operate and require considerable maintenance; due to operational problems, they are rarely available 100 percent of the time, unless costly redundancy is built into the plant.

5. FGD systems typically use large amounts of water for the scrubbing solution.

Costs of applying an FGD system to a resource recovery/incinerator facility were estimated by Environmental Research and Technology, Inc. (1981) as part of the PSD permit application for Westchester County (New York) Resource Recovery Facility. This facility is capable of firing 1,890 TPD of MSW, which is approximately the size of the proposed Broward County facilities (1,650 TPD each). Five different FGD system types were evaluated.

SO₂ removal efficiency of each system was assumed to be 70 percent. Capital costs of an FGD system were found to range from \$7 to \$9 million (1983 dollars). Annual costs, including fixed capital charges and operating and maintenance costs, ranged from \$0.94 to \$1.34 per 10⁶ Btu for the first year of operation. These annual costs equate to \$4.6 to \$6.5 million, based on a 90-percent availability factor.

There are no energy penalties associated with the proposed control technology. The associated environmental impacts are minimal. The predicted maximum 24-hour SO₂ impacts due to the proposed facility are 45 percent of the de minimis impact level (i.e., for monitoring exemption) and 118 percent of the significant impact levels (i.e., for modeling exemption). Predicted impacts for all averaging times are less than 7 percent of all PSD Class II increments and Florida AAQS. The minimal SO₂ emissions and environmental impacts do not justify a lower BACT emission limit.

Considering the low SO₂ emissions from the proposed facility and the severe economic penalties, potential additional environmental impacts due to solid/liquid waste disposal, additional water and energy requirements, and unproven ability on MSW-fired boilers, implementation of an FGD system on the proposed BCRR facilities is considered economically and

environmentally unacceptable. None of the SO₂ removal alternatives is considered superior to that of firing low-sulfur MSW fuel in the boiler.

4.2.3 Nitrogen Oxides and Carbon Monoxide

The proposed BACT control techniques for NO_x and CO emissions from the proposed BCRR facilities are: (1) limit peak combustion temperature to 1,800°F, (2) proper MSW firing in the boiler, and (3) high excess air operation. These control techniques are considered the only currently available methods of control for these pollutants.

The proposed BACT emission limits for NO_x result in maximum annual average predicted impacts of less than 5 percent of the de minimis impact level (i.e., for monitoring exemption), 60 percent of the significant impact level (i.e., for modeling exemption), and 0.6 percent of Florida AAQS. The proposed CO emission limit results in maximum predicted impacts of less than 1 percent of any de minimis impact level, significant impact level, or Florida AAQS.

Further reduction in emissions could be achieved through add-on flue gas cleaning equipment, but such equipment or processes have not been demonstrated in practice on incinerators (EPA, 1979). Flue gas cleaning methods for application to industrial/utility boilers with higher NO_x emissions are currently in the developmental stage only. Therefore, add-on NO_x/CO controls are not considered technically feasible for this application. In addition, the very small air quality impacts due to NO_x and CO emissions from the proposed BCRR facilities do not justify further reduction in emissions.

4.2.4 Other Pollutants

As discussed in Section 4.1.4, ESP used to control PM emissions will also control emissions of lead, beryllium, and inorganic arsenic. Alternative PM control technology is discussed in Section 4.2.1. For the reasons stated therein, ESP is considered to be the best choice of PM control

technology for the proposed source and, therefore, BACT for control of lead, beryllium, and arsenic. The maximum predicted air quality impacts for these pollutants are well below all applicable air quality standards and de minimis impact levels. The minimal environmental impacts of these pollutants do not justify additional controls or reduced emission levels.

Additional control technology (i.e., add-on equipment) could be used to further reduce emissions of fluorides, sulfuric acid mist, and mercury, which are emitted primarily in the gaseous phase. For example, a wet scrubber could be used, which has been demonstrated to remove more than 99 percent of the fluorides at phosphate rock plants. However, due to the low emission rates for these pollutants and the economic and energy penalties associated with add-on control equipment, additional add-on equipment is not justified. The maximum predicted air quality impacts for these pollutants are well below all applicable air quality standards and de minimis impact levels.

5.0 AIR QUALITY MODELING APPROACH

5.1 MODEL SELECTION

The ISC dispersion model (Cramer, 1979) was used to evaluate the proposed BCRR facilities' emissions. This model is contained in EPA's User's Network for Applied Modeling of Air Pollution (UNAMAP), Version 5 (EPA, 1983). The ISC model was selected primarily for the following reasons:

1. EPA and Florida DER have approved the general use of the model for air quality dispersion analyses because the model assumptions and methods are consistent with those in the Guideline on Air Quality Models (EPA, 1984).
2. The ISC model is capable of predicting the impacts from stack, area, and volume sources that are spatially distributed over large areas and located in flat or gently rolling terrain.
3. The results from the ISC model are appropriate for addressing compliance with AAQS and PSD Class I and Class II increments.

The ISC model has rural and urban options which affect the plume rise formulas, wind speed profile exponent law, dispersion curves, and mixing height formulations used in calculating ground-level concentrations. One criterion used to determine when the rural or urban mode is appropriate is based on land use near the proposed plant (Auer, 1978). If the land use is classified as heavy industrial, light-moderate industrial, commercial, or compact residential for more than 50 percent of the area within a 3-km radius circle centered on the proposed source, the urban mode should be selected. Otherwise, the rural option is more appropriate. Based on a review of the land use around both facilities, the rural mode was selected because of the general lack of or minimal industrial and commercial development.

The ISC model consists of two model codes. The first model code, the ISC short-term (ISCST) model, is an extended version of the single-source (CRSTER) model (EPA, 1977). The ISCST model is designed to calculate hourly concentrations based on hourly meteorological parameters (i.e.,

wind direction, wind speed, atmospheric stability, ambient temperature, and mixing heights). The hourly concentrations are processed into non-overlapping, short-term averaging periods. For example, a 24-hour average concentration is based on twenty-four 1-hour averages calculated from midnight to midnight of each day. For each short-term averaging period selected, the highest and second-highest average concentrations are calculated for each receptor. As an option, a table of the 50 highest concentrations over the entire field of receptors can be produced. For the annual averaging period, the 1-hour concentrations are summed for all hours in the year for each receptor.

The second model code is the ISC long-term (ISCLT) model, which is an extension of the Air Quality Display Model (AQDM) and the Climatological Dispersion Model (CDM). The ISCLT model uses joint frequencies of wind direction, wind speed, and atmospheric stability to calculate seasonal and/or annual average ground-level concentrations. This model code was not used because the annual average concentrations were obtained from the ISCST model.

5.2 METEOROLOGICAL DATA

Meteorological data used in the ISCST model to determine air quality impacts consisted of a 5-year period (1970 to 1974) of hourly surface weather observations and twice-daily concurrent radiosonde soundings from the NWS station in Miami, Florida.

The NWS station in Miami, located approximately 55 km south-southwest of the proposed north plant site and 35 km south-southwest of the proposed south plant site, was selected for use in the study because it is the closest primary weather station to the study area with similar surrounding topographical features and land-water boundaries. This station also has the most readily available and complete data base which is representative of the proposed plant sites.

The surface observations included wind direction, wind speed, temperature, cloud cover, and cloud ceiling. The wind speed, cloud cover, and cloud ceiling values are used in the ISCST meteorological preprocessor program to determine atmospheric stability using the Turner stability scheme. Based on the temperature measurements at Miami, Florida, morning and afternoon mixing heights were calculated with the radiosonde data at Miami using the Holzworth approach (1972). Hourly mixing heights were derived from the morning and afternoon mixing heights using the interpolation method developed by EPA (Holzworth, 1972). The hourly surface data and mixing heights were used to develop a sequential series of hourly meteorological data (i.e., wind direction, wind speed, temperature, stability, and mixing heights). Because the observed hourly wind directions are classified into one of thirty-six 10-degree sectors, the wind directions are randomized within each sector using an EPA preprocessing program to account for the expected variability in air flow.

5.3 RECEPTOR GRID

In the screening modeling analysis, concentrations were predicted for 360 receptor locations in a radial grid around each facility. The radial grid consisted of 36 radials located 10 degrees apart with 10 receptors located along each radial. The downwind distances of the receptors from the proposed source were 0.3, 0.7, 1.1, 1.5, 1.9, 2.3, 2.7, 3.1, 3.5, 3.9, and 4.3 km along each radial. For addressing compliance with PSD Class II increments, model results were calculated for only one facility because the proposed facilities are identical in stack and operating design; results for one facility will apply to the other.

In the refined modeling analysis, concentrations were predicted using a radial receptor grid centered on the receptor that produced the highest, second-highest concentration for the short-term averaging period. The grid consisted of 49 receptors which were located along seven radials spaced at 2-degree intervals and separated by 100-m intervals along each

radial. Refined modeling analysis was not performed for the annual average concentration because their spatial distribution is not expected to vary significantly for the radial receptor grid.

For addressing compliance with PSD Class I impacts, the two proposed facilities were modeled in the same model run to predict maximum impacts at 17 receptor locations, spaced 2 km apart, along the northeast boundary of the Everglades National Park. These receptor locations were selected along this boundary because it is the closest portion of the Class I area to the proposed sources. No refined modeling analysis was performed for Class I impacts.

5.4 REVIEW OF EXISTING AMBIENT MONITORING DATA

A listing of all the ambient monitoring locations in Broward County is presented in Table 5-1. There are currently 18 sites operated by Broward County and 3 sites operated by Florida Power & Light Company (FP&L). Based on the PSD monitoring guidelines (EPA, 1981), for a proposed source located in an area of multisource emissions and flat terrain, existing ambient monitoring data may be acceptable if the existing monitor is within 10 km of the proposed source or 1 km of predicted maximum impacts.

The existing monitoring sites located within 10 km of the north and south facilities are listed in Tables 5-2 and 5-3, respectively. The maximum concentrations measured during 1983 are also presented in Tables 5-2 and 5-3. Based on these measured maximum concentrations in Tables 5-2 and 5-3, pollutant concentrations within a 10-km radius from each facility are less than the national and Florida AAQS, except for CO. In Table 5-2, although Broward County monitoring site No. 4 is 10.9 km from the proposed facility site, concentrations from the monitor are included since it is the closest site with SO₂ and NO₂ concentrations. It should be noted that the SO₂ and NO₂ concentrations are not measured by an acceptable technique for use in PSD applications. However, based on the data presented in Tables 5-2 and 5-3, the measured SO₂ and NO₂

Table 5-1. Ambient Air Monitoring Sites in Broward County During 1983

SAROAD No.	Broward County No. or Operator	Location		Pollutant Measured	Location with Respect to			
		City/Division	UTM, X,Y Coordinates (km)		North Facility		South Facility	
					Direc- tion (°)	Distance (km)	Direc- tion (°)	Distance (km)
3700003G01	1	Pompano Beach	590.17, 2908.00	TSP, Pb	62	7.0	23	26.8
3700002G01	3	Pompano Beach	587.85, 2902.78	TSP	117	4.3	23	21.1
2270001G01/09	4	Lauderdale Lakes	579.55, 2894.76	TSP, NO ₂ , SO ₂ , CO	204	10.9	360	11.4
3640002G01	5	Plantation	575.52, 2891.27	TSP	212	15.9	334	9.4
1260003G01	6	Ft. Lauderdale	583.11, 2890.09	TSP, NO ₂ , SO ₂ , CO, Pb	183	14.7	27	7.6
4350001G01	7	Tamarac	574.44, 2897.87	TSP	234	11.8	340	15.4
0910002G01	8	Davie	576.19, 2884.99	TSP, NO ₂ , SO ₂	202	21.2	296	3.81
3530001G01	9	Pembroke Pines	575.26, 2877.44	NO ₂ , SO ₂	198	28.7	216	7.3
1840001G01	10	Hollywood	582.21, 2876.98	TSP, Pb	184	27.8	158	6.9
1640001G01	11	Hallandale	584.60, 2874.44	TSP	179	30.3	151	10.2
1260004G01/09	12	Ft. Lauderdale	585.20, 2887.20	TSP, NO ₂ , SO ₂	176	17.6	55	6.8
0420002G01	13	Hacienda Village	579.70, 2885.34	CO	192	19.9	3	2.0
0420003G03	14	Coral Springs	571.60, 2906.88	O ₃	280	12.6	341	24.9
3530002G01/09	15	Pembroke Pines	570.00, 2878.40	TSP	208	29.8	297	10.8

Table 5-1. Ambient Air Monitoring Sites in Broward County During 1983 (Continued, Page 2 of 2)

SAROAD No.	Broward County No. or Operator	Location		Pollutant Measured	Location with Respect to			
		City/Division	UTM, X,Y Coordinates (km)		North Facility		South Facility	
					Direc- tion (°)	Distance (km)	Direc- tion (°)	Distance (km)
0420004G01	16	N. Lauderdale	577.73, 2900.11	O ₃	234	7.8	354	16.9
3700004G01	17	Pompano Beach	585.34, 2900.13	CO	164	4.8	19	17.8
1840002G01	18	Hollywood	584.00, 2875.87	CO	180	28.9	150	8.6
2560002G01	19	Margate	578.86, 2903.51	TSP, Pb	257	5.3	358	20.2
1260005J02	FP&L	Ft. Lauderdale	579.28, 2882.35	TSP, NO ₂ , SO ₂	192	22.9	199	1.0
1260006J02	FP&L	Ft. Lauderdale	583.05, 2883.85	TSP, NO ₂ , SO ₂	183	20.9	81	3.5
1260007J02	FP&L	Ft. Lauderdale	589.10, 2886.85	TSP, NO ₂ , SO ₂	164	18.6	70	10.1

Source: ESE, 1985.

Table 5-2. 1983 Ambient Air Quality Data for Monitoring Stations Within 10 km of the North BCRR Facility

Broward County No. or Operator	SARQAD No.	Concentration ($\mu\text{g}/\text{m}^3$)*								
		TSP		SO ₂		NO ₂	CO†		Pb	O ₃
		24-hr	Annual	24-hr	Annual	Annual	1-hr	8-hr	Quarter	1-hr
1	3700003G01	103	39	—	—	—	—	—	0.2	—
3	3700002G01	91**	39**	—	—	—	—	—	—	—
4	2270001G01	138	39	5**	3†	36**	10	7	—	—
16	0420003603	—	—	—	—	—	—	—	—	196**
17	3700004G01	—	—	—	—	—	9**	6**	—	—
19	2560002G01	85	31	—	—	—	—	—	0.2**	—
Florida AAQS		150	60	260	60	100	40	10	1.5	235

*For short-term averages, second-highest concentration is shown.

†CO concentrations in mg/m^3 .

**Closest monitoring station for specified pollutant.

Source: ESE, 1985.

Table 5-3. 1983 Ambient Air Quality Data for Monitoring Stations Within 10 km of the South BCRR Facility

Broward County No. or Operator	SAROAD No.	Concentration (ug/m ³)*							
		TSP		SO ₂		NO ₂	CO†		Pb
		24-hr	Annual	24-hr	Annual	Annual	1-hr	8-hr	Quarter
5	3640002G01	84	31	—	—	—	—	—	—
6	1260003G01	115	59	11	3	48	18	9	0.7
8	0910002G01	76	33	21	9	31	—	—	—
9	3530001G01	—	—	6	3	34	—	—	—
10	1840001G01	95	45	—	—	—	—	—	0.3**
12	1260004G01	93	39	29	5	35	—	—	—
13	0420002G01	—	—	—	—	—	21**	10**	—
18	1840002G01	—	—	—	—	—	9	7	—
FP&L	1260005J02	95**	42**	19**	5**	38**	—	—	—
FP&L	1260006J02	92	38	12	5	42	—	—	—
FP&L	1260007J02	88	36	19	5	25	—	—	—
Florida AAQS		150	60	260	60	100	40	10	1.5

*For short-term averages, second-highest concentration is shown.

†CO concentrations in mg/m³.

**Closest monitoring station for specified pollutant.

Source: ESE, 1985.

concentrations are well below AAQS. Also, based on the modeling results presented in Section 6.0, the maximum predicted concentrations due to each resource recovery facility operating at initial capacity are expected to be below the de minimis impact levels for all pollutants except lead; therefore, no monitoring is required for those pollutants under those plant operating conditions. For each facility operating at maximum capacity, the maximum predicted concentrations are also expected to be below the de minimis impact levels for all pollutants except lead and fluorides.

Currently, a de minimis impact level has not been designated for inorganic arsenic because an appropriate monitoring method has not yet been developed. As a result, no monitoring is required for that pollutant. For lead, ambient concentrations are measured at 2 monitors within 8 km from the north facility and 2 monitors within 8 km from the south facility. These monitoring sites, which are expected to measure general population-created pollution, have measured maximum concentrations that are less than 50 percent of AAQS. Because the maximum impacts from the proposed facilities are expected to be low and existing ambient lead concentrations are well below AAQS, preconstruction monitoring for lead is not considered necessary for the BCRR facilities operating at initial or maximum capacity.

For each facility operating under maximum capacity, the maximum concentrations are predicted to be slightly above the de minimis monitoring levels for fluorides. Because the predicted impacts are low and there are no national or state AAQS for fluorides, monitoring is not considered necessary before each facility operates at maximum capacity.

The only measured pollutant that approached AAQS in 1983 was CO. Within a 10-km radius of the proposed south facility, the highest and second-highest 8-hour average CO concentrations equalled the 8-hour AAQS at one monitor location (i.e., Broward County Site No. 13). Based on

data received through September 1984 from DER and Broward County Environmental Quality Control Board (EQCB), the highest and second-highest 8-hour average concentrations measured at Broward County Site No. 13 in 1984 were 10 and 9 mg/m³, respectively. Thus, the second-highest concentration at this site is slightly less than the AAQS of 10 ug/m³. Based on the model results presented in Section 6.0, the maximum predicted 8-hour average concentration due to the proposed facilities is well below the PSD significant impact level. Therefore, the proposed facilities will not have a significant impact in the vicinity of the monitor.

6.0 AIR QUALITY MODELING RESULTS

Predicted maximum impact concentrations for each of the proposed BCRR facilities at initial projected operation, using screening and refined modeling receptor grids, are presented in Tables 6-1 and 6-2, respectively, and at maximum projected operation in Tables 6-3 and 6-4, respectively. These results are based on each plant charging 2,352 TPD or 98.0 tons per hour of MSW at initial projected operation and 3,795 TPD or 158.1 tons per hour of MSW at maximum projected operation. The maximum hourly emission rates are presented in Table 2-4 (see Section 2.5).

In general, maximum pollutant concentrations increased slightly for the plant at maximum projected operation compared to initial operation and for the refined receptor grid compared to the screening grid. For most of the pollutants, the predicted maximum concentrations are below the PSD significant impact levels and de minimis monitoring levels. As a result, the proposed plants' emissions do not produce a significant impact for PM, NO₂, or CO concentrations, and, therefore, do not require additional modeling analyses. For SO₂, the maximum 3- and 24-hour concentrations for both plant operations are greater than the significant impact levels. However, even under maximum projected operation, the maximum concentrations are predicted to be only 16 and 18 percent above the 3- and 24-hour significant impact levels, respectively. For Pb, the maximum predicted 24-hour concentration is greater than the de minimis monitoring level. However, based on existing monitoring data (see Section 5.4), the maximum plant concentration is low and will result in compliance with AAQS. For the other regulated pollutants for which significant impact levels have not been established, the predicted maximum concentrations are well below the de minimis monitoring levels established for these pollutants. Based on these results and the existing low measured pollutant concentrations in Broward County (see Section 5.4), the proposed emissions from each of the BCRR facilities are expected to comply with the national and Florida AAQS and PSD Class II increments.

Table 6-1. Predicted Maximum Concentrations for Each Proposed BCRR Facility at Initial Projected Operation (115 Percent of Nameplate Capacity) Using Screening Modeling Methods

Pollutant	Averaging Time	Maximum Concentration* (ug/m ³)	Receptor Location†		Period		
			Direction (°)	Distance (km)	Year	Julian Day	Hour Ending
SO ₂	3-hour	23.8	300	2.7	1971	126	12
	24-hour	5.4	310	2.3	1972	112	24
	Annual	0.6	280	4.3	1970	—	—
			300	3.1	1972, 1974	—	—
TSP	24-hour	0.74	310	2.3	1972	112	24
	Annual	0.08	280	4.3	1970	—	—
			300	3.1	1972, 1974	—	—
NO ₂	Annual	0.62	280	4.3	1970	—	—
			300	3.1	1972, 1974	—	—
CO	1-hour	9.7	10	1.1	1970	187	11
	8-hour	2.4	310	2.3	1972	111	16
Pb	24-hour (Quarterly)	0.30 (0.03)**	310	2.3	1972	112	24
			(300)	(3.5)	(1972)	(—)	(—)
			(300)	(3.9)	(1974)	(—)	(—)
F ⁻	24-hour	0.25	310	2.3	1972	112	24
Be	24-hour	0.0000091	310	2.3	1972	112	24
Hg	24-hour	0.0026	310	2.3	1972	112	24

*Highest, second-highest concentrations for short-term period; highest concentration for annual period. Values in parentheses represent results associated with revised de minimis monitoring levels. See Section 2.2 for details.

†With respect to proposed facility.

**Annual average.

Source: ESE, 1985.

Table 6-2. Predicted Maximum Concentrations for Each Proposed BCRR Facility at Initial Projected Operation (115 Percent of Nameplate Capacity) Using Refined Modeling Methods

Pollutant	Averaging Time	Maximum* Concentration (ug/m ³)	Receptor Location†		Period			Significant Impact Level (ug/m ³)	De Minimis Monitoring Level (ug/m ³)
			Direction (°)	Distance (km)	Year	Julian Day	Hour Ending		
SO ₂	3-hour	23.8	300	2.7	1971	126	12	25	NA
	24-hour	5.5	312	2.4	1973	112	24	5	13
	Annual	0.6	280	4.3	1970	--	--	1	NA
			300	3.1	1972, 74	--	--		
TSP	24-hour	0.75	312	2.4	1972	112	24	5	10
			270		1973	107	24		
	Annual	0.08	280	4.3	1970	--	--	1	NA
			300	3.1	1972, 74	--	--		
NO ₂	Annual	0.6	280	4.3	1970	--	--	1	14
			300	3.1	1972, 74	--	--		
CO	1-hour	10.4	8	1.0	1970	187	11	2,000	NA
	8-hour	2.7	312	2.3	1972	111	16	500	575
Pb	24-hour (Quarterly)	0.30 (0.03)**	312	2.4	1972	112	24	NA	0.1
			(280)	(4.3)	(1970)	--	--	(NA)	(0.1)
			(300)	(3.1)	(1972, 74)	--	--		
F ⁻	24-hour	0.25	312	2.4	1972	112	24	NA	0.25
Be	24-hour	0.0000093	312	2.4	1972	112	24	NA	0.0005 (0.001)
Hg	24-hour	0.0026	312	2.4	1972	112	24	NA	0.25

NA = Not applicable.

*Highest, second-highest concentration for short-term period; highest concentration for annual period.

Values in parentheses represent results associated with revised de minimis monitoring levels. See Section 2.2 for details.

†With respect to proposed facility.

**Annual average.

Source: ESE, 1985.

Table 6-3. Predicted Maximum Concentrations for Each Proposed BCRR Facility at Maximum Projected Operation (115 Percent of Nameplate Capacity) Using Screening Modeling Methods

Pollutant	Averaging Time	Maximum Concentration* ($\mu\text{g}/\text{m}^3$)	Receptor Location†		Year	Period	
			Direction (°)	Distance (km)		Julian Day	Hour Ending
SO ₂	3-hour	27.5	10	1.1	1970	187	12
	24-hour	5.8	310	2.7	1972	111	24
	Annual	0.6	300	3.5	1972	—	—
			300	3.9	1974	—	—
TSP	24-hour	0.79	310	2.7	1972	111	24
	Annual	0.08	300	3.5	1972	—	—
			300	3.9	1974	—	—
NO ₂	Annual	0.6	300	3.5	1972	—	—
			300	3.9	1974	—	—
CO	1-hour	13.5	10	1.1	1970	187	11
	8-hour	2.6	310	2.7	1972	183	16
Pb	24-hour (Quarterly)	0.32 (0.03)**	310	2.7	1972	111	24
			(300)	(3.5)	(1972)	(—)	(—)
			(300)	(3.9)	(1974)	(—)	(—)
F ⁻	24-hour	0.27	310	2.7	1972	111	24
Be	24-hour	0.0000098	310	2.7	1972	111	24
Hg	24-hour	0.0028	310	2.7	1972	111	24

*Highest, second-highest concentrations for short-term period; highest concentration for annual period. Values in parentheses represent results associated with revised de minimis monitoring levels. See Section 2.2 for details.

†With respect to proposed facility.

**Annual average.

Source: ESE, 1985.

Table 6-4. Predicted Maximum Concentrations for Each Proposed BCRR Facility at Maximum Projected Operation (115 Percent of Nameplate Capacity) Using Refined Modeling Methods

Pollutant	Averaging Time	Maximum* Concentration (ug/m ³)	Receptor Location†		Year	Period		Significant Impact Level (ug/m ³)	De Minimis Monitoring Level (ug/m ³)
			Direction (°)	Distance (km)		Julian Day	Hour Ending		
SO ₂	3-hour	29.1	8	1.0	1970	187	12	25	NA
	24-hour	5.9	312	2.8	1972	112	24	5	13
	Annual	0.6	300	3.5	1972	--	1	NA	
			300	3.9	1974	--	--		
TSP	24-hour	0.81	312	2.8	1972	112	24	5	10
	Annual	0.08	300	3.5	1972	--	--	1	NA
			300	3.9	1974	--	--		
NO ₂	Annual	0.6	300	3.5	1972	--	--	1	14
			300	3.9	1974	--	--		
CO	1-hour	14.3	8	1.0	1970	187	11	2,000	NA
	8-hour	2.6	308	2.7	1972	183	16	500	575
Pb	24-hour (Quarterly)	0.32 (0.03)**	312	2.8	1972	112	24	NA	0.1
			(300)	(3.5)	1972	--	--	(NA)	(0.1)
			(300)	(3.9)	1974	--	--		
F ⁻	24-hour	0.27	312	2.8	1972	112	24	NA	0.25
Be	24-hour	0.000010	312	2.8	1972	112	24	NA	0.0005 (0.001)
Hg	24-hour	0.0028	312	2.8	1972	112	24	NA	0.25

NA = Not applicable.

*Highest, second-highest concentration for short-term period; highest concentration for annual period.

Values in parentheses represent results associated with revised de minimis monitoring levels. See Section 2.2 for details.

†With respect to proposed facility.

**Annual average.

Source: ESE, 1985.

The proposed emissions for each of the BCRR facilities also produce predicted maximum concentrations that are less than the PSD significant impact levels and de minimis monitoring levels in the PSD Class I area in the Everglades National Park (Tables 6-5 through 6-8). These results are consistent with the predicted maximum concentrations within the near vicinity of the proposed facilities. Thus, the emissions for the two proposed BCRR facilities are expected to comply with national and Florida AAQS and PSD Class I increments in the Everglades National Park.

Table 6-5. Predicted Maximum Concentrations at the PSD Class I Area Due to the Proposed South BCRR Facility at Initial Projected Load (115 Percent of Nameplate Capacity)

Pollutant	Averaging Time	Maximum Concentration* (ug/m ³)	Receptor Location		Period			Significant Impact Level (ug/m ³)	Monitoring Level (ug/m ³)
			UTM Coordinates (km)		Year	Julian Day	Hour Ending		
			x	y					
SO ₂	3-hour	4.0	520.75	2849.4	1973	18	3	25	NA
	24-hour	0.8	522.75	2849.4	1973	17	24	5	13
	Annual	0.1	—	—	1971-74	—	—	1	NA
TSP	24-hour	0.10	522.75	2849.4	1973	17	24	5	10
	Annual	0.01	—	—	1971-74	—	—	1	NA
NO ₂	Annual	0.1	—	—	1971-74	—	—	1	14
CO	1-hour	1.4	532.75	2847.4	1971	216	20	2,000	NA
	8-hour	0.31	522.75	2849.4	1971	204	24	500	575
Pb	24-hour (Quarterly)	0.042 (0.0)†	522.75	2849.4	1973	17	24	NA	0.1 (0.1)
F ⁻	24-hour	0.035	522.75	2849.4	1973	17	24	NA	0.25
Be	24-hour	0.0000013	522.75	2849.4	1973	17	24	NA	0.0005 (0.001)
Hg	24-hour	0.00036	522.75	2849.4	1973	17	24	NA	0.25

NA = Not applicable.

*Highest, second-highest concentration for short-term period, highest concentration for annual period. Values in parentheses represent results associated with revised de minimis monitoring levels. See Section 2.2 for details.

†Annual average.

Source: ESE, 1985.

Table 6-6. Predicted Maximum Concentrations at the PSD Class I Area Due to the Proposed South BCRR Facility at Maximum Projected Load (115 Percent of Nameplate Capacity)

Pollutant	Averaging Time	Maximum Concentration* (ug/m ³)	Receptor Location UTM Coordinates (km)		Period			Significant Impact Level (ug/m ³)	Monitoring Level (ug/m ³)
			x	y	Year	Julian Day	Hour Ending		
SO ₂	3-hour	4.8	520.75	2849.4	1973	194	21	25	NA
	24-hour	1.0	522.75	2849.4	1974	60	24	5	13
	Annual	0.1	—	—	1971-74	—	—	1	NA
TSP	24-hour	0.13	522.75	2849.4	1974	60	—	5	10
	Annual	0.01	—	—	1971-74	—	—	1	NA
NO ₂	Annual	0.1	—	—	1971-74	—	—	1	14
CO	1-hour	1.7	532.75	2847.4	1971	216	20	2,000	NA
	8-hour	0.38	522.75	2849.4	1971	204	24	500	575
Pb	24-hour (Quarterly)†	0.054 (0.0)	522.75	2849.4	1974	60	24	NA	0.1 (0.1)
F ⁻	24-hour	0.045	522.75	2849.4	1974	60	24	NA	0.25
Be	24-hour	0.0000016	522.75	2849.4	1974	60	24	NA	0.0005 (0.001)
Hg	24-hour	0.00045	522.75	2849.4	1974	60	24	NA	0.25

NA = Not applicable.

*Highest, second-highest concentration for short-term period, highest concentration for annual period. Values in parentheses represent results associated with revised de minimis monitoring levels. See Section 2.2 for details.

†Annual average.

Source: ESE, 1985.

Table 6-7. Predicted Maximum Concentrations at the PSD Class I Area Due to the Proposed North BCRR Facility at Initial Projected Load (115 Percent of Nameplate Capacity)

Pollutant	Averaging Time	Maximum Concentration* (ug/m ³)	Receptor Location UTM Coordinates (km)		Period			Significant Impact Level (ug/m ³)	Monitoring Level (ug/m ³)
			x	y	Year	Julian Day	Hour Ending		
SO ₂	3-hour	2.8	522.75	2849.4	1970	258	6	25	NA
	24-hour	0.60	532.75	2845.4	1971	155	24	5	13
	Annual	0.0	—	—	—	—	—	1	NA
TSP	24-hour	0.081	532.75	2845.4	1971	155	24	5	10
	Annual	0.0	—	—	—	—	—	1	NA
NO ₂	Annual	0.0	—	—	—	—	—	1	14
CO	1-hour	1.1	526.75	2849.4	1970	163	22	2,000	NA
	8-hour	0.23	532.75	2843.4	1972	342	24	500	575
Pb	24-hour (Quarterly)	0.033 (0.0)†	532.75	2845.4	1971	155	24	NA	0.1 (0.1)
F ⁻	24-hour	0.028	532.75	2845.4	1971	155	24	NA	0.25
Be	24-hour	0.0000010	532.75	2845.4	1971	155	24	NA	0.0005 (0.001)
Hg	24-hour	0.00028	532.75	2845.4	1971	155	24	NA	0.25

NA = Not applicable.

*Highest, second-highest concentration for short-term period, highest concentration for annual period. Values in parentheses represent results associated with revised de minimis monitoring levels. See Section 2.2 for details.

†Annual average.

Source: ESE, 1985.

Table 6-8. Predicted Maximum Concentrations at the PSD Class I Area Due to the Proposed North BCRR Facility at Maximum Projected Load (115 Percent of Nameplate Capacity)

Pollutant	Averaging Time	Maximum Concentration* (ug/m ³)	Receptor Location		Year	Period		Significant Impact Level (ug/m ³)	Monitoring Level (ug/m ³)
			UTM Coordinates (km)	UTM Coordinates (km)		Julian Day	Hour Ending		
			x	y					
SO ₂	3-hour	3.5	522.75	2849.4	1970	42	9	25	NA
	24-hour	0.79	532.75	2845.4	1971	155	24	5	13
	Annual	0.0	—	—	—	—	—	1	NA
TSP	24-hour	0.11	532.75	2845.4	1971	155	—	5	10
	Annual	0.0	—	—	—	—	—	1	NA
NO ₂	Annual	0.0	—	—	—	—	—	1	14
CO	1-hour	1.4	526.75	2849.4	1970	163	22	2,000	NA
	8-hour	0.29	524.75	2849.4	1974	307	8	500	575
Pb	24-hour (Quarterly)	0.043 (0.0)†	532.75	2845.4	1971	155	24	NA	0.1 (0.1)
F ⁻	24-hour	0.036	532.75	2845.4	1971	155	24	NA	0.25
Be	24-hour	0.0000013	532.75	2845.4	1971	155	24	NA	0.0005 (0.001)
Hg	24-hour	0.00037	532.75	2845.4	1971	155	24	NA	0.25

NA = Not applicable.

*Highest, second-highest concentration for short-term period, highest concentration for annual period. Values in parentheses represent results associated with revised de minimis monitoring levels. See Section 2.2 for details.

†Annual average.

Source: ESE, 1985.

7.0 IMPACTS ON VEGETATION, SOILS, AND VISIBILITY

7.1 IMPACTS ON VEGETATION AND SOILS

The vegetation in the Broward County portion of southeastern Florida consists primarily of garden and landscape plants and weeds which occupy disturbed and undeveloped sites. Common plants for landscaping include tropical broadleaf evergreens such as Ficus species (spp.), palms, and Araucaria spp. Common species on disturbed sites include Brazilian pepper tree (Schinus terebinthefolius), Melaleuca quinquenervia, castor bean (Ricinis communis), and other quick-growing woody shrubs.

The site location for the proposed south BCRR facility contains a combination of upland and wetland vegetation. The southern portion of the site is upland in character and contains species such as Brazilian pepper, wax myrtle (Myrica cerifera), and various upland grasses. In mixed wetlands and upland areas to the north, typical species include wax myrtle, water pennywort (Hydrocatyle sp.), pickerel weed (Pontederia lanceolata), water plantain (Sagittaria sp.), water hyssop (Bacopa sp.), and spike rush (Eleocharis sp.), as well as exotic species such as Melaleuca, Brazilian pepper, and Australian pine (Casuarina equisetifolia). Deposition of dredge material from previous dredging operations along the South Fork of the New River, which flows along the southern and eastern border of the site, has created a narrow berm on which exotic and upland species grow. Much of the existing wetland area on the site has been degraded by previous site disturbances and is in a state of transition to weedy plant species.

The site location for the proposed north BCRR facility also contains a combination of upland and wetland vegetation. Most of the site is characterized as upland, with the predominant vegetation being dense stands of Brazilian pepper. There are three identifiable stands of cypress (Taxodium distichum) on the site which probably represent the remnants of an earlier, more extensive system. Other cypress trees and

cabbage palms (*Sabal palmetto*) are scattered throughout the Brazilian pepper but are gradually being replaced by the Brazilian pepper.

The eastern border of the Everglades National Park, a PSD Class I area, is approximately 75 and 57 km southwest of the north and south plant sites, respectively. Important plant species in the park include sawgrass (*Cladium jamaicense*), Dade County slash pine (*Pinus elliotti* var. *densa*), and epiphytic vascular plants.

Plant response to atmospheric pollutants is influenced by the concentration, duration of each exposure, and the frequency of exposures. The usual pattern of pollutant exposure is that of a few episodes of relatively high concentrations for a short duration, interspersed with long periods of extremely low concentrations. Effects on most plants will be from the short-term higher doses (i.e., product of the pollutant concentration and the duration of exposure). Very little information is available on the effects of airborne pollutants on species in south Florida. Therefore, the pollutant concentrations expected as a result of each facility operation are compared with the lowest concentrations known to affect the most sensitive plants that have been tested for response to each pollutant. It should be noted that these concentration levels that adversely affect plants are based on a literature review for plants that may not grow in this part of the state. Thus, these concentration levels represent a conservative threshold for comparison with the maximum predicted concentrations.

The maximum predicted total concentration for each pollutant due to each facility is presented in Table 7-1. The total predicted concentration consists of the maximum predicted facility concentration added to a background concentration developed from the maximum concentration measured at the monitoring station nearest either of the two proposed plant locations (see Section 5.4). The lowest concentrations known to

Table 7-1. Maximum Predicted Concentrations Due to Each Proposed BCRR Facility Compared to Concentrations Known to Adversely Impact Vegetation

Pollutant	Average Period	Concentration (ug/m ³)			Lowest Concentration Known to Impact Vegetation (ug/m ³)	Reference
		Maximum Predicted Due to Facility	Background*	Total (Facility Plus Background)		
SO ₂	3-hour	29.1	19†	48.1	260	Tingey, 1973.
TSP	24-hour	0.8	95	95.8	1,000 g/m ²	Williams, 1971.
NO ₂	Annual	0.6	38	38.6	120	Thompson, 1970.
	3-hour	29.6	**	29.6	188	Tingey, 1971.
CO	1-hour	14.3	21,000	21,014	Vegetation not impacted by CO	--
Pb	3-month	0.03	0.3	0.33	Not known to be available to plants	Zimdahl, 1973.
F ⁻	24-hour	0.27	**	0.27	1 to 3	McCune, 1969. Adams, 1956.
Be	24-hour	0.000010	**	0.000010	Not known to be available to plants	Gough, 1979.
Hg	24-hour	0.0028	**	0.0028	10 (Duration unknown)	Stahl, 1979.

*Second highest 3- or 24-hour or highest annual average concentration measured within 10 km of either the north or south facility (see Section 5.4).

†24-hour average concentration; shorter averaging period not available with monitoring technique.

**Ambient monitoring data not available in Broward County.

Source: ESE, 1985.

adversely impact the most sensitive plants tested for effects of pollutants are also presented in Table 7-1.

As indicated in Table 7-1, the maximum concentrations of pollutants expected to result from operation of the proposed facilities are either orders of magnitude below concentrations known to adversely impact sensitive plants or are not known to impact vegetation at all. Since the maximum concentrations of the same pollutants that are expected in the Everglades National Park are even lower than those expected near the facilities, no impact on the vegetation of the Class I area due to operation of the facilities is expected.

Soils in the region of south Florida where the proposed sites are located and the Everglades National Park are highly calcareous sands or organic soils with high cation exchange capacity. Thus, the soils have the capability of neutralizing or adsorbing any acidic pollutants attributable to the proposed facilities. Again, the concentration of pollutants expected to result from operation of the BCRR facilities is so low that, in any event, effects on soils will be negligible.

7.2 VISIBILITY IMPACTS

CAA Amendments of 1977 provide for implementation of guidelines to prevent visibility impairment in mandatory Class I areas. The guidelines are intended to protect the aesthetic quality of these pristine areas from reduction in visual range and atmospheric discoloration due to various pollutants. The nearest Class I area to the proposed plant sites is the Everglades National Park, located about 57 and 75 km from the south and north resource recovery facilities, respectively. Because the maximum predicted impacts are below the PSD significant and de minimis impact levels for all regulated pollutants, the impact on visibility in Class I areas due to the proposed plants will be insignificant. To demonstrate this conclusion, a Level-1 visibility screening analysis to determine potential adverse visibility effects was performed using the

procedures suggested in the Workbook for Estimating Visibility Impairment (EPA, 1980). Based on this analysis using worst-case meteorological conditions and assumptions, the three contrast parameters (i.e., plume contrast against sky, plume contrast against terrain, and change in sky/terrain contrast caused by primary and secondary aerosols) were estimated for the total emissions from the proposed north and south facilities. The results of this analysis indicated that the absolute values of the contrast parameters were lower than the criteria used to determine if potential adverse visibility impairment could occur in Class I areas. Based on these results, the emissions from both proposed facilities are highly unlikely to cause adverse visibility impairment in the Everglades National Park.

7.3 INDIRECT AIR QUALITY IMPACTS

The indirect air quality impacts associated with the proposed facilities would be attributable to the increased automotive traffic generated by employee travel and solid waste delivery. It is anticipated that about 835 solid waste transport vehicles per day would deliver municipal refuse to each facility when operating at maximum projected capacity (i.e., 3,795 TPD, which is 115 percent above nameplate capacity). The impact of the exhaust emissions from the solid waste transport vehicles is expected to be minimal. The vehicles associated with each facility would represent an increase of less than 1 percent of the traffic that travels on existing roadways (Malcolm Pirnie, 1985). In addition, the solid waste transport vehicles would largely replace the vehicles used for the existing solid waste transport pattern. Since the operation of the proposed facilities will require only about 40 fulltime employees, the impacts associated with employee traffic also will be negligible.

8.0 SUMMARY AND CONCLUSIONS

The following discussions present a summary and conclusions drawn from the results of this study.

1. Each of the proposed BCRR facilities will be a major source of emissions for PM, SO₂, NO₂, CO, Pb, and Fl. Each facility will also have significant emissions for Be, Hg, sulfuric acid mist, and As. Therefore, these pollutants must undergo review under the new source review requirements of the PSD regulations. The other regulated pollutants are not emitted above the PSD significant emission rates and, therefore, do not require PSD review. Since VOC emissions are expected to be less than 100 TPY, nonattainment review for O₃ is not required.
2. Emission control equipment to be used at each of the proposed facilities will be designed to remove more than 98 percent of PM. This will result in the emission of 0.03 gr/dscf of PM, which is about 60 percent better than existing EPA NSPS requirements for solid waste incinerators.
3. The proposed control systems included in the design and operational procedures for PM, SO₂, NO₂, CO, and trace pollutant emissions are considered BACT. No alternative particulate and trace pollutant control device, which would be capable of a higher degree of emission reduction, is currently considered for the proposed facilities.
4. The air quality dispersion modeling results show that the proposed emissions from each of the facilities operating at initial and maximum (ultimate) capacities will comply with the national and Florida AAQS and PSD Class I and II increments. The model results are conservative (i.e., higher than expected) because each plant was assumed to operate at 115 percent of nameplate capacity for both

initial and maximum conditions. The proposed emissions from each facility produce maximum ground-level concentrations that are below the de minimis air quality impact monitoring levels for all pollutants, except lead and fluorides (under maximum capacity only) near the vicinity of each facility. For lead and fluorides, the maximum predicted impacts due to each facility only slightly exceed the de minimis air quality level. However, PSD monitoring is not considered necessary because either the criteria pollutant (i.e., lead) is currently measured at existing monitoring stations in Broward County or the predicted pollutant concentrations (i.e., lead and fluorides) due to each facility are expected to be low.

Because the maximum predicted concentrations for pollutants emitted above the PSD significant emissions rates are below the AAQS and threshold limits that cause injury to vegetation and soils, the impacts due to each facility are not expected to have a significant impact on vegetation and soils in the PSD Class I and II areas. Also, the emissions from both proposed facilities are highly unlikely to cause adverse visibility impairment in the Everglades National Park.

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COASTAL ZONE MANAGEMENT CERTIFICATIONS

APPENDIX 10.1.6

APPENDIX 10.1.6

COASTAL ZONE MANAGEMENT CERTIFICATIONS

APPENDIX 10.1.6
COASTAL ZONE MANAGEMENT CERTIFICATIONS

As part of Florida's Coastal Management Program federal consistency procedures (15 CFR 930.50) all federal permits for which there are no corresponding state permits require certification of compliance with the State Coastal Management Program. For this project two such federal permits or approvals are necessary. These are the U.S. Department of Transportation, Federal Aviation Administration (FAA) approval for stack construction (FAR Part 77) and the USEPA NPDES permit for stormwater runoff (Section 404 of the Clean Water Act).

The Federal Consistency Evaluation Procedures require these permit applications to be accompanied by a consistency certification attachment which include:

- o A written and pictorial description of the project.
- o An assessment of probable impacts relevant to applicable FCMP statutes.
- o A signed statement by the applicant regarding consistency of the project with FCMP statutes.

In accordance with FCMP consistency evaluation procedures, the certification package and permit application must be sent to the appropriate federal agencies (FAA and Coordinator of the Florida State Planning and Development Clearinghouse, DER. Copies of the permit applications and certifications are included in this appendix.

FAA

COASTAL ZONE MANAGEMENT CERTIFICATION



Resource Recovery Office

Room 521, 115 South Andrews Avenue
Fort Lauderdale, Florida 33301
(305) 357-6458

March 15, 1985

State Planning & Development Clearinghouse
Office of Planning and Budgets
Executive Office of the Governor
The Capital
Tallahassee, Florida 32301

Attention: Richard Smith
Federal Consistency Coordinator

Re: South Broward County Resource Recovery Project, Inc.
FAA-Coastal Zone Management Certification

Dear Mr. Smith:

In accordance with the Florida Coastal Management Program (FCMP) Federal Consistency Evaluation Procedures (15 CFR 930.50), all federal permits for which there are no analogous state permits require certification of compliance with the FCMP.

A federal permit applicable to the proposed project for which no analogous state permit exists is the U.S. Department of Transportation Federal Aviation Administration (FAA) approval (SS.14 CRF 77). In accordance with the requirements of the Federal Consistency Evaluation Procedures, this permit application must be accompanied by a consistency certification. The certification package includes:

- o A written and pictorial description of the project.
- o An assessment of probable impacts relevant to applicable FCMP statutes.
- o A signed statement by the applicant regarding consistency of the project with FCMP statutes.

As specified in 15 CFR 930.58, the certification package and notice of proposed construction (FAA Form 7460-1) must be sent to the appropriate federal agency (FAA) and 10 copies must be submitted to the Federal Consistency Coordinator of the Florida State Planning and Development Clearinghouse. Copies of the notice and certification are enclosed. The certification package and notice has been sent under separate cover to the FAA Regional Office in Orlando for their review.

BROWARD COUNTY BOARD OF COUNTY COMMISSIONERS

Marcia Beach Scott I. Cowan Howard Craft Howard Forman Nicki Englander Grossman Ed Kennedy Gerald Thompson

An Equal Opportunity Employer

Mr. Richard Smith

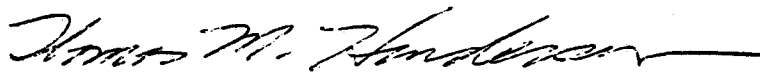
-2-

March 15, 1985

Broward County is submitting the enclosed FAA notice and the consistency certification package for the County's Resource Recovery Facility as required.

If you have any questions or require any additional information, please contact us at (305) 357-6456.

Sincerely,

A handwritten signature in cursive script, reading "Thomas M. Henderson", followed by a horizontal line.

Thomas Henderson
Project Director
Resource Recovery Office

TH/lfc

FEDERAL AVIATION ADMINISTRATION APPLICATION
AND CORRESPONDENCE
(NOTICE OF PROPOSED CONSTRUCTION OR ALTERATION)



Resource Recovery Office

Room 521, 115 South Andrews Avenue
Fort Lauderdale, Florida 33301
(305) 357-6458

March 15, 1985

U.S. Department of Transportation
Federal Aviation Administration
Orlando Airport District Office
4100 Sixth Street - Building 412
Orlando, Florida 32811

Attention: Mr. James E. Sheppard, Manager
Airports District Office

Re: South Broward County Resource Project, Inc.
Status Update

Gentlemen:

The Broward County Board of County Commissioners, Broward County Office of Resource Recovery, and their consultants (Malcolm Pirnie, Inc.) are presently preparing a Power Plant Site Certification Application for submittal to the Florida Department of Environmental Regulation. For the purposes of the submittal the above referenced facility will have an initial installed capacity of 2352 tons per day (tpd) and a projected estimated ultimate capacity of 3,300 tpd. Although, these design capacities are larger than originally indicated in our Federal Aviation Notice of Proposed Construction submitted to your office on December 2, 1983, there will be no affect on original facility architectural design specifications. That is, the building, its structures and the facility stack will remain at said specifications (height).

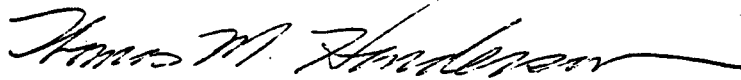
As specified in the Federal Consistency Evaluation Procedures (15 CFR 930.50) all federal permits for which there are not analogous state permits require certification of compliance with the Federal Coastal Zone Management Program. The Federal Aviation Administration Stack Height Approval has no analogous State of Florida permit. Therefore, in accordance with the requirements of the Federal Consistency Evaluation Procedures, we are submitting as an attachment to this letter the Coastal Zone Management Certification. As specified in 15 CFR 930.58, 10 copies of the FAA Form 7460-1 and the Coastal Zone Management Certification have been sent under separate cover to the Federal Consistency Coordinator of the Florida State Planning and Development Clearinghouse.

BROWARD COUNTY BOARD OF COUNTY COMMISSIONERS

Marcia Beach Scott I. Cowan Howard Craft Howard Forman Nicki Englander Grossman Ed Kennedy Gerald Thompson
An Equal Opportunity Employer

Should you have any questions concerning the above, please do not hesitate to contact us.

Sincerely,

A handwritten signature in cursive script, reading "Thomas M. Henderson". The signature is written in dark ink and has a long, sweeping horizontal line extending to the right.

Thomas M. Henderson
Project Director
Resource Recovery Office

MALCOLM
PIRNIE

File
Broward Co RR Project

MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

June 24, 1982

FAA Southern Regional Office
P.O. Box 20636
Atlanta, GA 30320

Attention: Mr. Carl Stokoe,
Airspace Specialist/ASO-530

Re: Proposed Resource Recovery Facility to be
located in Broward County, Florida

Gentlemen:

This letter confirms our telephone conversations on April 21 and June 21, 1982, during which FAA limitations that may apply to the subject project were informally discussed.

Per our discussion, the proposed resource recovery facility site is within 3 nautical miles of the Hollywood/Ft. Lauderdale airport reference point. Therefore, the facility stack must be no higher than 200 feet above grade (Part 77.23(a)(2) of the DOT Federal Aviation Regulations).

Given the above 200 feet above grade limitation, the stack should also pose no problem with respect to any of the VOR approach patterns to runway 9L at the Ft. Lauderdale airport. This is based on preliminary calculations which indicate that a 260 foot stack height limitation would apply to the proposed site in order to provide the required 300 foot buffer beneath the minimum allowable aircraft altitude of 560 feet over the site.

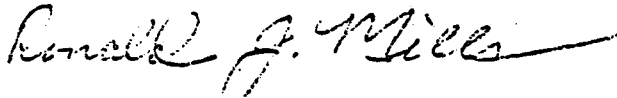
MALCOLM
PIRNIE

With respect to other air navigation obstruction standards specified in the FAA Regulations, such as height limitations to comply with Precision Instrument Approach Pattern imaginary surfaces, the proposed facility appears to meet applicable requirements.

If the above information is contrary to your understanding of the issues discussed, please contact me at your earliest convenience. We thank you for your assistance.

Sincerely,

MALCOLM PIRNIE, INC.

A handwritten signature in cursive script, reading "Ronald J. Mills". The signature is written in dark ink and is positioned above the typed name.

Ronald J. Mills
Project Scientist

RJM/pas



DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Miami Airports District Office
Post Office Box 59-2014
Miami, Florida 33159

JAN 2 1983

1983 JAN 10 PM 2:25
SOLID WASTE DIVISION

Mr. Edward J. Jablonowski, Director
Broward County Solid Waste Division
Governor's Club - Room 526
236 S.E. First Avenue
Fort Lauderdale, Florida 33301

Dear Mr. Jablonowski:

This responds to your November 18, 1982, letter inquiring about Federal Aviation Administration comments regarding the establishment of a mass-burning resource recovery facility adjacent to U.S. Route 441 between State Road 84 and the south fork of the New River Canal.

At that location it is our understanding that the site would be at least 10,000 feet west from the nearest point of the nearest runway at Fort Lauderdale-Hollywood International Airport.

On December 17, 1982, Mr. Ron Mills of Malcolm Pirnie, the Environmental Engineer for this project, was called by Mr. Lee Guenther for clarification of your letter. He said there were about 25 mass burn technology facilities in operation in the U.S.A. One is in Saugus, Massachusetts, operated by Refuse Energy Systems Company. He provided the following information:

1. The unprocessable trash to be landfilled is non-combustible material such as construction debris, cans, etc. This material will contain less than .2% putrescible material. This landfill will be covered daily.
2. The tipping and sorting will be under cover and completely enclosed. The building will have doors which can be closed in the event of a temporary breakdown. In the event of a prolonged breakdown of the facility, the garbage will be trucked to the landfill in Pompano.
3. The ash goes through a quenching tank to cool it. When it leaves the tank it contains 30% moisture by weight, therefore it does not cause a dust problem and has no attraction to birds. It will be placed in lined pits. Periodically this will be covered. Rain water may cause these pits to pond. (However, with all the other bodies of water now existing near the site, this should not be a problem. Writer's note.)

4. All the packers and trucks will be covered. The only uncovered material coming into the facility will be in private vehicles such as pick-up trucks.

Provided the operation is conducted as Mr. Mills outlined, this facility should not create a greater bird problem than now exists. The attraction of birds is our greatest concern in waste disposal operations.

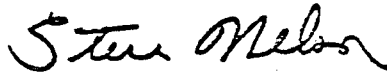
A few suggestions are offered:

1. Any accidental spills outside the facility should be cleaned up immediately.
2. The sponsor should be prepared, when the facility starts operation, to scare away any birds. If birds are not permitted to develop a habit of flocking there, they will stay away.

The enclosed FAA Form 7460-1 should be completed so that all of the aeronautical impacts of the proposed facility can be determined. This review has been preliminary and concerns for the heights of building and structures or possible vision and other hazards were not considered.

Please let me know if you have any questions concerning this matter.

Sincerely,



Steve Nelson
Airport Planning and
Development Specialist

Enclosure

December 2, 1983

U.S. Department of Transportation
Federal Aviation Administration
Orlando Airport District Office
4100 Sixth Street - Building 412
Orlando, Florida 32811

Attention: Mr. James E. Sheppard, Manager
Airports District Office

Re: Broward County, Florida Resource Recovery
Project/Notice of Proposed Construction

Gentlemen:

Per our recent discussion, please find enclosed two completed FAA Forms 7460-1, Notice of Proposed Construction or Alteration, prepared in accordance with FAA Regulations Part 77, Subchapter B. Because of their proposed proximity to the Hollywood/Ft. Lauderdale International Airport and the Pompano Beach Airpark, each of the two subject project component facilities must comply with FAA construction notice requirements set forth at Section 77.13 of Subchapter B.

As described in previous correspondence with your office, each of the component facilities would consist of a mass-burn waterwall technology resource recovery plant with an associated ash residue/non-processible waste landfill. Attachment number one shows the proposed locations of these facilities within Broward County. Each facility will be designed to generate electricity from municipal solid waste. The ash residue produced from this process together with non-processible waste (e.g., over-sized bulky items and construction debris) shall be disposed of at adjacent landfills. Because the ash residue will have a putrescible matter content of less than one percent, the proposed disposal of this material on-site is not expected to attract birdlife nor vectors.

Selection of the above referenced project sites (the northern on Copans Road site and the southern on Route 441 site) was the result of an exhaustive site evaluation and selection process. This process involved substantial input from FAA staff, as reflected in the attached copies of correspondence, to insure acceptability from the standpoint of compliance with FAA regulations and standards. We have enclosed copies of our February 1982 and March 1983 Site Evaluation Reports which present results of this selection process.

Attachments number two and three show the proposed facility layout at the northern and southern sites, respectively. Height of the resource recovery plant stacks will be less than 200 feet above grade at each site. As shown on the attachments, maximum fill height at each of the facility landfills will be 140 feet above mean sea level. No portion of either landfill will be within 10,000 feet of an FAA regulated airport.

With respect to FAA Obstruction Standards set forth at Part 77, Subchapter C, the above facility layouts were carefully developed to assure compliance. The northern facility clearly would not violate any such standards because of its distance from the nearest FAA regulated airport (Pompano Beach Airport) and its location outside any precision instrument approach surfaces. Please note the attached letter to Ms. Diane Sommerer of Hazen and Sawyer, P.C. from Mr. Robert Bielek of FAA dated November 9, 1982 relative to the proposed northern site. Concerning the southern site, the proposed resource recovery plant was located completely outside the precision instrument approach surface to Runway 9L of the Hollywood/Ft. Lauderdale Airport. As such, the plant stacks would be well below the transitional and/or conical surface height limitations described in Part 77.25(b) and (e) as well as any of the VOR approach pattern limitations associated with Runway 9L of this airport. Plate one contained in the enclosed February 1982 report shows the proximity of the precision instrument approach imaginary surfaces to the southern site. While the ash residue/non-processible waste landfill associated with the southern site would lie within the approach surface to Runway 9L of the airport, the maximum fill elevation has been designed to be well below the height limitation specified by Part 77.25(d).

The subject project is planned for implementation through a full-service contract between Broward County and a private sector vendor. While this vendor will be required to comply with specific provisions and restrictions (e.g., height limitations described in this submittal and a maximum permissible putrescible matter content of 0.2 percent in the ash residue), final detailed design of the facilities by the selected vendor may require refinement of the conceptual design performed to date. As an example, the number of stacks associated with the resource recovery plants may be reduced from two to one and the exact locations of stacks (item 4A of FAA Form 7460-1) may require adjustment by as much as plus or minus 50 feet. Should any such necessary adjustment in exact stack location exceed this amount, we will immediately consult FAA to determine the acceptability of this adjustment.

MALCOLM
PIRNIE

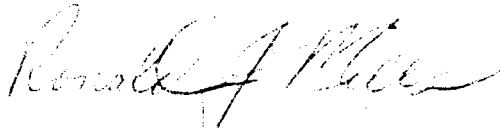
-3-

Implementation of an environmentally and economically sound method of municipal solid waste management is vital to the continued well-being of the Broward County citizenry. The subject project is presently scheduled for initiation of construction in late 1984 and to be on-line by mid-1987, at which time existing solid waste disposal capabilities in the County will be exhausted.

We greatly appreciate the assistance your office has provided during the planning phases of the project. Should you have any questions concerning information presented in this submittal, please do not hesitate to contact us at your convenience.

Very truly yours,

MALCOLM PIRNIE, INC.



Ronald J. Mills

RJM:vm

cc: P. A. Korab/Broward County

Attachments (7)
Enclosures (2)

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION NOTICE OF PROPOSED CONSTRUCTION OR ALTERATION				FOR FAA USE ONLY	
1. NATURE OF STRUCTURE				AERONAUTICAL STUDY NO.	
TYPE ☒ NEW CONSTRUCTION ☐ ALTERATION	B. CLASS ☒ PERMANENT ☐ TEMPORARY	C. PROPOSED LENGTH OF TIME TO COMPLETE (Months) 28	FAA will either return this form or issue a separate acknowledgement: A. The proposed structure: ☐ Does not require a notice to FAA. ☐ Would not exceed any obstruction standard of Part 77 and would not be a hazard to air navigation. ☐ Should be obstruction marked and lighted per FAA Advisory Circular 70/7460-1, Chapter(s) _____ ☐ Obstruction marking and lighting are not necessary. ☐ Requires supplement notice. Use FAA form enclosed. B. FCC ☐ was ☐ was not advised.		
2 NAME AND ADDRESS OF INDIVIDUAL, COMPANY, CORPORATION, ETC. PROPOSING THE CONSTRUCTION OR ALTERATION (Number, Street, City, State and Zip Code) Broward County Board of County Commissioners TO Broward County Courthouse - Room 248 201 S. E. 6th Street Ft. Lauderdale, Florida 33301				REMARKS ISSUING OFFICE: REVIEWING OFFICER: _____ DATE: _____	
3 COMPLETE DESCRIPTION OF STRUCTURE (include effective radiated power of proposed or modified AM, FM, or TV station and assigned frequency; size and configuration of power transmission line in vicinity of FAA facilities as appropriate). Please See Attached Sheet					
4 LOCATION OF STRUCTURE					
A. COORDINATES (To nearest second) LATITUDE _____ LONGITUDE _____		B. NEAREST CITY OR TOWN, AND STATE Hacienda Village, Florida			
See Attached		(1) DISTANCE FROM 4B 0.3 MILES		(2) DIRECTION FROM 4B South	
C. NAME OF NEAREST AIRPORT, HELIPORT, OR SEAPLANE BASE Hollywood/Ft. Lauderdale International Airport		(1) DISTANCE FROM NEAREST POINT OF NEAREST RUNWAY 10,000 Ft.		(2) DIRECTION FROM AIRPORT West	
D. DESCRIPTION OF LOCATION OF SITE WITH RESPECT TO HIGHWAYS, STREETS, AIRPORTS, PROMINENT TERRAIN FEATURES, EXISTING STRUCTURES, ETC. (Attach a highway, street, or any other appropriate map or scaled drawing showing the relationship of construction site to nearest airport(s). If more space is required, continue on a separate sheet of paper and attach to this notice). Please See Attached Sheet					
5. HEIGHT AND ELEVATION (Complete A, B, and C to the nearest foot)				6. WORK SCHEDULE DATES	
A. ELEVATION OF SITE ABOVE MEAN SEA LEVEL After Site Development (see attached)				A. BEGINNING 10/84	
B. HEIGHT OF STRUCTURE INCLUDING APPURTENANCES AND LIGHTING (if any) ABOVE GROUND, OR WATER IF SO SITUATED Less Than 200 Ft.				B. END	
C. OVERALL HEIGHT ABOVE MEAN SEA LEVEL (A + B) Less Than 215 Ft.				4/87	
7 OBSTRUCTION MARKED AND/OR LIGHTED IN ACCORDANCE WITH CURRENT FAA ADVISORY CIRCULAR 70/7460-1. OBSTRUCTION MARKING AND LIGHTING				YES NO	
				A MARKED ☒	
				B AVIATION RED OBSTRUCTION LIGHTS ☒	
				C HIGH INTENSITY WHITE OBSTRUCTION LIGHTS ☒	
				D DUAL LIGHTING SYSTEM ☒	
I HEREBY CERTIFY that all of the above statements made by me are true, complete, and correct to the best of my knowledge					
DATE 2/5/83	TEL. NO. (Give area code) 305/765-8068	TYPED NAME, TITLE OF PERSON FILING NOTICE Phyllis A. Korab Project Director		SIGNATURE 	
Notice is required by Part 77 of the Federal Aviation Regulations (14 C.F.R. Part 77) pursuant to Section 1101 of the Federal Aviation Act of 1958, as amended (49 U.S.C. 1101). Persons who knowingly and willfully violate the Notice requirements of Part 77 are subject to a fine (criminal penalty) of not more than \$500 for the first offense and not more than \$2,000 for subsequent offenses, pursuant to Section 902(a) of the Federal Aviation Act of 1958, as amended (49 U.S.C. 1472(a)).					

Attachment to FAA Form 7460-1

Item 3 - Description of Facilities

The Southern Resource Recovery Facility (RRF) and Residue/Unprocessable Waste Landfill will receive and process approximately 1600 tpd of solid waste from southern Broward County. The site will be located on U.S. Route 441 and Florida State Road 84 (see Figures 1 and 2). The facility will consist of two major elements, the RRF itself and a landfill for the disposal of RRF residue and unprocessable waste (e.g., oversize, bulky items, construction debris, earthen materials). A conceptual site layout for the RRF and landfill is presented in Figure 3.

Resource Recovery Facilities

The resource recovery facility will utilize a mass-burn technology. Figures 4 and 5 present a schematic drawing and cross section, respectively, of typical mass burning facilities.

Solid waste disposal vehicles will enter an enclosed turning platform/tipping floor area and discharge their load of municipal solid waste into the refuse storage bin. This bin will be sized to accommodate a minimum of 4 days waste generation. Overhead cranes will be utilized to lift refuse from the storage bin to the charging hoppers of the incinerators. Provisions will be made at the facilities to accommodate additional incinerators should future conditions dictate the need for such units. The crane operators will sort combustible bulky materials from the storage bin and deposit such material in the bulky shear shredder provided at the end of the refuse storage bin. The processable waste material moves down the charging hopper and is fed into the waterwall incinerator. Waste moves through the incinerator by means of a stoker, where moving grates pass the waste initially

through a drying zone and then into the combustion zone. Over and underfire air, regulated at approximately 85 to 115 percent excess combustion air, are provided to ensure optimal conditions for complete combustion of the light fraction of the waste and to ensure long grate bar life.

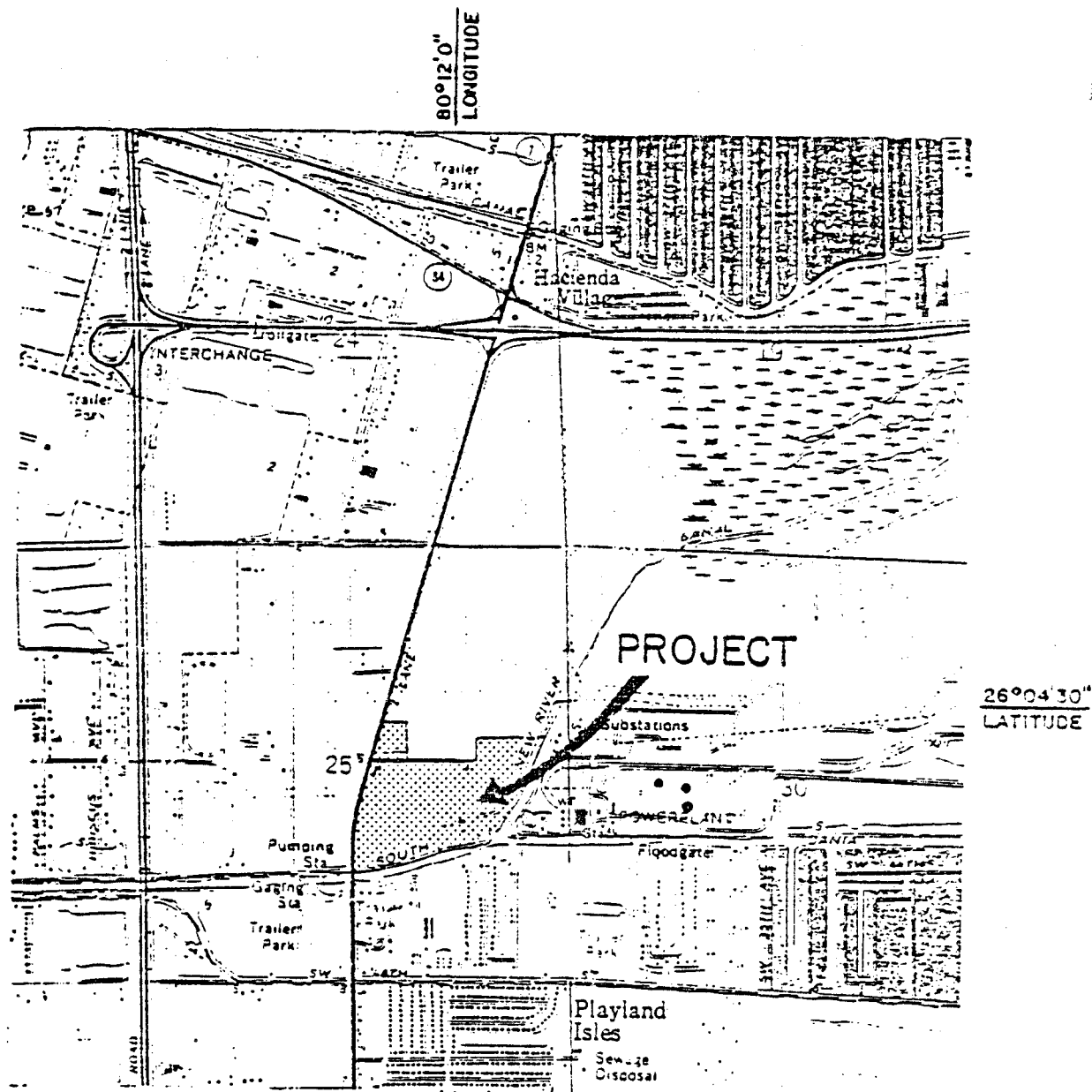
From the combustion zone, the hot gases move through the boiler and superheater where steam is generated and directed to the turbine generator to produce electricity. The gases continue to the economizer which serves to preheat the feed water that will be converted to steam in the boiler and superheater sections. After passing through the economizer, the combustion gases go through the electrostatic precipitators (or equivalent air pollution control device) for particulate removal prior to discharge through the stack.

The residue remaining on the grates after burnout is water cooled by spray or quenched in tanks or sumps before it is handled by the conveyors and then conveyed to the residue disposal area. Collected residue shall be hauled to the adjacent residue/unprocessible waste landfill. Fly ash from the electrostatic precipitators, superheater and economizer shall also be disposed of at this landfill.

The back-end recovery of ferrous metals may be incorporated into the proposed facilities. However, the decision to recover materials will be based upon the economic viability of such recovery options.

The power generating equipment shall include a turbine-generator set designed such that no loss of energy production, either thermal or electrical, occurs throughout the lifetime of each facility. Each facility shall be able to process processable waste at full capacity even during scheduled and unscheduled outages of the turbine-generator sets. The turbines shall be designed for continuous operation, while the generators shall be alternate current synchronous generators, of the non-salient pole revolved type.

FIGURE 1



PURPOSE: BROWARD COUNTY RESOURCE RECOVERY FACILITY
 DATUM: MEAN SEA LEVEL

SCALE: 1000 0 1000 2000

SOURCE: USC & GS T-8428 FORT LAUDERDALE SOUTH,
 FLORIDA QUADRANGLE (1962 PHOTO REVISED 1969)

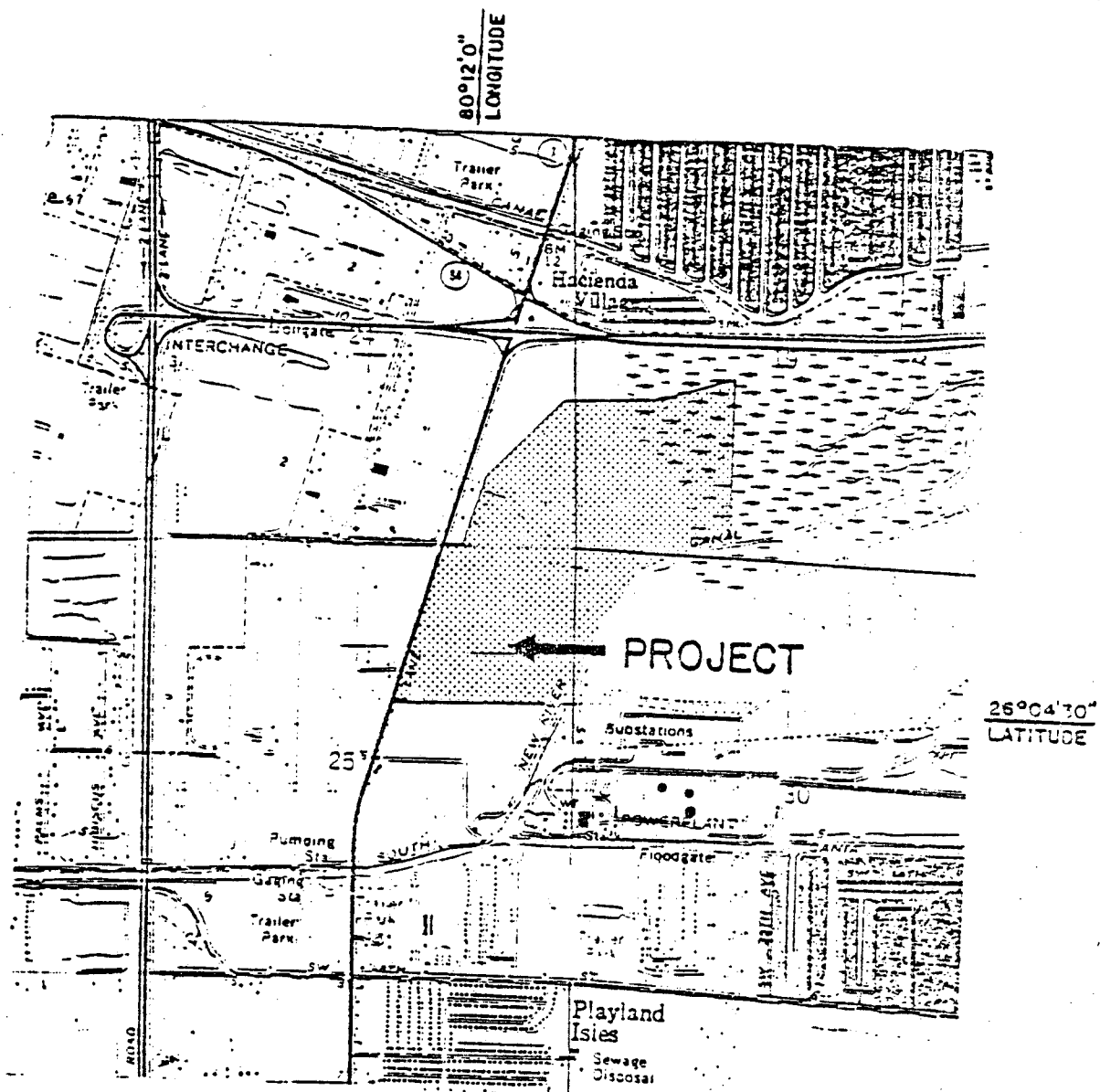
VICINITY MAP

IN AREA ADJACENT TO SOUTH FORK
 OF THE NEW RIVER

COUNTY OF BROWARD
 STATE OF FLORIDA
 APPLICATION BY BROWARD COUNTY

SHEET OF DATE

FIGURE 2



PURPOSE: SOUTHERN RESIDUE/UNPROCESSIBLE WASTE LANDFILL

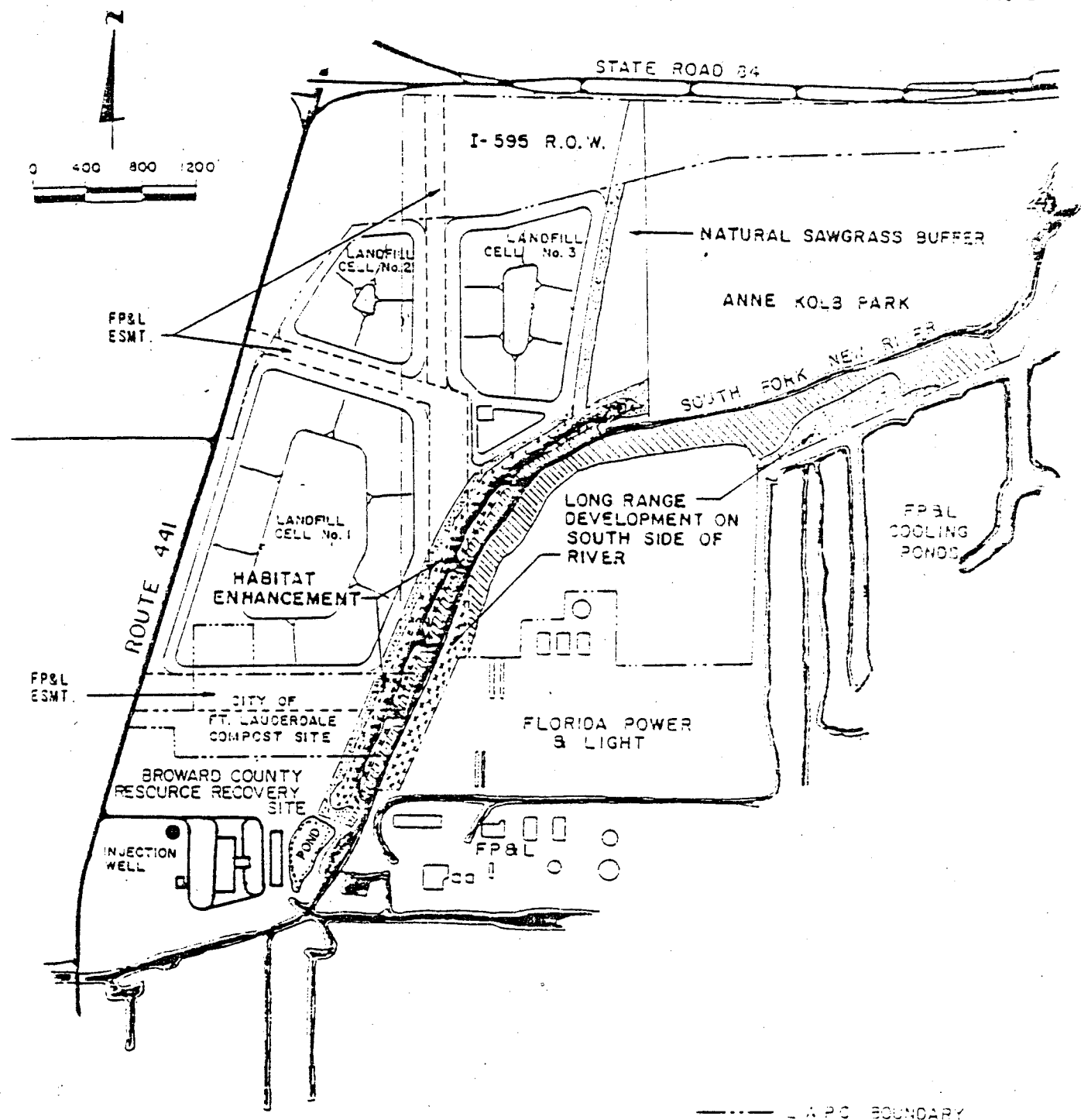
VICINITY MAP

SCALE: 1000' 0' 1000' 2000'

IN AREA ADJACENT TO SOUTH FORK OF THE NEW RIVER

SOURCE: USC & GS T-8423 FORT LAUDERDALE SOUTH, FLORIDA QUADRANGLE (1962 PHOTO REVISED 1963)

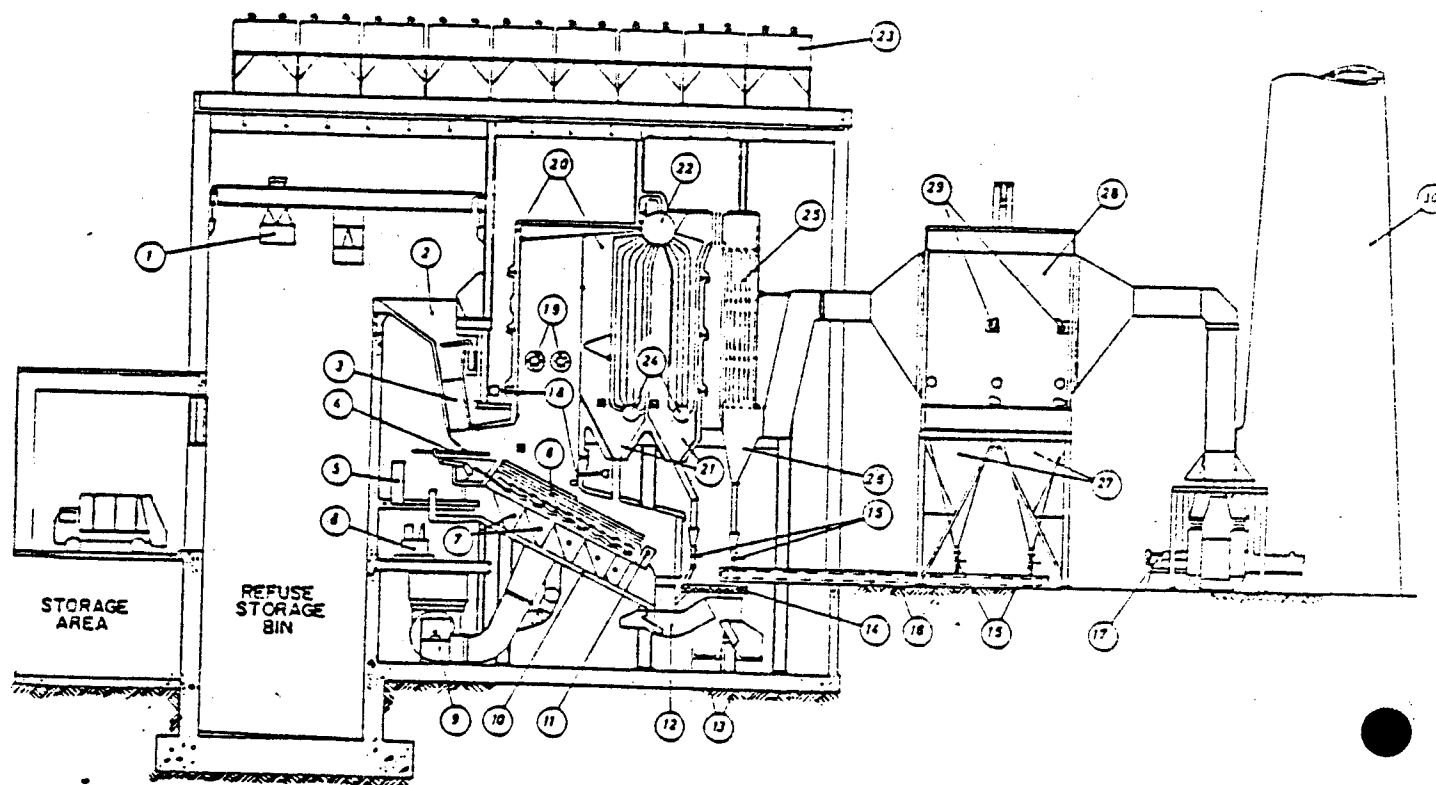
COUNTY OF BROWARD
STATE OF FLORIDA
APPLICATION BY BROWARD COUNTY



LEGEND

-  MARSH
-  CYPRESS
-  EXISTING VEGETATION

BROWARD COUNTY
 RESOURCE RECOVERY
 CONCEPTUAL DEVELOPMENT AND
 ENVIRONMENTAL ENHANCEMENT PLAN
 FOR THE ROUTE 441 SITE
 NOT TO SCALE



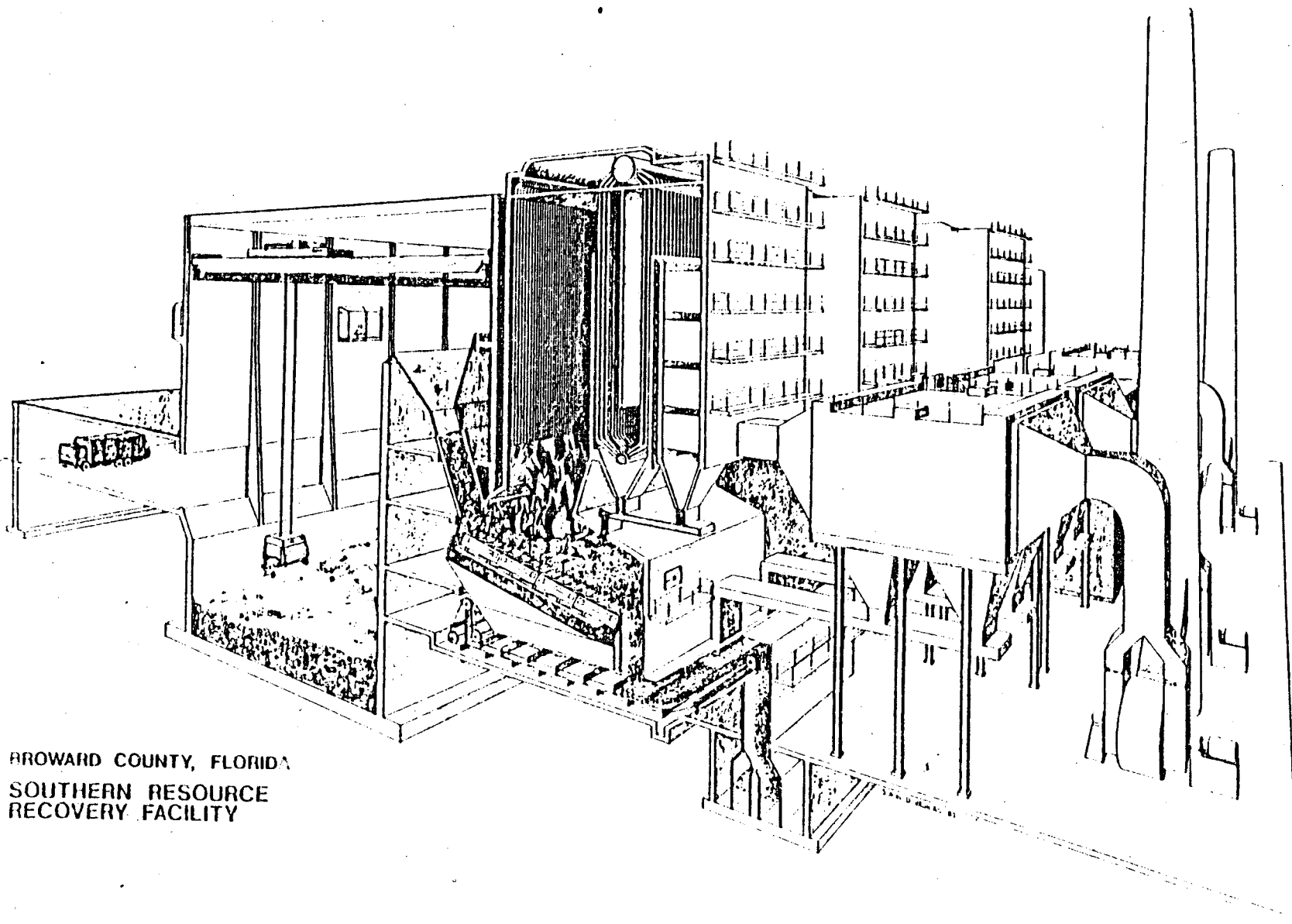
LEGEND

- 1) Crane
- 2) Refuse Hopper
- 3) Refuse Chute
- 4) Refuse Feed
- 5) Stoker Control Panel
- 6) Reverse Reciprocating Stoker
- 7) Undergrate Air Plenum Chambers
- 8) Hydraulic Pump

- 9) Forced Draft Fan
- 10) Automatic Siftings
- 11) Clinker Roll
- 12) Residue Discharger
- 13) Residue Conveyor
- 14) Fly-Ash Conditioning Screw
- 15) Rotary Valves for Fly-Ash Discharger
- 16) Fly-Ash Flight Conveyor
- 17) Induced Draft Fan
- 18) Overfire Air Nozzles
- 19) Auxiliary Burners. (100% capacity)

- 20) Radiant Waterwalls. (Welded Panel Const.)
- 21) Boiler Fly Ash Hoppers
- 22) Steam Drums
- 23) Steam Condensers
- 24) Bottom Boiler Drums
- 25) Economizer
- 26) Economizer Fly-Ash Hopper
- 27) Fly-Ash Hoppers for Electrostatic Precipitators
- 28) Electrostatic Precipitators
- 29) Rappers for Fly-Ash Collector Plates
- 30) Chimney

Typical Mass Burning System
(IBW-Martin)



BROWARD COUNTY, FLORIDA
SOUTHERN RESOURCE
RECOVERY FACILITY

Landfill

Ash residue from the RRF and unprocessable solid waste will be landfilled on site (Figure 3). At no time will the ash residue produced at the plants consist of a combustible content greater than 4 percent or a putrescible content greater than 0.2 percent.

The material will be filled in a series of subcells within each landfill area. All materials deposited in the fill will be placed at or above the 100-year flood elevation. Exposed (to public view) faces will be capped and landscaped as filling progresses.

When a landfill area is completed to design grades it will be closed in accordance with federal, state and local regulatory agency requirements. Final cover will consist of a layer of impervious material having a permeability of 10^{-7} cm/sec or less, covered with sufficient top soil to support the growth of vegetative cover. Roadways will be extended to the crown of the landfill for long term maintenance.

The landfill mass is expected to be a stable, inorganic material which would not be subject to the anaerobic decomposition processes associated with noxious end products common to the landfilling of organic solid wastes. Hazardous waste will not be accepted at the resource recovery facilities or residue/unprocessable waste landfill. The residue/unprocessable waste landfill is not expected to attract insects, rodents and birds as can be associated with landfills in which raw waste is deposited.

Item 4A - Coordinates

The following coordinates for the resource recovery plant stacks assume that two independent stacks will be necessary. During detailed design of the proposed plant, it may be found more feasible to utilize a single stack. Likewise, during detailed design it may be necessary to slightly adjust the

exact location of one or both stacks (e.g., plus or minus fifty feet). Should such an adjustment prove necessary, FAA will immediately be notified and consulted to ascertain any effect on compliance status.

North Stack

Latitude: $26^{\circ}04'04''$

Longitude: $80^{\circ}12'57''$

South Stack

Latitude: $26^{\circ}04'01''$

Longitude: $80^{\circ}12'57''$

Item 4D - Location

Please see the above response to Item 3 for a description of the proposed location of the subject facility.

Item 5A - Elevation of Site

Existing elevation at the proposed site ranges from 0 to 6 feet above mean sea level. The site will be developed to a base elevation of 7 feet above mean sea level in order to raise the proposed facilities above the established 100 year flood elevation of 6.5 feet above mean sea level.



DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Orlando Airports District Office
4100 Sixth Street
Orlando, Florida 32812

February 6, 1984

Ms. Phyllis A. Korab
Project Director
Broward County Board of County Commissioners
Broward County Courthouse, Room 248
201 S.E. 6th Street
Ft. Lauderdale, Florida 33301

Re: FAA Forms 7460-1 dated 12/5/83
Resource Recovery Projects

Dear Ms. Korab:

The Resource Recovery sites referenced above, which are located in the vicinity of the Ft. Lauderdale-Hollywood International and Pompano Beach Airports, have been reviewed from an airspace utilization standpoint and no objections are interposed.

FAA non-objection to this facility is based on Broward County's assurance that the operation of these facilities will not create a greater bird problem in the area nor create smoke hazards or result in noxious fumes that would create a hazard to the flying public.

It will be necessary for you to notify the FAA utilizing the attached form when the South Resource Recovery Plan is under construction.

Sincerely,

James E. Sheppard, Manager

Enclosure

CC:

- Ron Mills, Malcolm Pirnie, Inc.
 - Richard Niedenthal, Broward County Aviation Division
 Corps of Engineers, Jacksonville

DESCRIPTION OF THE PROJECT

The Broward County Resource Recovery Project has been selected as the best alternative for meeting Broward County's long-term solid waste disposal needs. This facility will:

- o dispose of garbage and trash in an environmentally sound manner;
- o reduce the need for siting and developing a raw garbage landfill;
- o recover energy by using solid waste as a fuel to produce electricity and;
- o create new opportunities for recreation and wetland habitat enhancement through extensive mitigation.

The proposed southern facility will be located on a 248 acre tract in unincorporated Broward County at the southeast quadrant of the intersection of U.S. Route 441 and State Road 84.

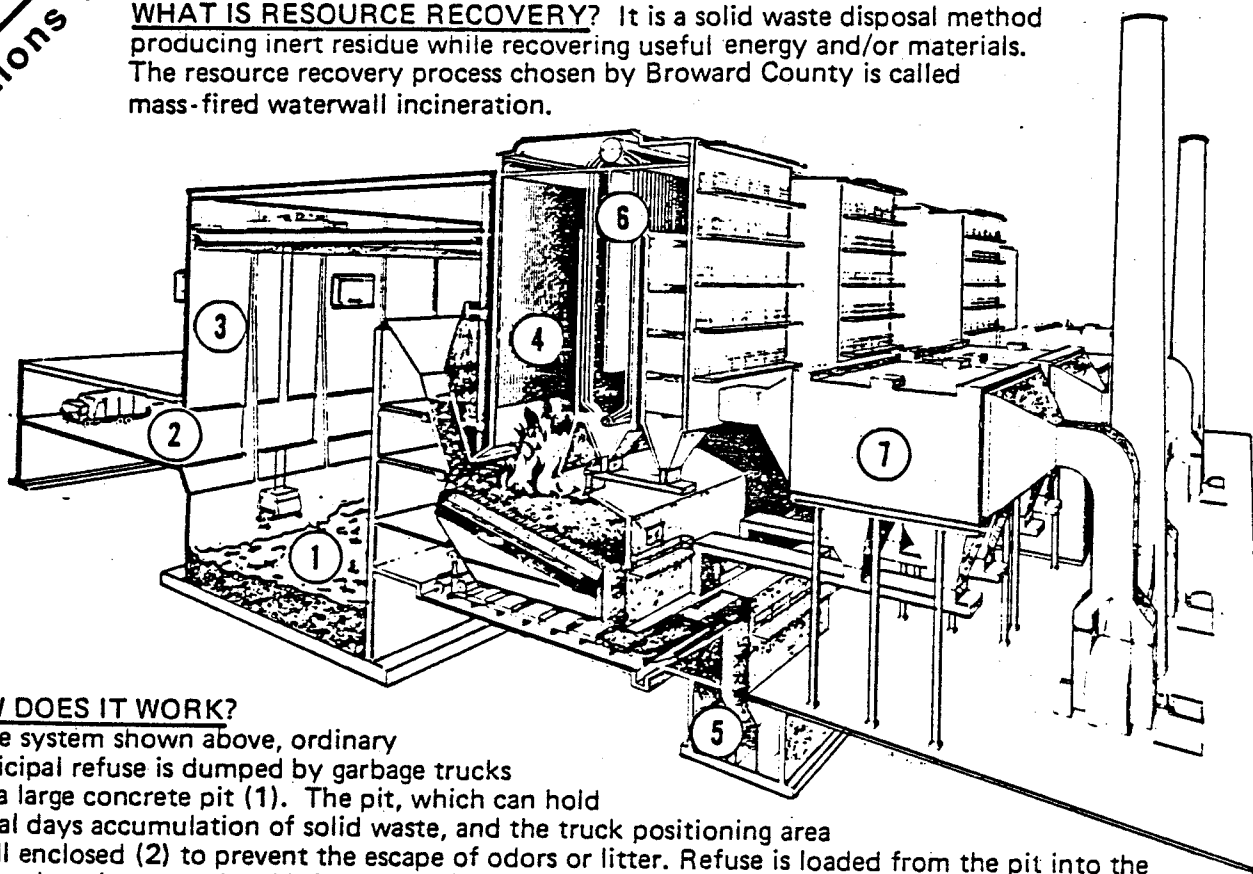
The facility is slated to have an initial installed capacity of 2,352 tons per day and an estimated projected ultimate capacity of approximately 3,300 tons per day. Since the proposed facility will utilize mass-burn technology, there will be no preprocessing of wastes at the facility prior to combustion. A schematic diagram describing the mass burn process of a typical resource recovery facility is presented in Figure 1. Solid waste will be delivered in collection trucks to the facility. It will be dumped directly into a bunker located entirely inside a building. All waste will be stored inside the building, therefore no waste will be visible from the outside. Two overhead cranes will mix the solid waste in the bunker and load the charging hoppers as required.

Waste will enter the furnace via a charging hopper and will progress through the combustion chamber by means of a stoker system that agitates the waste providing the proper air/fuel mixture to complete the combustion process. The

Questions & Answers

Broward County RESOURCE RECOVERY PROGRAM

WHAT IS RESOURCE RECOVERY? It is a solid waste disposal method producing inert residue while recovering useful energy and/or materials. The resource recovery process chosen by Broward County is called mass-fired waterwall incineration.



HOW DOES IT WORK?

In the system shown above, ordinary municipal refuse is dumped by garbage trucks into a large concrete pit (1). The pit, which can hold several days accumulation of solid waste, and the truck positioning area are all enclosed (2) to prevent the escape of odors or litter. Refuse is loaded from the pit into the furnace by a large overhead bridge crane (3). Oversized or unprocessable items (engine blocks, tree stumps, concrete rubble, etc.) which accidentally get into the pit can be removed at this point and either sent directly to the landfill, or put through a shredder for size reduction prior to being sent to landfill or sold.

In the furnace (4) the refuse is burned at high temperature and under controlled conditions of air and turbulence. The result is essentially complete destruction of organic material, (paper, plastic, wood, food wastes, etc.) leaving an ash residue (5) which contains the unburnable fraction (glass, metal, ceramics, etc.). This residue has a volume of five to ten percent of the original solid waste, thus lengthening the projected landfill lifetime by a factor of ten to twenty.

Hot gases from the combustion process pass up through the boiler portion (6) of the furnace where the heat is transferred to water-filled steel tubes. This heat is used to generate steam and ultimately electricity.

After passing through the boiler the hot gases pass through electrostatic precipitators (7) which act as giant filters removing the dust particles from the gas stream. The clean gases are then discharged at the stack.

HAS THIS METHOD OF RESOURCE RECOVERY BEEN SUCCESSFUL ELSEWHERE?

Yes. There are over 400 plants of this type in successful operation worldwide, some for as long as 30 years. There are about a dozen in the U. S., including Pinellas County, Florida; Saugus, Mass.; Hampton, Va.; Chicago, Ill.; Harrisburg, Pa.; and others. Several more are under construction.

WHAT ARE THE MAJOR ELEMENTS OF THE RESOURCE RECOVERY PROGRAM?

Broward County's resource recovery program consists of two major facilities. Serving the northern part of the County, a site north of Copans Road and west of Powerline Road will be developed to include a 1000 ton per day (tpd) resource recovery facility, and an 80 acre landfill for ash residue and unprocessable waste. A second facility, 1600 tpd in capacity, will serve the southern part of the County from a site at the intersection of SR 84 and Route 441. The southern facility will also include a landfill for ash residue and unprocessable wastes.

HOW WERE THESE SITES CHOSEN?

Broward County has been working on its resource recovery program for several years, and in that time more than 20 sites have been evaluated, for use as landfills, resource recovery facilities, or both. The site selection process included numerous reports, public meetings, and consultation with Federal, State, and local environmental officials. As a result of this process these two sites were chosen for the following reasons:

- (1) Adequate area is available to develop both the resource recovery facility and residue landfill at each site.
- (2) Each site is centrally located within the area of the County it is to serve, thus minimizing haul costs and traffic.
- (3) Each site is situated so that buffer areas and screening are available between the facilities and residential areas.
- (4) Each site is located and sized so that environmental impact will be manageable, and permits obtainable.

DO RESOURCE RECOVERY FACILITIES CAUSE ADVERSE HEALTH EFFECTS?

No. These facilities are tightly regulated by Federal, State, and local government and will be required to use the latest in state-of-the-art air pollution and other control equipment. Facilities of this type have been in successful operation around the world for over 30 years, many in densely populated urban areas, and no adverse health effects have been found.

WHAT IMPACT WILL THE RESOURCE RECOVERY PLANTS HAVE ON THE ENVIRONMENT?

Resource recovery facilities of the scale required in Broward County are major installations, and cannot be built and operated without some impact. Nevertheless, through proper siting, design, and operation, adverse environmental impacts can and will be reduced to negligible levels. Key issues are:

Air quality — The facilities will be equipped with the latest state-of-the-art air pollution control equipment. No visible smoke will be emitted from either facility, and high furnace temperatures will destroy all organic materials thereby preventing emission of odors.

Aesthetics — Each modern facility will be enclosed so that all garbage processing will take place indoors. This will prevent the attraction of scavenging animals (rodents, seagulls), and the escape of blowing refuse. Combustion air for the furnaces will be drawn from the tipping area, thereby preventing the escape of odors.

Traffic — Each resource recovery facility has been sited near major arterial routes to minimize local traffic impact. Analyses, using the County's TRIPS computer model, has demonstrated negligible traffic increases caused by the resource recovery facilities.

Ground Water — By replacing raw garbage landfills, the resource recovery program will, in fact, protect ground water in Broward County. The landfills which accompany each resource recovery facility will be for ash residue and unprocessable waste (construction debris and the like) only, and will include an impermeable liner and leachate collection system.

WHO IS GOING TO OWN AND OPERATE THESE FACILITIES?

These facilities will be leased from Broward County and operated by a private vendor. An extensive review of potential bidders is currently underway. The projects will be financed by thirty year bonds. Use of a private vendor will result in lower disposal charges thru available tax benefits.

For further information contact the Broward County Resource Recovery Office at 765-5844.

resulting ash will be deposited and quenched, and the heat from the furnace will be transferred through waterfilled steel tubes lining the furnace to produce steam. The steam will then be transmitted to turbine generators to produce electricity for sale to Florida Power and Light, Inc.

Each boiler will be equipped with an electrostatic precipitator (ESP) for particulate air emission control. An electrostatic precipitator is a pollution control device that removes small particles from exhaust gases. The gases pass through a strong electric field where the particles are charged and attracted to the opposite electrically charged collecting plates. The dust is then removed mechanically from these plates. The flue gas will be drawn through the ESPs by an induced draft fan located between the stack and the ESPs.

Bottom ash from the furnace and flyash from the precipitator will be mixed prior to removal from the facility. The combined ash will comprise 10 percent of the volume and 25 percent of the weight of the solid waste processed by the facility. The ash will be quenched with water to about 30 percent moisture prior to transport to the unprocessable waste landfill.

As noted above, while the proposed facility will have ultimate design capacity of approximately 3,300 tpd, its maximum initial installed capacity will be 2,352 tpd. Each boiler unit operates independently from the others. It will, therefore, be possible to routinely shut down units for periods of maintenance and inspection and still continuously operate the facility.

Assessment of Probable Project Impacts

As part of the Federal Consistency Evaluation Procedures, an assessment of the probable impacts of the project on the coastal zone were determined in relation to the Florida Coastal Management Program statutes.

Chapter 403, Environmental Control

The air and water pollution concerns will be addressed by obtaining the appropriate facility permits and using pollution control measures to abate impacts from facility construction and operations. Facility boilers will be equipped with electrostatic precipitators for particulate air emission control. Air construction and operating permits will be obtained through the Power Plant Siting Act process in accordance with requirements established in the Prevention of Significant Air Quality Deterioration (PSD) regulations and the regulation governing New Sources.

Stormwater retention basins will be used to collect runoff waters from the site. This discharge will comply with all DER requirements for protection of surface and groundwater.

Chapter 267, Archives, History and Records Management

The State of Florida Division of Archives, History and Records Management, has stated that there are no known or potential historical or archaeological resources at the site. Therefore, no significant cultural resources would be affected by the project.

Chapter 373 (Water Resources)

The South Florida Water Management District will review the project for water resources impacts. No consumptive use of water is anticipated therefore permits for such use do not apply. Monitoring wells will be installed to provide an early warning system of groundwater contamination and stormwater management practices will be employed to mitigate water resources impacts from runoff.

Power Plant Siting Act (PPSA)

An application is being filed with FDER under the power plant siting act. This application will present information discussing the conditions resulting from construction, and the anticipated impacts from facility operation in order to provide assurance that all applicable state, regional and local standards are met and that the project will be consistent with the FCMP.

Consistency Determination

The proposed project complies with Florida's Coastal Management Program and will be conducted in a manner consistent with that program.


Thomas M. Henderson
Project Director

NPDES

COASTAL ZONE MANAGEMENT CERTIFICATION



Resource Recovery Office

Room 521, 115 South Andrews Avenue
Fort Lauderdale, Florida 33301
(305) 357-6458

March 15, 1985

State Planning & Development Clearinghouse
Office of Planning and Budgeting
Executive Office of the Governor
The Capital
Tallahassee, Florida 32301

Attention: Richard Smith
Federal Consistency Coordinator

Re: South Broward County Resource Recovery Project Inc.
NPDES - Coastal Zone Management Certification

Dear Mr. Smith:

According to Florida Coastal Management Program (FCMP) Federal Consistency Evaluation Procedures (15 CFR 930.50), all federal permits for which there are no analogous state permits require certification of compliance with the FCMP.

A federal permit applicable to the proposed project for which no analogous state permit exists is the U.S. Environmental Protection Agency NPDES Permit (SS. 302 Clean Water Act). In accordance with the requirements of the Federal Consistency Evaluation Procedures, this permit application must be accompanied by a consistency certification. The certification package includes:

- o A written and pictorial description of the project.
- o An assessment of probable impacts relevant to applicable FCMP statutes.
- o A signed statement by the applicant regarding consistency of the project with FCMP statutes.

As specified in 15 CFR 930.58, the certification package and permit application (EPA Form 3510-1 must be sent to the appropriate federal agency (EPA) and ten 10 copies must be submitted to the Federal Consistency Coordinator of the Florida State Planning and Development Clearinghouse. Copies of the permit application and certification are included here.

BROWARD COUNTY BOARD OF COUNTY COMMISSIONERS

Marcia Beach Scott I. Cowan Howard Craft Howard Forman Nicki Englander Grossman Ed Kennedy Gerald Thompson

An Equal Opportunity Employer

Mr. Richard Smith

-2-

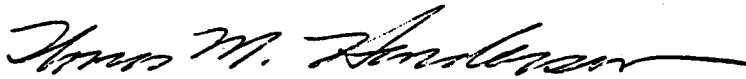
March 15, 1985

The certification package and permit application has been sent under separate cover to the EPA Regional Office in Atlanta for their review.

Broward County is submitting the enclosed NPDES application and the consistency certification package for the County's Resource Recovery Facility.

If you have any questions or require any additional information, please contact us at (305) 357-6456.

Sincerely,



Thomas Henderson
Project Director
Resource Recovery Office

TH/lfc

ENVIRONMENTAL PROTECTION AGENCY APPLICATION
(NATIONAL POLLUTANT DISCHARGE ELIMINATION
SYSTEM APPLICATION FOR PERMIT TO DISCHARGE)



Resource Recovery Office

Room 521, 115 South Andrews Avenue
Fort Lauderdale, Florida 33301
(305) 357-6458

March 15, 1985

U.S. Environmental Protection Agency
EPA Region IV
Water Management Division
345 Courtland Street
Atlanta, Georgia 30365

Attention: Mr. Michael Magee

Re: South Broward County Resource Recovery Project, Inc.
NPDES - Permit Application

Gentlemen:

Enclosed please find EPA Forms 3510-1 and 3510-2C which Broward County is submitting pursuant to the Clean Water Act under the National Pollutant Discharge Elimination System (NPDES) for the construction and operation of a Resource Recovery Facility in Broward County. The proposed facility will have an initial installed capacity of 2,352 tons per day with a projected estimated ultimate capacity of 3,300 tons per day of solid waste.

Uncontaminated stormwater will be the only discharge to surface waters during the construction and operation of this facility. This discharge will occur only during peak storms. The sanitary and process wastewater will be discharged to the existing Hollywood Wastewater Treatment Plant.

In accordance with the requirements of the Federal Consistency Evaluation Procedures (15 CFR 930.50), the permit application is accompanied by an "NPDES Florida Coastal Zone Management Certification". As specified in 15 CFR 930.58, 10 copies of EPA Forms 3510-1 and 3510-2C and the "NPDES Florida Coastal Zone Management Certification" have been sent under separate cover to the Federal Consistency Coordinator of the Florida State Planning and Development Clearinghouse.

BROWARD COUNTY BOARD OF COUNTY COMMISSIONERS

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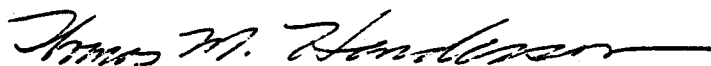
Mr. Michael Magee

-2-

March 15, 1985

Should you have any questions concerning the information presented in this submittal, please do not hesitate to contact us.

Sincerely,

A handwritten signature in cursive script, appearing to read "Thomas M. Henderson".

Thomas Henderson
Project Director
Resource Recovery Office

TH/lfc

FORM 1 GENERAL		U.S. ENVIRONMENTAL PROTECTION AGENCY GENERAL INFORMATION <i>Consolidated Permits Program</i> (Read the "General Instructions" before starting.)		I. EPA I.D. NUMBER																																																							
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				If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill-in area below. Also, if any of the preprinted data is absent (the area to the left of the label space lists the information that should appear), please provide it in the proper fill-in area(s) below. If the label is complete and correct, you need not complete items I, III, V, and VI (except VI-B which must be completed regardless). Complete a label if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.																																																							
II. POLLUTANT CHARACTERISTICS																																																											
INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold-faced terms.																																																											
<table border="1" style="width:100%; border-collapse: collapse;"><thead><tr><th rowspan="2" style="width: 40%;">SPECIFIC QUESTIONS</th><th colspan="3" style="text-align: center;">MARK 'X'</th><th rowspan="2" style="width: 40%;">SPECIFIC QUESTIONS</th><th colspan="3" style="text-align: center;">MARK 'X'</th></tr><tr><th>YES</th><th>NO</th><th>FORM ATTACHED</th><th>YES</th><th>NO</th><th>FORM ATTACHED</th></tr></thead><tbody><tr><td style="font-size: 0.8em;">A. Is this facility a publicly owned treatment works which results in a discharge to waters of the U.S.? (FORM 2A)</td><td></td><td style="text-align: center;">X</td><td></td><td style="font-size: 0.8em;">B. Does or will this facility (either existing or proposed) include a concentrated animal feeding operation or aquatic animal production facility which results in a discharge to waters of the U.S.? (FORM 2B)</td><td></td><td style="text-align: center;">X</td><td></td></tr><tr><td style="font-size: 0.8em;">C. 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CONTINUED FROM THE FRONT

VII. SIC CODES (4-digit, in order of priority)

A. FIRST				B. SECOND			
7	4	9	5	7			
Refuse Systems							
C. THIRD				D. FOURTH			
7				7			

VIII. OPERATOR INFORMATION

A. NAME												B. Is the name listed in Item VIII-A also the owner?			
S O. B R O W A R D C O. R E S. R E C O V E R Y P R O J. I N C.												☒ YES ☐ NO			
C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box; if "Other", specify.)															
F - FEDERAL				M - PUBLIC (other than federal or state)				M* (specify)				D. PHONE (area code & no.)			
S - STATE				O - OTHER (specify)								3 0 5 3 5 7 6 4 5 6			
P - PRIVATE															
E. STREET OR P.O. BOX															
115 S. A N D R E W S A V E R O O M 521															
F. CITY OR TOWN										G. STATE		H. ZIP CODE		IX. INDIAN LAND	
F T. L A U D E R D A L E										F L		33 3 01		Is the facility located on Indian lands? ☐ YES ☒ NO	

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water)										D. PSD (Air Emissions from Proposed Sources)									
9 N										9 P									
B. UIC (Underground Injection of Fluids)										E. OTHER (specify)									
9 U										(specify)									
C. RCRA (Hazardous Wastes)										E. OTHER (specify)									
9 R										(specify)									

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS (provide a brief description)

The proposed southern Resource Recovery Facility will receive and process initially approximately 2352 tpd of Municipal Solid Wastes and ultimately approximately 3300 tpd of MSW from Southern Broward County. Processible waste received at the RRF will be burned to reduce the original volume by approximately 90 percent and Energy will be recovered from the combustion process in the form of electricity.

XIII. CERTIFICATION (see instructions)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print)		B. SIGNATURE		C. DATE SIGNED	
Thomas Henderson Project Director		<i>Thomas M. Henderson</i>		3/13/85	

COMMENTS FOR OFFICIAL USE ONLY

C	
---	--

EPA Form 3510-1 (Rev. 10-80) Reverse

Items 3, 4 and 8 are subject to amendment pending initiation of final design for the facility.

**FORM
26
NPDES**



I. OUTFALL LOCATION

[illegible]

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined (*e.g., for certain mining activities*), provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

[illegible]

OFFICIAL USE ONLY (effluent guidelines sub-categories)

CONTINUED FROM THE FRONT

C. Except for storm runoff, leaks, or spills, are any of the discharges described in Items II-A or B intermittent or seasonal?

☐ YES (complete the following table)

☒ NO (go to Section III)

1. OUTFALL NUMBER (list)	2. OPERATION(s) CONTRIBUTING FLOW (list)	3. FREQUENCY		4. FLOW				5. DURATION (in days)
		a. DAYS PER WEEK (specify average)	b. MONTHS PER YEAR (specify average)	a. FLOW RATE (in mgd)		b. TOTAL VOLUME (specify with units)		
				1. LONG TERM AVERAGE	2. MAXIMUM DAILY	1. LONG TERM AVERAGE	2. MAXIMUM DAILY	

III. MAXIMUM PRODUCTION

A. Does an effluent guideline limitation promulgated by EPA under Section 304 of the Clean Water Act apply to your facility?

☐ YES (complete Item III-B)

☒ NO (go to Section IV)

B. Are the limitations in the applicable effluent guideline expressed in terms of production (or other measure of operation)?

☐ YES (complete Item III-C)

☐ NO (go to Section IV)

C. If you answered "Yes" to Item III-B, list the quantity which represents an actual measurement of your maximum level of production, expressed in the terms and units used in the applicable effluent guideline, and indicate the affected outfalls.

1. MAXIMUM QUANTITY

a. QUANTITY PER DAY	b. UNITS OF MEASURE	c. OPERATION, PRODUCT, MATERIAL, ETC. (specify)	2. AFFECTED OUTFALLS (list outfall numbers)

IV. IMPROVEMENTS

A. Are you now required by any Federal, State or local authority to meet any implementation schedule for the construction, upgrading or operation of waste-water treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes, but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.

☐ YES (complete the following table)

☒ NO (go to Item IV-B)

1. IDENTIFICATION OF CONDITION, AGREEMENT, ETC.	2. AFFECTED OUTFALLS		3. BRIEF DESCRIPTION OF PROJECT	4. FINAL COM- PLIANCE DATE	
	a. NO.	b. SOURCE OF DISCHARGE		a. RE- QUIRED	b. PRO- JECTED

B. OPTIONAL: You may attach additional sheets describing any additional water pollution control programs (or other environmental projects which may affect your discharges) you now have underway or which you plan. Indicate whether each program is now underway or planned, and indicate your actual or planned schedules for construction. ☐ MARK "X" IF DESCRIPTION OF ADDITIONAL CONTROL PROGRAMS IS ATTACHED

V. INTAKE AND EFFLUENT CHARACTERISTICS

D. Use the space below to list any of the pollutants listed in Table 2c-3 of the instructions, which you know or have reason to believe is discharged or may be discharged from any outfall. For every pollutant you list, briefly describe the reasons you believe it to be present and report any analytical data in your possession.

1. POLLUTANT	2. SOURCE	1. POLLUTANT	2. SOURCE

A. Is any pollutant listed in Item V-C a substance or a component of a substance which you do or expect that you will over the next 5 years use or manufacture as an intermediate or final product or byproduct?

☐ YES (list all such pollutants below)

☐ NO (go to Item VI-B)

B. Are your operations such that your raw materials, processes, or products can reasonably be expected to vary so that your discharges of pollutants may during the next 5 years exceed two times the maximum values reported in Item V?

☐ YES (complete Item VI-C below)

☐ **NO** (go to Section VII)

C. If you answered "Yes" to Item VI-B, explain below and describe in detail the sources and expected levels of such pollutants which you anticipate will be discharged from each outfall over the next 5 years, to the best of your ability at this time. Continue on additional sheets if you need more space.

☐ **YES** (identify the test(s) and describe their purposes below)☐ NO (go to Section VIII)

VIII. CONTRACT ANALYSIS INFORMATION

☐ YES (list the name, address, and telephone number of, and pollutants analyzed by, each such laboratory or firm below)

☐ **NO** (go to *Section IX*)

A. NAME	B. ADDRESS	C. TELEPHONE (area code & no.)	D. POLLUTANTS ANALYZED (list)

IX. CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print) Thomas Henderson Project Director	B. PHONE NO. (area code & no.) 305-357-6458
C. SIGNATURE <i>Thomas M. Henderson</i>	D. DATE SIGNED 3/13/85

EPA I.D. NUMBER (copy from Item 1 of Form 1)

Form Approved
OMB No. 2000-0059
Approval expires 3-31-84

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (use the same format) instead of completing these pages. SEE INSTRUCTIONS.

V. INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C)

OUTFALL NO.
001

PART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT							3. UNITS (specify if blank)		4. INTAKE (optional)		
	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biochemical Oxygen Demand (BOD)												
b. Chemical Oxygen Demand (COD)												
c. Total Organic Carbon (TOC)												
d. Total Suspended Solids (TSS)												
e. Ammonia (as N)												
f. Flow	VALUE		VALUE		VALUE					VALUE		
g. Temperature (winter)	VALUE		VALUE		VALUE			°C		VALUE		
h. Temperature (summer)	VALUE		VALUE		VALUE			°C		VALUE		
i. pH	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM				STANDARD UNITS				

PART B - Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2-a for any pollutant, you must provide the results of at least one analysis for that pollutant. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. (if available)	2. MARK 'X'		3. EFFLUENT							4. UNITS		5. INTAKE (optional)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Bromide (24959-67-9)		X												
b. Chlorine, Total Residual		X												
c. Color		X												
d. Fecal Coliform		X												
e. Fluoride (16984-48-8)		X												
f. Nitrate-Nitrite (as N)		X												

1. POLLUTANT AND CAS NO. (if available)	2. MARK 'X'		3. EFFLUENT						4. UNITS		5. INTAKE (optional)			
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG. VALUE (if available)		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	b. LONG TERM AVERAGE VALUE		d. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic (as N)		X												
h. Oil and Grease		X												
i. Phosphorus (as P), Total (7723-14-0)		X												
j. Radioactivity														
(1) Alpha, Total		X												
(2) Beta, Total		X												
(3) Radium, Total		X												
(4) Radium 226, Total		X												
k. Sulfate (as SO ₄) (14808-79-8)		X												
l. Sulfide (as S)		X												
m. Sulfite (as SO ₃) (14265-45-3)		X												
n. Surfactants		X												
o. Aluminum, Total (7429-90-5)		X												
p. Barium, Total (7440-39-3)		X												
q. Boron, Total (7440-42-8)		X												
r. Cobalt, Total (7440-48-4)		X												
s. Iron, Total (7439-89-6)		X												
t. Magnesium, Total (7439-95-4)		X												
u. Molybdenum, Total (7439-98-7)		X												
v. Manganese, Total (7439-96-5)		X												
w. Tin, Total (7440-31-5)		X												
x. Titanium, Total (7440-32-6)		X												

001

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OMB No. 2000-0059
Approval expires 3-31-84

CONTINUED FROM PAGE 3 OF FORM 2-C

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (*secondary industries, non-process wastewater outfalls, and non-required GC/MS fractions*), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe to be absent. If you mark either columns 2-a or 2-b for any pollutant, you must provide the results of at least one analysis for that pollutant. Note that there are seven pages to this part; please review each carefully. Complete one table (*all seven pages*) for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT						4. UNITS		5. INTAKE (optional)			
	a. TEST- ING RE- QUIR- ED	b. BE- LIEVED PRE- SENT	c. BE- LIEVED AB- SENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG. VALUE (if available)		d. NO. OF ANAL- YSES	a. CONCEN- TRATION	b. MASS	8. LONG TERM AVERAGE VALUE		b. NO. OF ANAL- YSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCEN- TRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)			X												
2M. Arsenic, Total (7440-38-2)			X												
3M. Beryllium, Total, 7440-41-7)			X												
4M. Cadmium, Total (7440-43-9)			X												
5M. Chromium, Total (7440-47-3)			X												
6M. Copper, Total (7550-50-8)			X												
7M. Lead, Total (7439-97-6)			X												
8M. Mercury, Total (7439-97-6)			X												
9M. Nickel, Total (7440-02-0)			X												
10M. Selenium, Total (7782-49-2)			X												
11M. Silver, Total (7440-22-4)			X												
12M. Thallium, Total (7440-28-0)			X												
13M. Zinc, Total (7440-66-6)			X												
14M. Cyanide, Total (57-12-5)			X												
15M. Phenols, Total			X												
DIOXIN															
2,3,7,8-Tetra- chlorodibenzo-P- Dioxin (1764-01-6)			X	DESCRIBE RESULTS											

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT						4. UNITS		5. INTAKE (optional)			
	a. TEST ING. RE- QUIN- ED	b. DE- LIVERED PRE- SENT	c. BE- LIEVED AB- SENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANAL- YSES	a. CONCEN- TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANAL- YSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCEN- TRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)			X												
2V. Acrylonitrile (107-13-1)			X												
3V. Benzene (71-43-2)			X												
4V. Bis (Chloro- methyl) Ether (542-88-1)			X												
5V. Bromoform (75-25-2)			X												
6V. Carbon Tetrachloride (56-23-5)			X												
7V. Chlorobenzene (108-90-7)			X												
8V. Chlorodi- bromomethane (124-48-1)			X												
9V. Chloroethane (75-00-3)			X												
10V. 2-Chloro- ethylvinyl Ether (110-75-8)			X												
11V. Chloroform (67-66-3)			X												
12V. Dichloro- bromomethane (75-27-4)			X												
13V. Dichloro- difluoromethane (75-71-8)			X												
14V. 1,1-Dichloro- ethane (75-34-3)			X												
15V. 1,2-Dichloro- ethane (107-06-2)			X												
16V. 1,1-Dichloro- ethylene (75-35-4)			X												
17V. 1,2-Dichloro- propane (78-87-5)			X												
18V. 1,3 Dichloro- propylene (542-75-6)			X												
19V. Ethylbenzene (100-41-4)			X												
20V. Methyl Bromide (74-83-9)			X												
21V. Methyl Chloride (74-87-3)			X												

3. EFFLUENT										4. UNITS		5. INTAKE (optional)		
a. MAXIMUM 30 DAY VALUE				b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	b. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES	
CONCENTRATION		(2) MASS		(1) CONCENTRATION		(2) MASS					(1) CONCENTRATION			(2) MASS
3C/MS FRACTION - ACID COMPOUNDS														
1A. 2-Chlorophenol (95-57-8)														
2A. 2,4-Dichlorophenol (120-83-2)														
3A. 2,4-Dimethylphenol (105-67-9)														
4A. 4,6-Dinitro-O-Cresol (534-52-1)														
5A. 2,4-Dinitrophenol (51-28-5)														
6A. 2-Nitrophenol (88-75-5)														
7A. 4-Nitrophenol (100-02-7)														
3A. P-Chloro-M-Cresol (59-50-7)														
3A. Pentachlorophenol (87-86-5)														
10A. Phenol (108-95-2)														
11A. 2,4,6-Trichlorophenol (88-06-2)														

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT						4. UNITS		5. INTAKE (optional)			
	A. TEST ING RE- QUIR- ED	B. DE- LIEVED PRE- SENT	C. DE- LIEVED AS- SENT	B. MAXIMUM DAILY VALUE		D. MAXIMUM 30 DAY VALUE (if available)		C. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANAL- YSES	B. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANAL- YSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (83-32-9)			X												
2B. Acenaphthylene (208-96-8)			X												
3B. Anthracene (120-12-7)			X												
4B. Benzidine (92-87-5)			X												
5B. Benzo (a) Anthracene (56-55-3)			X												
6B. Benzo (a) Pyrene (50-32-8)			X												
7B. 3,4-Benzo- fluoranthene (205-99-2)			X												
8B. Benzo (ghi) Perylene (191-24-2)			X												
9B. Benzo (k) Fluoranthene (207-08-9)			X												
10B. Bis (2-Chloro- ethoxy) Methane (111-91-1)			X												
11B. Bis (2-Chloro- ethyl) Ether (111-44-4)			X												
12B. Bis (2-Chloro- isopropyl) Ether (39638-32-9)			X												
13B. Bis (2-Ethyl- hexyl) Phthalate (117-81-7)			X												
14B. 4-Bromo- phenyl Phenyl Ether (101-55-3)			X												
15B. Butyl Benzyl Phthalate (85-68-7)			X												
16B. 2-Chloro- naphthalene (91-58-7)			X												
17B. 4-Chloro- phenyl Phenyl Ether (7005-72-3)			X												
18B. Chrysene (218-01-9)			X												
19B. Dibenzo (a,h) Anthracene (53-70-3)			X												
20B. 1,2-Dichloro- benzene (95-50-1)			X												
21B. 1,3-Dichloro- benzene (541-73-1)			X												

CONTINUED FROM PAGE V-6

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT						d. NO. OF ANAL- YSES	4. UNITS		5. INTAKE (optional)		
	AT- TACH- ING RE- QUIR- ED	D. BE- LIEVED PRE- SENT	C. BE- LIEVED AB- SENT	8. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)			a. CONCEN- TRATION	b. MASS	8. LONG TERM AVERAGE VALUE		b. NO. OF ANAL- YSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCEN- TRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B. 1,4-Dichloro- benzene (106-46-7)			X												
23B. 3,3'-Dichloro- benzidine (91-94-1)			X												
24B. Diethyl Phthalate (84-66-2)			X												
25B. Dimethyl Phthalate (131-11-3)			X												
26B. Di-N-Butyl Phthalate (84-74-2)			X												
27B. 2,4-Dinitro- toluene (121-14-2)			X												
28B. 2,6-Dinitro- toluene (606-20-2)			X												
29B. Di-N-Octyl Phthalate (117-84-0)			X												
30B. 1,2-Diphenyl- hydrazine (as Azo- benzene) (122-66-7)			X												
31B. Fluoranthene (206-44-0)			X												
32B. Fluorene (86-73-7)			X												
33B. Hexa- chlorobenzene (118-71-1)			X												
34B. Hexa- chlorobutadiene (87-68-3)			X												
35B. Hexachloro- cyclopentadiene (77-47-4)			X												
36B. Hexachloro- ethane (67-72-1)			X												
37B. Indeno (1,2,3-cd) Pyrene (193-39-5)			X												
38B. Isophorone (78-59-1)			X												
39B. Naphthalene (91-20-3)			X												
40B. Nitrobenzene (98-95-3)			X												
41B. N-Nitro- sodimethylamine (62-75-9)			X												
42B. N-Nitrosodi- N-Propylamine (621-64-7)			X												

CONTINUED FROM THE FRONT

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT						4. UNITS		5. INTAKE (optional)			
	A. TEST ING RE- QUIR- ED	B. DE- LIVERED PWL- SENT	C. DE- LIVERED AD- SENT	A. MAXIMUM DAILY VALUE		B. MAXIMUM 30 DAY VALUE (if available)		C. LONG TERM AVRG. VALUE (if available)		D. NO. OF ANAL- YSES	A. CONCEN- TRATION	B. MASS	A. LONG TERM AVERAGE VALUE		D. NO. OF ANAL- YSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCEN- TRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B. N-Nitro- sodiphenylamine (86-30-6)			X												
44B. Phenanthrene (85-01-8)			X												
45B. Pyrene (129-00-0)			X												
46B. 1,2,4 - Tri- chlorobenzene (120-82-1)			X												
GC/MS FRACTION - PESTICIDES															
1P. Aldrin (309-00-2)			X												
2P. α -BHC (319-84-6)			X												
3P. β -BHC (319-85-7)			X												
4P. γ -BHC (58-89-9)			X												
5P. δ -BHC (319-86-8)			X												
6P. Chlordane (57-74-9)			X												
7P. 4,4'-DDT (50-29-3)			X												
8P. 4,4'-DDE (72-55-9)			X												
9P. 4,4'-DDD (72-54-8)			X												
10P. Dieldrin (60-57-1)			X												
11P. α -Endosulfan (115-29-7)			X												
12P. β -Endosulfan (115-29-7)			X												
13P. Endosulfan Sulfate (1031-07-8)			X												
14P. Endrin (72-20-8)			X												
15P. Endrin Aldehyde (7421-93-4)			X												
16P. Heptachlor (76-44-8)			X												

CONTINUED FROM V-8

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT						4. UNITS		5. INTAKE (optional)			
	a. TEST ING RE- QUIR- ED	b. BE- LIEVED PRE- SENT	c. BE- LIEVED AB- SENT	b. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANAL- YSES	a. CONCEN- TRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANAL- YSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES (continued)															
17P. Heptachlor Epoxide (1024-57-3)			X												
18P. PCB-1242 (53469-21-9)			X												
19P. PCB-1254 (11097-69-1)			X												
20P. PCB-1221 (11104-28-2)			X												
21P. PCB-1232 (11141-16-5)			X												
22P. PCB-1248 (12672-29-6)			X												
23P. PCB-1260 (11096-82-5)			X												
24P. PCB-1016 (12674-11-2)			X												
25P. Toxaphene (8001-35-2)			X												

EPA Form 3510-2C (Rev. 12-80)

PAGE V-9

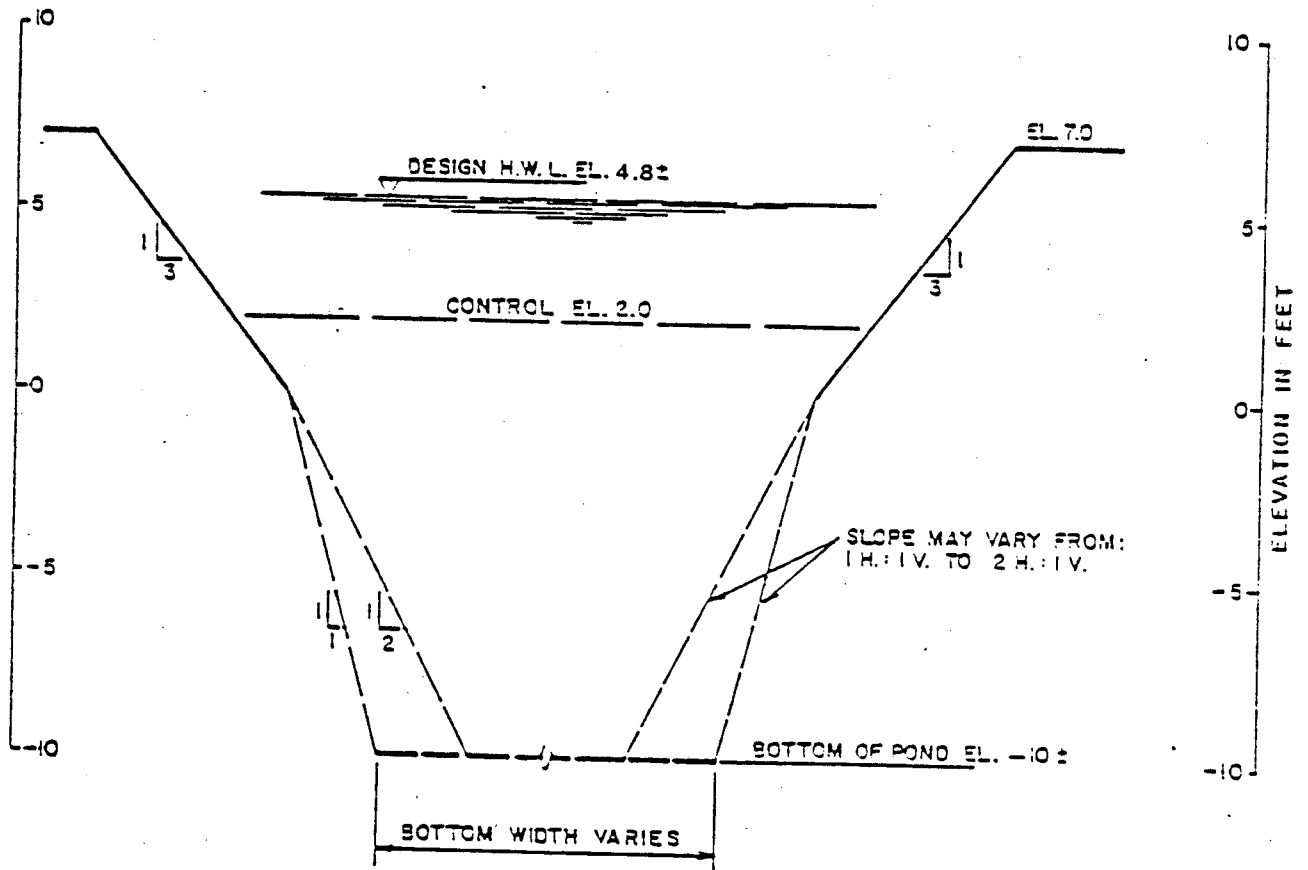
ATTACHMENT A

Resource Recovery Facility

The required stormwater retention will typically be provided by on-site dry retention swales and/or dry retention ponds. Disposal of retained water in these areas will be accomplished via percolation and evaporation processes. Excess runoff, beyond that which is retained in the retention areas will be conveyed to two ponds (pond 1 and pond 2). These ponds (See Figure 1 for typical cross section) which are approximately 3.4 and 4.3 acres in area, will be constructed at the southern and eastern portions of the RRF site (Figure 2). Detained water in the ponds will be released by controlled gravity discharge, via a weir/culvert structure to the C-11 canal in accordance with SFWMD discharge criteria. The ponds will be hydraulically connected with a single discharge at pond 2.

The major outfall structure for the site is located at Pond 2. It consists of a weir overflow structure (invert el. 2.0 ft. NGVD) with a pipe, sluice gate and a baffle for water quality and discharge control. An approximately 36-inch in diameter RCP connects the structure to the C-11 canal, which is the final discharge point for project drainage. Specifically, post development peak discharges from the resource recovery facility site, for the 25 year-72 hour design storm, will not exceed predevelopment levels. Peak discharge to the C-11 canal will be approximately 23 cubic feet per second (cfs) which is the estimated predevelopment discharge. Discharge velocities will be limited to below 4 feet per second, for erosion control purposes. The weir outfall control structure will be furnished with a baffle for oil, grease and sediment control. The invert of the weir will be set at elevation 2.3 feet NGVD. This elevation provides sufficient retention for water quality control. Elevation 2.0 feet NGVD is the established control elevation for the site. Water level in the ponds will rise to elevation 4.8 ft NGVD during the 25 year-72 hour storm. Ponds will be constructed with a 0.5 foot freeboard.

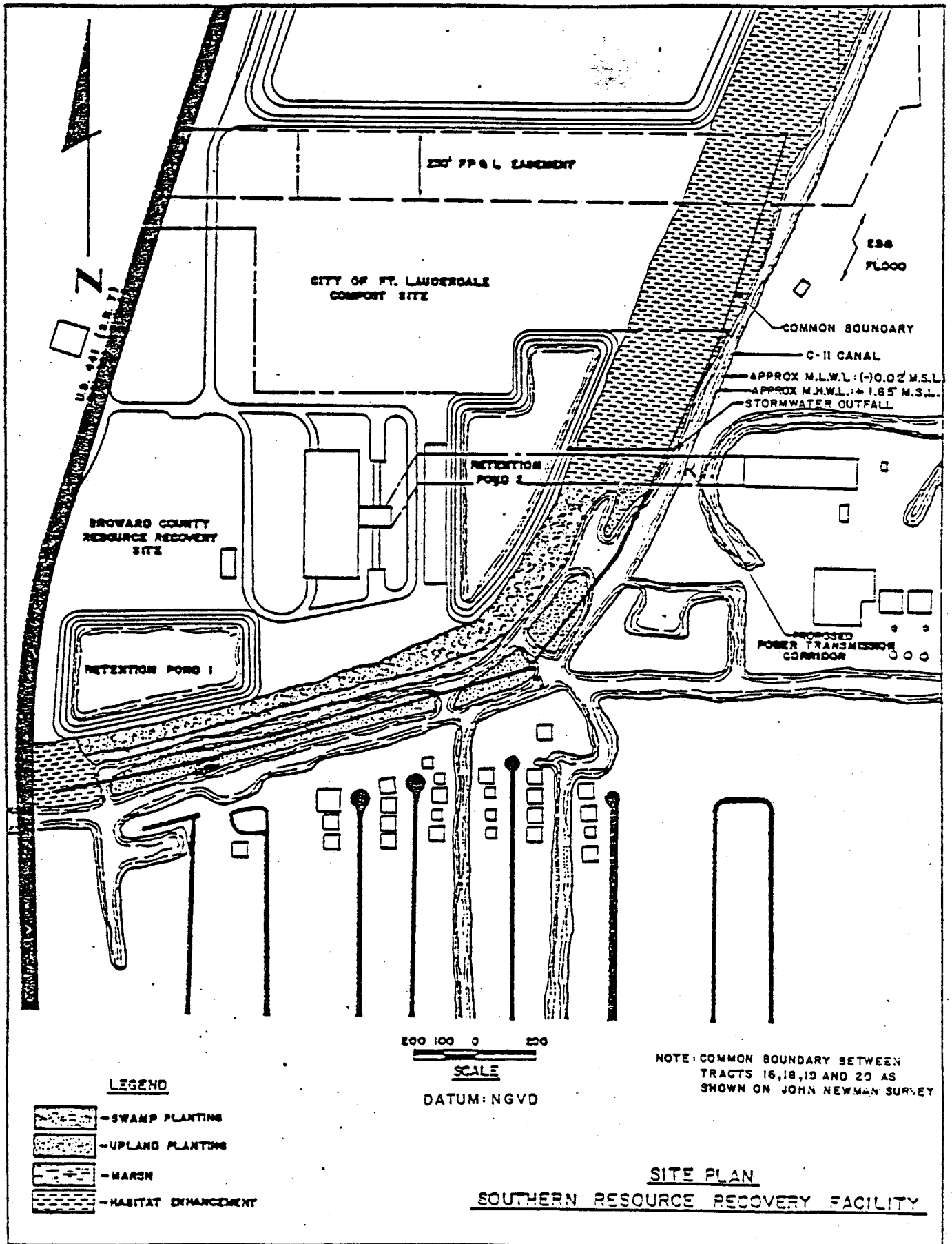
A berm will be constructed to contain water during dredging and filling. Sediment traps and screens will be strategically placed to trap runoff. All permanent berms constructed for the development will be grassed to prevent erosion.

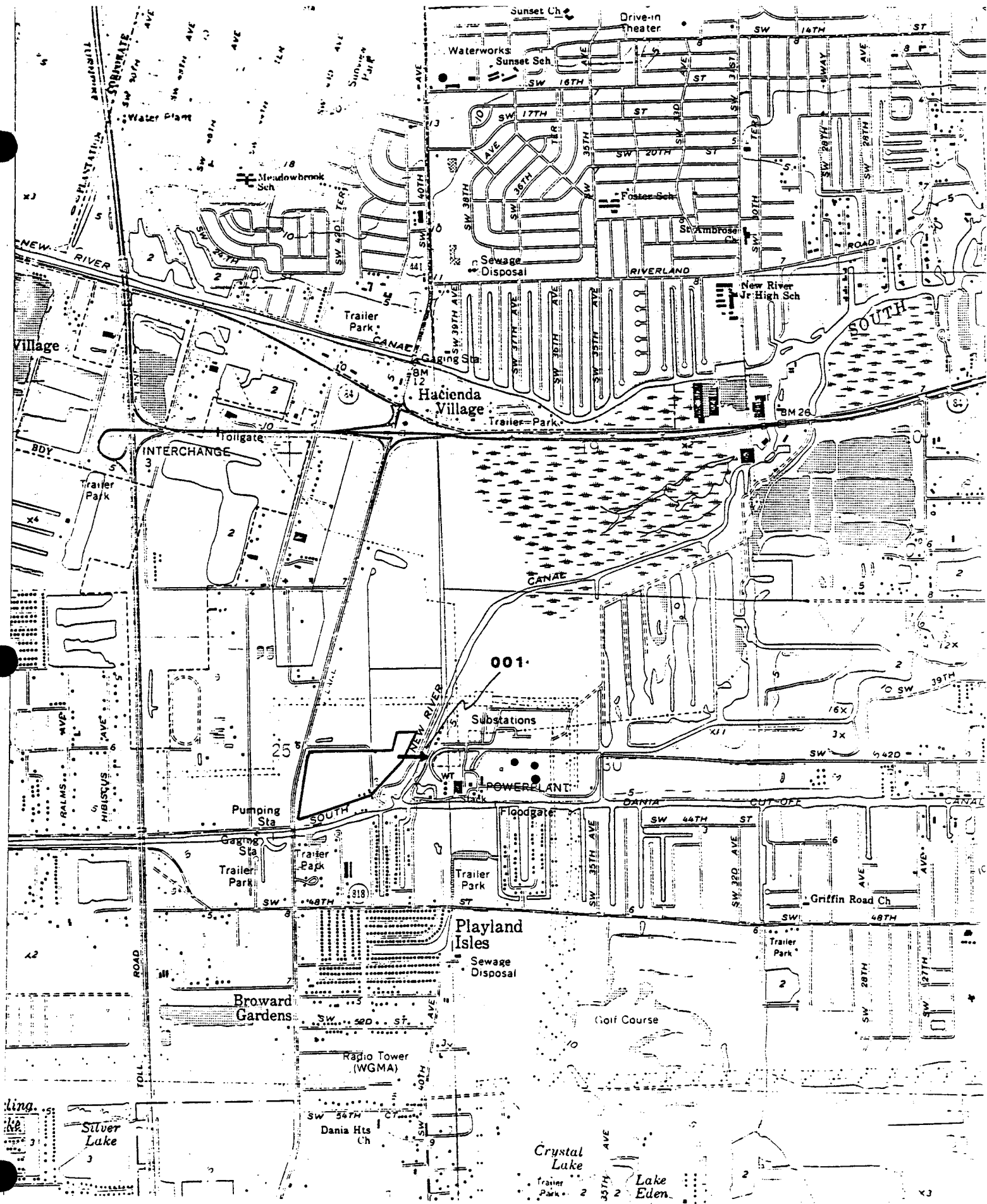


SCALES: HORIZ. 1" = 20'
VERT. 1" = 5'

DATUM:
FT, N.G.V.O

SOUTHERN RESOURCE RECOVERY FACILITY
TYPICAL POND CROSS SECTION DETAIL

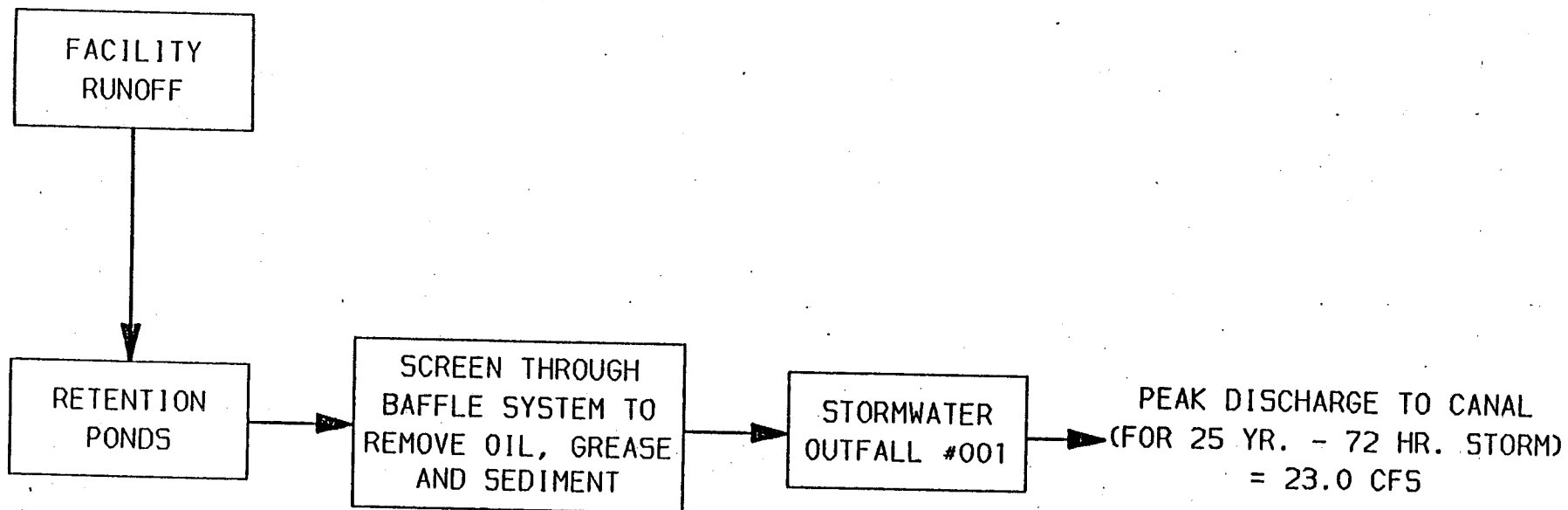




SCALE: 1:24,000

SITE LOCATION PLAN

BROWARD COUNTY
RESOURCE RECOVERY
ROUTE 441 SITE



BROWARD COUNTY
SOUTHERN RESOURCE RECOVERY FACILITY
STORMWATER OUTFALL

DESCRIPTION OF THE PROJECT

The Broward County Resource Recovery Project has been selected as the best alternative for meeting Broward County's long-term solid waste disposal needs. This facility will:

- o dispose of garbage and trash in an environmentally sound manner;
- o reduce the need for siting and developing a raw garbage landfill;
- o recover energy by using solid waste as a fuel to produce electricity and;
- o create new opportunities for recreation and wetland habitat enhancement through extensive mitigation.

The proposed southern facility will be located on a 248 acre tract in unincorporated Broward County at the southeast quadrant of the intersection of U.S. Route 441 and State Road 84.

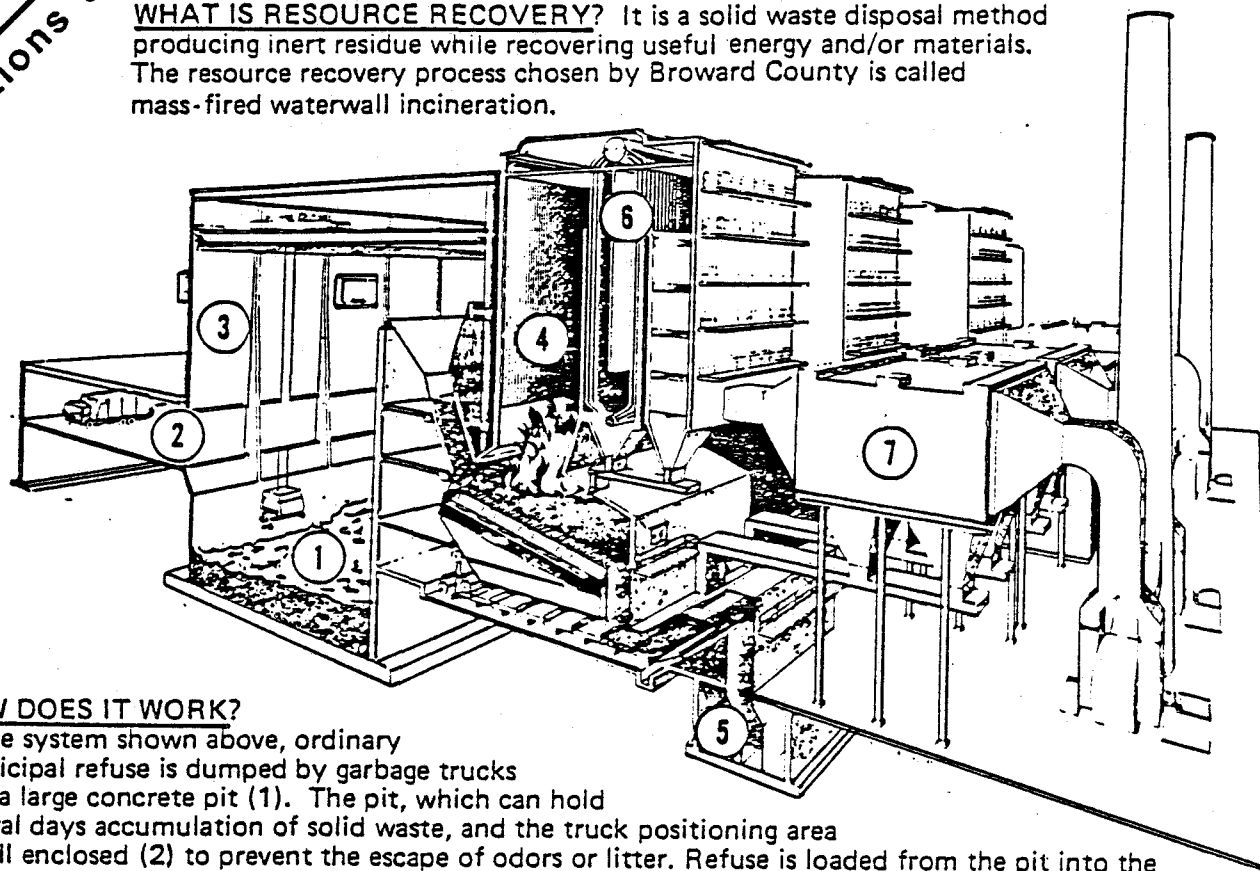
The facility is slated to have an initial installed capacity of 2,352 tons per day and an estimated projected ultimate capacity of approximately 3,300 tons per day. Since the proposed facility will utilize mass-burn technology, there will be no preprocessing of wastes at the facility prior to combustion. A schematic diagram describing the mass burn process of a typical resource recovery facility is presented in Figure 1. Solid waste will be delivered in collection trucks to the facility. It will be dumped directly into a bunker located entirely inside a building. All waste will be stored inside the building, therefore no waste will be visible from the outside. Two overhead cranes will mix the solid waste in the bunker and load the charging hoppers as required.

Waste will enter the furnace via a charging hopper and will progress through the combustion chamber by means of a stoker system that agitates the waste providing the proper air/fuel mixture to complete the combustion process. The

Questions & Answers

Broward County RESOURCE RECOVERY PROGRAM

WHAT IS RESOURCE RECOVERY? It is a solid waste disposal method producing inert residue while recovering useful energy and/or materials. The resource recovery process chosen by Broward County is called mass-fired waterwall incineration.



HOW DOES IT WORK?

In the system shown above, ordinary municipal refuse is dumped by garbage trucks into a large concrete pit (1). The pit, which can hold several days accumulation of solid waste, and the truck positioning area are all enclosed (2) to prevent the escape of odors or litter. Refuse is loaded from the pit into the furnace by a large overhead bridge crane (3). Oversized or unprocessable items (engine blocks, tree stumps, concrete rubble, etc.) which accidentally get into the pit can be removed at this point and either sent directly to the landfill, or put through a shredder for size reduction prior to being sent to landfill or sold.

In the furnace (4) the refuse is burned at high temperature and under controlled conditions of air and turbulence. The result is essentially complete destruction of organic material, (paper, plastic, wood, food wastes, etc.) leaving an ash residue (5) which contains the unburnable fraction (glass, metal, ceramics, etc.). This residue has a volume of five to ten percent of the original solid waste, thus lengthening the projected landfill lifetime by a factor of ten to twenty.

Hot gases from the combustion process pass up through the boiler portion (6) of the furnace where the heat is transferred to water-filled steel tubes. This heat is used to generate steam and ultimately electricity.

After passing through the boiler the hot gases pass through electrostatic precipitators (7) which act as giant filters removing the dust particles from the gas stream. The clean gases are then discharged at the stack.

HAS THIS METHOD OF RESOURCE RECOVERY BEEN SUCCESSFUL ELSEWHERE?

Yes. There are over 400 plants of this type in successful operation worldwide, some for as long as 30 years. There are about a dozen in the U. S., including Pinellas County, Florida; Saugus, Mass.; Hampton, Va.; Chicago, Ill.; Harrisburg, Pa.; and others. Several more are under construction.

WHAT ARE THE MAJOR ELEMENTS OF THE RESOURCE RECOVERY PROGRAM?

Broward County's resource recovery program consists of two major facilities. Serving the northern part of the County, a site north of Copans Road and west of Powerline Road will be developed to include a 1000 ton per day (tpd) resource recovery facility, and an 80 acre landfill for ash residue and unprocessable waste. A second facility, 1600 tpd in capacity, will serve the southern part of the County from a site at the intersection of SR 84 and Route 441. The southern facility will also include a landfill for ash residue and unprocessable wastes.

HOW WERE THESE SITES CHOSEN?

Broward County has been working on its resource recovery program for several years, and in that time more than 20 sites have been evaluated, for use as landfills, resource recovery facilities, or both. The site selection process included numerous reports, public meetings, and consultation with Federal, State, and local environmental officials. As a result of this process these two sites were chosen for the following reasons:

- (1) Adequate area is available to develop both the resource recovery facility and residue landfill at each site.
- (2) Each site is centrally located within the area of the County it is to serve, thus minimizing haul costs and traffic.
- (3) Each site is situated so that buffer areas and screening are available between the facilities and residential areas.
- (4) Each site is located and sized so that environmental impact will be manageable, and permits obtainable.

DO RESOURCE RECOVERY FACILITIES CAUSE ADVERSE HEALTH EFFECTS?

No. These facilities are tightly regulated by Federal, State, and local government and will be required to use the latest in state-of-the-art air pollution and other control equipment. Facilities of this type have been in successful operation around the world for over 30 years, many in densely populated urban areas, and no adverse health effects have been found.

WHAT IMPACT WILL THE RESOURCE RECOVERY PLANTS HAVE ON THE ENVIRONMENT?

Resource recovery facilities of the scale required in Broward County are major installations, and cannot be built and operated without some impact. Nevertheless, through proper siting, design, and operation, adverse environmental impacts can and will be reduced to negligible levels. Key issues are:

Air quality — The facilities will be equipped with the latest state-of-the-art air pollution control equipment. No visible smoke will be emitted from either facility, and high furnace temperatures will destroy all organic materials thereby preventing emission of odors.

Aesthetics — Each modern facility will be enclosed so that all garbage processing will take place indoors. This will prevent the attraction of scavenging animals (rodents, seagulls), and the escape of blowing refuse. Combustion air for the furnaces will be drawn from the tipping area, thereby preventing the escape of odors.

Traffic — Each resource recovery facility has been sited near major arterial routes to minimize local traffic impact. Analyses, using the County's TRIPS computer model, has demonstrated negligible traffic increases caused by the resource recovery facilities.

Ground Water — By replacing raw garbage landfills, the resource recovery program will, in fact, protect ground water in Broward County. The landfills which accompany each resource recovery facility will be for ash residue and unprocessable waste (construction debris and the like) only, and will include an impermeable liner and leachate collection system.

WHO IS GOING TO OWN AND OPERATE THESE FACILITIES?

These facilities will be leased from Broward County and operated by a private vendor. An extensive review of potential bidders is currently underway. The projects will be financed by thirty year bonds. Use of a private vendor will result in lower disposal charges thru available tax benefits.

For further information contact the Broward County Resource Recovery Office at 765-5844.

resulting ash will be deposited and quenched, and the heat from the furnace will be transferred through waterfilled steel tubes lining the furnace to produce steam. The steam will then be transmitted to turbine generators to produce electricity for sale to Florida Power and Light, Inc.

Each boiler will be equipped with an electrostatic precipitator (ESP) for particulate air emission control. An electrostatic precipitator is a pollution control device that removes small particles from exhaust gases. The gases pass through a strong electric field where the particles are charged and attracted to the opposite electrically charged collecting plates. The dust is then removed mechanically from these plates. The flue gas will be drawn through the ESPs by an induced draft fan located between the stack and the ESPs.

Bottom ash from the furnace and flyash from the precipitator will be mixed prior to removal from the facility. The combined ash will comprise 10 percent of the volume and 25 percent of the weight of the solid waste processed by the facility. The ash will be quenched with water to about 30 percent moisture prior to transport to the unprocessable waste landfill.

As noted above, while the proposed facility will have ultimate design capacity of approximately 3,300 tpd, its maximum initial installed capacity will be 2,352 tpd. Each boiler unit operates independently from the others. It will, therefore, be possible to routinely shut down units for periods of maintenance and inspection and still continuously operate the facility.

Assessment of Probable Project Impacts

As part of the Federal Consistency Evaluation Procedures, an assessment of the probable impacts of the project on the coastal zone were determined in relation to the Florida Coastal Management Program statutes.

Chapter 403, Environmental Control

The air and water pollution concerns will be addressed by obtaining the appropriate facility permits and using pollution control measures to abate impacts from facility construction and operations. Facility boilers will be equipped with electrostatic precipitators for particulate air emission control. Air construction and operating permits will be obtained through the Power Plant Siting Act process in accordance with requirements established in the Prevention of Significant Air Quality Deterioration (PSD) regulations and the regulation governing New Sources.

Stormwater retention basins will be used to collect runoff waters from the site. This discharge will comply with all DER requirements for protection of surface and groundwater.

Chapter 267, Archives, History and Records Management

The State of Florida Division of Archives, History and Records Management, has stated that there are no known or potential historical or archaeological resources at the site. Therefore, no significant cultural resources would be affected by the project.

Chapter 373 (Water Resources)

The South Florida Water Management District will review the project for water resources impacts. No consumptive use of water is anticipated therefore permits for such use do not apply. Monitoring wells will be installed to provide an early warning system of groundwater contamination and stormwater management practices will be employed to mitigate water resources impacts from runoff.

Power Plant Siting Act (PPSA)

An application is being filed with FDER under the power plant siting act. This application will present information discussing the conditions resulting from construction, and the anticipated impacts from facility operation in order to provide assurance that all applicable state, regional and local standards are met and that the project will be consistent with the FCMP.

Consistency Determination

The proposed project complies with Florida's Coastal Management Program and will be conducted in a manner consistent with that program.


Thomas M. Henderson
Project Director

ZONING DESCRIPTIONS/ZONING



General Counsel's Office
Room 248, Broward County Courthouse
Fort Lauderdale, Florida 33301
(305) 765-5105

November 9, 1983

Our File: 83-148

Department of the Army
Jacksonville District
Corps of Engineers
P. O. Box 4970
Jacksonville, Florida 32232

Attention: Mr. John F. Adams, Chief
Regulatory Division

Re: Broward County Resource Recovery Project

Gentlemen:

We are in receipt of your inquiry concerning the potential use of the Davie site for development of the referenced project. Since the jurisdictional location of this site is a critical factor in determining its acceptability, our office has been involved in investigating this matter. The legal background regarding the proposed Davie site is as follows.

On September 19, 1974, Ordinance No. 74-44 which called for a referendum election to annex the proposed site into the Town of Davie pursuant to Florida Statute 171.04 was passed. The subsequent referendum election, held October 1, 1974, resulted in the annexation of the proposed site into the Town of Davie.

The owner of the proposed site, Imagination Farms, Inc., subsequently brought suit against the Town of Davie requesting that the annexation be declared null and void. This case (Case 74-14130) resulted in a final judgment for the plaintiff since the subject lands were predominantly used for agricultural purposes and were not urban in character as required by Florida Statute 171.043. Included was the stipulation that in the event of any alteration, omission or addition to the consent judgment, both parties reserve the right to withdraw from the settlement, and the agreement shall become void. Section 171.031 of the Florida Statutes defines "urban purposes" to include land used for governmental purposes.

Department of the Army
Page Two
November 9, 1983

The Town of Davie has informed the County that it believes the agreement between the Town and Imagination Farms, Inc., is illegal and unenforceable since:

- Proper contraction (deannexation) procedures were not followed under F.S. Chp. 171.051, and the Judgment Order cannot substitute for these procedures.
- The Town counsel, who was party to the agreement, did not have the authority to override the ordinance and referendum which annexed the land originally; and,
- The contraction of the property out of the Town of Davie would violate F.S. Chp. 171.052, because it would create out parcels and areas not contiguous to the Town which is prohibited.

In addition, the Town of Davie has engaged legal counsel to defend its jurisdiction over the proposed site for the purpose of preventing the development of a resource recovery facility and/or landfill at this site.

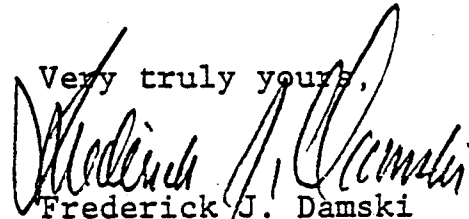
In summary, the information obtained during our investigation, indicates that there is considerable uncertainty as to whether the Davie site will ultimately be held to be within the corporate boundaries of the Town of Davie or in an unincorporated area. It is apparent that this issue will only be resolved through litigation. Should this litigation result in a confirmation of the Town of Davie's claim to jurisdictional authority, then the Town can prevent the County from developing this site for resource recovery. Regardless of the outcome of this litigation, the time required to complete this process will delay the implementation of the project beyond the exhaustion of the County's current waste disposal capabilities.

Based on the foregoing, implementation of the proposed project at the Davie site cannot be considered as an acceptable solution to the County's waste disposal needs. It is our opinion, therefore, that the Davie site is not feasible for development of the referenced project.

Department of the Army
Page Three
November 9, 1983

Should you have any questions regarding this matter, please do not hesitate to contact us.

Very truly yours,


Frederick J. Damski
Assistant General Counsel

FJD:lb1

TABLE OF CONTENTS

INTRODUCTION

CHRONOLOGICAL SUMMARY

Reference I	Development Review Committee Meeting January 19, 1984
Reference II	Broward County Zoning Board Meeting February 1, 1984 A. Public Hearings for Rezoning of Route 441 site. 1. Petition 5-Z-84 2. Petition 6-Z-84 B. Letters and Correspondence
Reference III	Broward County Board of County Commission- ers Meeting March 16, 1984
Reference IV	Copy of Ordinance #84-6(Z) April 23, 1984
Reference V	Copy of Ordinance #84-7(Z) April 23, 1984

INTRODUCTION

INTRODUCTION

This Compilation of Information - Route 441 Zoning and Land Use, Special Study Report is submitted in accordance with FAC rule 17-17.121(3)(1). The information presented is a compilation of Development Review Committee meeting minutes, Broward County Zoning Board meeting and public hearing notes and correspondence, Broward County Board of County Commissions meeting minutes, as well as Copies of Ordinances and related materials leading up to the rezoning of the Route 441 site to accommodate resource recovery development. A chronological summary of events is presented immediately following this section.

CHRONOLOGICAL SUMMARY

BROWARD COUNTY
RESOURCE RECOVERY PROJECT
ZONING AND LAND USE
CHRONOLOGICAL SUMMARY

- January 25, 1983 - The Board of County Commissioners authorizes staff to obtain appraisals, title information, owners' authority to proceed to rezone and to proceed with rezoning and begin negotiations toward the acquisition of two resource recovery/ash residue disposal sites (Agenda Item No. 65D).
- April 12, 1983 - The Board of County Commissioners:

Adopts the recommendation of the March 1983 Site Evaluation Report prepared by Malcolm Pirnie, Inc. (Agenda Item No. 68A).

Authorizes staff to secure all necessary information and to conduct negotiations for acquisition of the Route 441 site for resource recovery/disposal facilities (Agenda Item No. 68B).
- January 19, 1984 - The Broward County Development Review Committee votes to recommend to the Broward County Zoning Board the rezoning of the Route 441 Resource Recovery Project site from A-1, Limited Agricultural; B-3, General Business; M-1, Light Industrial, M-3, General Industrial and M-4, Limited Heavy Industrial to Planned Unit Development for Special Complexes.
- February 1, 1984 - The Broward County Zoning Board votes to recommend to the Board of County Commissioners the rezoning of the Route 441 Resource Recovery Project site from A-1, Limited Agricultural; B-3, General Business; M-1, Light Industrial; M-3, General Industrial and M-4, Limited Heavy Industrial to Planned Unit Development for Special Complexes.
- March 16, 1984 - The Board of Commissioners approve the rezoning of the Route 441 Resource Recovery Project site from A-1. Limited Agriculture; B-3, General Business; M-1, Light Industrial; M-3, General Industrial and M-4, Limited Heavy Industrial to Planned Unit Development for Special Complexes.

JANUARY 19, 1984 DEVELOPMENT REVIEW COMMITTEE MEETING



December 28, 1983

Office of Planning
Tarpon River Building
4th Floor, 955 S. Federal Highway
Fort Lauderdale, Florida 33316

DEVELOPMENT REVIEW COMMITTEE MEETING
January 19, 1984

AGENDA

The regular meeting of the Development Review Committee will be held on Thursday, January 19, 1984, at 9:00 a.m. in the Conference Room at SECRET WOODS PARK, 2701 West State Road 84, Fort Lauderdale, Florida, to discuss the following:

9:00 a.m. 1. Roll Call

2. Approval of the Minutes of January 5, 1984

3. VACATIONS

None

4. UNINCORPORATED AREA SUBMISSIONS

A) Preliminary Plats

1) Centra Care - Sample Road	23-48-42	46-UP-83
2) Taft Street Baptist Church	10-51-41	47-UP-83

B) Site Plans - Final

1) Ann Storck Center Inc.	13-50-41	58-SP-83
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C) Rezoning

1) Broward County Resource Recovery Office	25-50-41	5-Z-84 ✓
2) Broward County Resource Recovery Office		6-Z-84 ✓
24 & 25-50-41 and 19 & 30-50-42		
3) J & C Business Enterprising, Inc.	24-48-42	7-Z-84
4) Harry R. Volpe & Anne Volpe	24-48-42	8-Z-84
5) David L. St. Clair	23-50-39	9-Z-84
6) Morris Engelberg	31-50-42	10-Z-84
7) Ernesto Sartori	18-49-42	11-Z-84

D) Special Exception

1) City of Sunrise (Richard Coker)	16-50-41	1-SE-84
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BROWARD COUNTY BOARD OF COUNTY COMMISSIONERS

Marcia Beach Scott I. Cowan Howard Craft Howard C. Forman Jack Fried Nicki Englander Grossman Gerald F. Thompson
An Equal Opportunity Employer

DEVELOPMENT REVIEW COMMITTEE MEETING

January 19, 1984

Agenda - Page 2

5. MUNICIPAL SUBMISSIONS - Preliminary Plats

1) Petty Place (Deerfield)	3-48-42	145-MP-83
2) Huttig Plat (Deerfield)	2-48-42	146-MP-83
3) Bujalski Plat (Deerfield)	7-48-43	147-MP-83
4) Riverglen East (Deerfield)	33-47-42	148-MP-83
5) Broward Financial I (Hallandale)	27-51-42	149-MP-83
6) The Plaza (Davie)	12-50-40	150-MP-83
7) Taft Street Industrial Park (Hollywood)	8-51-42	151-MP-83
8) Stirling Trail West (Davie)	33-50-41	152-MP-83
9) Grenadier Lakes (C. Springs) Heard 6/2/82	17-48-41	42-MP-83
10) 26 Acres (Sunrise) Heard 6/18/81	19-49-41	76-MP-81

A REPRESENTATIVE MUST BE PRESENT IN ORDER FOR THE COMMITTEE TO REVIEW A SUBMISSION.

AS:lm

DEVELOPMENT REVIEW COMMITTEE MEETING
January 19, 1984

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A) Preliminary Plats

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2) Taft Street Baptist Church	10-51-41	47-UP-83
3) Falcon's Lea (Def. from 1/5/82 mtg.)	4-51-40	44-UP-83

B) Site Plans - Final

1) Ann Storck Center Inc.	13-50-41	58-SP-83
2) Cabana Bay Village	7-40-43	52-SP-81

C) Rezoning

1) Broward County Resource Recovery Office	25-50-41	5-Z-84 ✓
2) Broward County Resource Recovery Office 24 & 25-50-41 and 19 & 30-50-42		6-Z-84 ✓
3) J & C Business Enterprising, Inc.	24-48-42	7-Z-84
4) Harry R. Volpe & Anne Volpe	24-48-42	8-Z-84
5) David L. St. Clair	23-50-39	9-Z-84
6) Morris Engelberg	31-50-42	10-Z-84
7) Ernesto Sartori	18-49-42	11-Z-84

D) Special Exception

1) City of Sunrise (Richard Coker)	16-50-51	1-SE-84
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1) Petty Place (Deerfield)	4-48-42	145-MP-83
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3) Bujalski Plat (Deerfield)	7-48-43	147-MP-83
4) Riverglen East (Deerfield)	33-47-42	148-MP-83
5) Broward Financial I (Hallandale)	27-51-42	149-MP-83
6) The Plaza (Davie) (Withdrawn)	12-50-40	150-MP-83
7) Taft Street Industrial Park (Hollywood)	8-51-42	151-MP-83
8) Stirling Trail West (Davie)	33-50-41	152-MP-83
9) Grenadier Lakes (Coral Springs)	17-48-41	42-MP-83
10) 26 Acres (Sunrise)	19-49-41	76-MP-81
11) Alpine Center (Davie)	28-50-41	136-MP-83

COMMITTEE MEMBERS PRESENT

Dave Huizenga - Engineering Division
Irene Cooper - Traffic Engineering Division
Don Waldron - Broward County Planning Council
Raquel Pazos - Parks & Recreation Division
John Rains - Broward County Environmental Quality Control Board
Carl Burbridge - Water & Wastewater Division
Carl Burbridge - Solid Waste Division
George Gatterer - Building & Zoning Enforcement Division
Judy Carlson - Broward County Health Department
Duane Bateman - Florida Power & Light Company
Troy McDavid and J. Leroy Walden - Southern Bell Company
Ken Woods - Florida D.O.T.
Thomas R. Smith - Broward Sheriff's Office
Sanford Weber - Office of Planning - Development Review
Cyrena Rodgers - Office of Planning - Land Use

DEVELOPMENT REVIEW COMMITTEE MEETING

January 19, 1984

Page 2

COMMITTEE MEMBERS PRESENT. - Continued

Joe Houston - Fire Protection Division
Donald Kowell - Office of Planning (Chairman)
Dave Markward - Water Management Division

COMMITTEE MEMBERS ABSENT

Gloria Stephenson - Broward County School Board
Robert Trickel - Urban Forester
Glenn Margoles - Mass Transit Division
William Towery - Broward Soil & Water Conservation District
Robert Cunningham - Emergency Services Division
Steve Reel - South Florida Water Management District

Duane Bateman moved to approve the minutes of the meeting of January 5, 1984, subject to any additions and corrections (all corrections are to be forwarded to the Office of Planning in the next two days.). Irene Cooper seconded the motion and it was carried unanimously.

DEVELOPMENT REVIEW COMMITTEE MEETING

January 19, 1984

Page 8

REZONING

5-Z-84 Broward County Resource Recovery Office 25-50-41

6-Z-84 Broward County Resource Recovery Office 24 & 25-50-41 19 & 30-50-42

Representative: Phyllis A. Korab - Resource Recovery Office
Project Director for the Resource Recovery Program

Ms. Korab stated that they had reviewed the comments and had no problems with them. She added that they will continue to work with the agencies involved in this project in the future.

Cyrena Rodger of the Office of Planning - Land Use - had no comments.

Sanford Weber of the Office of Planning pointed out that this property is a portion of a Local Area of Particular Concern and a Urban Wilderness Area. The Office of Planning staff is in the process of finalizing an Environmental Impact Report as required by Ord. 81-16.

George Gatterer asked the representative if anyone had contacted General Counsel regarding whether this is a permitted use according to zoning.

Ms. Korab responded that General Counsel had been working with the Office of Planning in developing the P.U.D. special ~~conflicts~~ *Complex* zoning category.

5-Z-84

Raquel Pazos moved to let the rezoning proceed. Joe Houston seconded the motion and it was carried unanimously.

6-Z-84

Irene Cooper moved to let the rezoning proceed. Sanford Weber seconded the motion and it was carried unanimously.

FEBRUARY 1, 1984 BROWARD COUNTY ZONING BOARD MEETING

BROWARD COUNTY ZONING BOARD

DATE: FEBRUARY 1, 1984

TIME: 7:30 P.M.

LOCATION: ROOM 250 - COURTHOUSE

A G E N D A

A. ROLL CALL

B. MINUTES OF JANUARY 4, 1984

C. CORRESPONDENCE

D. CONTINUED LAND USE PLAN CONFORMITY PUBLIC HEARING:

1. 82-ZL-82
20-50-42

PETITIONER: OFFICE OF PLANNING
COUNTY COMMISSION DISTRICT #4

A. LOCATION:

Subject properties are located in the Southwest section of the County, South of State Road #84 and West of Ravenswood Road.

B. SIZE:

8.6 Acres

FROM: R-3 TO: M-1

E. SPECIAL EXCEPTION PUBLIC HEARING:

2. 1-SE-84
16-50-41

PETITIONER: CITY OF SUNRISE
COUNTY COMMISSION DISTRICT #4

A. LOCATION:

Subject property is located in the Southwest section of the County, South of S.R.384 and East of Pine Island Road.

B. SIZE:

2.5 Acres

Request for Special Exception to Permit the Continued Use of -- and Future Additions to -- A Wastewater Treatment Facility on a T-1 Zoned Site.

F. PUBLIC HEARINGS:

3. 5-Z-84
25-50-41

PETITIONER: B.C. RESOURCE RECOVERY OFFICE
COUNTY COMMISSION DISTRICT #4

A. LOCATION:

Subject parcel is located in the Southwest section of the County, on the North side of the South New River Canal and on the East side of State Road #7.

B. SIZE:

50.46 Acres

FROM: A-1, B-3, M-3, M-4
TO: PUD-Special Complex

4. 6-Z-84
24,25-50-41
19,30-50-42

PETITIONER: B.C. RESOURCE RECOVERY OFFICE
COUNTY COMMISSION DISTRICT #4

A. LOCATION:

Subject property is located in the Southwest section of the County, South of State Road #84 and on the East side of State Road #7.

B. SIZE:

197.87 Acres

FROM: A-1, B-3, M-1
TO: PUD-Special Complex

5. 7-Z-84
24-48-42

PETITIONER: J & C BUSINESS ENTERPRISING, INC.
COUNTY COMMISSION DISTRICT #2

A. LOCATION:

Subject parcel is located in the North-east section of the County, South of N.E. 34th Street, and West of Old Dixie Highway.

B. SIZE:

0.17 Acre

FROM: B-2 TO: B-3

6. 8-Z-84
24-48-42

A. LOCATION:

PETITIONER: HARRY R. VOLPE
COUNTY COMMISSION DISTRICT #2

Subject property is located in the Northeast section of the County, South of N.E. 34th Street and West of Old Dixie Highway.

B. SIZE:

0.17 Acre

FROM: R-2P TO: B-2

7. 9-Z-84
23-50-39

A. LOCATION:

PETITIONER: DAVID L. ST. CLAIR
COUNTY COMMISSION DISTRICT #3

Subject parcel is located in the Southwest section of the County, approximately one mile North of Orange Drive and one mile East of U.S.#27.

B. SIZE:

40.0 Acres

FROM: A-1 TO: A-4

8. 10-Z-84
31-50-42

A. LOCATION:

PETITIONER: MORRIS ENGELBERG, TRUSTEE
COUNTY COMMISSION DISTRICT #6

Subject parcel is located in the Southwest section of the County, on the North side of Stirling Road and West of S. W. 35th Avenue.

B. SIZE:

2.4+ Acres

FROM: A-1 TO: RS-0 Utilizing 5% Comm'l.
Flex of LUP

9. 11-Z-84
18-49-42

A. LOCATION:

PETITIONER: ERNESTO SARTORI
COUNTY COMMISSION DISTRICT #1

Subject parcel is located in the Northwest section of the County, South of Commercial Blvd., and West of N.W. 31st Avenue.

B. SIZE:

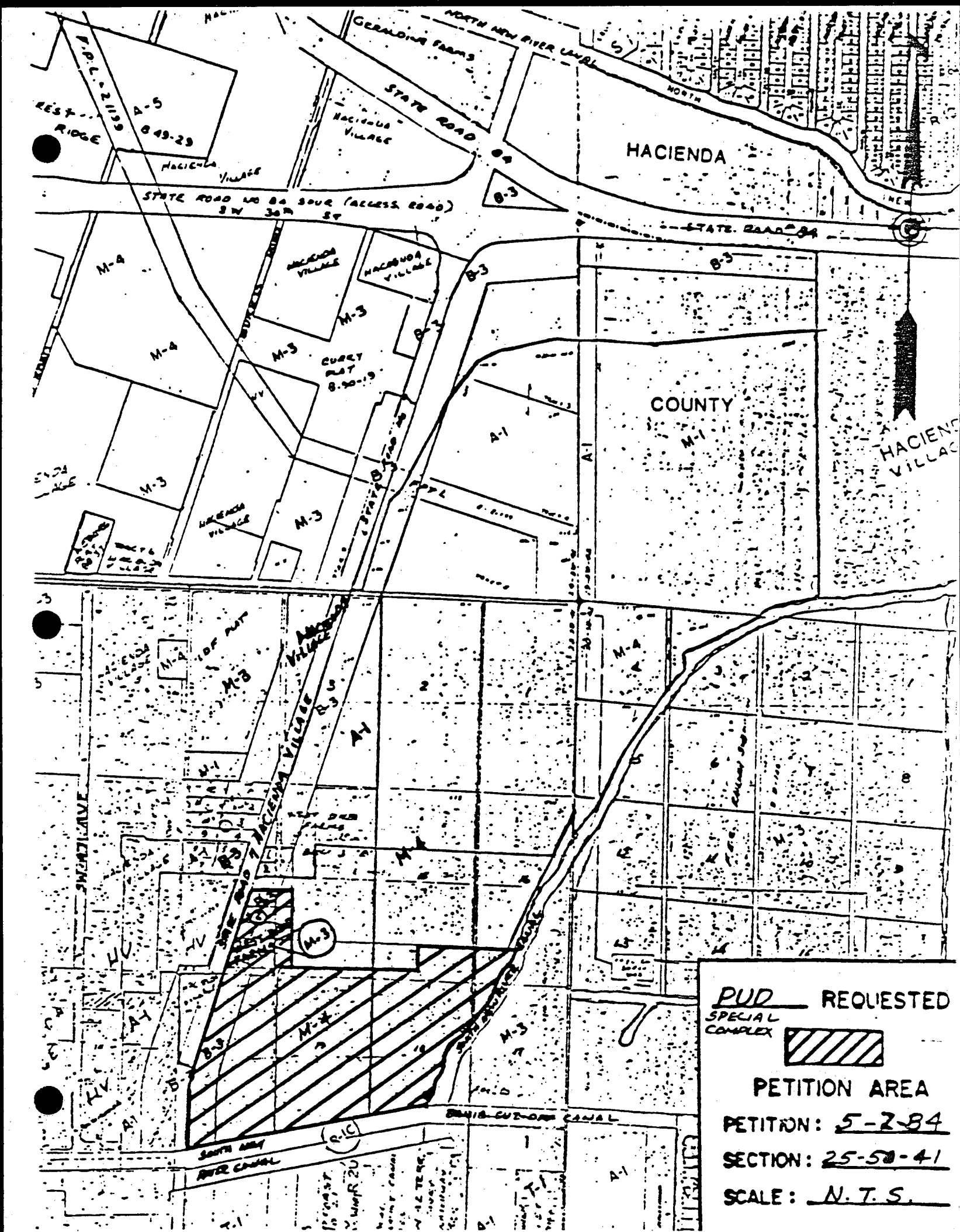
0.108 Acre

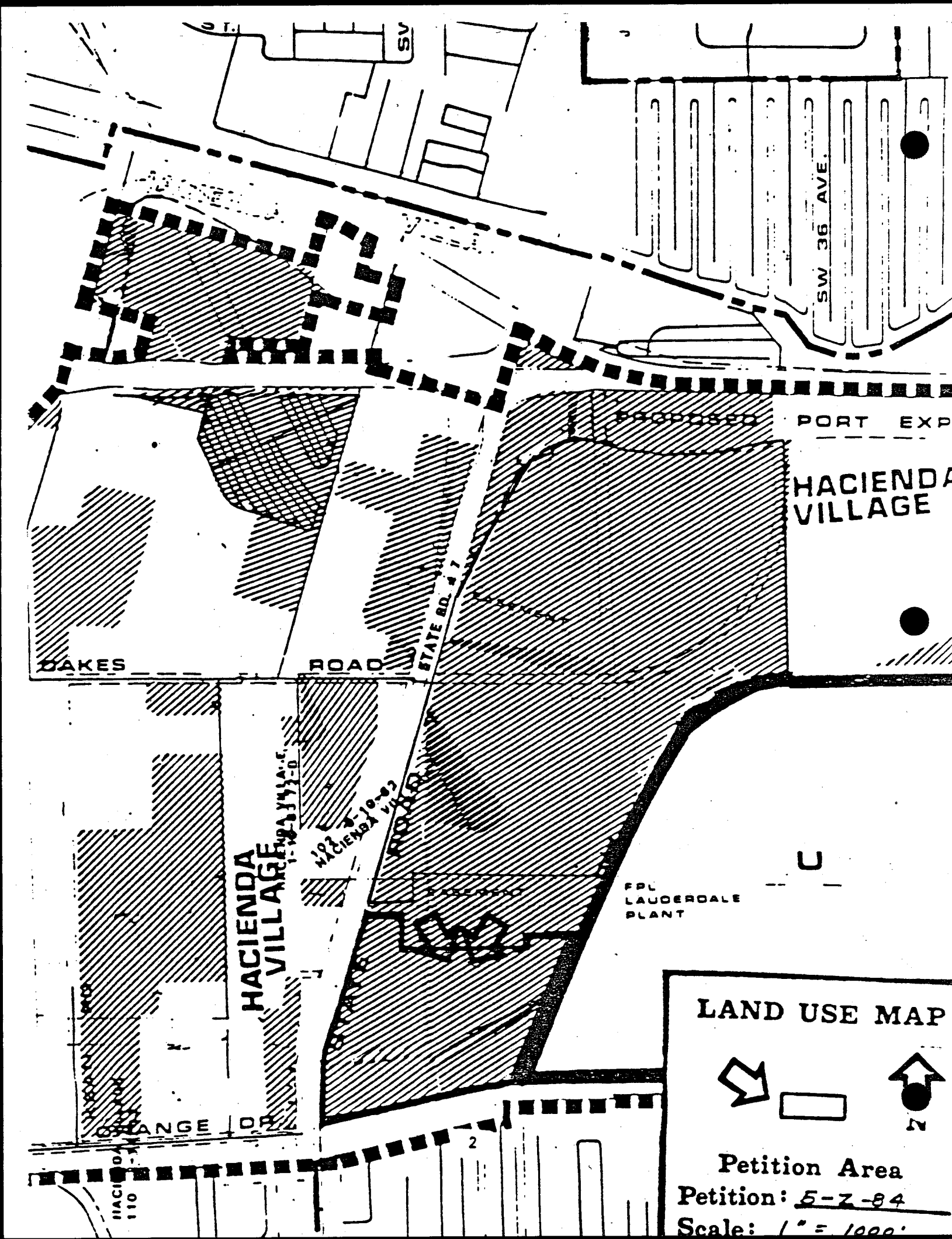
FROM: RM-5 TO: B-2 Utilizing 5% Flex of
the LUP

AGENDA ITEM #: 1

PETITIONER: BROWARD COUNTY RESOURCE
RECOVERY OFFICE

PETITION #: 5-2-84





STAFF REPORT FOR PETITION 5-2-84

PETITIONER: Broward County Resource Recovery Office

OWNER: Powell Brothers, Inc. and, Florida Power and Light Co.

LAND USE DESIGNATION: Industrial

EXISTING ZONING: A-1 Limited Agricultural, B-3 General Business
M-3 General Industrial, M-4 Limited Heavy Industrial

PROPOSED ZONING: PUD Special Complex

I. SITE CHARACTERISTICS:

A. LOCATION: Southwest section of County, on the North side of the South New River Canal and on the East side of State Road #7.

B. SIZE: 50.46 Acres

II. EXISTING LAND USE:

A. ON SITE: Industrial uses and vacant

B. ADJACENT:

North-vacant
South-New River Canal and
Industrial

East-New River Canal and F.P.L. power plant
West-Industrial and Commercial

III. ZONING HISTORY: All existing zoning approved prior to November, 1971

IV. DEVELOPMENT REVIEW COMMITTEE MEETING:

On January 19, 1984 the Committee transmitted the petition to the Zoning Board.

V. STAFF COMMENTS:

A. Findings of Fact:

1. Subjected site is designated industrial on the Broward County Land Use Plan.
2. Resource recovery/ash residue landfill is a utility (for solid waste disposal) and, as such, is an allowable use in an industrial designation of the Broward County Land Use Plan and the Unincorporated Land Use Plan.

3. The rezoning request for Planned Unit Development for Planned Special Complexes is in conformance with the permitted nonresidential uses listed under "Planned Special Complexes" (Section 39-883(b)(3) of the Broward County Zoning Code.
4. A portion of the resource recovery facility adjacent to the South Fork New River Canal (C-11) is included in the South Fork New River Urban Wilderness Area.
5. The portion of land proposed for ash residue waste landfill is within the designated South Fork New River Local Area of Particular Concern (LAPC) and the South Fork New River Urban Wilderness Area.
6. An environmental impact report has been prepared by the Office of Planning to fulfill the requirements of Section 5-182(i) of the Land Development Code (Ordinance 81-16) of Broward County with respect to LAPC's and Urban Wilderness Areas.
7. The Department of Environmental Regulations (D.E.R.) cannot issue a permit until the site is rezoned. During the permitting process, D.E.R. may conduct environmental studies.
8. The Resource Recovery Program meets the goals and objectives of the Broward County Land Use Plan, the UALUP, and the Solid Waste Sub-Element of the Broward County Comprehensive Plan.
9. Constructing a resource recovery facility on this site meets the goals and objectives of the BCLUP, UALUP and the Solid Waste Sub-Element and does not conflict with the goals and objectives and policies of the Coastal Zone Protection/Conservation Element.
10. The development of the ash/unprocessable waste landfill will eliminate fifty-one (51) acres of wetlands located within the LAPC and urban wilderness area. However, the proposed mitigation plan will provide for 47 acres on site and 15 acres off site.

B. Staff Recommendation:

Staff recommends approval of Petition 5-Z-84.

VI. ZONING BOARD RECOMMENDATION:

Approval

VERIFICATION OF COMPLIANCE OR NON-COMPLIANCE WITH THE UNINCORPORATED AREA

LAND USE PLAN MAP



Office of Planning
609 S. Andrews Avenue
2nd Floor
Fort Lauderdale, Florida 33301

DATE: January 5, 1984

FILE NUMBER: 5-Z-84

TYPE:

REZONING X

PLAT _____

SITE PLAN _____

ADMINISTRATIVE REPORT _____

OTHER _____

PETITIONER OR NAME: Broward County Resource Recovery Office

LAND USE PLAN DESIGNATION Industrial

REQUESTED: PUD - Special Complexes

X CONFORMS TO LAND USE PLAN MAP

_____ DOES NOT CONFORM TO LAND USE PLAN MAP

COMMENTS: STUDY AREA 21 FLEX ZONE 58

ADJACENT LAND USES: NORTH - Industrial
SOUTH - Hacienda Village
EAST - Utility
WEST - Hacienda Village; Industrial

ANY CONCURRENCE OR APPROVAL STATED HEREON IS BASED SOLELY ON THE TERMS OF THE UNINCORPORATED LAND USE PLAN MAP AND SHALL NOT BE CONSTRUED TO BE AN APPROVAL OR WAIVER OF REQUIREMENTS OF ANY OTHER CODE, ORDINANCE OR LAW.

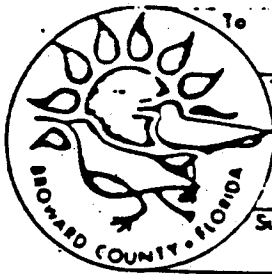
Cyrene Rodriguez
Authorized Signature

5.

LAND USE IMPLEMENTATION SECTION
OFFICE OF PLANNING

BROWARD COUNTY BOARD OF COUNTY COMMISSIONERS

Marcia Beach Scott I Cowan Howard Craft Howard C. Forman Jack Fried Nick Englander Grossman Gerald F. Thompson
An Equal Opportunity Employer



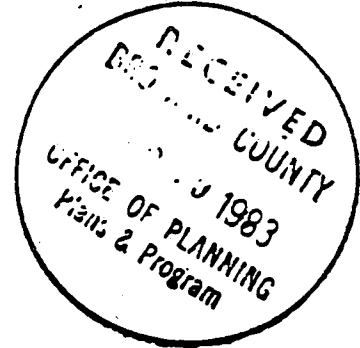
To: Roy H. Groves, Chief Planner
Office of Planning
Thru: Henry P. Cook, P. E.
Director
From: David P. Honaker, Right of Way Engineer
Engineering Division
Subject: REZONING PETITION NO. 5-2-84

INTEROFFICE
MEMORANDUM
PUBLIC WORKS
DEPARTMENT
ENGINEERING
DIVISION

Date
Dec. 22, 1984

This Division has no recommendations at this time regarding subject Petitions.

Additional comments may be forthcoming at the Development Review Committee Meeting of January 19, 1984.



HPC:DPH: mek

cc: Roger C. Travis
David P. Honaker
James B. Duncan



Resource Recovery Office
Governor's Club, Room 526
236 S.E. First Avenue
Fort Lauderdale, Florida 33301

MEMORANDUM

TO: Kelly Carpenter-Craft, AICP
Plan Implementation Director, Office of Planning

FROM: Phyllis A. Korab
Resource Recovery Project Director

RE: Rte 441 Resource Recovery Center Legal Descriptions for Rezoning Application

DATE: March 1, 1984

I have been advised that the updated legal descriptions you have requested in your February 27, 1984 memo to me should be available from Keith and Schnars by Friday, March 2, 1984.

Also, please find attached a copy for your information of a letter from Mr. William K. Fowler, FDOT District Engineer to F. T. Johnson dated February 27, 1984. In his letter Mr. Fowler explains his Department's perception of the impact the County's rezoning of this site would have in its negotiations with property owners affected by I-595 right-of-way acquisition.

PAK/bd
Attachment



February 27, 1984

Mr. F.T. Johnson
County Administrator
Room 248
Broward County Courthouse
Fort Lauderdale, Florida 33301

Dear Mr. Johnson:

After studying the rezoning issues for the development of a Resource Recovery Center within the southeast quadrant of State Road 7 and State Road 84, my administrative staff has recommended that we view these parcels as if the zoning had not been changed.

The intent of the rezoning initiated by Broward County is understood to be a developmental requirement for the public works project which would service all citizens of Broward County. The change of zoning is not intended to penalize nor benefit landowners whose property is being affected.

The Department plans to continue to actively negotiate these parcels based upon their present highest and best use. We are anxious to settle these parcels administratively and will continue to treat all property owners as fairly and equitably as possible.

Sincerely,

William K. Fowler
District Engineer

WKF/dc

Composed by Timothy A. Brown, typed by Doris Curry, phone 522-4211

ORIGINATOR: Timothy A. Brown / T. Michael Harris DATE: 2-24-84

✓	Referrals	Init.	Date	✓	Referrals	Init.	Date	✓	Referrals	Init.	Date
	DE				Ft. Laud. Maint.				Traffic Plans		
	DDE Ops.				W. Palm Maint.				Planning Eng.		
	DDE Prod.				Ft. Pierce Maint.				Engineer Services		
	Const. Eng.				Admin. Services				Design Eng.		
	W. Palm Const.				Production Eng.				PTO		
	Ft. Pierce Const.				Special Projects				✓ R/W Admin.		
	Ft. Laud. Const.				P D & E				Traffic Operations		
	Maint. Eng.				Prod. Management				Miami Testing		

8

DEVELOPMENT REVIEW COMMITTEE MEETING

January 19, 1984

Page 8

REZONING

✓ 5-Z-84 Broward County Resource Recovery Office 25-50-41
6-Z-84 Broward County Resource Recovery Office 24 & 25-50-41 19 & 30-50-42

Representative: Phyllis A. Korab - Resource Recovery Office
Project Director for the Resource Recovery Program

Ms. Korab stated that they had reviewed the comments and had no problems with them. She added that they will continue to work with the agencies involved in this project in the future.

Cyrena Rodger of the Office of Planning - Land Use - had no comments.

Sanford Weber of the Office of Planning pointed out that this property is a portion of a Local Area of Particular Concern and a Urban Wilderness Area. The Office of Planning staff is in the process of finalizing an Environmental Impact Report as required by Ord. 81-16.

George Gatterer asked the representative if anyone had contacted General Counsel regarding whether this is a permitted use according to zoning.

Ms. Korab responded that General Counsel had been working with the Office of Planning in developing the P.U.D. special conflicts zoning category.

5-Z-84

Raquel Pazos moved to let the rezoning proceed. Joe Houston seconded the motion and it was carried unanimously.

6-Z-84

Irene Cooper moved to let the rezoning proceed. Sanford Weber seconded the motion and it was carried unanimously.

Image Quality

As you review the next group of images, Please note that the original documents were of poor quality.

5-2-84 S.O. RESOURCE RECOVERY OFFICE

Parcel is located in the southwest section of the county, on the north side of the South New River Canal and on the east side of State Road 27, 50.45 acres from A-1, E-3, I-3, and I-4 to PUD-Special Complex. This petition was discussed simultaneously with Item #4 (6-2-84). Adjacent area to the north is vacant, to the south is New River Canal and Industrial, to the east is New River Canal and FF IL plant, and to the west is Industrial and Commercial. The site is Industrial and vacant and is designated Industrial on the County Land Use Plan. Ms. Carpenter-Craft spoke on behalf of the Office of Planning, stating the existing land use is Industrial and vacant. The purpose of this rezoning is to allow for resource recovery plant and ash and residue landfill to be used as a utility for solid waste disposal. The proposed use is an allowable use in an Industrial designation of the Broward County Land Use Plan and the Unincorporated Land Use Plan. The rezoning request for Planned Unit Development for Planned Special Complexes is in conformance with the permitted non-residential uses listed under "Planned Special Complexes", (Section 39-833(b)(3) of the Broward County Zoning Code. A portion of the resource recovery facility adjacent to the South New River Canal (C-11) is included in the South Fork New River Urban Wilderness Area. A portion of land proposed for the ash/residue waste landfill is within the designated South Fork New River Local Area of Particular Concern (LAPC) and the South Fork New River Urban Wilderness Area. An environmental impact report has been prepared by the Office of Planning to fulfill the requirements of Section 5-162(1) of the Land Development Code (Ordinance 81-16) of Broward County with respect to LAPC's and Urban Wilderness Areas.

The Department of Environmental Regulations (D.E.R.) cannot issue a permit until the site is rezoned. During the permitting process, DER may conduct environmental studies.

The Resource Recovery Program meets the goals and objectives of the Broward County Land Use Plan, the ULUP, and the Solid Waste Sub-Element of the Broward County Comprehensive Plan.

Constructing a resource recovery facility on this site meets the goals and objectives of the ULUP, ULUP and the Solid Waste Sub-Element and does not conflict with the goals and objectives and policies of the Coastal Zone Protection/Conservation Element.

The development of the ash/unprocessable waste landfill will eliminate fifty-one (51) acres of wetlands located within the LAPC and urban wilderness area. However, the proposed mitigation plan will provide for 47 acres on-site and 15 acres off-site replacement.

Staff recommends approval.

Phyllis Korab, the Director of the Broward County Resource Recovery Office spoke stating that this proposed zoning of approximately 247 acres is just one of the many tasks which must be accomplished in solving the extremely urgent solid waste program. The amount of solid waste to be disposed is projected at 3200 tons daily by the year 1987. The landfill owned by the County in Davie will reach capacity by the year 1986. There is a privately owned landfill in the central part of the county which is expected to cease operation in 1990.

waterwall

In January, 1983, the County Commission made a firm policy decision to come up with alternatives to our solid waste disposal problems. The technology that was selected as the best was called mass burning wall to wall Incineration. This would be a full service facility which the county would eventually agree to contract to design, construct and operate for twenty years with a 10-year option. Based on studies made, the best location was found to be the 441 site. The County Commission has authorized the staff to proceed with the rezoning for several reasons: The Resource Recovery Office must be able to move ahead with the rezoning before they can start the development of this project due to the fact it is on a tight time schedule. In addition, this would insure that strict measures will be in place to promote orderly development and to maintain the natural environment.

Mr. Bob Schneider of Malcolm Pirnie Engineering Consultants presented slides depicting the technology, and the site locations. He stated his firm has designed incinerators all over the United States and Europe, some of which have been in operation for years and have proven to be safe and cost effective. The system they are proposing would dispose of all the waste in the County for the next twenty years or more, including such things as stoves, refrigerators and similar materials. This is a completely different system than what we are now using and is not similar to the current situation such as raw landfill. The landfill would be for residue and not for combustible waste. There would be a northern and southern location to provide flexibility to minimize transportation costs so it would be more economically viable. Mr. Schneider stated that in 1981, his firm looked into a composting system and what they found to be the most reliable is the mass burning system shown here.

He then demonstrated, using slides, that the first step is when the waste leaves the trucks and is dumped into a closed facility, then into a storage pit. As part of the combustion process, air is required. The air that is used in the furnace is drawn from the tipping floor and storage pit and creates a negative vacuum which draws out the air. The heat kills the organic matter and also the odors. The temperature reaches as high as 2,000 degrees Fahrenheit. The waste is then introduced into a hopper and fed into a furnace and a stoker system to insure complete combustion. As the material continues, it is deposited into a quencher tank and cooled. It reaches complete burnout because of the very high degree of heat. When it is cold the ashes are taken out by conveyors and taken to a landfill.

The heat creates the steam which turns the conveyors. Gases produced in the combustion process are used to transfer the heat or energy to a series of water filled steel tubes which line the boiler system. This creates the steam which is used to turn the turbine generators which generate electricity, that will be sold to FP & L, which produces revenue for the project. The gases pass through economizers which serve to pre-heat the steam and then enter the electrostatic precipitators, which are air pollution control devices that act as giant filters to remove the impurities. Then the gases go out and are exhausted through the stack. He went on to explain that you can go to the facility and can't tell if it is operational because the atmosphere is clear.

Mr. Schneider then showed slides of similar facilities which his firm has designed in Bern, Switzerland and has been in operation since 1953. The steam that is generated is utilized by a chocolate factory located in a densely populated area. Other slides were shown of similar facilities in West Germany, northwest Chicago, which has been in operation since 1970, in Long Island and Massachusetts.

EXCERPTS FROM THE ZONING BOARD MINUTES: FEBRUARY 1, 1984

In selecting the 441 site, four studies were done including the impact on air, traffic, water, transportation, permitability, etc. Other aerial views were shown of the nearby, Powell Brothers Construction Company and the FP & L generating stations, which will be the major recipient of the electrical power.

An area of 50 acres will be devoted to the resource recovery, and 1600 and 2000 tons of waste will be processed daily. It was noted that 25 acres would be sufficient for this purpose, but they are setting aside fifty acres. There will be excellent buffering provided between the facility and 441.

Additional graphics were shown illustrating the air quality impact measured in micrograms per cubic meter. The air quality impact will be measured by the Broward County Environmental Quality Control Board and other regulatory agencies and must meet their standards in order to obtain permits. Other air impact studies will be made based on computer data from existing operating facilities. The total amount of air pollution must come below the maximum levels as required by the DER and other agencies. The engineering consultants state that the air impact is insignificant in view of their findings. They will have to monitor the air impact for 20 days and must be approved in order to obtain permits from the County, State and Federal agencies.

In regard to the traffic impact, studies were made utilizing the county, TRIPS program and the Average Daily Traffic Volumes report. Information was also secured from Florida Department of Transportation. The result was, there was a very small increase over the existing traffic on 441 and SR 64.

Another requirement by the County is to provide a synthetic impermeable liner for dumping the refuse and leachate. On top would be 18" to 24" of porous material to be installed and interspersed with perforated collection pipes. The unprocessable material will be taken off site to the Hollywood Wastewater treatment plant for disposal. Once the area is completed, it will be capped. This involves granular material, soil and a non-porous type of impermeable material to prevent rain water from entering and then top soil and vegetative cover.

In regard to run-off, a swale will enclose the landfill and run-off will be kept separate and not allowed to run in the South Fork New River.

In addition to the 32 permits required, a well system will be set up for detailed monitoring of the ground water and to verify that the liner is working. This will be an additional safeguard in respect to the leachate.

Mr. Huggins addressed the Local Area of Particular Concern (LAPC) and the environmental enhancement proposal of the project. Slides were presented showing the existing vegetation and some disturbed habitat. He stated the key element in the mitigation plan would be enhancement and replacement. The first step would be to set aside the land, then enhance the land, where appropriate. The plan is to leave some of the natural habitat and remove some exotic vegetation. Also, then land will be scraped in some areas to make some open water. Some land would be taken down to swamp and marsh land. There will be some planting of swamp and forest species, also fresh water species of plants. Included in the planting will be cypress, pineapple, red maple, palmettos, sawgrass and others. They will be trying some experimental plants and trees. Cypress trees will be used for buffering in some instances. The mole crickets will be controlled by pulling out and patrolling. Slides were shown

Illustrating how the melaleucads have taken over in some areas. Australian pines could be removed and replaced by high quality swamp species. Other aerial views were shown of the area along I-55 around the Powerline corridor. This was basically high quality swamp marsh and represents what is left of the swamp forest, and they plan to let this area remain as is.

Mr. Huggins reiterated that they have put a lot of thought and work into the best development of this area, not only technically but environmentally, and as the plan develops they will continue to monitor the environmental aspects of this project.

This concluded the applicant's presentation and the Zoning Board then began to question the applicant.

Mr. Edmond asked why the carbon monoxide level was so high. This question was answered by a representative of Malcolm Pirnie. He said the 8-hour readings were taken at a monitoring station at the intersection of SR 64 and 441 and it is influenced by the amount of traffic congestion.

Mr. Edmond then asked about when the landfills were capped after 20 years, would they be maintained. The applicant responded yes, they would be maintained.

Mr. Edmond questioned if access would be provided to the urban wilderness area. The applicant responded yes, the basic plan is to provide access by water but not by land. It would be accessible to small boaters. People will be prevented from entering the industrial area and it will be guarded by a screened fence.

Mr. Edmond asked what experience the consulting firm has had in transplanting cypress seedlings. The applicant responded that they have planted a fair number of species in the past, including cypress, and have had good luck and believe they will take and be successful. The plant will be obtained from the State and full grown trees from nurseries.

Mr. Tortora said we have heard, regarding other landfills about the problems of smells from the gas. The applicant responded that the gas is generated by combustion and the requirement is it be less than 1%.

Mr. Tortora asked where the off-site mitigation areas would be. The applicant responded that there are several sites - one north of SR 64 adjacent to the Admiralty Yards which includes 14 to 15 acres. Also the Tree Top Park would like to put in sawgrass habitat. Another area would be 74 acres to the west of 441 and near US 127. This is part of the land that once was water and will be maintained.

Ms. Fleisher asked if yard trimmings would be included. The applicant responded yes, they can be burned but because of the moisture it would hurt the amount of electricity used.

Mr. McTigue questioned how long the present site in Davie would continue to operate. The applicant responded that the plans are to eventually close it, but it would continue to operate until 1986, or until the new facility is built. The capacity is there and it may be possible to keep it in use longer if necessary. The long range plan is that the landfill site will be maintained and monitored as long as necessary and when it is closed it will be capped. After that possibly it may be turned into a recreational area.

EXCERPTS FROM THE ZONING BOARD MINUTES: FEBRUARY 1, 1984

Mr. Edmond questioned if there would be any public transportation or open forum meetings involved before permits are issued. The applicant answered that there are approximately 32 permits required involving matters such as air, water, and solid waste and these involve public participation prior to the issue of permits. In terms of sites selected, there might be some public participation. In some instances it would be at the option of the regulatory agencies and this might also involve public hearings.

Mr. Tortora brought up the subject of hazardous waste and asked about the possibility of industrial plants being able to dump this type of material. The applicant stated there would be no risk of hazardous waste. The county will provide the staff to monitor the operation. The county will give the operators of this facility the responsibility of seeing that there would be no hazardous waste and there will be a security gate and it will be carefully guarded. There will be a pit and you can see what you are putting into the incinerator.

Mr. DeLeo posed the question as to who the vendors will be. The applicant answered that the county received approximately 10 responses and they have narrowed this down to three firms who have been pre-qualified and have the financial backing to assume the risk. In the past 120 days, the prospective vendors have presented proposals and these are now being evaluated. These firms are familiar with landfill operations. The vendor chosen would build and operate the facility and the county would supervise.

The development order was discussed. Kelly Carpenter-Craft announced there have been four changes in the original development order and if anyone in the audience wishes a copy of the addendum, it is available.

At this time, Chairman Solomon said the hearing is open for public discussion.

Mr. Schwartz, agent for Mr. Kaufman who is the owner of adjacent property, spoke on this subject. His client owns 37-1/2 acres with some frontage on 441, which is near Oakes Road. They are mainly concerned about the rezoning from E-3 to PUD. He stated they have 2 appraisals on the property and he believes the proposed rezoning will definitely affect the price of the property. Mr. Schwartz said they are not against the resource recovery and they are personally working with Florida Department of Transportation and the county, and they have a contract with the state and understand their property will be taken. They are presently in negotiation with the state. Mr. Dooey, Assistant General Counsel, gave the legal opinion that a determination will be made based on the opinion of whether this action is arbitrary or unreasonable. If the Board determines it to be reasonable, the county has the power to take the property.

Mr. Farrell appeared on behalf of Mr. Stringfellow, owner of Woods Nursery, Inc., which fronts on 441. He wanted to address the question as to whether the county has the lawful authority to use this land without having to rezone it. He believes the answer to be yes. He went on to state he believes any governmental authority, having acquired the property, may utilize the property for any governmental purpose without the necessity of making any changes whatsoever in the existing zoning. Mr. Farrell said they have been involved in eminent domain cases before and believe any change in the zoning will have a potentially devastating effect, especially in regards to the price of the land. He is of the opinion that the value of the land is controlled by use and use is controlled by zoning. By changing the zoning, they have impaired the value.

Mr. Farrell said he was not aware of the statement that it is necessary to change the zoning in order to secure a permit from the DER. He believes that what the DER is looking for is assurance by the appropriate body that they are qualified to use the property for the purposes necessary. Mr. Farrell went on to state it may not be necessary to have the zoning designation changed in order to effect the purposes the Board seeks and might very well be accepted by the DER under the present zoning, and this, in turn will not have impaired the property rights of the owners.

Mr. Farrell asked consideration that his client's property not be included in the PUD.

Mr. Stringfellow, owner of Woods Nursery, spoke saying he runs a large retail nursery and has been in that location for many years. He needs approximately 7 or more acres to run his type of operation. He is concerned about how much damage may be done to his property and surrounding property, and

how the damage may be minimized. He said the county is still in the process of deciding how much of his property will be taken. The question was asked about how much of the property in question would be used for resource recovery and Mrs. Carpenter-Craft responded that the FP & L land was the only parcel not to be used for this project.

There was discussion as to whether the rezoning included any of the right-of-way taking by DOT for I-505. It was pointed out that the legal description should not include any right-of-way and that the legal description would be double checked prior to this item going to the County Commission.

Mr. Delee made a motion that a recommendation be made to the County Commission for an amendment that would exclude rezoning on the properties owned by Mr. Kaufman and Mr. Stringfellow, and it should remain as it exists. Motion was seconded by Ms. Marsicano. Motion was passed by, roll call vote.

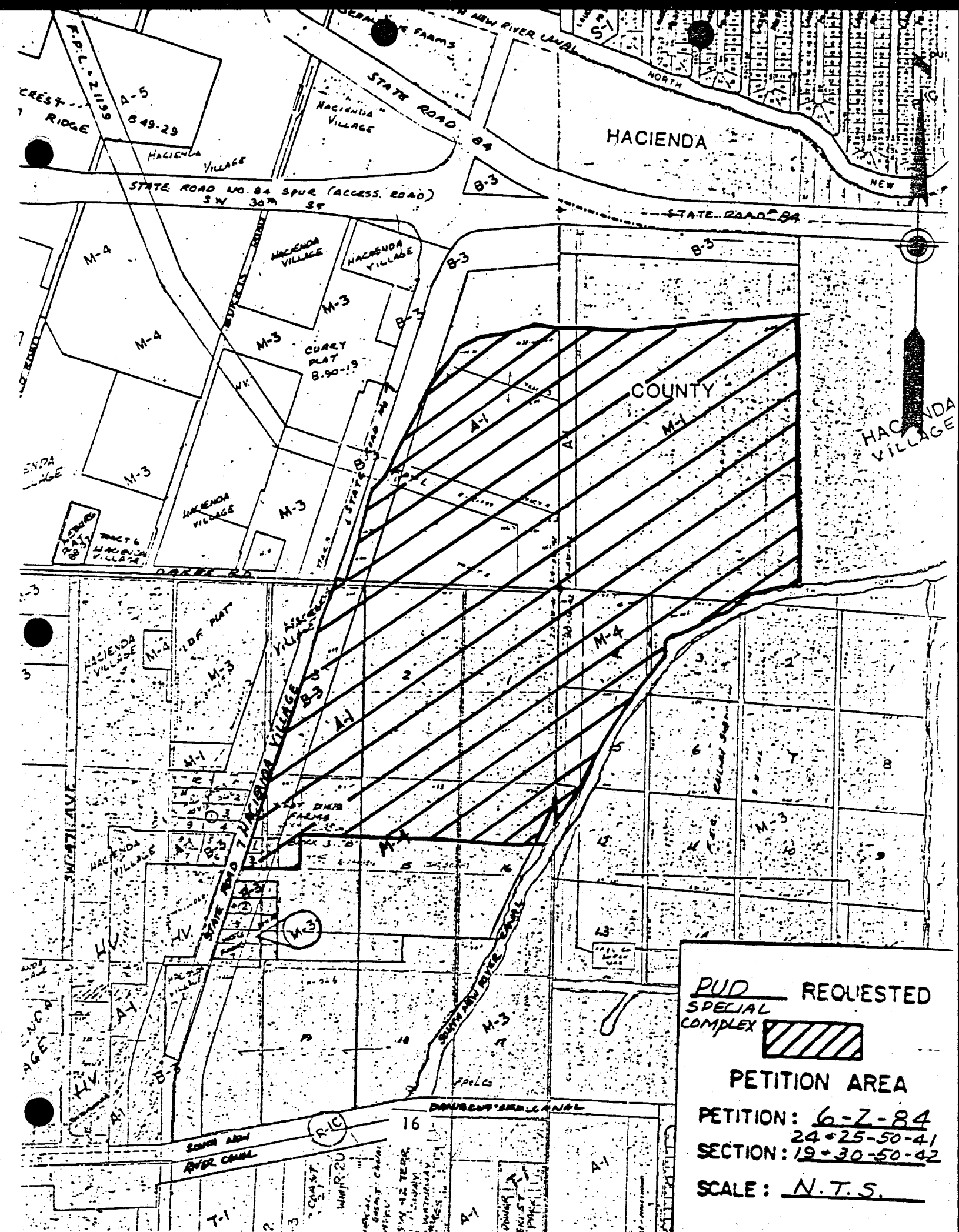
Mr. Brady made motion for approval, seconded by Ms. Marsicano. Motion was approved by, roll call vote, with Ms. Fleisher voting no.

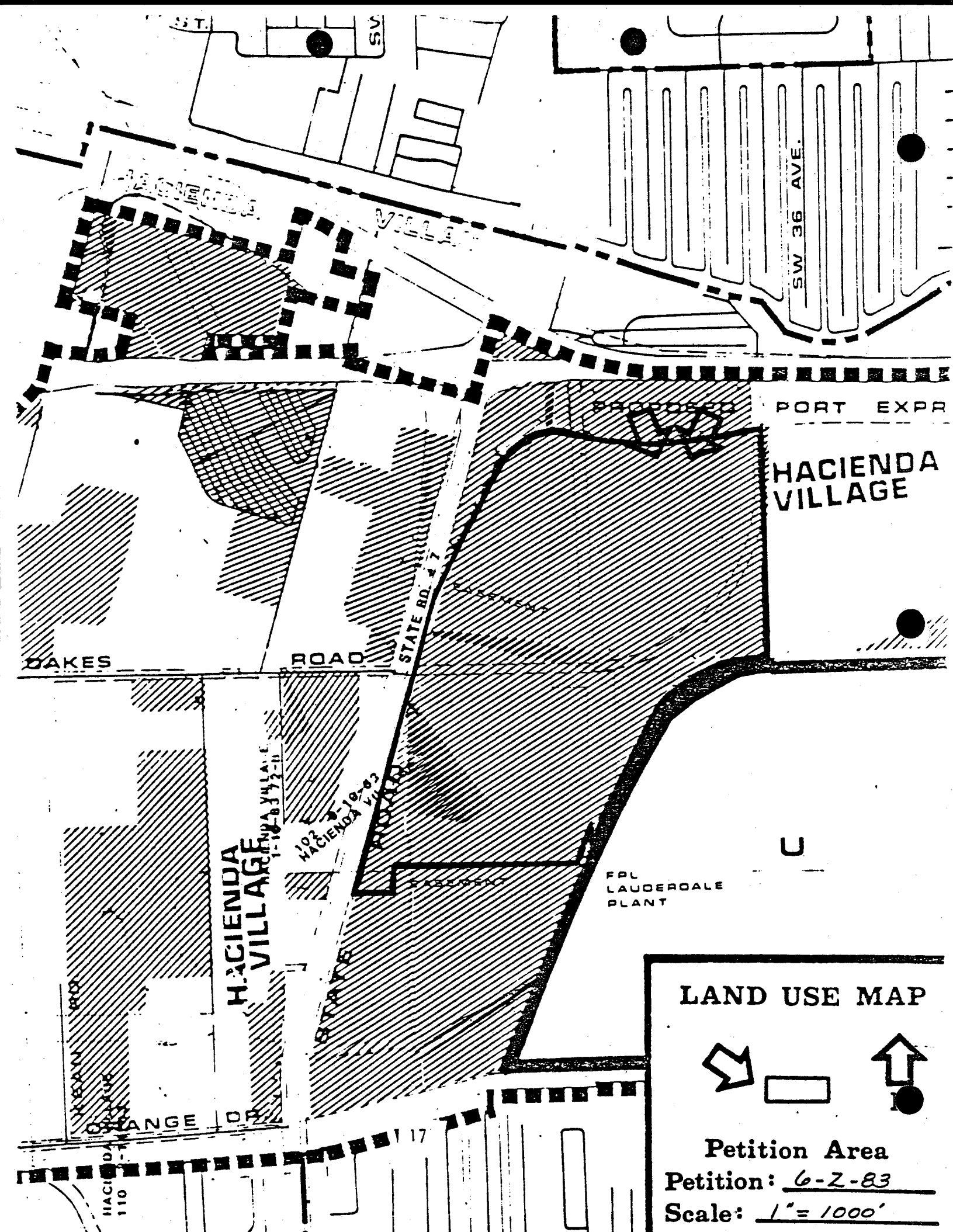
5-2-84 WILL BE RECOMMENDED TO THE COUNTY COMMISSION FOR APPROVAL

AGENDA ITEM #: 1

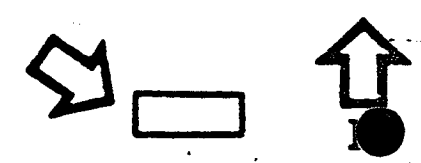
PETITIONER: BROWARD COUNTY RESOURCE
RECOVERY OFFICE

PETITION #: 6-2-84





LAND USE MAP



Petition Area
Petition: 6-2-83
Scale: 1" = 1000'

STAFF REPORT FOR PETITION 6-2-84

PETITIONER: Broward County Resource Recovery Office

OWNER: Multiple Ownership; see list in file

LAND USE DESIGNATION: Industrial

EXISTING ZONING: A-1 Limited Agricultural, B-3 General Business, and M-1
Light Industrial

PROPOSED ZONING:
PUD Special Complex

I. SITE CHARACTERISTICS:

A. LOCATION: Southwest section of the County, south of State Road #84 and
on the East side of State Road #7.

B. SIZE: 197.87 Acres

II. EXISTING LAND USE:

A. ON SITE: Several commercial uses and vacant

B. ADJACENT:

North-vacant
Souty-vacant

East-New River canal and vacant
West-Industrial and commercial uses

III. ZONING HISTORY:

All existing zoning approved prior to 1972.

IV. DEVELOPMENT REVIEW COMMITTEE MEETING:

On January 19, 1984, the Committee transmitted the petition to the Zoning Board.

V. STAFF COMMENTS:

A. Findings of Fact:

1. Subjected site is designated industrial on the Broward County Land Use Plan.
2. Resource recovery/ash residue landfill is a utility (for solid waste disposal) and, as such, is an allowable use in an industrial designation of the Broward County Land Use Plan and the Unincorporated Land Use Plan.

3. The rezoning request for Planned Unit Development for Planned Special Complexes is in conformance with the permitted nonresidential uses listed under "Planned Special Complexes" (Section 39-883(b)(3) of the Broward County Zoning Code.
4. A portion of the resource recovery facility adjacent to the South Fork New River Canal (C-11) is included in the South Fork New River Urban Wilderness Area.
5. The portion of land proposed for ash residue waste landfill is within the designated South Fork New River Local Area of Particular Concern (LAPC) and the South Fork New River Urban Wilderness Area.
6. An environmental impact report has been prepared by the Office of Planning to fulfill the requirements of Section 5-182(i) of the Land Development Code (Ordinance 81-16) of Broward County with respect to LAPC's and Urban Wilderness Areas.
7. The Department of Environmental Regulations (D.E.R.) cannot issue a permit until the site is rezoned. During the permitting process, D.E.R. may conduct environmental studies.
8. The Resource Recovery Program meets the goals and objectives of the Broward County Land Use Plan, the UALUP, and the Solid Waste Sub-Element of the Broward County Comprehensive Plan.
9. Constructing a resource recovery facility on this site meets the goals and objectives of the BCLUP, UALUP and the Solid Waste Sub-Element and does not conflict with the goals and objectives and policies of the Coastal Zone Protection/ Conservation Element.
10. The development of the ash/unprocessable waste landfill will eliminate fifty-one (51) acres of wetlands located within the LAPC and urban wilderness area. However, the proposed mitigation plan will provide for 47 acres on site and 15 acres off site.

B. Staff Recommendation:

Staff recommends approval of Petition 6-Z-84.

VI. ZONING BOARD RECOMMENDATION:

Approval

VERIFICATION OF COMPLIANCE OR NON-COMPLIANCE WITH THE UNINCORPORATED AREA

LAND USE PLAN MAP



Office of Planning
609 S. Andrews Avenue
2nd Floor
Fort Lauderdale, Florida 33301

DATE: January 5, 1984

FILE NUMBER: 6-Z-84

TYPE:

REZONING X

PLAT _____

SITE PLAN _____

ADMINISTRATIVE REPORT _____

OTHER _____

PETITIONER OR NAME: Broward County Resource Recovery Office

LAND USE PLAN DESIGNATION Industrial

REQUESTED: PUD - Special Complexes

X CONFORMS TO LAND USE PLAN MAP

_____ DOES NOT CONFORM TO LAND USE PLAN MAP

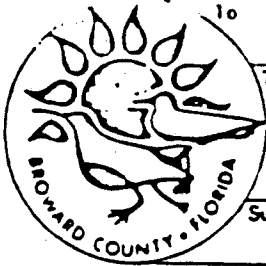
COMMENTS: STUDY AREA 21 FLEX ZONE 58

ADJACENT LAND USES: NORTH - Industrial
SOUTH - Industrial
EAST - Hacienda Village; Utility
WEST - Hacienda Village; Industrial

ANY CONCURRENCE OR APPROVAL STATED HEREON IS BASED SOLELY ON THE TERMS OF THE UNINCORPORATED LAND USE PLAN MAP AND SHALL NOT BE CONSTRUED TO BE AN APPROVAL OR WAIVER OF REQUIREMENTS OF ANY OTHER CODE, ORDINANCE OR LAW.

Cyrena Rodgers
Authorized Signature

LAND USE IMPLEMENTATION SECTION
OFFICE OF PLANNING



10
Ray H. Cook, Chief Planner
Office of Planning

Thru Henry P. Cook, P. E.

From Director *H.P. Cook*
David P. Honaker, Right of Way Engineer
Engineering Division *Les Spencer*

Subject REZONING PETITION NO. 6-Z-84

INTEROFFICE
MEMORANDUM

PUBLIC WORKS
DEPARTMENT
ENGINEERING
DIVISION

Date
Dec. 22, 1983

This Division has no recommendations at this time regarding subject Petition.

Additional comments may be forthcoming at the Development Review Committee Meeting of January 19, 1984.

HPC:DPH:mek

cc: Roger C. Travis
David P. Honaker
James B. Duncan

Comments
For
Development Review Committee Meeting

Subject: PLAT/SITE PLAN NO. _____ DATE Jan. 19, 1984
PLAT/SITE PLAN NAME _____
VACATION _____
REZONING 6-Z-84 Broward County Resource Recovery Office (Phyllis A. Korab)
LAND USE AMENDMENTS _____

I have reviewed the above referenced plat or site plan and my comments are as follows:

WE OBJECT TO THE INCLUSION IN THIS APPLICATION
FOR REZONING AS PROPERTY OWNERS OF
THE FOLLOWING LANDS:

1. 0125-03-0111
2. 0219-00-007

DEVELOPMENT REVIEW COMMITTEE MEETING

January 19, 1984

Page 8

REZONING

5-Z-84 Broward County Resource Recovery Office 25-50-41

✓ 6-Z-84 Broward County Resource Recovery Office 24 & 25-50-41 19 & 30-50-42

Representative: Phyllis A. Korab - Resource Recovery Office
Project Director for the Resource Recovery Program

Ms. Korab stated that they had reviewed the comments and had no problems with them. She added that they will continue to work with the agencies involved in this project in the future.

Cyrena Rodger of the Office of Planning - Land Use - had no comments.

Sanford Weber of the Office of Planning pointed out that this property is a portion of a Local Area of Particular Concern and a Urban Wilderness Area. The Office of Planning staff is in the process of finalizing an Environmental Impact Report as required by Ord. 81-16.

George Gatterer asked the representative if anyone had contacted General Counsel regarding whether this is a permitted use according to zoning.

Ms. Korab responded that General Counsel had been working with the Office of Planning in developing the P.U.D. special conflicts zoning category.

5-Z-84

Raquel Pazos moved to let the rezoning proceed. Joe Houston seconded the motion and it was carried unanimously.

6-Z-84

Irene Cooper moved to let the rezoning proceed. Sanford Weber seconded the motion and it was carried unanimously.

BROWARD COUNTY

BROWARD COUNTY OFFICE OF PLANNING

609 South Andrews Avenue
Ft. Lauderdale, Fl. 33301

765-5088

NOTICE OF PUBLIC HEARING ON PETITION FOR REZONING

The Broward County Zoning Board will hold a public hearing in the Commission Room (250) of the Broward County Courthouse in Ft. Lauderdale, Florida, at or after 7:30 P.M. on the date hereinafter specified. Comments of any interested party relative to this matter may be submitted in writing and/or may be presented in person at the hearing.

STAFF MEMBERS from the Office of Planning will conduct a question and answer period for the General Public at 6:30 P.M. prior to the start of the Public Hearing.

DATE OF HEARING: February 1, 1984

THIS MATTER SHOULD BE REFERRED TO AS ZONING PETITION:

PETITION: 5-Z-84
SECTION: 25-50-41

PETITIONER: BROWARD COUNTY RESOURCE RECOVERY OFFICE
COUNTY COMMISSION DISTRICT #4

AN ORDINANCE OF BROWARD COUNTY, FLORIDA, CHANGING THE ZONING DISTRICT BOUNDARIES BY REZONING A PARCEL OF LAND LYING WITHIN THE EAST ONE HALF (E 1/2) OF SECTION 25, TOWNSHIP 50 SOUTH, RANGE 41 EAST, BEING ALL OF TRACTS 18 AND 19 AND A PORTION OF TRACTS 15, 16 AND 20 OF THE JOHN W. NEWMAN SURVEY AS RECORDED IN PLAT BOOK 2, PAGE 26, OF THE PUBLIC RECORDS OF DADE COUNTY, FLORIDA, TOGETHER WITH ALL OF LOTS 4 THROUGH 8, INCLUSIVE OF BLOCK 2, WEST DIXIE FARMS AS RECORDED IN PLAT BOOK 24, PAGE 36, OF THE PUBLIC RECORDS OF BROWARD COUNTY, FLORIDA, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE EAST QUARTER (E 1/4) CORNER OF SAID SECTION 25; THENCE SOUTH 88° 34' 16" WEST ALONG THE SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4) OF SAID SECTION 25, A DISTANCE OF 491.85 FEET TO THE EASTERLY BOUNDARY OF AFORESAID TRACT 16, SAID POINT ALSO BEING THE POINT OF BEGINNING THENCE SOUTH 20° 05' 06" WEST, ALONG SAID EASTERLY BOUNDARY 492.28 FEET TO THE SOUTHEAST CORNER OF AFORESAID TRACT 18; THENCE SOUTH 35° 44' 42" WEST ALONG THE SOUTHEASTERLY BOUNDARY OF SAID TRACT 18, A DISTANCE OF 508.13 FEET; THENCE SOUTH 72° 06' 20" WEST, ALONG THE SOUTHERLY BOUNDARY OF SAID TRACT 18 AND AFORESAID TRACT 19, A DISTANCE OF 1053.32 FEET TO THE SOUTHEAST CORNER OF AFORESAID TRACT 20; THENCE SOUTH 76° 30' 24" WEST, ALONG THE SOUTHERLY BOUNDARY OF SAID TRACT 20, A DISTANCE OF 529.67 FEET TO THE EASTERLY RIGHT-OF-WAY LINE OF STATE ROAD NO. 7; THENCE NORTH 01° 51' 23" WEST, ALONG SAID EASTERLY RIGHT-OF-WAY LINE, 248.90 FEET; THENCE NORTHERLY ALONG SAID EASTERLY RIGHT-OF-WAY LINE AND ALONG THE ARC OF A TANGENT CURVE, CONCAVE TO THE EAST, HAVING A RADIUS OF 1810.08 FEET, A DELTA OF 16° 43' 20", AN ARC DISTANCE OF 528.28 FEET; THENCE TANGENT TO SAID CURVE NORTH 14° 51' 56" EAST ALONG SAID EASTERLY RIGHT-OF-WAY LINE, 1120.96 FEET; THENCE NORTH 88° 34' 16" EAST ALONG THE NORTH LINE OF SAID LOT 4, A DISTANCE OF 239.67 FEET TO THE NORTHEAST CORNER OF SAID LOT 4; THENCE SOUTH 01° 42' 40" EAST, ALONG THE EAST BOUNDARY OF LOTS 4 THROUGH 8 INCLUSIVE 524.08 FEET TO THE SOUTHEAST CORNER OF SAID LOT 8; THENCE NORTH 88° 34' 16" EAST, ALONG A LINE 50.00 FEET NORTH OF AND PARALLEL WITH THE AFORESAID SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4), 843.36 FEET; THENCE NORTH 01° 42' 40" WEST, 210.00 FEET, THENCE NORTH 88° 34' 16" EAST ALONG A LINE 260.00 FEET NORTH OF AND PARALLEL WITH THE SAID SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4) 648.41 FEET TO AFORESAID EASTERLY BOUNDARY OF TRACT 16; THENCE SOUTH 20° 05' 06" WEST, ALONG SAID EASTERLY BOUNDARY, 279.47 FEET TO THE POINT OF BEGINNING.

SAID PARCEL LYING WITHIN BROWARD COUNTY, FLORIDA, CONTAINING 50.46 ACRES MORE OR LESS.

SUBJECT TO RIGHTS OF WAY AND EASEMENTS OF RECORD; FROM A-1 LIMITED AGRICULTURAL, B-3 GENERAL BUSINESS, M-3 GENERAL INDUSTRIAL, AND M-4 LIMITED HEAVY INDUSTRIAL TO PUD SPECIAL COMPLEX; AND PROVIDING FOR AN EFFECTIVE DATE.

THE SUBJECT PROPERTY IS DESIGNATED FOR INDUSTRIAL DEVELOPMENT ON THE UNINCORPORATED BROWARD COUNTY LAND USE PLAN.

SUBJECT PARCEL IS LOCATED IN THE SOUTHWEST SECTION OF THE COUNTY, ON THE NORTH SIDE OF THE SOUTH NEW RIVER CANAL AND ON THE EAST SIDE OF STATE ROAD #7.

BROWARD COUNTY

BROWARD COUNTY OFFICE OF PLANNING

609 South Andrews Avenue
Ft. Lauderdale, Fl. 33301

765-5088

NOTICE OF PUBLIC HEARING ON PETITION FOR REZONING

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STAFF MEMBERS from the Office of Planning will conduct a question and answer period for the General Public at 6:30 P.M. prior to the start of the Public Hearing.

DATE OF HEARING: February 1, 1984

THIS MATTER SHOULD BE REFERRED TO AS ZONING PETITION:

SEE ATTACHED SUBJECT MATTER

PETITION: 6-7-84
SECTION: 24,25-50-41
19,30-50-42

PETITIONER: BROWARD COUNTY RESOURCE RECOVERY OFFICE
COUNTY COMMISSION DISTRICT #4

AN ORDINANCE OF BROWARD COUNTY, FLORIDA, CHANGING THE ZONING DISTRICT BOUNDARIES BY REZONING A PARCEL OF LAND LYING WITHIN SECTIONS 24 AND 25, TOWNSHIP 50 SOUTH, RANGE 41 EAST, AND SECTION 19 AND 30, TOWNSHIP 50 SOUTH, RANGE 42 EAST, SAID PARCEL ALSO BEING TRACTS 1 AND 2 AND A PORTION OF TRACT 3, 15 AND 16 IN SAID SECTION 25 AND A PORTION OF TRACTS 2, 3, 4 AND 5 OF TIER 1 IN SAID SECTION 24 OF THE JOHN W. NEWMAN SURVEY AS RECORDED IN PLAT BOOK 2, PAGE 26, OF THE PUBLIC RECORDS OF DADE COUNTY, FLORIDA AND A PORTION OF BLOCKS 2 AND 3, WEST DIXIE FARMS AS RECORDED IN PLAT BOOK 24, PAGE 36, OF THE PUBLIC RECORDS OF BROWARD COUNTY, FLORIDA, AND A PORTION OF LOTS 3, 4 AND 5 OF THE FLORIDA EAST COAST RAILWAY SUBDIVISION AS RECORDED IN PLAT BOOK "B", PAGE 142, OF THE PUBLIC RECORDS OF DADE COUNTY, FLORIDA, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE EAST QUARTER (E 1/4) CORNER OF SAID SECTION 25; THENCE SOUTH 88° 34' 16" WEST, ALONG THE SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4) OF SAID SECTION 25, A DISTANCE OF 491.85 FEET TO THE EASTERLY BOUNDARY OF AFORESAID TRACT 16; THENCE NORTH 20° 05' 06" EAST, ALONG SAID EASTERLY BOUNDARY, 984.08 FEET TO THE POINT OF BEGINNING; THENCE SOUTH

88° 38' 08" WEST ALONG A LINE 409.00 FEET SOUTH OF AND PARALLEL WITH THE NORTH LINE OF SAID TRACT 16 AND AFORESAID TRACT 15 AND WEST DIXIE FARMS, 1626.40 FEET; THENCE SOUTH 01° 42' 50" EAST ALONG A LINE 433.00 FEET WEST OF AND PARALLEL WITH THE EAST BOUNDARY OF SAID WEST DIXIE FARMS 229.64 FEET; THENCE SOUTH 88° 34' 16" WEST ALONG A LINE 8.83 FEET NORTH OF AND PARALLEL WITH THE NORTH LINE OF LOT 3 OF AFORESAID BLOCK 2, A DISTANCE OF 385.0 FEET, TO THE EASTERLY RIGHT-OF-WAY LINE OF STATE ROAD NO. 7 (100' WIDE RIGHT-OF-WAY); THENCE NORTH 14° 51' 56" EAST ALONG SAID RIGHT-OF-WAY LINE 2,032.16 FEET; THENCE CONTINUE ALONG SAID RIGHT-OF-WAY LINE, NORTH 15° 02' 23" EAST, 35.35 FEET TO A POINT OF INTERSECTION WITH THE NORTH RIGHT-OF-WAY LINE OF OAKS ROAD; THENCE NORTH 88° 41' 58" EAST, ALONG SAID NORTH RIGHT-OF-WAY LINE 71.72 FEET TO A POINT OF INTERSECTION WITH THE PROPOSED LIMITED ACCESS LINE AS SHOWN ON FLORIDA DEPARTMENT OF TRANSPORTATION RIGHT-OF-WAY MAP FOR STATE ROAD NO. 862. (1-595) SHEET 6 OF 9, DATED NOVEMBER, 1981: THENCE ALONG SAID LIMITED ACCESS LINE THE FOLLOWING NINE (9) COURSES AND DISTANCES: THENCE NORTH 15° 01' 35" EAST, 645.68 FEET; THENCE NORTH 43° 15' 17" EAST, 109.67 FEET; THENCE NORTH 26° 24' 46" EAST, 541.56 FEET; THENCE NORTH 22° 49' 40" EAST, 98.27 FEET; THENCE NORTH 36° 53' 09" EAST, 379.73 FEET; THENCE NORTH 62° 27' 20" EAST, 178.19 FEET; THENCE, NORTH 79° 24' 18" EAST, 356.52 FEET; THENCE NORTH 89° 37' 32" EAST, 642.81 FEET; THENCE NORTH 77° 33' 36" EAST, 1096.41 FEET; THENCE SOUTH 03° 32' 53" EAST, ALONG A LINE 3,478.00 FEET WEST OF AND PARALLEL WITH THE EAST LINE OF AFORESAID SECTION 19, A DISTANCE OF 1,836 FEET MORE OR LESS TO THE NORTHERLY WATERS OF THE SOUTH NEW RIVER CANAL; THENCE WESTERLY AND SOUTHWESTERLY ALONG THE NORTHERLY AND WESTERLY WATERS OF THE SAID SOUTH NEW RIVER CANAL TO A POINT OF INTERSECTION WITH THE EAST BOUNDARY OF AFORESAID RANGE 41 EAST; THENCE NORTH 01° 46' 20" WEST ALONG SAID EAST BOUNDARY 161.16 FEET MORE OR LESS TO A POINT 95.31 FEET SOUTH OF THE NORTHEAST CORNER OF AFORESAID TRACT 16; THENCE SOUTH 20° 05' 06" WEST ALONG THE EASTERLY BOUNDARY OF SAID TRACT 16, A DISTANCE OF 337.04 FEET TO THE POINT OF BEGINNING.

SAID PARCEL LYING WITHIN BROWARD COUNTY, FLORIDA, CONTAINING 197.87 ACRES, MORE OR LESS.

SUBJECT TO RIGHTS-OF-WAY AND EASEMENTS OF RECORD; FROM A-1 LIMITED AGRICULTURAL, B-3 GENERAL BUSINESS, AND M-1 LIGHT INDUSTRIAL TO PUD SPECIAL COMPLEX; AND PROVIDING FOR AN EFFECTIVE DATE.

THE SUBJECT PARCEL IS DESIGNATED FOR INDUSTRIAL DEVELOPMENT ON THE UNINCORPORATED BROWARD COUNTY LAND USE PLAN.

SUBJECT PROPERTY IS LOCATED IN THE SOUTHWEST SECTION OF THE COUNTY, SOUTH OF STATE ROAD #84 AND ON THE EAST SIDE OF STATE ROAD #7.

5-2-84

BROWARD COUNTY OFFICE OF PLANNING

609 S. Andrews Avenue, 2nd Floor

Ft. Lauderdale, FL 33301

Phone: 765-5088

NOTICE OF PUBLIC HEARING ON PETITION FOR REZONING

The Board of County Commissioners will hold a public hearing in the Commission Meeting Room (250) of the Broward County Courthouse in Ft. Lauderdale, Florida, at or after 10:00 A.M., on the date herein-after specified. Comments of any interested party relative to this matter may be submitted in writing and/or may be presented in person at the hearing.

PLEASE BE ADVISED that in order to appeal a decision made by the Zoning Board or County Commission, it may be necessary for the appealing party to provide a verbatim transcript of the proceedings. This notice is given pursuant to the laws of Florida; Chapter 80-150.

CASE FILES AND MAPPING regarding all zoning petitions, as well as the Broward County Zoning Code, are available for public inspection in the Office of Planning, 609 South Andrews Avenue, Fort Lauderdale, FL.

Please see the map on the reverse side of this notice for the exact location of the property under consideration for rezoning.

DATE OF HEARING: March 16, 1984

SEE ATTACHED

PETITION: 5-2-84
SECTION: 25-50-41

PETITIONER: BROWARD COUNTY RESOURCE RECOVERY OFFICE
COUNTY COMMISSION DISTRICT #4

AN ORDINANCE OF BROWARD COUNTY, FLORIDA, CHANGING THE ZONING DISTRICT BOUNDARIES BY REZONING A PARCEL OF LAND LYING WITHIN THE EAST ONE HALF (E 1/2) OF SECTION 25, TOWNSHIP 50 SOUTH, RANGE 41 EAST, BEING ALL OF TRACTS 18 AND 19 AND A PORTION OF TRACTS 15, 16 AND 20 OF THE JOHN W. NEWMAN SURVEY AS RECORDED IN PLAT BOOK 2, PAGE 26, OF THE PUBLIC RECORDS OF DADE COUNTY, FLORIDA, TOGETHER WITH ALL OF LOTS 4 THROUGH 8, INCLUSIVE OF BLOCK 2, WEST DIXIE FARMS AS RECORDED IN PLAT BOOK 24, PAGE 36, OF THE PUBLIC RECORDS OF BROWARD COUNTY, FLORIDA, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

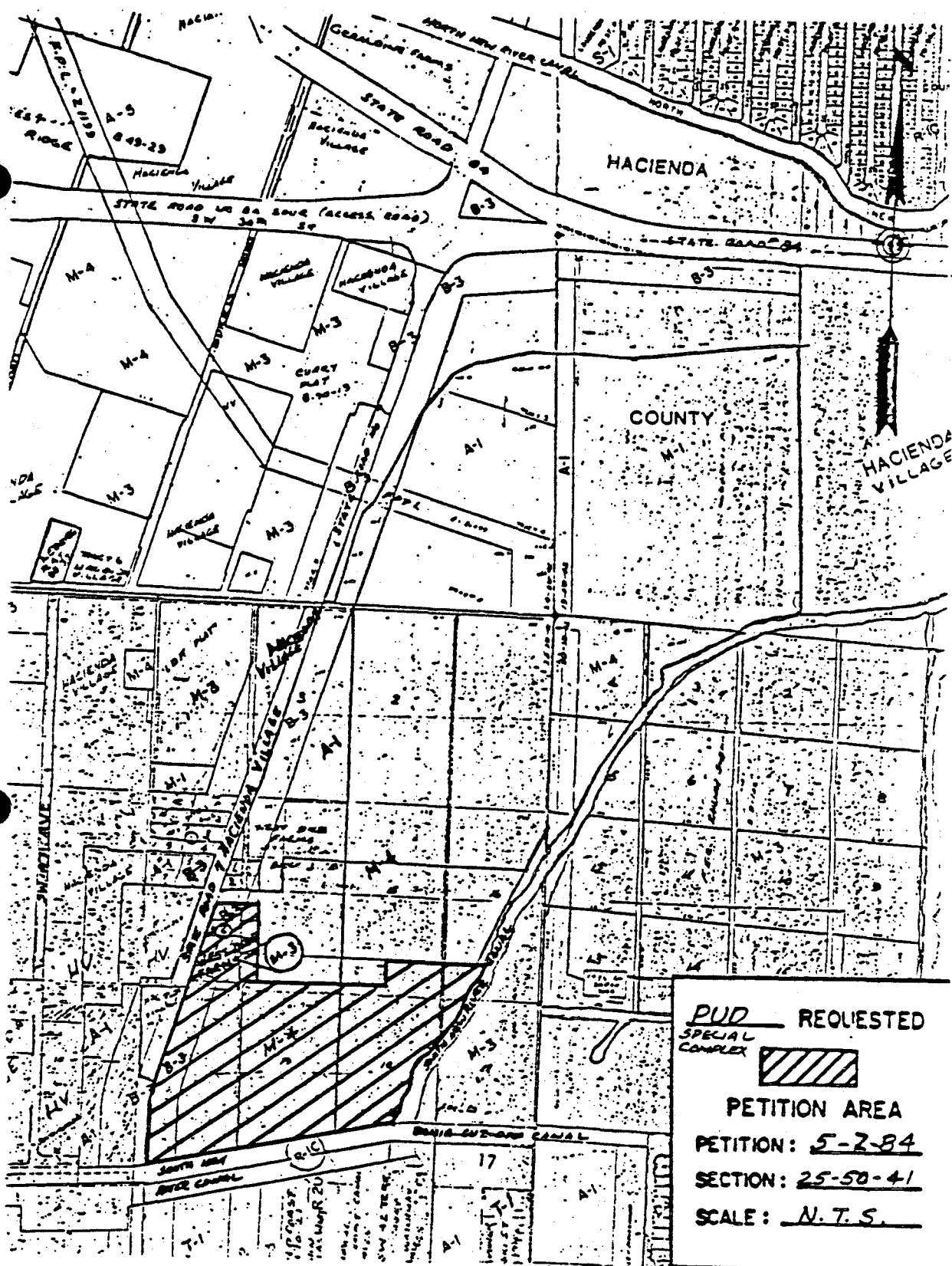
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PUD REQUESTED
SPECIAL
COMPLEX



PETITION AREA

PETITION: 5-284

SECTION: 25-50-41

SCALE: N.T.S.

6-2-84

BROWARD COUNTY OFFICE OF PLANNING

609 S. Andrews Avenue, 2nd Floor

Ft. Lauderdale, FL 33301

Phone: 765-5088

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SECTION: 24,25-50-41
19,30-50-42

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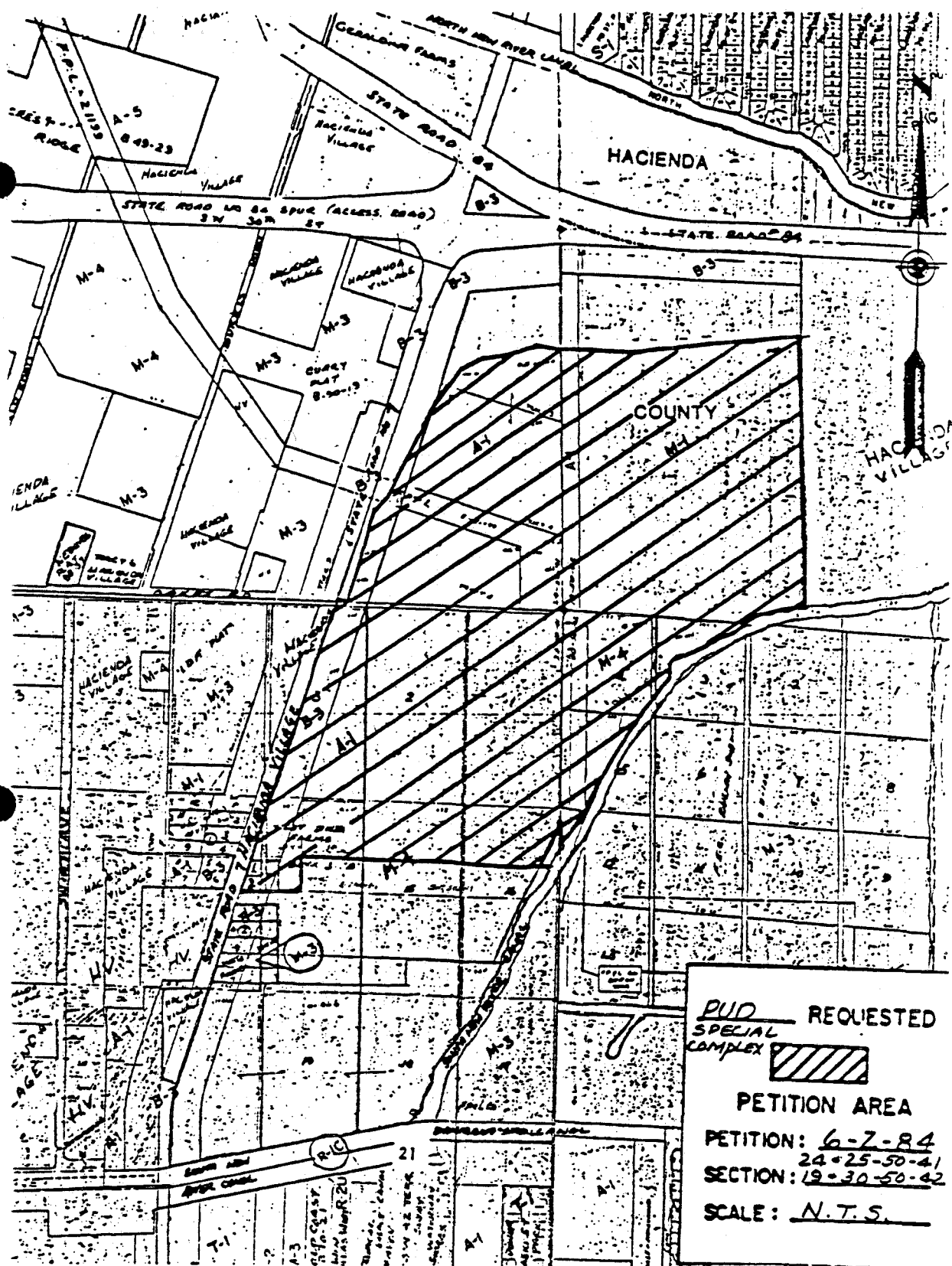
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SAID PARCEL LYING WITHIN BROWARD COUNTY, FLORIDA, CONTAINING 197.87 ACRES, MORE OR LESS.

SUBJECT TO RIGHTS-OF-WAY AND EASEMENTS OF RECORD; FROM A-1 LIMITED AGRICULTURAL, B-3 GENERAL BUSINESS, AND M-1 LIGHT INDUSTRIAL TO PUD SPECIAL COMPLEX; AND PROVIDING FOR AN EFFECTIVE DATE.

THE SUBJECT PARCEL IS DESIGNATED FOR INDUSTRIAL DEVELOPMENT ON THE UNINCORPORATED BROWARD COUNTY LAND USE PLAN.

SUBJECT PROPERTY IS LOCATED IN THE SOUTHWEST SECTION OF THE COUNTY, SOUTH OF STATE ROAD #84 AND ON THE EAST SIDE OF STATE ROAD #7.



MARCH 16, 1984 BROWARD COUNTY BOARD OF COUNTY COMMISSIONERS MEETING

AGENDA

Broward County

Board of County Commissioners

MEETING OF Friday, March 16, 1984

GERALD F. THOMPSON
Commissioner, District 1

MARCIA BEACH
Commissioner, District 2

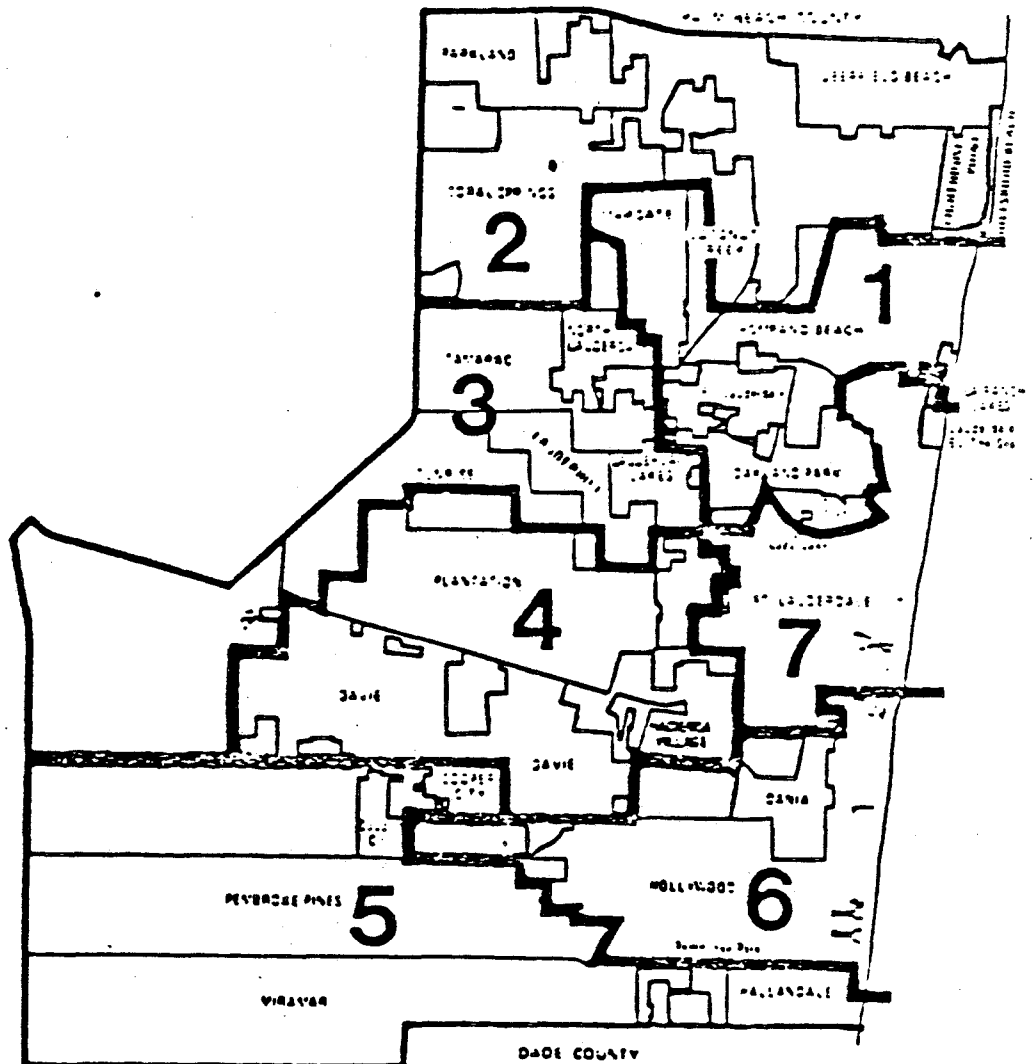
HOWARD CRAFT
Commissioner, District 3

SCOTT I. COWAN
Vice-Chairman, District 4

HOWARD C. FORMAN
Commissioner, District 5

NICKI ENGLANDER GROSSMAN
Chairman, District 6

JACK FRIED
Commissioner, District 7



ZONING PUBLIC HEARINGS

County Commission meetings are scheduled on
Fridays at 10:00 a.m., Room 250, Broward County Courthouse.
Citizen's participation is encouraged. For further information call 765-5121

GENERAL RULES & PROCEDURES FOR PUBLIC PARTICIPATION AT COMMISSION MEETINGS

I. WHO MAY SPEAK

Any individual who wishes to address the Commission, on any subject within the scope of the Commission authority, may do so providing it is accomplished in an orderly manner and in accordance with the procedures outlined below:

A. SPEAKING ON ITEMS ON THE AGENDA

1. *Consent Agenda Items.* These are items which the Commission does not need to discuss individually and which are voted on as a group. If any member of the public wishes to comment or to be heard on any of these items, he/she must notify the Commission Chairman, in writing, prior to the start of the meeting. This will permit the Chairman to pull such items for individual discussion at a time convenient to the Board. Notification can be accomplished by a handwritten note addressed to the Chairman but furnished to the Minutes Secretary or Deputy, indicating the individual's name, address, telephone number, the agenda item(s) and reason for discussion.
2. *Regular Agenda Items.* These are items which the Commission will discuss individually in the order listed on the agenda. Individuals who wish to participate in these discussions may do so by merely raising their hand during the discussion and being recognized by the Chairman. The Chairman will determine the order in which each individual will speak and length of time allotted.

B. SPEAKING ON SUBJECTS NOT ON THE AGENDA

1. Any individual or group may petition the Board to speak on any subject pertinent to Broward County. This can be done by submitting an application to the County Administrator at least two (2) weeks in advance of the meeting at which they wish to appear. Applications may be obtained from and returned to Calene Bruce, Assistant County Administrator, Room 248, Broward County Courthouse, Fort Lauderdale, FL 33301, telephone number 765-5142. Back-up material, if any, must be included with the application. Late distribution of such material or distribution to other individuals or groups without furnishing copies to the Board of County Commissioners may mean deferral of the delegation to a future meeting in order to allow the Board an opportunity to review such material before discussion.
2. Each delegation will be notified of the scheduled appearance date and time. Copies of the Agenda may be obtained by furnishing a self-addressed stamped envelope with the application. Copies of the agenda will be available in the meeting room on the day of the meeting.

C. SPEAKING AT PUBLIC HEARINGS

1. Any member of the public may participate in discussions held at public hearings. Discussion is limited to the subject being discussed, as listed on the Agenda. The Chairman will call for interested parties to be heard as each item for discussion is introduced. Those interested will ask for recognition by raising their hand at the time indicated by the Chairman.
2. Public hearings will be duly advertised according to law and are usually held on the third Thursday of each month. Zoning Public Hearings are usually held on the first Friday after the second Wednesday of each month.

II. ADDRESSING COMMISSION, MANNER, TIME

The length of time each individual may speak must be limited in the interest of order and conduct of the business at hand. The Chairman will set this limit at his/her discretion, but will allow the individual sufficient time for a thorough presentation, if within reason and proper order. Each person, other than salaried members of the County staff, who addresses the Commission shall step up to the speaker's lectern and shall give his/her name, address and who he/she represents and whether he/she is being compensated by the person(s) for whom he/she speaks.

III. DECORUM

Any person making impertinent or slanderous remarks or who becomes boisterous while addressing the Commission shall be barred from further audience before the Commission by the presiding officer, unless permission to continue or again address the Commission be granted by majority vote of the Commission members present.

(The above represents a summarization of rules pertaining to public participation at Board Meetings. Copies of the Resolution 79-AC-1 establishing the Method of Organization and Rules of Procedures of the Board of County Commissioners of Broward County are available in Room 248 from the Receptionist or from the Minutes Section, County Records Division, Room 130, Courthouse, 201 S.E. Sixth Street, Ft. Lauderdale, FL. 33301.

BROWARD COUNTY

BROWARD COUNTY BOARD OF COUNTY COMMISSIONERS

DATE: March 16, 1984

TIME: AT OR AFTER 10:00 A.M. - ROOM 250

A G E N D A

A. PLEDGE OF ALLEGIANCE

B. CORRESPONDENCE

C. MOTION TO ENACT ORDINANCE ZONING CERTAIN LANDS
WITHIN UNINCORPORATED BROWARD COUNTY, FLORIDA

D. PUBLIC HEARINGS:

1. 5-2-84
25-50-84

PETITIONER: B. C. RESOURCE RECOVERY OFFICE
COUNTY COMMISSION DISTRICT #4

A. LOCATION:

Subject parcel is located in the Southwest section of the County, on the North side of the South New River Canal and on the East side of State Road #7.

B. SIZE:

50.46 Acres

FROM: A-1, B-3, M-3, M-4
TO: PUD, Special Complex

2. 6-2-84
24,25-50-41
19,30-50-42

PETITIONER: B. C. RESOURCE RECOVERY OFFICE
COUNTY COMMISSION DISTRICT #4

A. LOCATION:

Subject property is located in the Southwest section of the County, South of State Road #84 and on the East side of State Road #7.

B. SIZE:

197.87 Acres

FROM: A-1, B-3, M-1
TO: PUD, Special Complex

E. CONTINUED PUBLIC HEARING:

3. 42-Z-84
30-50-41

PETITIONER: CURTIS DEEM
COUNTY COMMISSION DISTRICT #5

A. LOCATION:

Subject parcel is located in the Southwest section of the County, South of Griffin Road and West of S.W. 106th Avenue.

B. SIZE:

4.4+ Acres

FROM: B-2

TO: B-2 Utilizing 5% Comm'l Flex of the L.U.P.

F. CONTINUED LAND USE PLAN CONFORMITY PUBLIC HEARING:

4. 67-ZL-82
30-50-41

PETITIONER: OFFICE OF PLANNING
COUNTY COMMISSION DISTRICT #5

A. LOCATION:

Subject parcel is located in the Southwest section of the County, South of Griffin Road and West of 106th Avenue.

B. SIZE:

4.4+ Acres

FROM: B-2 TO: A-1

G. CONTINUED PUBLIC HEARINGS:

5. 43-Z-83
11&14-48-42

PETITIONER: EUGENE F. METZGER
COUNTY COMMISSION DISTRICT #2

A. LOCATION:

Subject parcel is located in the Northwest section of the County, South of N.W. 51st Street and West of I-95.

B. SIZE:

2.91 Acres

FROM: B-2 TO: M-1

6. 2-2-84
13-48-42

PETITIONER: ROBERT ROBINSON III, M.D.
COUNTY COMMISSION DISTRICT #2

A. LOCATION:

Subject parcel is located in the Northeast section of the County, on the South side of Northeast 38th Street and East of N. E. 3rd Avenue.

B. SIZE:

0.18 Acre

FROM: R-2

TO: B-2 Utilizing 5% Commercial Flex
of L.U.P.

H. PUBLIC HEARINGS:

7. 7-2-84
24-48-42

PETITIONER: J & C BUSINESS ENTERPRISING
COUNTY COMMISSION DISTRICT #2

A. LOCATION:

Subject parcel is located in the Northeast section of the County, South of N.E. 34th Street, and West of Old Dixie Highway.

B. SIZE:

.172 Acre

FROM: B-2

TO: B-3

8. 8-2-84
24-48-42

PETITIONER: HARRY R. VOLPE
COUNTY COMMISSION DISTRICT #2

A. LOCATION:

Subject property is located in the Northeast section of the County, South of N. E. 34th Street and West of Old Dixie Highway.

B. SIZE:

.172 Acre

FROM: R-2P

TO: B-2

9. 10-Z-84
31-50-42

PETITIONER: MORRIS ENGELBERG, TRUSTEE
COUNTY COMMISSION DISTRICT #6

A. LOCATION:

Subject parcel is located in the Southwest section of the County, on the North side of Stirling Road and West of S. W. 35th Avenue.

B. SIZE:

2.4+ Acres

FROM: A-1 TO: RS-0 Utilizing 5% Comm'l
Flex of LUP

10. 11-Z-84
18-49-42

PETITIONER: ERNESTO SARTORI
COUNTY COMMISSION DISTRICT #1

A. LOCATION:

Subject parcel is located in the Northwest section of the County, South of Commercial Boulevard, and West of N.W. 31st Avenue.

B. SIZE:

0.108 Acre

FROM: RM-5 TO: B-2 Utilizing 5% Flex of
the LUP

1. LAND USE PLAN CONFORMITY PUBLIC HEARING:

11. 82-ZL-82
20-50-42

PETITIONER: OFFICE OF PLANNING
COUNTY COMMISSION DISTRICT #4

A. LOCATION:

Subject properties are located in the Southwest section of the County, South of State Road #84 and West of Ravenswood Road.

B. SIZE:

8.6 Acres

FROM: R-3 TO: M-1

After discussion, and on motion of Commissioner Forman, seconded by Commissioner Thompson and unanimously carried, the Board approved this Statement of Intent, including the amendments.

(Mr. Stewart left the meeting room at this time, and Mr. Stacker took his place.)

ZONING - PUBLIC HEARING - ORDINANCE - ENACTED

PETITIONER: B. C. RESOURCE RECOVERY OFFICE (5-2-84) (1)

It now being the time advertised to hold a public hearing to consider the enactment of an ordinance on recommendations of the Zoning Board setting forth recommended building and zoning regulations in the following described area, the Chairman called for interested persons to be heard:

AN ORDINANCE OF BROWARD COUNTY, FLORIDA, CHANGING THE ZONING DISTRICT BOUNDARIES BY REZONING A PARCEL OF LAND LYING WITHIN THE EAST ONE HALF (E 1/2) OF SECTION 25, TOWNSHIP 50 SOUTH, RANGE 41 EAST, BEING ALL OF TRACTS 18 AND 19 AND A PORTION OF TRACTS 15, 16 AND 20 OF THE JOHN W. NEWMAN SURVEY AS RECORDED IN PLAT BOOK 2, PAGE 26, OF THE PUBLIC RECORDS OF DADE COUNTY, FLORIDA, TOGETHER WITH ALL OF LOTS 4 THROUGH 8, INCLUSIVE OF BLOCK 2, WEST DIXIE FARMS AS RECORDED IN PLAT BOOK 24, PAGE 36, OF THE PUBLIC RECORDS OF BROWARD COUNTY FLORIDA, BEING MORE PARTICULARLY DESCRIBED HEREIN; FROM A-1 LIMITED AGRICULTURAL, B-3 GENERAL BUSINESS, M-3 GENERAL INDUSTRIAL, AND M-4 LIMITED HEAVY INDUSTRIAL TO PUD SPECIAL COMPLEX; AND PROVIDING FOR AN EFFECTIVE DATE.

Roy Groves of the Office of Planning advised the Board that both this item and the following item, 6-2-84, are rezoning for Resource/Recovery. They will be discussed simultaneously, but will be voted on independently.

Mr. Groves reviewed the properties, and the stated that this particular petition is for the resource/recovery site, and the next item, 6-2-84, is for the landfill. For the record Mr. Groves reviewed portions of staff comments, a copy of which is filed in the supplemental papers of this meeting. The Office of Planning recommends approval of this rezoning.

A copy of the Environmental Impact Report, the proposed ordinance and Development Order prepared by the Office of Planning has been filed in the supplemental papers of this meeting.

Jim Hudgens from Coastal Zone Resources Incorporated appeared to address the issues raised relative to the proposal for this particular site, reviewed the mitigation plans, gave a slide presentation of the property.

(Commissioner Thompson left the meeting room at this time.)

Robert Reynolds, attorney representing Mr. Springfield, stated that he has spoken to Phyllis Korab, Project Director, and has received assurances, which are satisfactory to his client, that the rezoning would only cover the portion the county seeks to take for this purpose. Also, the legal uses for which the property is presently being used would be allowed to continue until such time as the order of taking has been accomplished.

After discussion, a motion was made by Commissioner Cowan, and seconded by Commissioner Fried, that the Board close

D.J.O.

Zon. P.H. Min. 3-16-84

the public hearing and enact the ordinance to be effective as provided by law. Whereupon, the Chairma called for a roll call vote with members voting as follows:

Commissioner Cowan	Yes
Commissioner Craft	No
Commissioner Forman	Yes
Commissioner Fried	Yes
Commissioner Grossman	Yes

The Chairman declared the motion carried.

(Commissioner Thompson returned to the meeting room at this time.)

ZONING - PUBLIC HEARING - ORDINANCE - ENACTED

PETITIONER: B.C. RESOURCE RECOVERY OFFICE (6-2-84) (2)

It now being the time advertised to hold a public hearing to consider the enactment of an ordinance on recommendations of the Zoning Board setting forth recommended building and zoning regulations in the following described area, the Chairman called for interested persons to be heard:

AN ORDINANCE OF BROWARD COUNTY, FLORIDA, CHANGING THE ZONING DISTRICT BOUNDARIES BY REZONING A PARCEL OF LAND LYING WITHIN SECTIONS 24 AND 25, TOWNSHIP 50 SOUTH, RANGE 41 EAST, AND SECTION 19 AND 30, TOWNSHIP 50 SOUTH, RANGE 42 EAST, SAID PARCEL ALSO BEING TRACTS 1 AND 2 AND A PORTION OF TRACT 3, 15 AND 16, IN SAID SECTION 25 AND A PORTION OF TRACTS 2, 3, 4 AND 5 OF TIER 1 IN SAID SECTION 24 OF THE JOHN W. NEWMAN SURVEY AS RECORDED IN PLAT BOOK 2, PAGE 26, OF THE PUBLIC RECORDS OF DADE COUNTY, FLORIDA, AND A PORTION OF BLOCKS 2 AND 3, WEST DIXIE FARMS AS RECORDED IN PLAT BOOK 24, PAGE 36, OF THE PUBLIC RECORDS OF BROWARD COUNTY, FLORIDA, AND A PORTION OF LOTS 3, 4 AND 5 OF THE FLORIDA EAST COAST RAILWAY SUBDIVISION AS RECORDED IN PLAT BOOK "B", PAGE 142, OF THE PUBLIC RECORDS OF DADE COUNTY, FLORIDA, BEING MORE PARTICULARLY DESCRIBED HEREIN; FROM A-1 LIMITED AGRICULTURAL, B-3 GENERAL BUSINESS, AND M-1 LIGHT INDUSTRIAL TO PUD SPECIAL COMPLEX; AND PROVIDING FOR AN EFFECTIVE DATE.

(Staff comments relative to this rezoning were made during the prior item, 5-2-84.)

John Anderson, City Planner for the city of Plantation, appeared before the Board and expressed the city's concern about traffic on State Road 7. Bob Snyder of Malcolm Pirney, consultants for this project, responded to the questions raised by Mr. Anderson. Mr. Anderson stated that the city would like to have the plan changed so that, if at all possible, the additional traffic for this site be diverted from State Road 7.

(Commissioner Fried left the meeting room during discussion on this item.)

After discussion, a motion was made by Commissioner Cowan, and seconded by Commissioner Fried, that the Board close the public hearing and enact the ordinance to be effective as provided by law. Whereupon, the Chairman called for a roll call vote with members voting as follows:

D.J.O.

Zon. P.H. Min. 3-16-84

Commissioner Cowan	Yes
Commissioner Craft	No
Commissioner Forman	Yes
Commissioner Thompson	Yes
Commissioner Grossman	Yes

The Chairman declared the motion carried.

ZONING - CONTINUED LAND USE PLAN PUBLIC HEARING - ORDINANCE -
CONTINUED FOR 60 DAYS

PETITIONER: OFFICE OF PLANNING (67-ZL-82) (4)

It now being the time advertised to hold a continued public hearing to consider the enactment of an ordinance on recommendations of the Zoning Board setting forth recommended building and zoning regulations in the following described area, the Chairman called for interested persons to be heard:

Section 30, Township 50 South, Range 41 East
(From B-2 To A-1) (67-ZL-82)

Subject parcel is located in the southwest section of the county, south of Griffin Road and west of 106 Avenue, containing 4.4± acres.

On motion of Commissioner Cowan, seconded by Commissioner Forman and unanimously carried, the Board deferred action on this rezoning for 60 days as requested by the planning staff for further deliberation.

ZONING - CONTINUED PUBLIC HEARING - ORDINANCE - ENACTED SUBJECT
TO RECEIPT OF R/W WITHIN 120 DAYS

PETITIONER: EUGENE F. METZGER (43-Z-83) (5)

It now being the time advertised to hold a continued public hearing to consider the enactment of an ordinance on recommendations of the Zoning Board setting forth recommended building and zoning regulations in the following described area, the Chairman called for interested persons to be heard:

AN ORDINANCE OF BROWARD COUNTY, FLORIDA, CHANGING THE ZONING DISTRICT BOUNDARIES BY REZONING A PORTION OF SECTION 11, TOWNSHIP 48 SOUTH, RANGE 42 EAST TOGETHER WITH A PORTION OF THE NORTH 40 FEET OF SECTION 14, TOWNSHIP 48 SOUTH, RANGE 42 EAST, BEING MORE PARTICULARLY DESCRIBED HEREIN; FROM B-2, COMMUNITY BUSINESS TO A-1, LIMITED AGRICULTURAL; AND PROVIDING FOR AN EFFECTIVE DATE.

Roy Groves of the Office of Planning reviewed the rezoning history on this petition. Mr. Groves advised that staff recommends denial of this petition, but the Zoning Board recommends approval.

Eugene F. Metzger, the petitioner, appeared before the Board in support of this rezoning.

(Commissioner Fried entered the meeting room at this time.)

After discussion, a motion was made by Commissioner Thompson, and seconded by Commissioner Forman, that the Board enact the ordinance, subject to receipt of necessary right-of-way within 120 days, and the ordinance is to be effective as provided by law. Whereupon, the Chairman called for a roll call vote with members voting as follows:

D.J.O.

Zon. P.H. Min. 3-16-84

APRIL 23, 1984 COPY OF ORDINANCE #84-6(Z)



Office of Planning
Room 329
115 S. Andrews Avenue
Fort Lauderdale, Florida 33301
April 30, 1984

TO WHOM IT MAY CONCERN:

Enclosed is one copy of Ordinance # 84-6(Z) that was recorded
on April 23, 1984.

Sincerely,

Al Shamoun
Associate Planner

AS/bb

84-139703

ORDINANCE NO. 84-6(2)

AN ORDINANCE AND DEVELOPMENT ORDER OF THE BOARD OF COUNTY COMMISSIONERS OF BROWARD COUNTY, FLORIDA, CHANGING ZONING DISTRICT BOUNDARIES BY REZONING A PARCEL OF LAND LYING WITHIN SECTIONS 24 AND 25, TOWNSHIP 50 SOUTH, RANGE 41 EAST, AND SECTION 19 AND 30, TOWNSHIP 50 SOUTH, RANGE 42 EAST, SAID PARCEL ALSO BEING TRACTS 1 AND 2 AND A PORTION OF TRACT 3, 15 AND 16 IN SAID SECTION 25 AND A PORTION OF TRACTS 2, 3, 4 AND 5 OF TIER 1 IN SAID SECTION 24 OF THE JOHN W. NEWMAN SURVEY AS RECORDED IN PLAT BOOK 2, PAGE 26, OF THE PUBLIC RECORDS OF DADE COUNTY, FLORIDA AND A PORTION OF BLOCKS 2 AND 3, WEST DIXIE FARMS AS RECORDED IN PLAT BOOK 24, PAGE 36, OF THE PUBLIC RECORDS OF BROWARD COUNTY, FLORIDA, AND A PORTION OF LOTS 3, 4, 5, AND 12 OF THE FLORIDA EAST COAST RAILWAY SUBDIVISION AS RECORDED IN PLAT BOOK "B", PAGE 142, OF THE PUBLIC RECORDS OF DADE COUNTY, FLORIDA, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE EAST QUARTER (E 1/4) CORNER OF SAID SECTION 25; THENCE SOUTH 88° 34' 16" WEST, ALONG THE SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4) OF SAID SECTION 25, A DISTANCE OF 491.85 FEET TO THE EASTERLY BOUNDARY OF AFORESAID TRACT 16; THENCE NORTH 20° 05' 06" EAST, ALONG SAID EASTERLY BOUNDARY, 984.08 FEET TO THE POINT OF BEGINNING; THENCE SOUTH 88° 38' 08" WEST ALONG A LINE 409.00 FEET SOUTH OF AND PARALLEL WITH THE NORTH LINE OF SAID TRACT 16, AND AFORESAID TRACT 15 AND WEST DIXIE FARMS, 1626.40 FEET; THENCE SOUTH 01° 42' 50" EAST ALONG A LINE 433.00 FEET WEST OF AND PARALLEL WITH THE EAST BOUNDARY OF SAID WEST DIXIE FARMS 229.64 FEET; THENCE SOUTH 88° 34' 16" WEST ALONG A LINE 8.83 FEET NORTH OF AND PARALLEL WITH THE NORTH LINE OF LOT 3 OF AFORESAID BLOCK 2; A DISTANCE OF 385.0 FEET, TO THE EASTERLY RIGHT-OF-WAY LINE OF STATE ROAD NO. 7 (100' WIDE RIGHT-OF-WAY); THENCE NORTH 14° 51' 56" EAST ALONG SAID RIGHT-OF-WAY LINE 2,032.16 FEET; THENCE CONTINUE ALONG SAID RIGHT-OF-WAY LINE, NORTH 15° 02' 23" EAST, 35.35 FEET TO A POINT OF INTERSECTION WITH THE NORTH RIGHT-OF-WAY LINE OF OAKS ROAD; THENCE NORTH 88° 41' 58" EAST, ALONG SAID NORTH RIGHT-OF-WAY LINE 71.72 FEET TO A POINT OF INTERSECTION WITH THE PROPOSED LIMITED ACCESS LINE AS SHOWN ON FLORIDA DEPARTMENT OF TRANSPORTATION RIGHT-OF-WAY MAP FOR STATE ROAD NO. 862. (1-595)

84 APR 23 PM 3 25

REC 11644 PAGE 897

Attn - Al Shamoun
Office of Planning
Broward County

73
MC

SHEET 6 OF 9, DATED NOVEMBER, 1981; THENCE ALONG SAID LIMITED ACCESS LINE THE FOLLOWING NINE (9) COURSES AND DISTANCES; THENCE NORTH $15^{\circ} 01' 35''$ EAST, 645.68 FEET; THENCE NORTH $43^{\circ} 15' 17''$ EAST, 109.67 FEET; THENCE NORTH $26^{\circ} 24' 46''$ EAST, 541.56 FEET; THENCE NORTH $22^{\circ} 49' 40''$ EAST, 98.27 FEET; THENCE NORTH $36^{\circ} 53' 09''$ EAST, 379.73, THENCE NORTH $62^{\circ} 27' 20''$ EAST, 178.19 FEET; THENCE NORTH $79^{\circ} 24' 18''$ EAST, 356.52 FEET; THENCE NORTH $89^{\circ} 37' 32''$ EAST, 642.81 FEET;; THENCE NORTH $77^{\circ} 33' 36''$ EAST, 1096.41 FEET; THENCE SOUTH $03^{\circ} 32' 53''$ EAST, ALONG A LINE 3,478.00 FEET WEST OF AND PARALLEL WITH THE EAST LINE OF AFORESAID SECTION 19, A DISTANCE OF 1,836 FEET MORE OR LESS TO THE NORTHERLY WATERS OF THE SOUTH NEW RIVER CANAL; THENCE WESTERLY AND SOUTHWESTERLY ALONG THE NORTHERLY AND WESTERLY WATERS OF THE SAID SOUTH NEW RIVER CANAL TO A POINT OF INTERSECTION WITH THE EAST BOUNDARY OF AFORESAID RANGE 41 EAST; THENCE NORTH $01^{\circ} 46' 20''$ WEST ALONG SAID EAST BOUNDARY 161.16 FEET MORE OR LESS TO A POINT 95.31 FEET SOUTH OF THE NORTHEAST CORNER OF AFORESAID TRACT 16; THENCE SOUTH $20^{\circ} 05' 06''$ WEST ALONG THE EASTERLY BOUNDARY OF SAID TRACT 16, A DISTANCE OF 337.04 FEET TO THE POINT OF BEGINNING. SAID PARCEL LYING WITHIN BROWARD COUNTY, FLORIDA, CONTAINING 197.87 ACRES, MORE OR LESS, FROM A-1 LIMITED AGRICULTURAL, B-3 GENERAL BUSINESS, AND M-1 LIGHT INDUSTRIAL TO PUD SPECIAL COMPLEX; TOGETHER WITH A PARCEL OF LAND LYING WITHIN THE EAST ONE HALF (E 1/2) OF SECTION 25, TOWNSHIP 50 SOUTH, RANGE 41 EAST, BEING ALL OF TRACTS 18 AND 19 AND A PORTION OF TRACTS 15, 16 AND 20 OF THE JOHN W. NEWMAN SURVEY AS RECORDED IN PLAT BOOK

2, PAGE 26, OF THE PUBLIC RECORDS OF DADE COUNTY, FLORIDA, TOGETHER WITH ALL OF LOTS 4 THROUGH 8, INCLUSIVE OF BLOCK 2, WEST DIXIE FARMS AS RECORDED IN PLAT BOOK 24, PAGE 36, OF THE PUBLIC RECORDS OF BROWARD COUNTY, FLORIDA, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE EAST QUARTER (E 1/4) CORNER OF SAID SECTION 25; THENCE SOUTH $88^{\circ} 34' 16''$ WEST ALONG THE SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4) OF SAID SECTION 25, A DISTANCE OF 491.85 FEET TO THE EASTERLY BOUNDARY OF AFORESAID TRACT 16, SAID POINT ALSO BEING THE POINT OF BEGINNING; THENCE SOUTH $20^{\circ} 05' 06''$ WEST, ALONG SAID EASTERLY BOUNDARY 492.28 FEET TO THE SOUTHEAST CORNER OF AFORESAID TRACT 18; THENCE SOUTH $35^{\circ} 44' 42''$ WEST ALONG THE SOUTHEASTERLY BOUNDARY OF SAID TRACT 18; A DISTANCE OF 508.13 FEET; THENCE SOUTH $72^{\circ} 06' 20''$ WEST, ALONG THE SOUTHERLY BOUNDARY OF SAID TRACT 18 AND AFORESAID TRACT 19, A DISTANCE OF 1053.32 FEET TO THE SOUTHEAST CORNER OF

OFF 11644 PAGE 808

AFORESAID TRACT 20; THENCE SOUTH $76^{\circ} 30' 24''$ WEST, ALONG THE SOUTHERLY BOUNDARY OF SAID TRACT 20, A DISTANCE OF 529.67 FEET TO THE EASTERLY RIGHT-OF-WAY LINE OF STATE ROAD NO. 7; THENCE NORTH $01^{\circ} 51' 23''$ WEST, ALONG SAID EASTERLY RIGHT-OF-WAY LINE, 248.90 FEET; THENCE NORTHERLY ALONG SAID EASTERLY RIGHT-OF-WAY LINE AND ALONG THE ARC OF A TANGENT CURVE, CONCAVE TO THE EAST, HAVING A RADIUS OF 1810.08 FEET, A DELTA OF $16^{\circ} 43' 20''$, AN ARC DISTANCE OF 528.28 FEET; THENCE TANGENT TO SAID CURVE NORTH $14^{\circ} 51' 56''$ EAST ALONG SAID EASTERLY RIGHT-OF-WAY LINE, 1120.96 FEET; THENCE NORTH $88^{\circ} 34' 16''$ EAST ALONG THE NORTH LINE OF SAID LOT 4, A DISTANCE OF 239.67 FEET TO THE NORTHEAST CORNER OF SAID LOT 4; THENCE SOUTH $01^{\circ} 42' 40''$ EAST, ALONG THE EAST BOUNDARY OF LOTS 4 THROUGH 8, INCLUSIVE, 524.08 FEET TO THE SOUTHEAST CORNER OF SAID LOT 8; THENCE NORTH $88^{\circ} 34' 16''$ EAST, ALONG A LINE 50.00 FEET NORTH OF AND PARALLEL WITH THE AFORESAID SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4), 843.36 FEET; THENCE NORTH $01^{\circ} 42' 40''$ WEST, 210.00 FEET, THENCE NORTH $88^{\circ} 34' 16''$ EAST, ALONG A LINE 260.00 FEET NORTH OF AND PARALLEL WITH THE SAID SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4) 648.41 FEET TO AFORESAID EASTERLY BOUNDARY OF TRACT 16; THENCE SOUTH $20^{\circ} 05' 06''$ WEST, ALONG SAID EASTERLY BOUNDARY, 279.47 FEET TO THE POINT OF BEGINNING. SAID PARCEL LYING WITHIN BROWARD COUNTY, FLORIDA, CONTAINING 50.46 ACRES MORE OR LESS. FROM A-1 LIMITED AGRICULTURAL, B-3 GENERAL BUSINESS, M-3 GENERAL INDUSTRIAL, AND M-4 LIMITED HEAVY INDUSTRIAL TO PUD SPECIAL COMPLEX; PURSUANT TO CHAPTER 39, ARTICLE LII, PLANNED UNIT DEVELOPMENT DISTRICT, SECTIONS 39-880 THROUGH 39-890 OF THE BROWARD COUNTY CODE OF ORDINANCES; PROVIDING FOR LIMITATIONS, CONDITIONS, AND QUALIFICATIONS; PROVIDING THAT THE CONCEPTUAL SITE PLAN ATTACHED HERETO AS EXHIBIT "A" IS INCORPORATED HEREIN AND MADE A PART THEREOF; PROVIDING THAT ALL DEVELOPMENT SHALL BE IN ACCORDANCE WITH SAID CONCEPTUAL SITE PLAN EXCEPT AS OTHERWISE MODIFIED AS PERMITTED BY THE ORDINANCE; PROVIDING FOR A CHANGE OF THE ZONING OF THE DISTRICT MAPS TO REFLECT THE CHANGE OF ZONING EFFECTED BY THIS ORDINANCE; PROVIDING FOR SEVERABILITY; AND PROVIDING FOR AN EFFECTIVE DATE.

(Sponsored by Board of County Commissioners)

WHEREAS, ON JANUARY 25, 1983, THE BOARD OF COUNTY COMMISSIONERS OF BROWARD COUNTY DETERMINED RESOURCE RECOVERY WAS THE MOST VIABLE OPTION FOR PROCESSING THE FUTURE WASTE GENERATED BY THE RESIDENTS OF, AND VISITORS TO, BROWARD COUNTY, AND IN THE BEST INTERESTS OF BROWARD COUNTY; AND

REF 11644 PAGE 809

WHEREAS, THE INTENDED USE OF THE SUBJECT PROPERTY FOR A RESOURCE RECOVERY FACILITY, RESIDUE AND UNPROCESSABLE WASTE LANDFILL; RETENTION AREAS AND ACCESSORY USES, WAS APPROVED BY THE BOARD OF COUNTY COMMISSIONERS ON APRIL 12, 1983; AND

WHEREAS, CHAPTER 39, ARTICLE LII, PLANNED UNIT DEVELOPMENT DISTRICT, 539-880 THROUGH 39-890, BROWARD COUNTY CODE OF ORDINANCES, PROVIDES FOR PLANNED UNIT DEVELOPMENTS IN ORDER TO PROMOTE PLANNED GROWTH, MORE EFFICIENT USE OF LAND, REDUCE CAPITAL IMPROVEMENT COSTS, ENCOURAGE INNOVATIVE DESIGN AND CONSERVE THE NATURAL AMENITIES OF THE LAND; AND

WHEREAS, THE BROWARD COUNTY SOLID WASTE DIVISION HAS APPLIED FOR A CHANGE OF ZONING FROM A-1 LIMITED AGRICULTURAL, B-3 GENERAL BUSINESS, M-1 LIGHT INDUSTRIAL, M-3 GENERAL INDUSTRIAL AND M-4 LIMITED HEAVY INDUSTRIAL TO SPECIAL USE PLANNED UNIT DEVELOPMENT; AND

WHEREAS, THE BROWARD COUNTY ZONING BOARD HAS HELD A PUBLIC HEARING AND MADE A FORMAL RECOMMENDATION; NOW, THEREFORE,

BE IT ORDAINED BY THE BOARD OF COUNTY COMMISSIONERS OF BROWARD COUNTY, FLORIDA:

SECTION 1.

1.01 THIS IS A DEVELOPMENT ORDER OF THE BOARD OF COUNTY COMMISSIONERS OF BROWARD COUNTY AS REQUIRED FOR REZONING OF PROPERTY BY CHAPTER 5, ARTICLE IX, DIVISION 1, 5-180, ET. SEQ., BROWARD COUNTY CODE OF ORDINANCES

SECTION 2.

2.01 THE PROPERTY WHICH IS THE SUBJECT OF THIS ORDINANCE, HEREINAFTER "PROPERTY," IS LEGALLY DESCRIBED AS FOLLOWS:

THAT PORTION OF SECTIONS 24 AND 25, TOWNSHIP 50 SOUTH, RANGE 41 EAST, AND SECTION 19 AND 30, TOWNSHIP 50 SOUTH, RANGE 42 EAST, LOCATED IN BROWARD COUNTY, FLORIDA; DESCRIBED MORE PARTICULARLY AS FOLLOWS:

COMMENCING AT THE EAST QUARTER (E 1/4) CORNER OF SAID SECTION 25; THENCE SOUTH 88° 34' 16" WEST, ALONG THE SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4) OF SAID SECTION 25, A DISTANCE OF 491.85 FEET TO THE EASTERLY BOUNDARY OF AFORESAID TRACT 16; THENCE NORTH 20° 05' 06" EAST, ALONG SAID EASTERLY BOUNDARY, 984.08 FEET TO THE POINT OF BEGINNING; THENCE SOUTH 88° 38' 08" WEST ALONG A LINE 409.00 FEET SOUTH OF AND PARALLEL WITH THE NORTH LINE OF SAID TRACT 16 AND AFORESAID TRACT 15 AND WEST DIXIE FARMS, 1626.40 FEET; THENCE SOUTH 01° 42' 50" EAST ALONG A LINE 433.00 FEET WEST OF AND PARALLEL WITH THE EAST BOUNDARY OF SAID WEST DIXIE FARMS 229.64 FEET; THENCE SOUTH 88° 34' 16"

OFF 11644 PAGE 900

WEST ALONG A LINE 8.83 FEET NORTH OF AND PARALLEL WITH THE NORTH LINE OF LOT 3 OF AFORESAID BLOCK 2, A DISTANCE OF 385.0 FEET, TO THE EASTERLY RIGHT-OF-WAY LINE OF STATE ROAD NO. 7 (100' WIDE RIGHT-OF-WAY); THENCE NORTH 14° 51' 56" EAST ALONG SAID RIGHT-OF-WAY LINE 2,032.16 FEET; THENCE CONTINUE ALONG SAID RIGHT-OF-WAY LINE, NORTH 15° 02' 23" EAST, 35.35 FEET TO A POINT OF INTERSECTION WITH THE NORTH RIGHT-OF-WAY LINE OF OAKS ROAD; THENCE NORTH 88° 41' 58" EAST, ALONG SAID NORTH RIGHT-OF-WAY LINE 71.72 FEET TO A POINT OF INTERSECTION WITH THE PROPOSED LIMITED ACCESS LINE AS SHOWN ON FLORIDA DEPARTMENT OF TRANSPORTATION RIGHT-OF-WAY MAP FOR STATE ROAD NO. 862. (1-595) SHEET 6 OF 9, DATED NOVEMBER, 1981: THENCE ALONG SAID LIMITED ACCESS LINE THE FOLLOWING NINE (9) COURSES AND DISTANCES; THENCE NORTH 15° 01' 35" EAST, 645.68 FEET; THENCE NORTH 43° 15' 17" EAST, 109.67 FEET; THENCE NORTH 26° 24' 46" EAST, 541.56 FEET; THENCE NORTH 22° 49' 40" EAST, 98.27 FEET; THENCE NORTH 36° 53' 09" EAST, 379.73 FEET; THENCE NORTH 62° 27' 20" EAST, 178.19 FEET; THENCE, NORTH 79° 24' 18" EAST, 356.52 FEET; THENCE NORTH 89° 37' 32" EAST, 642.81 FEET;; THENCE NORTH 77° 33' 36" EAST, 1096.41 FEET; THENCE SOUTH 03° 32' 53" EAST, ALONG A LINE 3,478.00 FEET WEST OF AND PARALLEL WITH THE EAST LINE OF AFORESAID SECTION 19, A DISTANCE OF 1,836 FEET MORE OR LESS TO THE NORTHERLY WATERS OF THE SOUTH NEW RIVER CANAL; THENCE WESTERLY AND SOUTHWESTERLY ALONG THE NORTHERLY AND WESTERLY WATERS OF THE SAID SOUTH NEW RIVER CANAL TO A POINT OF INTERSECTION WITH THE EAST BOUNDARY OF AFORESAID RANGE 41 EAST; THENCE NORTH 01° 46' 20" WEST ALONG SAID EAST BOUNDARY 161.16 FEET MORE OR LESS TO A POINT 95.31 FEET SOUTH OF THE NORTHEAST CORNER OF AFORESAID TRACT 16; THENCE SOUTH 20° 05' 06" WEST ALONG THE EASTERLY BOUNDARY OF SAID TRACT 16, A DISTANCE OF 337.04 FEET TO THE POINT OF BEGINNING. SAID PARCEL LYING WITHIN BROWARD COUNTY, FLORIDA, CONTAINING 197.87 ACRES, MORE OR LESS, TOGETHER WITH THAT PORTION OF SECTION 25, TOWNSHIP 50 SOUTH, RANGE 41 EAST, LOCATED IN BROWARD COUNTY, FLORIDA; DESCRIBED MORE PARTICULARLY AS FOLLOWS:

COMMENCING AT THE EAST QUARTER (E 1/4) CORNER OF SAID SECTION 25; THENCE SOUTH 88° 34' 16" WEST ALONG THE SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4) OF SAID SECTION 25, A DISTANCE OF 491.85 FEET TO THE EASTERLY BOUNDARY OF AFORESAID TRACT 16, SAID POINT ALSO BEING THE POINT OF BEGINNING THENCE SOUTH 20° 05' 06" WEST, ALONG SAID EASTERLY BOUNDARY 492.28 FEET TO THE SOUTHEAST CORNER OF AFORESAID TRACT 18; THENCE SOUTH 35° 44' 42" WEST ALONG THE

REF 11644 PAGE 901

...TRACT 18, A DISTANCE OF 508.13 FEET; THENCE SOUTH 72° 06' 20" WEST, ALONG THE SOUTHERLY BOUNDARY OF SAID TRACT 18 AND AFORESAID TRACT 19, A DISTANCE OF 1053.32 FEET TO THE SOUTHEAST CORNER OF AFORESAID TRACT 20; THENCE SOUTH 76° 30' 24" WEST, ALONG THE SOUTHERLY BOUNDARY OF SAID TRACT 20, A DISTANCE OF 529.67 FEET TO THE EASTERLY RIGHT-OF-WAY LINE OF STATE ROAD NO. 7; THENCE NORTH 01° 51' 23" WEST, ALONG SAID EASTERLY RIGHT-OF-WAY LINE, 248.90 FEET; THENCE NORTHERLY ALONG SAID EASTERLY RIGHT-OF-WAY LINE AND ALONG THE ARC OF A TANGENT CURVE, CONCAVE TO THE EAST, HAVING A RADIUS OF 1810.06 FEET, A DELTA OF 16° 43' 20", AN ARC DISTANCE OF 528.28 FEET; THENCE TANGENT TO SAID CURVE NORTH 14° 51' 56" EAST ALONG SAID EASTERLY RIGHT-OF-WAY LINE, 1120.96 FEET; THENCE NORTH 88° 34' 16" EAST ALONG THE NORTH LINE OF SAID LOT 4, A DISTANCE OF 239.67 FEET TO THE NORTHEAST CORNER OF SAID LOT 4; THENCE SOUTH 01° 42' 40" EAST, ALONG THE EAST BOUNDARY OF LOTS 4 THROUGH 8 INCLUSIVE, 524.08 FEET TO THE SOUTHEAST CORNER OF SAID LOT 8; THENCE NORTH 88° 34' 16" EAST, ALONG A LINE 50.00 FEET NORTH OF AND PARALLEL WITH THE AFORESAID SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4), 843.36 FEET; THENCE NORTH 01° 42' 40" WEST, 210.00 FEET, THENCE NORTH 88° 34' 16" EAST, ALONG A LINE 260.00 FEET NORTH OF AND PARALLEL WITH THE SAID SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4) 648.41 FEET TO AFORESAID EASTERLY BOUNDARY OF TRACT 16; THENCE SOUTH 20° 05' 06" WEST, ALONG SAID EASTERLY BOUNDARY, 279.47 FEET TO THE POINT OF BEGINNING. SAID PARCEL LYING WITHIN BROWARD COUNTY, FLORIDA, CONTAINING 50.46 ACRES MORE OR LESS.

SECTION 3.

3.01 THE PROPERTY DESCRIBED HEREINABOVE IN SECTION 2 OF THIS ORDINANCE IS HEREBY DESIGNATED AS A SPECIAL USE PLANNED UNIT DEVELOPMENT DISTRICT, ACCORDING TO THE PROVISIONS IN CHAPTER 39, ARTICLE LII, PLANNED UNIT DEVELOPMENT DISTRICT, SECTIONS 39-880 THROUGH 39-880, BROWARD COUNTY CODE OF ORDINANCES, SUBJECT TO THE FOLLOWING LIMITATIONS, CONDITIONS AND QUALIFICATIONS.

- (A) ALL DEVELOPMENT MUST BE IN COMPLIANCE WITH THE APPLICABLE PROVISIONS OF THE BROWARD COUNTY CODE OF ORDINANCES AND SHALL AT ALL TIMES COMPLY WITH ALL APPLICABLE GOVERNMENTAL LAWS, RULES AND REGULATIONS PERTAINING TO THE PROPERTY INCLUDING, BUT NOT LIMITED TO, APPLICABLE REGULATIONS OF THE STATE OF FLORIDA, DEPARTMENT OF

OFF 11644 PAGE 902

PROTECTION AGENCY, SOUTH FLORIDA WATER MANAGEMENT DISTRICT, THE BROWARD COUNTY ENVIRONMENTAL QUALITY CONTROL BOARD, U.S. ARMY CORPS OF ENGINEERS, AND THE FEDERAL AVIATION ADMINISTRATION.

(B) ALL DEVELOPMENT SHALL BE IN CONFORMANCE WITH THE BROWARD COUNTY LAND USE PLAN, 1977, AS AMENDED, AND THE BROWARD COUNTY UNINCORPORATED AREA LAND USE PLAN, 1979, AS AMENDED.

(C) THE CONCEPTUAL SITE PLAN FOR SAID PROPERTY IS ATTACHED HERETO AS EXHIBIT "A", AND IS HEREBY APPROVED AND MADE A PART OF THIS ORDINANCE AND ALL DEVELOPMENT ON SAID PROPERTY SHALL BE IN ACCORDANCE WITH SAID CONCEPTUAL SITE PLAN EXCEPT AS OTHERWISE SPECIFICALLY PROVIDED IN THIS ORDINANCE. THE BROWARD COUNTY OFFICE OF PLANNING STAFF IS AUTHORIZED TO APPROVE MINOR CHANGES TO THE CONCEPTUAL SITE PLAN TO ALLOW FLEXIBILITY, BUT NOT TO THE DEVELOPMENTAL ORDER ITSELF. MINOR CHANGES ARE DEFINED AS:

- (1) AN INCREASE NOT TO EXCEED FIVE PERCENT (5%) OF THE RESOURCE RECOVERY FACILITY CONSTRUCTION ENVELOPE VOLUME, WHICH IS 750 FEET WIDE BY 800 FEET LONG BY 175 FEET HIGH, EXCLUSIVE OF THE STACKS.
- (2) REVISIONS TO BUILDING LOCATIONS SHOWN ON THE CONCEPTUAL SITE PLAN, EXHIBIT "A", AS LONG AS THE REVISIONS DO NOT DEVIATE MORE THAN 1000 FEET.
- (3) REVISIONS TO THE CONCEPTUAL SITE PLAN AS IT RELATES TO TREE AND SHRUBBERY PLANTING, DRAINAGE CONTROL MAINTENANCE, ACCESS ROAD, SWALE INSTALLATION AND MAINTENANCE WITHIN THE REQUIRED BUFFERS.
- (4) CHANGES IN POINTS OF INGRESS AND EGRESS ON U.S. #441.

OFF 116,
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A Relocation of the FP&L facilities to either:

- a. Within 50 feet north or south of the existing FP&L easement (shown on site plan), or
- b. parallel to the State Road #7 right-of-way, provided these changes are approved by the Resource Recovery Manager.

(D) ANY REQUESTS FOR DEVIATION FROM THE APPROVED CONCEPTUAL SITE PLAN WHICH MAY NOT BE APPROVED BY STAFF PURSUANT TO THE TERMS AND CONDITIONS STATED IN (C) ABOVE, SHALL BE SUBJECT TO REVIEW AND APPROVAL BY THE BOARD OF COUNTY COMMISSIONERS. MAJOR CHANGES TO THE CONCEPTUAL SITE PLAN SHALL BE DEFINED AS:

(1) A CHANGE IN THE USE OF THE PRINCIPAL BUILDING(S) OR PROPERTY TO A USE NOT PERMITTED IN THE SPECIAL USE PLANNED UNIT DEVELOPMENT DISTRICT ESTABLISHED HEREIN;

(2) AN INCREASE IN THE STACK HEIGHTS ABOVE 220 FEET MEAN SEA LEVEL OR AN INCREASE OF MORE THAN FIVE PERCENT (5%) IN THE RESOURCE RECOVERY FACILITY CONSTRUCTION ENVELOPE VOLUME;

(3) AN INCREASE IN THE SIZE OF PRINCIPAL BUILDINGS AS ORIGINALLY CONSTRUCTED;

(4) CHANGES IN POINTS OF INGRESS AND EGRESS OTHER THAN US #441

(5) A REDUCTION IN REQUIRED LANDSCAPING IN THE BUFFER AND ENHANCEMENT AREAS.

(6) ANY OTHER CHANGES NOT HEREIN MENTIONED AS MINOR.

ANY REVISIONS TO THE DEVELOPMENT ORDER ITSELF ARE CONSIDERED MAJOR CHANGES AND ARE SUBJECT TO REVIEW AND APPROVAL BY THE BOARD OF COUNTY COMMISSIONERS. PRIOR

REF 11644 PAGE 904

TO REVIEW BY THE BOARD OF COUNTY COMMISSIONERS, OF ANY MAJOR CHANGES,
RECOMMENDATIONS FROM THE DEVELOPMENT REVIEW COMMITTEE AND THE BROWARD COUNTY
ZONING BOARD SHALL BE FORWARDED TO THE BOARD OF COUNTY COMMISSIONERS.

SECTION 4.

4.01 DEFINITIONS:

(A) RESIDUE: MATERIAL REMAINING SUBSEQUENT TO A COMBUSTION PROCESS
AND MATERIALS REMOVED FROM APPURTENANT AIR POLLUTION CONTROL
DEVICES.

(B) RESIDUE/UNPROCESSABLE WASTE LANDFILL:

A LAND DISPOSAL AREA, CONSTRUCTED IN CONFORMANCE WITH LOCAL,
STATE AND FEDERAL LAWS AND REGULATIONS, IN WHICH THE RESIDUE FROM
A RESOURCE RECOVERY FACILITY AND UNPROCESSABLE WASTE ARE
DEPOSITED.

(C) RESOURCE RECOVERY FACILITY: FACILITY WHICH WILL RECEIVE AND
PROCESS SOLID WASTE IN AN ENVIRONMENTALLY ACCEPTABLE MANNER
PRODUCING A NON-PUTRESCIBLE RESIDUE [LESS THAN TWO-TENTHS (0.2)
PERCENT BY DRY WEIGHT AS DETERMINED BY ASME LARGE INCINERATOR
PERFORMANCE TEST CODE ANSI/ASME PTC 33-LATEST) AND RECOVERY
ENERGY IN THE FORM OF STEAM OR ELECTRIC POWER OR BOTH.

(D) RETENTION AREA: SURFACE WATER IMPOUNDMENT WHICH IS UTILIZED
TO CAPTURE AND PREVENT DIRECT DISCHARGE OF STORM RUNOFF TO
RECEIVING WATERS. RETENTION SYSTEMS CAN DISCHARGE THROUGH SUCH
MECHANISMS AS PERCOLATION, EXFILTRATION, DEEP WELL INJECTION,
CONTROLLED SURFACE WATER-RELEASE OR EVAPORATION PROCESSES.

(E) SOLID WASTE: SOLID WASTE IS ANY GARBAGE, RUBBISH, REFUSE OR
OTHER SOLID OR SEMI-SOLID MATERIAL COLLECTED OR DISPOSED OF, OR
BOTH, IN A REGION, RESULTING FROM DOMESTIC, COMMERCIAL,
INDUSTRIAL, AGRICULTURAL AND GOVERNMENTAL OPERATIONS INCLUDING
OVERSIZED BULKY ARTICLES BUT EXCLUDING HAZARDOUS WASTES.

(F) UNPROCESSABLE WASTE: THAT PORTION OF THE WASTE STREAM WHICH IS OVERSIZED AND PREDOMINATELY NON-COMBUSTIBLE AND, THEREFORE, CANNOT BE PROCESSED BY THE RESOURCE RECOVERY SYSTEM. INCLUDED, BUT NOT LIMITED TO, ARE SUCH WASTES AS:

- METAL OBJECTS AND APPLIANCE
- CONCRETE RUBBLE
- MIXED ROOFING MATERIALS
- NON-COMBUSTIBLE BUILDING DEBRIS
- ROCK, GRAVEL AND OTHER EARTHEN MATERIALS
- YARD TRIMMINGS

(G) SEDIMENT: SOLID MATERIAL, BOTH MINERAL AND ORGANIC, THAT IS IN SUSPENSION, IS BEING TRANSPORTED, OR HAS BEEN MOVED FROM ITS SITE OF ORIGIN BY AIR, WATER, OR GRAVITY AS A PRODUCT OF EROSION.

(H) EROSION: THE PROCESS BY WHICH THE SOIL AND ROCK COMPONENTS OF THE EARTH'S CRUST ARE WORN AWAY AND REMOVED FROM ONE PLACE TO ANOTHER BY NATURAL FORCES SUCH AS WEATHERING, FLOWING SURFACES, AND TRANSPORTATION.

WETLAND HAND ENHANCEMENT AREA

THE REHABILITATION OF WETLAND ECOSYSTEMS THROUGH THE IMPROVEMENT OR REESTABLISHMENT OF WATER FORMS, VEGETATION (REPLANTING, EXOTIC REMOVAL) AND LAND FROM ADJUSTMENT.

SECTION 5.

5.01 THE SPECIAL COMPLEX PLANNED UNIT DEVELOPMENT SHALL INCLUDE THE FOLLOWING MAJOR SPECIAL USES, IN ORDER TO PERMIT A VARIETY OF STRUCTURES AND DIVERSITY OF BUILDING ARRANGEMENTS TO PROVIDE FOR ORDERLY OPERATION OF THE ENTIRE RESOURCE RECOVERY SITE:

OFF 11644 PAGE 906

(A) RESOURCE RECOVERY FACILITY;

(B) RESIDUE/UNPROCESSABLE WASTE LANDFILL;

(C) RETENTION AREAS;

(D) A 2.0 ACRE, MORE OR LESS, FLORIDA POWER AND LIGHT TRANSMISSION
AND DISTRIBUTION FACILITY;

(E) A 5.0 ACRE, MORE OR LESS, FLORIDA POWER AND LIGHT TRANSMISSION
AND DISTRIBUTION FACILITY;

(F) ACCESSORY USES, INCLUDING BUT NOT LIMITED TO, ADMINISTRATION
BUILDING, SCALE HOUSE AND SCALES, EQUIPMENT MANAGEMENT FACILITY,
ELECTRIC GENERATOR FACILITY AND ASH RESIDUE STORAGE BUILDINGS.

SECTION 6. RESOURCE RECOVERY FACILITY

6.01 THE VENDOR SHALL CONSTRUCT AND MAINTAIN A FENCE AROUND THE RESOURCE
RECOVERY FACILITY IN ORDER TO CONTAIN LITTER AND TRASH AND TO PROVIDE SECURITY.

6.02 NO STORAGE OF SANITARY WASTES SHALL BE PERMITTED OUTSIDE THE RESOURCE
RECOVERY FACILITY.

6.03 DISCHARGED AIR POLLUTANTS SHALL NOT RESULT IN A VIOLATION OF ANY
AMBIENT AIR QUALITY STANDARDS AS PROVIDED BY THE DEPARTMENT OF ENVIRONMENTAL
REGULATIONS, U.S. ENVIRONMENTAL PROTECTION AGENCY AND THE BROWARD COUNTY
ENVIRONMENTAL QUALITY CONTROL BOARD.

6.04 VECTORS, DUST AND ODOR SHALL BE CONTROLLED AND SUBJECT TO ALL
GOVERNMENTAL REGULATIONS.

6.05 NO STACK SHALL EXCEED TWO HUNDRED TWENTY FEET (220) FEET IN HEIGHT
ABOVE MEAN SEA LEVEL.

SECTION 7. LANDFILL OPERATION

7.01 ONLY RESIDUE FROM A RESOURCE RECOVERY FACILITY AND UNPROCESSABLE
WASTE SHALL BE DEPOSITED ON THE LANDFILL AREAS.

7.02 HAZARDOUS OR TOXIC WASTE, AS DEFINED BY LOCAL, STATE AND FEDERAL LAWS
OR REGULATIONS, IS SPECIFICALLY PROHIBITED FROM BEING DEPOSITED IN THE
RESIDUE/UNPROCESSABLE WASTE LANDFILL AND FROM PROCESSING AT THE RESOURCE
RECOVERY FACILITY.

7.03 AS RESIDUE OR UNPROCESSABLE WASTE IS DEPOSITED ON THE LANDFILL
FRONTING ON THE SOUTH FORK NEW RIVER OR DESIGNATED BUFFER AREAS, THE EXTERIOR

REF 11644 PAGE 807

LANDSCAPED WITHIN THIRTY (30) DAYS.

7.04 AS RESIDUE OR UNPROCESSIBLE WASTE IS DEPOSITED ON ADDITIONAL PORTIONS OF THE LANDFILL, OTHER EXTERIOR SIDE SLOPES SHALL BE CAPPED IMMEDIATELY UPON REACHING DESIGN GRADE AND LANDSCAPED WITHIN THIRTY (30) DAYS.

7.05 THE HEIGHT OF THE FILL AREA SHALL NOT EXCEED ONE HUNDRED FORTY (140) FEET ABOVE MEAN SEA LEVEL.

7.06 LANDFILL CELL NO. 1 AND CELLS NOS. 2 SHALL CONTAIN A MEMBRANE LINER WHICH ACHIEVES A PERMEABILITY OF 1×10^{-7} CM/SEC OR LESS. THE LINER SHALL BE PLACED ON A SUITABLE SUBGRADE. THE LINER MATERIAL AND SUBGRADE SHALL BE SUBJECT TO APPROVAL BY THE APPROPRIATE REGULATORY AGENCIES.

7.07 RESIDUE SHALL CONTAIN NOT MORE THAN 5% COMBUSTIBLES AND 0.3% PUTRESCIBLE AND SHALL BE QUENCHED TO PROVIDE DUST CONTROL AND TO MINIMIZE BIRD AND RODENT ATTRACTION. IN ADDITION, WATER TANK VEHICLES SHALL BE UTILIZED TO MAINTAIN CONSISTENT DUST CONTROL.

SECTION 8. STORMWATER MANAGEMENT PLAN

8.01 THE USE OF BAFFLED CATCH BASIN (ON THE RESOURCE RECOVERY SITE) FOR OIL, GREASE AND SEDIMENT REMOVAL SHALL BE INCLUDED PRIOR TO THE POINT OF OUTFALL IN THE STORMWATER COLLECTION SYSTEM. A REGULAR MAINTENANCE SCHEDULE BE IMPLEMENTED.

8.02 THE DISCHARGE OF SEWAGE, INDUSTRIAL WASTE, OR OTHER WASTEWATER EFFLUENT INTO SEWERS DESIGNATED TO CARRY STORMWATER RUNOFF SHALL BE PROHIBITED.

8.03 WASTEWATER FROM EQUIPMENT DRAINS, SANITARY DRAINS, WASTE PIT DRAINS, AND TRUCK WASH DRAINS SHALL BE DISCHARGED TO SANITARY SEWERS.

8.04 THE LEACHATE COLLECTION AND DISPOSAL SYSTEM SHALL BE SEPARATE FROM THE STORMWATER RUNOFF SYSTEM.

8.05 THE AREAS DESIGNATED ON THE CONCEPTUAL SITE PLAN AS RETENTION AREA NO. 1, RETENTION AREA NO. 2, AND RETENTION AREA NO. 3, SHALL BE UTILIZED SOLELY FOR STORMWATER RETENTION.

8.06 THERE SHALL BE NO DISCHARGE OF THE LANDFILL LEACHATE INTO THE STORMWATER DETENTION/RETENTION AREAS.

8.07 RETENTION AREA NO. 1 AND RETENTION AREA NO. 2 SHALL BE CONSTRUCTED PRIOR TO THE ISSUANCE OF THE CERTIFICATE OF OCCUPANCY FOR THE RESOURCE RECOVERY FACILITY AND IS A CONDITION PRECEDENT TO THE ISSUANCE OF SAID CERTIFICATE OF OCCUPANCY.

SECTION 9. CONSTRUCTION ACTIVITIES

REF 1164 & PAGE 908

9.01 ALL PERMANENT BERMS CONSTRUCTED FOR THE DEVELOPMENT OF LANDFILLS AND RETENTION AREAS SHALL BE VEGETATED.

9.02 CONSTRUCTION ACTIVITIES SHOULD BE SCHEDULED AND COORDINATED IN ORDER TO MINIMIZE EXPOSURES, ESPECIALLY DURING PERIODS OF HIGHLY EROSION RAINS.

9.03 ADEQUATE SILT BOXES SHALL BE PROVIDED FOR THE CONTROL OF DRAINAGE DURING EXCAVATION OF THE FOUNDATIONS.

9.04 SILT BARRIERS SHALL EXTEND ALONG THE LENGTH OF THE SHORELINE DURING CONSTRUCTION/DREDGING ACTIVITIES TO MINIMIZE SILT AND SOIL ENTERING THE SOUTH FORK NEW RIVER.

SECTION 10. MITIGATION PLAN: WETLAND/HABITAT ENHANCEMENT AND PRESERVATION PLAN

10.01 THE MITIGATION PLAN SHALL INCLUDE A 200' WIDE AND A 300' STRIP ALONG THE RIVER.

THE 300 FOOT WIDE URBAN WILDERNESS AREA (INCLUDES PART OF THE LAPC) FORMS THE SOUTHEASTERN BORDER OF THE LANDFILL PROJECT AND IS ADJACENT TO THE SOUTH FORK NEW RIVER. A PORTION OF THE 300 FOOT WIDE URBAN WILDERNESS AREA EXTENDS FURTHER SOUTH OF THE LAPC AND IS ADJACENT TO THE RESOURCE RECOVERY SITE. IN ADDITION, A 200 FOOT WIDE STRIP WILL EXTEND SOUTH OF THE URBAN WILDERNESS AREA TO THE US 441 BRIDGE OVER THE RIVER. THIS STRIP OF LAND ALONG THE SOUTH FORK NEW RIVER WILL BE A PART OF THE WETLAND ENHANCEMENT PROGRAM FOR THIS PROJECT. THE MAJORITY OF THIS AREA WILL BE RESHAPED TO DEVELOP A MARSH AND SWAMP ENVIRONMENT AND THE CREATION OF A STREAM MEANDER WILL PROVIDE A SHALLOW WATER HABITAT.

10.02 OTHER ON-SITE MITIGATION INCLUDES THE PRESERVATION OF A BUFFER AREA BETWEEN LANDFILL CELL NO. 2 AND THE ANN ROLO PARK TO THE EAST. A 100 FOOT STRIP ADJACENT TO THE EASTERN EDGE OF LANDFILL CELLS NOS. 2/3 WILL BE PLANTED WITH CYPRESS TREES. IMMEDIATELY ADJACENT TO THE CYPRESS PLANTING AREA WILL BE A MARSH BUFFER AREA, WHICH WILL REMAIN UNDEVELOPED. THE WIDTH OF THIS BUFFER AREA WILL BE 250 FEET WIDE ON THE NORTHERN END INCREASING TO 550 FEET WIDE ON THE SOUTHERN END. THE MARSH BUFFER AREA WILL EXTEND TO THE WESTERN BOUNDARY OF THE POND APPLE SLOUGH.

10.3 OFF-SITE MITIGATION PLANS HAVE BEEN DEVELOPED FOR TREE TOPS PARK WHICH IS LOCATED AT THE NORTHEAST CORNER OF ORANGE DRIVE AND GOLDEN SHOE ROAD. FOR THIS PROJECT, THE MITIGATION ENTAILS CREATING A SEMI-PERMANENTLY FLOODED SAWGRASS MARSH AND HARDWOOD HAMMOCK FROM AN EXISTING WAX MYRTLE SALT-BUSH SHRUB THICKET.

REF 11644 PAGE 908

OTHER WETLAND AREAS ARE BEING EXPLORED FOR THEIR POTENTIAL USE AS WETLAND MITIGATION AREAS, AND WETLAND COMMUNITIES SIMILAR TO THOSE ON THE ROUTE 441 SITE ARE BEING INVESTIGATED.

10.04 THE FOLLOWING INCLUDES THE ACREAGES OF THE MITIGATION AREAS:

ON-SITE

LANDFILL MITIGATION AREA

- WETLAND ENHANCEMENT ALONG RIVER ----- 32.0 ACRES

BUFFER AREAS EAST OF LANDFILL CELL NOS. 21

10.04 RESOURCE FACILITY - WETLAND ENHANCEMENT AREA ----- 15.0 ACRES

OFF-SITE

TREE TOPS PARK ----- 15.0 ACRES

IN THE EVENT ANY AREA OR AREAS OTHER THAN TREE TOPS PARK ARE IDENTIFIED AS SUITABLE OFF-SITE MITIGATION AREAS BY APPLICABLE PERMITTING AGENCIES, SUCH AREA OR AREAS MAY BE SUBSTITUTED FOR TREE TOPS PARK PROVIDED THE CUMULATIVE ACREAGE OF SUCH AREA OR AREAS IS NO LESS THAN 15 ACRES AND SUCH SUBSTITUTION IS APPROVED BY THE BROWARD COUNTY OFFICE OF PLANNING.

1) VEGETATION REQUIREMENTS

A) THE ON-SITE MITIGATION PLAN SHALL BE SUBJECT TO APPROVAL BY THE BROWARD COUNTY OFFICE OF PLANNING AND OTHER AGENCIES INCLUDING USCOE AND FDER. THE MITIGATION PLAN FOR THE LANDFILLS AND RESOURCE RECOVERY FACILITIES INCLUDES THE PRESERVATION AND ENHANCEMENT OF LAND ADJACENT TO THE SOUTH FORK NEW RIVER. THE PLAN ENTAILS THE CREATION OF WETLAND HABITATS, WHICH INCLUDES RESHAPING THE LAND AND PLANTING THE AREA WITH WETLAND AND RELATED SPECIES. THE NATIVE PLANT SPECIES PRESENT IN THE PRESERVATION/ENHANCEMENT AREA SHALL BE PRESERVED AND INCORPORATED INTO THE MITIGATION PLAN. PROPER BARRIERS SHALL BE CONSTRUCTED AROUND EACH TREE (AS SPECIFIED BY THE OFFICE OF PLANNING) TO PROTECT THE TREE FROM CONSTRUCTION ACTIVITIES.

B) WETLAND ENHANCEMENT AREA ADJACENT TO THE RRF AND SOUTH OF US 441 BRIDGE SHALL BE PLANTED ACCORDING TO THE SPECIFICATIONS OUTLINED IN TABLE III (RESOURCE RECOVERY FACILITY-WETLAND ENHANCEMENT AREA). THE PLANT SPECIES LIST MAY BE MODIFIED BY THE APPLICABLE PERMITTING AGENCIES AND IT WILL BE INCLUDED IN THE FINAL PLANTING SPECIFICATIONS.

C) THE WETLAND ENHANCEMENT AREA ADJACENT TO THE LANDFILL CELLS SHALL BE PLANTED ACCORDING TO THE SPECIFICATIONS OUTLINED IN TABLE IV (LANDFILL WETLAND ENHANCEMENT AREA). THE PLANT SPECIES LIST MAY BE MODIFIED BY

OFF 11644 PAGE 910

FINAL PLANTING SPECIFICATIONS.

- D) THE 100 FOOT STRIP ADJACENT TO THE EASTERN EDGE OF LANDFILL CELL NO 2 SHALL BE PLANTED WITH CYPRESS TREES AND SEEDLINGS WITH EACH TREE A MINIMUM OF EIGHT (8) FEET IN HEIGHT AT PLANTING. THE PLANTING SPECIFICATIONS SHALL BE APPROVED BY THE BROWARD COUNTY OFFICE OF PLANNING AND OTHER APPLICABLE PERMITTING AGENCIES. ALL EXOTIC TREES (NON-PROTECTED) AS DEFINED IN THE BROWARD COUNTY ORDINANCE 33-1/2 SHALL BE REMOVED FROM THIS AREA.
- E) THE MARSH BUFFER AREA, IMMEDIATELY ADJACENT TO THE CYPRESS PLANTING AREA, SHALL REMAIN UNDISTURBED. THE WIDTH OF THE BUFFER AREA SHALL BE 250 FEET WIDE ON THE NORTHERN END INCREASING TO 550 FEET WIDE ON THE SOUTHERN END. ALL EXOTIC TREES (NON-PROTECTED) AS DEFINED IN THE BROWARD COUNTY ORDINANCE 33-1/2 SHALL BE REMOVED FROM THIS AREA.
- ALL EXOTIC TREES (NON-PROTECTED) AS DEFINED IN THE BROWARD COUNTY ORDINANCE 33-1/2 SHALL BE REMOVED FROM THIS AREA.
- F) ALL DISCARDED CONSTRUCTION MATERIAL AND EQUIPMENT ON THE SITE SHALL BE REMOVED.
- G) THE MITIGATION WORK ON THE SITE SHALL BE COMPLETED PRIOR TO THE COMMENCEMENT OF ANY LANDFILL OPERATION ON SAID PROPERTY OR PRIOR TO ISSUANCE OF THE CERTIFICATE OF OCCUPANCY FOR THE RESOURCE RECOVERY FACILITY, WHICHEVER SHALL OCCUR FIRST.

SECTION 11 HABITAT MAINTENANCE

- 11.01 A MONITORING REPORT SHALL BE SUBMITTED SEMI-ANNUALLY TO THE COUNTY FOR A PERIOD OF THREE (3) YEARS AFTER PLANTING, INDICATING THE SURVIVAL RATES OF THE PLANTED MATERIAL.
- 11.02 THERE SHALL BE 80% SURVIVED OF THE PLANT SPECIES FOR THE FIRST TWO YEARS (2). THE REPLANTING OF VEGETATION SHALL BE INITIATED TO INSURE THE SURVIVAL OF THE PLANT MATERIAL.

SECTION 12. FUTURE PLAT

12.01 THE PLAT FOR THIS PROPERTY SHALL DELINEATE THE WETLAND ENHANCEMENT/PRESERVATION AREAS, THE CYPRESS PLANTING AREA ADJACENT TO THE EASTERN EDGE OF LANDFILL CELL NO. 2, AND THE MARCH BUFFER AREA ADJACENT TO THE CYPRESS PLANTING AREA.

SECTION 13 MANAGEMENT PLAN FOR ANN KOLB PARK

- 13.01 PRIOR TO LANDFILL DEVELOPMENT, AN IMPACT ASSESSMENT SHALL BE PREPARED

REF 1164 4 PAGE 911

OF THE RESOURCE RECOVERY OFFICE OF BROWARD COUNTY TO ADDRESS THE POTENTIAL HYDROLOGICAL IMPACTS OF THE DEVELOPMENT OF THE LANDFILL ON ANN KOLB PARK. DATA AND INFORMATION UTILIZED TO OBTAIN FDER PERMITS WILL BE USED TO CONDUCT THIS ASSESSMENT. IN THE EVENT POTENTIALLY SIGNIFICANT IMPACTS ARE IDENTIFIED, A MANAGEMENT PLAN SHALL BE DEVELOPED TO OFFER RECOMMENDATIONS AND MITIGATIVE ACTIONS TO INSURE THE INTEGRITY OF THE ANN KOLB PARK.

SECTION 14

14.01 THE ZONING DISTRICT MAP SHALL BE, AND HEREBY ARE, AMENDED TO REFLECT THE CHANGE OF ZONING AFFECTED BY THIS ORDINANCE.

14.02 ALL RESOLUTIONS OR PARTS OF RESOLUTIONS OR ORDINANCES OR PARTS OF ORDINANCES IN CONFLICT WITH THIS ORDINANCE ARE HEREBY REPEALED TO THE EXTENT OF SUCH CONFLICT.

SECTION 15 SEVERABILITY

15.01 IF ANY SECTION, SENTENCE, CLAUSE OR PHRASE OF THIS ORDINANCE IS HELD TO BE VALID OR UNCONSTITUTIONAL BY ANY COURT OF COMPETENT JURISDICTION, THEN SAID HOLDING SHALL IN NO WAY AFFECT THE VALIDITY OF THE REMAINING PORTIONS OF THIS ORDINANCE.

SECTION 16 EFFECTIVE DATE

16.01 THIS ORDINANCE SHALL BECOME EFFECTIVE AS PROVIDED BY LAW.

ENACTED: March 16, 1984

FILED WITH DEPARTMENT OF STATE: April 11, 1984

EFFECTIVE: April 18, 1984

5-2-84

OFF
REC 11644 PAGE 912

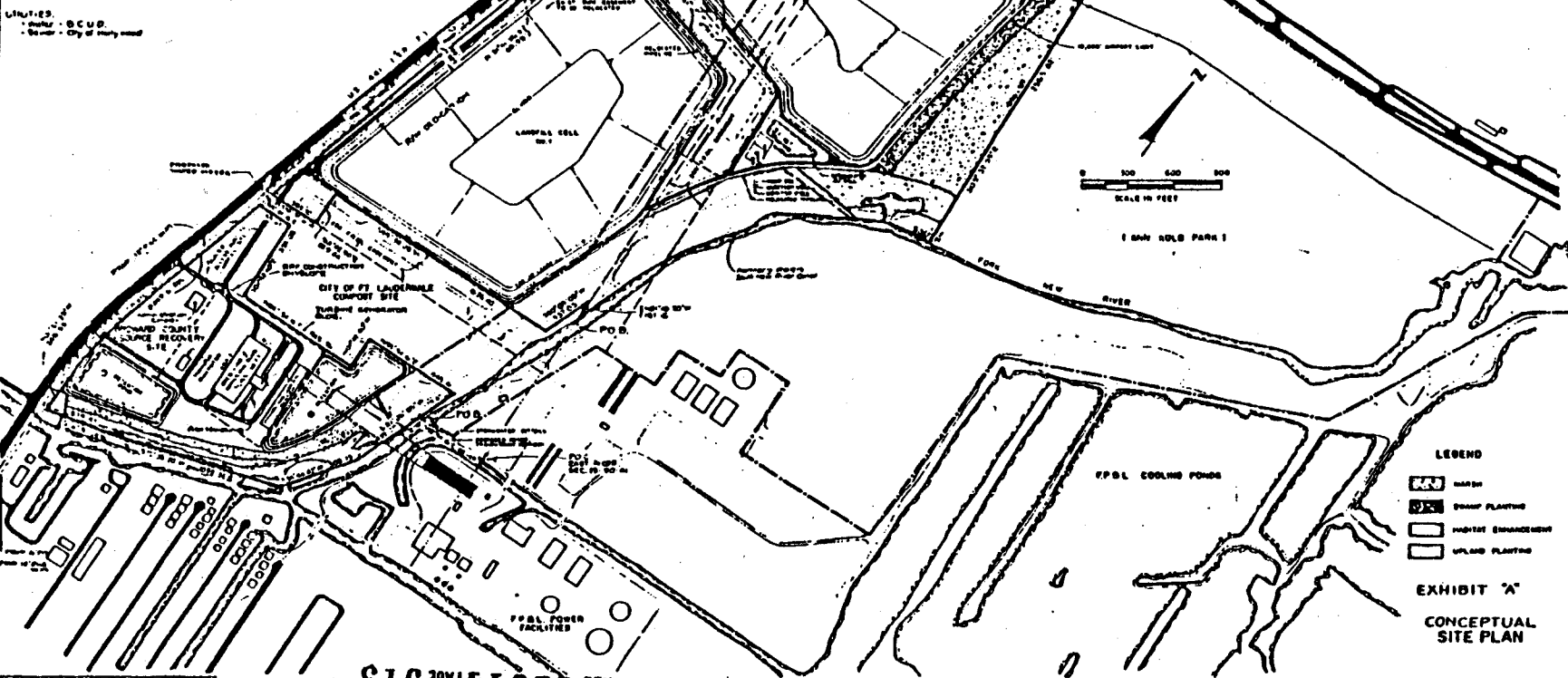
BOUNDARIES:

A portion of land lying within Section 26 and 27, Township 34 North, Range 40 West, and Section 28 and 29, Township 35 North, Range 40 West, being all of Tracts 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 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990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

UTILITIES:

• Water - City of Miami, Miami

• Sewer - City of Miami, Miami



LEGEND

• Hatched area: LAND

• Dashed line: PROPERTY PLANTING

• Solid line: HIGHWAY ENHANCEMENT

• Stippled area: UPLAND PLANTING

EXHIBIT "A"

CONCEPTUAL SITE PLAN

1. 10.00 AC. TOTAL PROJECT AREA	2. 10.00 AC. TOTAL PROJECT AREA	3. 10.00 AC. TOTAL PROJECT AREA	4. 10.00 AC. TOTAL PROJECT AREA	5. 10.00 AC. TOTAL PROJECT AREA	6. 10.00 AC. TOTAL PROJECT AREA	7. 10.00 AC. TOTAL PROJECT AREA	8. 10.00 AC. TOTAL PROJECT AREA	9. 10.00 AC. TOTAL PROJECT AREA	10. 10.00 AC. TOTAL PROJECT AREA
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STATE OF FLORIDA)
COUNTY OF BROWARD) SS

I, F. T. JOHNSON, County Administrator in and
for Broward County, Florida, and Ex-Officio Clerk of the
Board of County Commissioners of said County, DO HEREBY
CERTIFY that the above and foregoing is a true and correct
copy of ordinance 84-62 and attachments

as the same appears of record in the Minutes of a meeting
of said Board of County Commissioners held on 16th
day of March, 1984

IN WITNESS WHEREOF, I have hereunto set my hand
and official seal this 6th day of April
A. D., 1984.

F. T. JOHNSON
COUNTY ADMINISTRATOR

By

Deputy

return to: Al Shamoun
Office of Planning
Governmental Center

(S E A L)



FILED IN THE OFFICIAL RECORDS BOOK
OF BROWARD COUNTY, FLORIDA
JOHNSON
ADMINISTRATOR

REC 11644 PAGE 914

REFERENCE V

APRIL 23, 1984 COPY OF ORDINANCE #84-7(Z)



Office of Planning
Room 329
115 S. Andrews Avenue
Fort Lauderdale, Florida 33301

April 30, 1984

TO WHOM IT MAY CONCERN:

Enclosed is one copy of Ordinance #84-7 (2) that was recorded
on April 23, 1984.

Sincerely,

Al Shamoun
Associate Planner

AS/bb

BROWARD COUNTY BOARD OF COUNTY COMMISSIONERS

Marcia Beach Scott I. Cowan Howard Craft Howard Forman Jack Fried Nicki Englander Grossman Gerald Thompson

84-139705

ORDINANCE NO. 84-7(Z)

AN ORDINANCE AND DEVELOPMENT ORDER OF THE BOARD OF COUNTY COMMISSIONERS OF BROWARD COUNTY, FLORIDA, CHANGING ZONING DISTRICT BOUNDARIES BY REZONING A PARCEL OF LAND LYING WITHIN SECTIONS 24 AND 25, TOWNSHIP 50 SOUTH, RANGE 41 EAST, AND SECTION 19 AND 30, TOWNSHIP 50 SOUTH, RANGE 42 EAST, SAID PARCEL ALSO BEING TRACTS 1 AND 2 AND A PORTION OF TRACT 3, 15 AND 16 IN SAID SECTION 25 AND A PORTION OF TRACTS 2, 3, 4 AND 5 OF TIER 1 IN SAID SECTION 24 OF THE JOHN W. NEWMAN SURVEY AS RECORDED IN PLAT BOOK 2, PAGE 26, OF THE PUBLIC RECORDS OF DADE COUNTY, FLORIDA AND A PORTION OF BLOCKS 2 AND 3, WEST DIXIE FARMS AS RECORDED IN PLAT BOOK 24, PAGE 36, OF THE PUBLIC RECORDS OF BROWARD COUNTY, FLORIDA, AND A PORTION OF LOTS 3, 4, 5, AND 12 OF THE FLORIDA EAST COAST RAILWAY SUBDIVISION AS RECORDED IN PLAT BOOK "B", PAGE 142, OF THE PUBLIC RECORDS OF DADE COUNTY, FLORIDA, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE EAST QUARTER (E 1/4) CORNER OF SAID SECTION 25; THENCE SOUTH 88° 34' 16" WEST, ALONG THE SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4) OF SAID SECTION 25, A DISTANCE OF 491.85 FEET TO THE EASTERLY BOUNDARY OF AFORESAID TRACT 16; THENCE NORTH 20° 05' 06" EAST, ALONG SAID EASTERLY BOUNDARY, 984.08 FEET TO THE POINT OF BEGINNING; THENCE SOUTH 88° 38' 08" WEST ALONG A LINE 409.00 FEET SOUTH OF AND PARALLEL WITH THE NORTH LINE OF SAID TRACT 16, AND AFORESAID TRACT 15 AND WEST DIXIE FARMS, 1626.40 FEET; THENCE SOUTH 01° 42' 50" EAST ALONG A LINE 433.00 FEET WEST OF AND PARALLEL WITH THE EAST BOUNDARY OF SAID WEST DIXIE FARMS 229.64 FEET; THENCE SOUTH 88° 34' 16" WEST ALONG A LINE 8.83 FEET NORTH OF AND PARALLEL WITH THE NORTH LINE OF LOT 3 OF AFORESAID BLOCK 2, A DISTANCE OF 385.0 FEET, TO THE EASTERLY RIGHT-OF-WAY LINE OF STATE ROAD NO. 7 (100' WIDE RIGHT-OF-WAY); THENCE NORTH 14° 51' 56" EAST ALONG SAID RIGHT-OF-WAY LINE 2,032.16 FEET; THENCE CONTINUE ALONG SAID RIGHT-OF-WAY LINE, NORTH 15° 02' 23" EAST, 35.35 FEET TO A POINT OF INTERSECTION WITH THE NORTH RIGHT-OF-WAY LINE OF OAKS ROAD; THENCE NORTH 88° 41' 58" EAST, ALONG SAID NORTH RIGHT-OF-WAY LINE 71.72 FEET TO A POINT OF INTERSECTION WITH THE PROPOSED LIMITED ACCESS LINE AS SHOWN ON: FLORIDA DEPARTMENT OF TRANSPORTATION RIGHT-OF-WAY MAP FOR STATE ROAD NO. 862. (1-595)

RE 11644 MAY 9 1984

Att: Al Shamoun
Office of Planning

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SHEET 6 OF 9, DATED NOVEMBER, 1981; THENCE ALONG SAID LIMITED ACCESS LINE THE FOLLOWING NINE (9) COURSES AND DISTANCES; THENCE NORTH $15^{\circ} 01' 35''$ EAST, 645.68 FEET; THENCE NORTH $43^{\circ} 15' 17''$ EAST, 109.67 FEET; THENCE NORTH $26^{\circ} 24' 46''$ EAST, 541.56 FEET; THENCE NORTH $22^{\circ} 49' 40''$ EAST, 98.27 FEET; THENCE NORTH $36^{\circ} 53' 09''$ EAST 379.73, THENCE NORTH $62^{\circ} 27' 20''$ EAST, 178.19 FEET; THENCE NORTH $79^{\circ} 24' 18''$ EAST, 356.52 FEET; THENCE NORTH $89^{\circ} 37' 32''$ EAST, 642.81 FEET;; THENCE NORTH $77^{\circ} 33' 36''$ EAST, 1096.41 FEET; THENCE SOUTH $03^{\circ} 32' 53''$ EAST, ALONG A LINE 3,478.00 FEET WEST OF AND PARALLEL WITH THE EAST LINE OF AFORESAID SECTION 19, A DISTANCE OF 1,836 FEET MORE OR LESS TO THE NORTHERLY WATERS OF THE SOUTH NEW RIVER CANAL; THENCE WESTERLY AND SOUTHWESTERLY ALONG THE NORTHERLY AND WESTERLY WATERS OF THE SAID SOUTH NEW RIVER CANAL TO A POINT OF INTERSECTION WITH THE EAST BOUNDARY OF AFORESAID RANGE 41 EAST; THENCE NORTH $01^{\circ} 46' 20''$ WEST ALONG SAID EAST BOUNDARY 161.16 FEET MORE OR LESS TO A POINT 95.31 FEET SOUTH OF THE NORTHEAST CORNER OF AFORESAID TRACT 16; THENCE SOUTH $20^{\circ} 05' 06''$ WEST ALONG THE EASTERLY BOUNDARY OF SAID TRACT 16, A DISTANCE OF 337.04 FEET TO THE POINT OF BEGINNING. SAID PARCEL LYING WITHIN BROWARD COUNTY, FLORIDA, CONTAINING 197.87 ACRES, MORE OR LESS, FROM A-1 LIMITED AGRICULTURAL, B-3 GENERAL BUSINESS, AND M-1 LIGHT INDUSTRIAL TO PUD SPECIAL COMPLEX; TOGETHER WITH A PARCEL OF LAND LYING WITHIN THE EAST ONE HALF (E 1/2) OF SECTION 25, TOWNSHIP 50 SOUTH, RANGE 41 EAST, BEING ALL OF TRACTS 18 AND 19 AND A PORTION OF TRACTS 15, 16 AND 20 OF THE JOHN W. NEWMAN SURVEY AS RECORDED IN PLAT BOOK

2, PAGE 26, OF THE PUBLIC RECORDS OF DADE COUNTY, FLORIDA, TOGETHER WITH ALL OF LOTS 4 THROUGH 8, INCLUSIVE OF BLOCK 2, WEST DIXIE FARMS AS RECORDED IN PLAT BOOK 24, PAGE 36, OF THE PUBLIC RECORDS OF BROWARD COUNTY, FLORIDA, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE EAST QUARTER (E 1/4) CORNER OF SAID SECTION 25; THENCE SOUTH $88^{\circ} 34' 16''$ WEST ALONG THE SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4) OF SAID SECTION 25, A DISTANCE OF 491.85 FEET TO THE EASTERLY BOUNDARY OF AFORESAID TRACT 16, SAID POINT ALSO BEING THE POINT OF BEGINNING; THENCE SOUTH $20^{\circ} 05' 06''$ WEST, ALONG SAID EASTERLY BOUNDARY 492.28 FEET TO THE SOUTHEAST CORNER OF AFORESAID TRACT 18; THENCE SOUTH $35^{\circ} 44' 42''$ WEST ALONG THE SOUTHEASTERLY BOUNDARY OF SAID TRACT 18; A DISTANCE OF 506.13 FEET; THENCE SOUTH $72^{\circ} 06' 20''$ WEST, ALONG THE SOUTHERLY BOUNDARY OF SAID TRACT 18 AND AFORESAID TRACT 19, A DISTANCE OF 1053.32 FEET TO THE SOUTHEAST CORNER OF

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AFORESAID TRACT 20; THENCE SOUTH $76^{\circ} 30' 24''$ WEST, ALONG THE SOUTHERLY BOUNDARY OF SAID TRACT 20, A DISTANCE OF 529.67 FEET TO THE EASTERLY RIGHT-OF-WAY LINE OF STATE ROAD NO. 7; THENCE NORTH $01^{\circ} 51' 23''$ WEST, ALONG SAID EASTERLY RIGHT-OF-WAY LINE, 248.90 FEET; THENCE NORTHERLY ALONG SAID EASTERLY RIGHT-OF-WAY LINE AND ALONG THE ARC OF A TANGENT CURVE, CONCAVE TO THE EAST, HAVING A RADIUS OF 1810.08 FEET, A DELTA OF $16^{\circ} 43' 20''$, AN ARC DISTANCE OF 528.28 FEET; THENCE TANGENT TO SAID CURVE NORTH $14^{\circ} 51' 56''$ EAST ALONG SAID EASTERLY RIGHT-OF-WAY LINE, 1120.96 FEET; THENCE NORTH $88^{\circ} 34' 16''$ EAST ALONG THE NORTH LINE OF SAID LOT 4, A DISTANCE OF 239.67 FEET TO THE NORTHEAST CORNER OF SAID LOT 4; THENCE SOUTH $01^{\circ} 42' 40''$ EAST, ALONG THE EAST BOUNDARY OF LOTS 4 THROUGH 8, INCLUSIVE, 524.08 FEET TO THE SOUTHEAST CORNER OF SAID LOT 8; THENCE NORTH $88^{\circ} 34' 16''$ EAST, ALONG A LINE 50.00 FEET NORTH OF AND PARALLEL WITH THE AFORESAID SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4), 843.36 FEET; THENCE NORTH $01^{\circ} 42' 40''$ WEST, 210.00 FEET, THENCE NORTH $88^{\circ} 34' 16''$ EAST, ALONG A LINE 260.00 FEET NORTH OF AND PARALLEL WITH THE SAID SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4) 648.41 FEET TO AFORESAID EASTERLY BOUNDARY OF TRACT 16; THENCE SOUTH $20^{\circ} 05' 06''$ WEST, ALONG SAID EASTERLY BOUNDARY, 279.47 FEET TO THE POINT OF BEGINNING. SAID PARCEL LYING WITHIN BROWARD COUNTY, FLORIDA, CONTAINING 50.46 ACRES MORE OR LESS. FROM A-1 LIMITED AGRICULTURAL, B-3 GENERAL BUSINESS, M-3 GENERAL INDUSTRIAL, AND M-4 LIMITED HEAVY INDUSTRIAL TO PUD SPECIAL COMPLEX; PURSUANT TO CHAPTER 39, ARTICLE LII, PLANNED UNIT DEVELOPMENT DISTRICT, SECTIONS 39-880 THROUGH 39-890 OF THE BROWARD COUNTY CODE OF ORDINANCES; PROVIDING FOR LIMITATIONS, CONDITIONS, AND QUALIFICATIONS; PROVIDING THAT THE CONCEPTUAL SITE PLAN ATTACHED HERETO AS EXHIBIT "A" IS INCORPORATED HEREIN AND MADE A PART THEREOF; PROVIDING THAT ALL DEVELOPMENT SHALL BE IN ACCORDANCE WITH SAID CONCEPTUAL SITE PLAN EXCEPT AS OTHERWISE MODIFIED AS PERMITTED BY THE ORDINANCE; PROVIDING FOR A CHANGE OF THE ZONING OF THE DISTRICT MAPS TO REFLECT THE CHANGE OF ZONING EFFECTED BY THIS ORDINANCE; PROVIDING FOR SEVERABILITY; AND PROVIDING FOR AN EFFECTIVE DATE.

(Sponsored by Board of County Commissioners)

WHEREAS, ON JANUARY 25, 1963, THE BOARD OF COUNTY COMMISSIONERS OF BROWARD COUNTY DETERMINED RESOURCE RECOVERY WAS THE MOST VIABLE OPTION FOR PROCESSING THE FUTURE WASTE GENERATED BY THE RESIDENTS OF, AND VISITORS TO, BROWARD COUNTY, AND IN THE BEST INTERESTS OF BROWARD COUNTY; AND

REF 11644 PAGE 918

WHEREAS, THE INTENDED USE OF THE SUBJECT PROPERTY FOR A RESOURCE RECOVERY FACILITY, RESIDUE AND UNPROCESSABLE WASTE LANDFILL; RETENTION AREAS AND ACCESSORY USES, WAS APPROVED BY THE BOARD OF COUNTY COMMISSIONERS ON APRIL 12, 1983; AND

WHEREAS, CHAPTER 39, ARTICLE LII, PLANNED UNIT DEVELOPMENT DISTRICT, S39-880 THROUGH 39-890, BROWARD COUNTY CODE OF ORDINANCES, PROVIDES FOR PLANNED UNIT DEVELOPMENTS IN ORDER TO PROMOTE PLANNED GROWTH, MORE EFFICIENT USE OF LAND, REDUCE CAPITAL IMPROVEMENT COSTS, ENCOURAGE INNOVATIVE DESIGN AND CONSERVE THE NATURAL AMENITIES OF THE LAND; AND

WHEREAS, THE BROWARD COUNTY SOLID WASTE DIVISION HAS APPLIED FOR A CHANGE OF ZONING FROM A-1 LIMITED AGRICULTURAL, B-3 GENERAL BUSINESS, M-1 LIGHT INDUSTRIAL, M-3 GENERAL INDUSTRIAL AND M-4 LIMITED HEAVY INDUSTRIAL TO SPECIAL USE PLANNED UNIT DEVELOPMENT; AND

WHEREAS, THE BROWARD COUNTY ZONING BOARD HAS HELD A PUBLIC HEARING AND MADE A FORMAL RECOMMENDATION; NOW, THEREFORE,

BE IT ORDAINED BY THE BOARD OF COUNTY COMMISSIONERS OF BROWARD COUNTY, FLORIDA:

SECTION 1.

1.01 THIS IS A DEVELOPMENT ORDER OF THE BOARD OF COUNTY COMMISSIONERS OF BROWARD COUNTY AS REQUIRED FOR REZONING OF PROPERTY BY CHAPTER 5, ARTICLE IX, DIVISION 1, 5-180, ET. SEQ., BROWARD COUNTY CODE OF ORDINANCES

SECTION 2.

2.01 THE PROPERTY WHICH IS THE SUBJECT OF THIS ORDINANCE, HEREINAFTER "PROPERTY," IS LEGALLY DESCRIBED AS FOLLOWS:

THAT PORTION OF SECTIONS 24 AND 25, TOWNSHIP 50 SOUTH, RANGE 41 EAST, AND SECTION 19 AND 30, TOWNSHIP 50 SOUTH, RANGE 42 EAST, LOCATED IN BROWARD COUNTY, FLORIDA; DESCRIBED MORE PARTICULARLY AS FOLLOWS:

COMMENCING AT THE EAST QUARTER (E 1/4) CORNER OF SAID SECTION 25; THENCE SOUTH $88^{\circ} 34' 16''$ WEST, ALONG THE SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4) OF SAID SECTION 25, A DISTANCE OF 491.85 FEET TO THE EASTERLY BOUNDARY OF AFORESAID TRACT 16; THENCE NORTH $20^{\circ} 05' 06''$ EAST, ALONG SAID EASTERLY BOUNDARY, 984.08 FEET TO THE POINT OF BEGINNING; THENCE SOUTH $88^{\circ} 38' 08''$ WEST ALONG A LINE 409.00 FEET SOUTH OF AND PARALLEL WITH THE NORTH LINE OF SAID TRACT 16 AND AFORESAID TRACT 15 AND WEST DIXIE FARMS, 1626.40 FEET; THENCE SOUTH $01^{\circ} 42' 50''$ EAST ALONG A LINE 433.00 FEET WEST OF AND PARALLEL WITH THE EAST BOUNDARY OF SAID WEST DIXIE FARMS 229.64 FEET; THENCE SOUTH $88^{\circ} 34' 16''$

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WEST ALONG A LINE 8.83 FEET NORTH OF AND PARALLEL WITH THE NORTH LINE OF LOT 3 OF AFORESAID BLOCK 2, A DISTANCE OF 385.0 FEET, TO THE EASTERLY RIGHT-OF-WAY LINE OF STATE ROAD NO. 7 (100' WIDE RIGHT-OF-WAY); THENCE NORTH $14^{\circ} 51' 56''$ EAST ALONG SAID RIGHT-OF-WAY LINE 2,032.16 FEET; THENCE CONTINUE ALONG SAID RIGHT-OF-WAY LINE, NORTH $15^{\circ} 02' 23''$ EAST, 35.35 FEET TO A POINT OF INTERSECTION WITH THE NORTH RIGHT-OF-WAY LINE OF OAKS ROAD; THENCE NORTH $88^{\circ} 41' 58''$ EAST, ALONG SAID NORTH RIGHT-OF-WAY LINE 71.72 FEET TO A POINT OF INTERSECTION WITH THE PROPOSED LIMITED ACCESS LINE AS SHOWN ON FLORIDA DEPARTMENT OF TRANSPORTATION RIGHT-OF-WAY MAP FOR STATE ROAD NO. 862. (1-595) SHEET 6 OF 9, DATED NOVEMBER, 1981: THENCE ALONG SAID LIMITED ACCESS LINE THE FOLLOWING NINE (9) COURSES AND DISTANCES; THENCE NORTH $15^{\circ} 01' 35''$ EAST, 645.68 FEET; THENCE NORTH $43^{\circ} 15' 17''$ EAST, 109.67 FEET; THENCE NORTH $26^{\circ} 24' 46''$ EAST, 541.56 FEET; THENCE NORTH $22^{\circ} 49' 40''$ EAST, 98.27 FEET; THENCE NORTH $36^{\circ} 53' 09''$ EAST, 379.73 FEET; THENCE NORTH $62^{\circ} 27' 20''$ EAST, 178.19 FEET; THENCE, NORTH $79^{\circ} 24' 18''$ EAST, 356.52 FEET; THENCE NORTH $89^{\circ} 37' 32''$ EAST, 642.81 FEET; THENCE NORTH $77^{\circ} 33' 36''$ EAST, 1096.41 FEET; THENCE SOUTH $03^{\circ} 32' 53''$ EAST, ALONG A LINE 3,478.00 FEET WEST OF AND PARALLEL WITH THE EAST LINE OF AFORESAID SECTION 19, A DISTANCE OF 1,836 FEET MORE OR LESS TO THE NORTHERLY WATERS OF THE SOUTH NEW RIVER CANAL; THENCE WESTERLY AND SOUTHWESTERLY ALONG THE NORTHERLY AND WESTERLY WATERS OF THE SAID SOUTH NEW RIVER CANAL TO A POINT OF INTERSECTION WITH THE EAST BOUNDARY OF AFORESAID RANGE 41 EAST; THENCE NORTH $01^{\circ} 46' 20''$ WEST ALONG SAID EAST BOUNDARY 161.16 FEET MORE OR LESS TO A POINT 95.31 FEET SOUTH OF THE NORTHEAST CORNER OF AFORESAID TRACT 16; THENCE SOUTH $20^{\circ} 05' 06''$ WEST ALONG THE EASTERLY BOUNDARY OF SAID TRACT 16, A DISTANCE OF 337.04 FEET TO THE POINT OF BEGINNING. SAID PARCEL LYING WITHIN BROWARD COUNTY, FLORIDA, CONTAINING 197.87 ACRES, MORE OR LESS, TOGETHER WITH THAT PORTION OF SECTION 25, TOWNSHIP 50 SOUTH, RANGE 41 EAST, LOCATED IN BROWARD COUNTY, FLORIDA; DESCRIBED MORE PARTICULARLY AS FOLLOWS:

COMMENCING AT THE EAST QUARTER (E 1/4) CORNER OF SAID SECTION 25; THENCE SOUTH $88^{\circ} 34' 16''$ WEST ALONG THE SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4) OF SAID SECTION 25, A DISTANCE OF 491.85 FEET TO THE EASTERLY BOUNDARY OF AFORESAID TRACT 16, SAID POINT ALSO BEING THE POINT OF BEGINNING THENCE SOUTH $20^{\circ} 05' 06''$ WEST, ALONG SAID EASTERLY BOUNDARY 492.28 FEET TO THE SOUTHEAST CORNER OF AFORESAID TRACT 18; THENCE SOUTH $35^{\circ} 44' 42''$ WEST ALONG THE

REF 11644 PM 920

SOUTHEASTERLY BOUNDARY OF SAID TRACT 18, A DISTANCE OF 508.13 FEET; THENCE SOUTH 72° 06' 20" WEST, ALONG THE SOUTHERLY BOUNDARY OF SAID TRACT 18 AND AFORESAID TRACT 19, A DISTANCE OF 1053.32 FEET TO THE SOUTHEAST CORNER OF AFORESAID TRACT 20; THENCE SOUTH 76° 30' 24" WEST, ALONG THE SOUTHERLY BOUNDARY OF SAID TRACT 20, A DISTANCE OF 529.67 FEET TO THE EASTERLY RIGHT-OF-WAY LINE OF STATE ROAD NO. 7; THENCE NORTH 01° 51' 23" WEST, ALONG SAID EASTERLY RIGHT-OF-WAY LINE, 248.90 FEET; THENCE NORTHERLY ALONG SAID EASTERLY RIGHT-OF-WAY LINE AND ALONG THE ARC OF A TANGENT CURVE; CONCAVE TO THE EAST, HAVING A RADIUS OF 1810.06 FEET, A DELTA OF 16° 43' 20", AN ARC DISTANCE OF 528.28 FEET; THENCE TANGENT TO SAID CURVE NORTH 14° 51' 56" EAST ALONG SAID EASTERLY RIGHT-OF-WAY LINE, 1120.96 FEET; THENCE NORTH 88° 34' 16" EAST ALONG THE NORTH LINE OF SAID LOT 4, A DISTANCE OF 239.67 FEET TO THE NORTHEAST CORNER OF SAID LOT 4; THENCE SOUTH 01° 42' 40" EAST, ALONG THE EAST BOUNDARY OF LOTS 4 THROUGH 8 INCLUSIVE, 524.08 FEET TO THE SOUTHEAST CORNER OF SAID LOT 8; THENCE NORTH 88° 34' 16" EAST, ALONG A LINE 50.00 FEET NORTH OF AND PARALLEL WITH THE AFORESAID SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4), 843.36 FEET; THENCE NORTH 01° 42' 40" WEST, 210.00 FEET, THENCE NORTH 88° 34' 16" EAST, ALONG A LINE 260.00 FEET NORTH OF AND PARALLEL WITH THE SAID SOUTH LINE OF THE NORTHEAST ONE QUARTER (NE 1/4) 648.41 FEET TO AFORESAID EASTERLY BOUNDARY OF TRACT 16; THENCE SOUTH 20° 05' 06" WEST, ALONG SAID EASTERLY BOUNDARY, 279.47 FEET TO THE POINT OF BEGINNING. SAID PARCEL LYING WITHIN BROWARD COUNTY, FLORIDA, CONTAINING 50.46 ACRES MORE OR LESS.

SECTION 3.

3.01 THE PROPERTY DESCRIBED HEREINABOVE IN SECTION 2 OF THIS ORDINANCE IS HEREBY DESIGNATED AS A SPECIAL USE PLANNED UNIT DEVELOPMENT DISTRICT, ACCORDING TO THE PROVISIONS IN CHAPTER 39, ARTICLE LII, PLANNED UNIT DEVELOPMENT DISTRICT, SECTIONS 39-880 THROUGH 39-880, BROWARD COUNTY CODE OF ORDINANCES, SUBJECT TO THE FOLLOWING LIMITATIONS, CONDITIONS AND QUALIFICATIONS.

- (A) ALL DEVELOPMENT MUST BE IN COMPLIANCE WITH THE APPLICABLE PROVISIONS OF THE BROWARD COUNTY CODE OF ORDINANCES AND SHALL AT ALL TIMES COMPLY WITH ALL APPLICABLE GOVERNMENTAL LAWS, RULES AND REGULATIONS PERTAINING TO THE PROPERTY INCLUDING, BUT NOT LIMITED TO, APPLICABLE REGULATIONS OF THE STATE OF FLORIDA, DEPARTMENT OF

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ENVIRONMENTAL REGULATION, THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, SOUTH FLORIDA WATER MANAGEMENT DISTRICT, THE BROWARD COUNTY ENVIRONMENTAL QUALITY CONTROL BOARD, U.S. ARMY CORPS OF ENGINEERS, AND THE FEDERAL AVIATION ADMINISTRATION.

- (B) ALL DEVELOPMENT SHALL BE IN CONFORMANCE WITH THE BROWARD COUNTY LAND USE PLAN, 1977, AS AMENDED, AND THE BROWARD COUNTY UNINCORPORATED AREA LAND USE PLAN, 1979, AS AMENDED.
- (C) THE CONCEPTUAL SITE PLAN FOR SAID PROPERTY IS ATTACHED HERETO AS EXHIBIT "A", AND IS HEREBY APPROVED AND MADE A PART OF THIS ORDINANCE AND ALL DEVELOPMENT ON SAID PROPERTY SHALL BE IN ACCORDANCE WITH SAID CONCEPTUAL SITE PLAN EXCEPT AS OTHERWISE SPECIFICALLY PROVIDED IN THIS ORDINANCE. THE BROWARD COUNTY OFFICE OF PLANNING STAFF IS AUTHORIZED TO APPROVE MINOR CHANGES TO THE CONCEPTUAL SITE PLAN TO ALLOW FLEXIBILITY, BUT NOT TO THE DEVELOPMENTAL ORDER ITSELF. MINOR CHANGES ARE DEFINED AS:
- (1) AN INCREASE NOT TO EXCEED FIVE PERCENT (5%) OF THE RESOURCE RECOVERY FACILITY CONSTRUCTION ENVELOPE VOLUME, WHICH IS 750 FEET WIDE BY 800 FEET LONG BY 175 FEET HIGH, EXCLUSIVE OF THE STACKS.
 - (2) REVISIONS TO BUILDING LOCATIONS SHOWN ON THE CONCEPTUAL SITE PLAN, EXHIBIT "A", AS LONG AS THE REVISIONS DO NOT DEVIATE MORE THAN 1000 FEET.
 - (3) REVISIONS TO THE CONCEPTUAL SITE PLAN AS IT RELATES TO TREE AND SHRUBBERY PLANTING, DRAINAGE CONTROL MAINTENANCE, ACCESS ROAD, SWALE INSTALLATION AND MAINTENANCE WITHIN THE REQUIRED BUFFERS.
 - (4) CHANGES IN POINTS OF INGRESS AND EGRESS ON U.S. #441.

REC 11644 PAGE 922

(5)

A Relocation of the F&L facilities to either:

- a. Within 50 feet north or south of the existing F&L easement (shown on site plan), or
- b. parallel to the State Road #7 right-of-way, provided these changes are approved by the Resource Recovery Manager.

(D) ANY REQUESTS FOR DEVIATION FROM THE APPROVED CONCEPTUAL SITE PLAN WHICH MAY NOT BE APPROVED BY STAFF PURSUANT TO THE TERMS AND CONDITIONS STATED IN (C) ABOVE, SHALL BE SUBJECT TO REVIEW AND APPROVAL BY THE BOARD OF COUNTY COMMISSIONERS. MAJOR CHANGES TO THE CONCEPTUAL SITE PLAN SHALL BE DEFINED AS:

- (1) A CHANGE IN THE USE OF THE PRINCIPAL BUILDING(S) OR PROPERTY TO A USE NOT PERMITTED IN THE SPECIAL USE PLANNED UNIT DEVELOPMENT DISTRICT ESTABLISHED HEREIN;
- (2) AN INCREASE IN THE STACK HEIGHTS ABOVE 220 FEET MEAN SEA LEVEL OR AN INCREASE OF MORE THAN FIVE PERCENT (5%) IN THE RESOURCE RECOVERY FACILITY CONSTRUCTION ENVELOPE VOLUME;
- (3) AN INCREASE IN THE SIZE OF PRINCIPAL BUILDINGS AS ORIGINALLY CONSTRUCTED;
- (4) CHANGES IN POINTS OF INGRESS AND EGRESS OTHER THAN US #441
- (5) A REDUCTION IN REQUIRED LANDSCAPING IN THE BUFFER AND ENHANCEMENT AREAS.
- (6) ANY OTHER CHANGES NOT HEREIN MENTIONED AS MINOR.

ANY REVISIONS TO THE DEVELOPMENT ORDER ITSELF ARE CONSIDERED MAJOR CHANGES AND ARE SUBJECT TO REVIEW AND APPROVAL BY THE BOARD OF COUNTY COMMISSIONERS. PRIOR

REC 11644 PM 923

TO REVIEW BY THE BOARD OF COUNTY COMMISSIONERS, OF ANY MAJOR CHANGES, RECOMMENDATIONS FROM THE DEVELOPMENT REVIEW COMMITTEE AND THE BROWARD COUNTY ZONING BOARD SHALL BE FORWARDED TO THE BOARD OF COUNTY COMMISSIONERS.

SECTION 4.

4.01 DEFINITIONS:

(A) RESIDUE: MATERIAL REMAINING SUBSEQUENT TO A COMBUSTION PROCESS AND MATERIALS REMOVED FROM APPURTENANT AIR POLLUTION CONTROL DEVICES.

(B) RESIDUE/UNPROCESSABLE WASTE LANDFILL:

A LAND DISPOSAL AREA, CONSTRUCTED IN CONFORMANCE WITH LOCAL, STATE AND FEDERAL LAWS AND REGULATIONS, IN WHICH THE RESIDUE FROM A RESOURCE RECOVERY FACILITY AND UNPROCESSABLE WASTE ARE DEPOSITED.

(C) RESOURCE RECOVERY FACILITY: FACILITY WHICH WILL RECEIVE AND PROCESS SOLID WASTE IN AN ENVIRONMENTALLY ACCEPTABLE MANNER PRODUCING A NON-PUTRESCIBLE RESIDUE [LESS THAN TWO-TENTHS (0.2) PERCENT BY DRY WEIGHT AS DETERMINED BY ASME LARGE INCINERATOR PERFORMANCE TEST CODE ANSI/ASME PTC 33-LATEST) AND RECOVERY ENERGY IN THE FORM OF STEAM OR ELECTRIC POWER OR BOTH.

(D) RETENTION AREA: SURFACE WATER IMPOUNDMENT WHICH IS UTILIZED TO CAPTURE AND PREVENT DIRECT DISCHARGE OF STORM RUNOFF TO RECEIVING WATERS. RETENTION SYSTEMS CAN DISCHARGE THROUGH SUCH MECHANISMS AS PERCOLATION, EXFILTRATION, DEEP WELL INJECTION, CONTROLLED SURFACE WATER-RELEASE OR EVAPORATION PROCESSES.

(E) SOLID WASTE: SOLID WASTE IS ANY GARBAGE, RUBBISH, REFUSE OR OTHER SOLID OR SEMI-SOLID MATERIAL COLLECTED OR DISPOSED OF, OR BOTH, IN A REGION, RESULTING FROM DOMESTIC, COMMERCIAL, INDUSTRIAL, AGRICULTURAL AND GOVERNMENTAL OPERATIONS INCLUDING OVERSIZED BULKY ARTICLES BUT EXCLUDING HAZARDOUS WASTES.

OFF 11644 PAGE 924

(F) UNPROCESSABLE WASTE: THAT PORTION OF THE WASTE STREAM WHICH IS OVERSIZED AND PREDOMINATELY NON-COMBUSTIBLE AND, THEREFORE, CANNOT BE PROCESSED BY THE RESOURCE RECOVERY SYSTEM. INCLUDED, BUT NOT LIMITED TO, ARE SUCH WASTES AS:

- METAL OBJECTS AND APPLIANCE
- CONCRETE RUBBLE
- MIXED ROOFING MATERIALS
- NON-COMBUSTIBLE BUILDING DEBRIS
- ROCK, GRAVEL AND OTHER EARTHEN MATERIALS
- YARD TRIMMINGS

(G) SEDIMENT: SOLID MATERIAL, BOTH MINERAL AND ORGANIC, THAT IS IN SUSPENSION, IS BEING TRANSPORTED, OR HAS BEEN MOVED FROM ITS SITE OF ORIGIN BY AIR, WATER, OR GRAVITY AS A PRODUCT OF EROSION.

(H) EROSION: THE PROCESS BY WHICH THE SOIL AND ROCK COMPONENTS OF THE EARTH'S CRUST ARE WORN AWAY AND REMOVED FROM ONE PLACE TO ANOTHER BY NATURAL FORCES SUCH AS WEATHERING, FLOWING SURFACES, AND TRANSPORTATION.

WETLAND HAND ENHANCEMENT AREA

THE REHABILITATION OF WETLAND ECOSYSTEMS THROUGH THE IMPROVEMENT OR REESTABLISHMENT OF WATER FORMS, VEGETATION (REPLANTING, EXOTIC REMOVAL) AND LAND FORM ADJUSTMENT.

SECTION 5.

5.01 THE SPECIAL COMPLEX PLANNED UNIT DEVELOPMENT SHALL INCLUDE THE FOLLOWING MAJOR SPECIAL USES, IN ORDER TO PERMIT A VARIETY OF STRUCTURES AND DIVERSITY OF BUILDING ARRANGEMENTS TO PROVIDE FOR ORDERLY OPERATION OF THE ENTIRE RESOURCE RECOVERY SITE:

OFF 11644 PM 925

- (A) RESOURCE RECOVERY FACILITY;
- (B) RESIDUE/UNPROCESSABLE WASTE LANDFILL;
- (C) RETENTION AREAS;
- (D) A 2.0- ACRE, MORE OR LESS, FLORIDA POWER AND LIGHT TRANSMISSION AND DISTRIBUTION FACILITY;
- (E) A 5.0 ACRE, MORE OR LESS, FLORIDA POWER AND LIGHT TRANSMISSION AND DISTRIBUTION FACILITY;
- (F) ACCESSORY USES, INCLUDING BUT NOT LIMITED TO, ADMINISTRATION BUILDING, SCALE HOUSE AND SCALES, EQUIPMENT MANAGEMENT FACILITY, ELECTRIC GENERATOR FACILITY AND ASH RESIDUE STORAGE BUILDINGS.

SECTION 6. RESOURCE RECOVERY FACILITY

6.01 THE VENDOR SHALL CONSTRUCT AND MAINTAIN A FENCE AROUND THE RESOURCE RECOVERY FACILITY IN ORDER TO CONTAIN LITTER AND TRASH AND TO PROVIDE SECURITY.

6.02 NO STORAGE OF SANITARY WASTES SHALL BE PERMITTED OUTSIDE THE RESOURCE RECOVERY FACILITY.

6.03 DISCHARGED AIR POLLUTANTS SHALL NOT RESULT IN A VIOLATION OF ANY AMBIENT AIR QUALITY STANDARDS AS PROVIDED BY THE DEPARTMENT OF ENVIRONMENTAL REGULATIONS, U.S. ENVIRONMENTAL PROTECTION AGENCY AND THE BROWARD COUNTY ENVIRONMENTAL QUALITY CONTROL BOARD.

6.04 VECTORS, DUST AND ODOR SHALL BE CONTROLLED AND SUBJECT TO ALL GOVERNMENTAL REGULATIONS.

6.05 NO STACK SHALL EXCEED TWO HUNDRED TWENTY FEET (220) FEET IN HEIGHT ABOVE MEAN SEA LEVEL.

SECTION 7. LANDFILL OPERATION

7.01 ONLY RESIDUE FROM A RESOURCE RECOVERY FACILITY AND UNPROCESSABLE WASTE SHALL BE DEPOSITED ON THE LANDFILL AREAS.

7.02 HAZARDOUS OR TOXIC WASTE, AS DEFINED BY LOCAL, STATE AND FEDERAL LAWS OR REGULATIONS, IS SPECIFICALLY PROHIBITED FROM BEING DEPOSITED IN THE RESIDUE/UNPROCESSABLE WASTE LANDFILL AND FROM PROCESSING AT THE RESOURCE RECOVERY FACILITY.

7.03 AS RESIDUE OR UNPROCESSABLE WASTE IS DEPOSITED ON THE LANDFILL FRONTING ON THE SOUTH FORK NEW RIVER OR DESIGNATED BUFFER AREAS, THE EXTERIOR

OFF 11644 MAY 926

SIDE SLOPES SHALL BE CAPPED IMMEDIATELY UPON REACHING DESIGN GRADE AND LANDSCAPED WITHIN THIRTY (30) DAYS.

7.04 AS RESIDUE OR UNPROCESSIBLE WASTE IS DEPOSITED ON ADDITIONAL PORTIONS OF THE LANDFILL, OTHER EXTERIOR SIDE SLOPES SHALL BE CAPPED IMMEDIATELY UPON REACHING DESIGN GRADE AND LANDSCAPED WITHIN THIRTY (30) DAYS.

7.05 THE HEIGHT OF THE FILL AREA SHALL NOT EXCEED ONE HUNDRED FORTY (140) FEET ABOVE MEAN SEA LEVEL.

7.06 LANDFILL CELL NO. 1 AND CELLS NOS. 2 SHALL CONTAIN A MEMBRANE LINER WHICH ACHIEVES A PERMEABILITY OF 1×10^{-7} CM/SEC OR LESS. THE LINER SHALL BE PLACED ON A SUITABLE SUBGRADE. THE LINER MATERIAL AND SUBGRADE SHALL BE SUBJECT TO APPROVAL BY THE APPROPRIATE REGULATORY AGENCIES.

7.07 RESIDUE SHALL CONTAIN NOT MORE THAN 5% COMBUSTIBLES AND 0.3% PUTRESCIBLE AND SHALL BE QUENCHED TO PROVIDE DUST CONTROL AND TO MINIMIZE BIRD AND RODENT ATTRACTION. IN ADDITION, WATER TANK VEHICLES SHALL BE UTILIZED TO MAINTAIN CONSISTENT DUST CONTROL.

SECTION 8. STORMWATER MANAGEMENT PLAN

8.01 THE USE OF BAFFLED CATCH BASIN (ON THE RESOURCE RECOVERY SITE) FOR OIL, GREASE AND SEDIMENT REMOVAL SHALL BE INCLUDED PRIOR TO THE POINT OF OUTFALL IN THE STORMWATER COLLECTION SYSTEM. A REGULAR MAINTENANCE SCHEDULE BE IMPLEMENTED.

8.02 THE DISCHARGE OF SEWAGE, INDUSTRIAL WASTE, OR OTHER WASTEWATER EFFLUENT INTO SEWERS DESIGNATED TO CARRY STORMWATER RUNOFF SHALL BE PROHIBITED.

8.03 WASTEWATER FROM EQUIPMENT DRAINS, SANITARY DRAINS, WASTE PIT DRAINS, AND TRUCK WASH DRAINS SHALL BE DISCHARGED TO SANITARY SEWERS.

8.04 THE LEACHATE COLLECTION AND DISPOSAL SYSTEM SHALL BE SEPARATE FROM THE STORMWATER RUNOFF SYSTEM.

8.05 THE AREAS DESIGNATED ON THE CONCEPTUAL SITE PLAN AS RETENTION AREA NO. 1, RETENTION AREA NO. 2, AND RETENTION AREA NO. 3, SHALL BE UTILIZED SOLELY FOR STORMWATER RETENTION.

8.06 THERE SHALL BE NO DISCHARGE OF THE LANDFILL LEACHATE INTO THE STORMWATER DETENTION/RETENTION AREAS.

8.07 RETENTION AREA NO. 1 AND RETENTION AREA NO. 2 SHALL BE CONSTRUCTED PRIOR TO THE ISSUANCE OF THE CERTIFICATE OF OCCUPANCY FOR THE RESOURCE RECOVERY FACILITY AND IS A CONDITION PRECEDENT TO THE ISSUANCE OF SAID CERTIFICATE OF OCCUPANCY.

SECTION 9. CONSTRUCTION ACTIVITIES

REC 11644 MAY 9 27

9.01 ALL PERMANENT BERMS CONSTRUCTED FOR THE DEVELOPMENT OF LANDFILLS AND RETENTION AREAS SHALL BE VEGETATED.

9.02 CONSTRUCTION ACTIVITIES SHOULD BE SCHEDULED AND COORDINATED IN ORDER TO MINIMIZE EXPOSURES, ESPECIALLY DURING PERIODS OF HIGHLY EROSIVE RAINS.

9.03 ADEQUATE SILT BOXES SHALL BE PROVIDED FOR THE CONTROL OF DRAINAGE DURING EXCAVATION OF THE FOUNDATIONS.

9.04 SILT BARRIERS SHALL EXTEND ALONG THE LENGTH OF THE SHORELINE DURING CONSTRUCTION/DREDGING ACTIVITIES TO MINIMIZE SILT AND SOIL ENTERING THE SOUTH FORK NEW RIVER.

SECTION 10. MITIGATION PLAN: WETLAND/HABITAT ENHANCEMENT AND PRESERVATION PLAN:

10.01 THE MITIGATION PLAN SHALL INCLUDE A 200' WIDE AND A 300' STRIP ALONG THE RIVER.

THE 300 FOOT WIDE URBAN WILDERNESS AREA (INCLUDES PART OF THE LAPC) FORMS THE SOUTHEASTERN BORDER OF THE LANDFILL PROJECT AND IS ADJACENT TO THE SOUTH FORK NEW RIVER. A PORTION OF THE 300 FOOT WIDE URBAN WILDERNESS AREA EXTENDS FURTHER SOUTH OF THE LAPC AND IS ADJACENT TO THE RESOURCE RECOVERY SITE. IN ADDITION, A 200 FOOT WIDE STRIP WILL EXTEND SOUTH OF THE URBAN WILDERNESS AREA TO THE US 441 BRIDGE OVER THE RIVER. THIS STRIP OF LAND ALONG THE SOUTH FORK NEW RIVER WILL BE A PART OF THE WETLAND ENHANCEMENT PROGRAM FOR THIS PROJECT. THE MAJORITY OF THIS AREA WILL BE RESHAPED TO DEVELOP A MARSH AND SWAMP ENVIRONMENT AND THE CREATION OF A STREAM MEANDER WILL PROVIDE A SHALLOW WATER HABITAT.

10.02 OTHER ON-SITE MITIGATION INCLUDES THE PRESERVATION OF A BUFFER AREA BETWEEN LANDFILL CELL NO. 2 AND THE ANN ROBB PARK TO THE EAST. A 100 FOOT STRIP ADJACENT TO THE EASTERN EDGE OF LANDFILL CELLS NOS. 2/3 WILL BE PLANTED WITH CYPRESS TREES. IMMEDIATELY ADJACENT TO THE CYPRESS PLANTING AREA WILL BE A MARSH BUFFER AREA, WHICH WILL REMAIN UNDEVELOPED. THE WIDTH OF THIS BUFFER AREA WILL BE 250 FEET WIDE ON THE NORTHERN END INCREASING TO 550 FEET WIDE ON THE SOUTHERN END. THE MARSH BUFFER AREA WILL EXTEND TO THE WESTERN BOUNDARY OF THE POND APPLE SLOUGH.

10.03 OFF-SITE MITIGATION PLANS HAVE BEEN DEVELOPED FOR TREE TOPS PARK WHICH IS LOCATED AT THE NORTHEAST CORNER OF ORANGE DRIVE AND GOLDEN SHOE ROAD. FOR THIS PROJECT, THE MITIGATION ENTAILS CREATING A SEMI-PERMANENTLY FLOODED SAWGRASS MARSH AND HARDWOOD HAMMOCK FROM AN EXISTING WAX MYRTLE SALTBUSH SHRUB THICKET.

REC 11044 MAY 928

OTHER OFF-SITE AREAS ARE BEING EXPLORED FOR THEIR POTENTIAL USE AS WETLAND MITIGATION AREAS, AND WETLAND COMMUNITIES SIMILAR TO THOSE ON THE ROUTE 441 SITE ARE BEING INVESTIGATED.

10.04 THE FOLLOWING INCLUDES THE ACREAGES OF THE MITIGATION AREAS:

ON-SITE

LANDFILL MITIGATION AREA

- WETLAND ENHANCEMENT ALONG RIVER ----- 32.0 ACRES

BUFFER AREAS EAST OF LANDFILL CELL NOS. 21

10.04 RESOURCE FACILITY - WETLAND ENHANCEMENT AREA ----- 15.0 ACRES

OFF-SITE

TREE TOPS PARK ----- 15.0 ACRES

IN THE EVENT ANY AREA OR AREAS OTHER THAN TREE TOPS PARK ARE IDENTIFIED AS SUITABLE OFF-SITE MITIGATION AREAS BY APPLICABLE PERMITTING AGENCIES, SUCH AREA OR AREAS MAY BE SUBSTITUTED FOR TREE TOPS PARK PROVIDED THE CUMULATIVE ACREAGE OF SUCH AREA OR AREAS IS NO LESS THAN 15 ACRES AND SUCH SUBSTITUTION IS APPROVED BY THE BROWARD COUNTY OFFICE OF PLANNING.

1) VEGETATION REQUIREMENTS

A) THE ON-SITE MITIGATION PLAN SHALL BE SUBJECT TO APPROVAL BY THE BROWARD COUNTY OFFICE OF PLANNING AND OTHER AGENCIES INCLUDING USCOE AND FDER. THE MITIGATION PLAN FOR THE LANDFILLS AND RESOURCE RECOVERY FACILITIES INCLUDES THE PRESERVATION AND ENHANCEMENT OF LAND ADJACENT TO THE SOUTH FORK NEW RIVER. THE PLAN ENTAILS THE CREATION OF WETLAND HABITATS, WHICH INCLUDES RESHAPING THE LAND AND PLANTING THE AREA WITH WETLAND AND RELATED SPECIES. THE NATIVE PLANT SPECIES PRESENT IN THE PRESERVATION/ENHANCEMENT AREA SHALL BE PRESERVED AND INCORPORATED INTO THE MITIGATION PLAN. PROPER BARRIERS SHALL BE CONSTRUCTED AROUND EACH TREE (AS SPECIFIED BY THE OFFICE OF PLANNING) TO PROTECT THE TREE FROM CONSTRUCTION ACTIVITIES.

B) WETLAND ENHANCEMENT AREA ADJACENT TO THE RRF AND SOUTH OF US 441 BRIDGE SHALL BE PLANTED ACCORDING TO THE SPECIFICATIONS OUTLINED IN TABLE III (RESOURCE RECOVERY FACILITY-WETLAND ENHANCEMENT AREA). THE PLANT SPECIES LIST MAY BE MODIFIED BY THE APPLICABLE PERMITTING AGENCIES AND IT WILL BE INCLUDED IN THE FINAL PLANTING SPECIFICATIONS.

C) THE WETLAND ENHANCEMENT AREA ADJACENT TO THE LANDFILL CELLS SHALL BE PLANTED ACCORDING TO THE SPECIFICATIONS OUTLINED IN TABLE IV (LANDFILL WETLAND ENHANCEMENT AREA). THE PLANT SPECIES LIST MAY BE MODIFIED BY

THE APPLICABLE PERMITTING AGENCIES AND IT WILL BE INCLUDED IN THE FINAL PLANTING SPECIFICATIONS.

- D) THE 100 FOOT STRIP ADJACENT TO THE EASTERN EDGE OF LANDFILL CELL NO 2 SHALL BE PLANTED WITH CYPRESS TREES AND SEEDLINGS WITH EACH TREE A MINIMUM OF EIGHT (8) FEET IN HEIGHT AT PLANTING. THE PLANTING SPECIFICATIONS SHALL BE APPROVED BY THE BROWARD COUNTY OFFICE OF PLANNING AND OTHER APPLICABLE PERMITTING AGENCIES. ALL EXOTIC TREES (NON-PROTECTED) AS DEFINED IN THE BROWARD COUNTY ORDINANCE 33-1/2 SHALL BE REMOVED FROM THIS AREA.
- E) THE MARSH BUFFER AREA, IMMEDIATELY ADJACENT TO THE CYPRESS PLANTING AREA, SHALL REMAIN UNDISTURBED. THE WIDTH OF THE BUFFER AREA SHALL BE 250 FEET WIDE ON THE NORTHERN END INCREASING TO 550 FEET WIDE ON THE SOUTHERN END. ALL EXOTIC TREES (NON-PROTECTED) AS DEFINED IN THE BROWARD COUNTY ORDINANCE 33-1/2 SHALL BE REMOVED FROM THIS AREA.
- ALL EXOTIC TREES (NON-PROTECTED) AS DEFINED IN THE BROWARD COUNTY ORDINANCE 33-1/2 SHALL BE REMOVED FROM THIS AREA.
- F) ALL DISCARDED CONSTRUCTION MATERIAL AND EQUIPMENT ON THE SITE SHALL BE REMOVED.
- G) THE MITIGATION WORK ON THE SITE SHALL BE COMPLETED PRIOR TO THE COMMENCEMENT OF ANY LANDFILL OPERATION ON SAID PROPERTY OR PRIOR TO ISSUANCE OF THE CERTIFICATE OF OCCUPANCY FOR THE RESOURCE RECOVERY FACILITY, WHICHEVER SHALL OCCUR FIRST.

SECTION 11 HABITAT MAINTENANCE

- 11.01 A MONITORING REPORT SHALL BE SUBMITTED SEMI-ANNUALLY TO THE COUNTY FOR A PERIOD OF THREE (3) YEARS AFTER PLANTING, INDICATING THE SURVIVAL RATES OF THE PLANTED MATERIAL.
- 11.02 THERE SHALL BE 80% SURVIVED OF THE PLANT SPECIES FOR THE FIRST TWO YEARS (2). THE REPLANTING OF VEGETATION SHALL BE INITIATED TO INSURE THE SURVIVAL OF THE PLANT MATERIAL.

SECTION 12. FUTURE PLAT

- 12.01 THE PLAT FOR THIS PROPERTY SHALL DELINEATE THE WETLAND ENHANCEMENT/PRESERVATION AREAS, THE CYPRESS PLANTING AREA ADJACENT TO THE EASTERN EDGE OF LANDFILL CELL NO. 2, AND THE MARSH BUFFER AREA ADJACENT TO THE CYPRESS PLANTING AREA.

SECTION 13 MANAGEMENT PLAN FOR ANN KOLB PARK

- 13.01 PRIOR TO LANDFILL DEVELOPMENT, AN IMPACT ASSESSMENT SHALL BE PREPARED

REC 11644 PM 930

BY THE RESOURCE RECOVERY OFFICE OF BROWARD COUNTY TO ADDRESS THE POTENTIAL HYDROLOGICAL IMPACTS OF THE DEVELOPMENT OF THE LANDFILL ON ANN KOLB PARK. DATA AND INFORMATION UTILIZED TO OBTAIN FDER PERMITS WILL BE USED TO CONDUCT THIS ASSESSMENT. IN THE EVENT POTENTIALLY SIGNIFICANT IMPACTS ARE IDENTIFIED, A MANAGEMENT PLAN SHALL BE DEVELOPED TO OFFER RECOMMENDATIONS AND MITIGATIVE ACTIONS TO INSURE THE INTEGRITY OF THE ANN KOLB PARK.

SECTION 14

14.01 THE ZONING DISTRICT MAP SHALL BE, AND HEREBY ARE, AMENDED TO REFLECT THE CHANGE OF ZONING AFFECTED BY THIS ORDINANCE.

14.02 ALL RESOLUTIONS OR PARTS OF RESOLUTIONS OR ORDINANCES OR PARTS OF ORDINANCES IN CONFLICT WITH THIS ORDINANCE ARE HEREBY REPEALED TO THE EXTENT OF SUCH CONFLICT.

SECTION 15 SEVERABILITY

15.01 IF ANY SECTION, SENTENCE, CLAUSE OR PHRASE OF THIS ORDINANCE IS HELD TO BE VALID OR UNCONSTITUTIONAL BY ANY COURT OF COMPETENT JURISDICTION, THEN SAID HOLDING SHALL IN NO WAY AFFECT THE VALIDITY OF THE REMAINING PORTIONS OF THIS ORDINANCE.

SECTION 16 EFFECTIVE DATE

16.01 THIS ORDINANCE SHALL BECOME EFFECTIVE AS PROVIDED BY LAW.

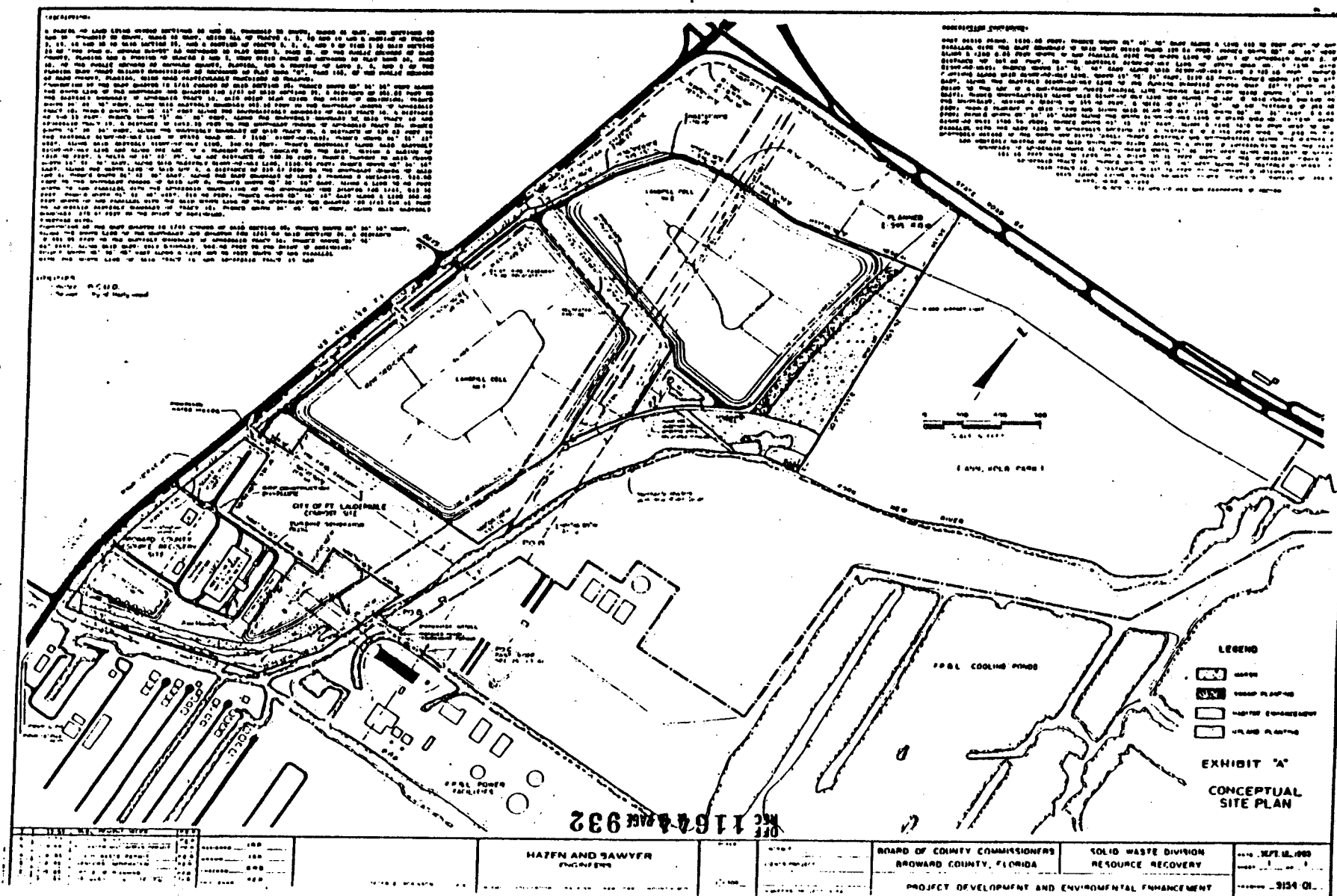
ENACTED: March 16, 1984

FILED WITH DEPARTMENT OF STATE: April 11, 1984

EFFECTIVE: April 18, 1984

6-2-84

REC 11646 MAR 931



STATE OF FLORIDA)
COUNTY OF BROWARD) SS

I, F. T. JOHNSON, County Administrator in and
for Broward County, Florida, and Ex-Officio Clerk of the
Board of County Commissioners of said County, DO HEREBY
CERTIFY that the above and foregoing is a true and correct
copy of ordinance 84-72 and attachments
as the same appears of record in the Minutes of a meeting
of said Board of County Commissioners held on 16th
day of March, 1984.

IN WITNESS WHEREOF, I have hereunto set my hand
and official seal this 6th day of April
A. D., 1984.

F. T. JOHNSON
COUNTY ADMINISTRATOR

By

Phyllis Naylor
Deputy

Return to: Al Shamoun
Office of Planning
Governmental Center

(S E A L)

REC 11644 MAR 933

RECORDED IN THE OFFICIAL RECORDS BOOK
OF BROWARD COUNTY, FLORIDA
F. T. JOHNSON
COUNTY ADMINISTRATOR

1
2
3
4 RESOLUTION

5 OVERALL ECONOMIC DEVELOPMENT PLANNING COMMITTEE

6
7 WHEREAS, the Board of County Commissioners has taken the lead in
8 resource recovery;

9 WHEREAS, the Board has determined that mass burning technology is the
10 appropriate resource recovery technology for Broward County;

11 WHEREAS, the Board has identified two sites, which are appropriate for
12 resource recovery;

13 WHEREAS, solid waste disposal is an integral part of the infrastructure
14 system in Broward County;

15 WHEREAS, without adequate infrastructure, economic development in
16 Broward County is hindered;

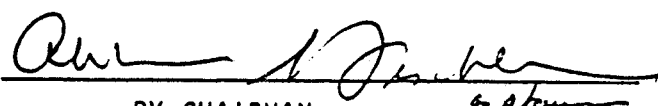
17 NOW, THEREFORE, BE IT RESOLVED THAT:

18 (1) If resource recovery is not implemented on a timely basis, a
19 major deterrent to economic development exists.

20 (2) The Board of County Commissioners is urged to take all expeditious
21 actions to implement resource recovery on the two recommended sites.

22 (3) The Overall Economic Development Planning Committee urges that
23 any governmental actions necessary to implement the resource recovery program
24 be undertaken immediately.

25
26 Jan. 19, 1984
27 DATE

28 
29 BY CHAIRMAN
30 Dr. Abe Fischler

Commissioner Grossman expressed her concerns about the grave underestimation of the cost of the telephones in the jail and would hope that any other additions to the system would be under administrative control.

Mr. Johnson stated that he is aware of the concerns of the entire commission and is proposing to update the total master plan on all the facilities so that the Board will be apprised of the entire situation.

The Chairman now called for a roll call vote on the aforementioned motion, and same was unanimously carried.

COUNTY ADMINISTRATOR'S REPORT - MUNICIPALITY - POMPANO BEACH -
RESOURCE RECOVERY FACILITY & INDUSTRIAL DEVELOPMENT (19)

County Administrator Floyd T. Johnson informed the Board of a meeting that he attended on January 15, 1985 at the Pompano Beach City Commission where a report had been received from two consultants who were retained to present a plan for industrial development in the area in which Broward County has an interest to build the northern resource recovery facility. In speaking before the City Commission, Mr. Johnson informed them that the county is still interested in that site for the resource recovery facility; and apparently Mr. Johnson's comments were met with favor because they voted to have a committee comprised of membership from the staff of the city of Pompano Beach, their Chamber of Commerce, their Industrial Development Board and representation from the county in order to work out a compromise in terms of building the facility as planned, and at the same time not preclude industrial development in the area.

Mr. Johnson concluded by stating that the Mayor had requested him to serve on the committee and advised that he would make that request to the Board of County Commissioners.

Without objection, the Board requested that Mr. Johnson serve on subject committee.

Commissioner Beach mentioned that she intends to place on a future agenda, discussion regarding the construction of a proposed facility on that particular site as it relates to composting for the disposal of sludge.

Commissioner Thompson suggested that with the proposed industrial construction in the area and the incinerator that generates electricity an industrial zone could be created; and with the generation of power from the facility and working in conjunction with Florida Power & Light Company (FP&L) in its distribution to provide electricity for the industrial complex from that site, there could be some cost savings which would be beneficial to the development.

Mr. Johnson stated that part of the package is to negotiate with FP&L for the sale of electricity, but the county is required by law to make that sale to the provider of electric power in the area and doubts whether a separate type of arrangement could be made with other agencies.

In answer to Commissioner Craft's inquiry regarding the use of steam which could be used by heavy type industry, Mr. Johnson stated that the city of Pompano Beach is envisioning an industrial park-warehouse development.

PLATS - CYPRESS FINANCIAL CENTER - DEFERRED INDEFINITELY (44)

The Board now discussed the plat entitled "Cypress Financial Center", District 1, 18-UP-84. (Deferred from the County Commission meeting of December 4, 1984 at applicant's request in order to submit the linen.)

LAND USE PLAN DESCRIPTIONS



BROWARD COUNTY PLANNING COUNCIL
115 SOUTH ANDREWS AVENUE, ROOM 3-307, FORT LAUDERDALE, FLORIDA, 33301
Telephone: (305) 357-6695

March 15, 1985

Phyllis:

Reminder. Remember that 1983 Land Use Map is only labeledd Exhibit with no further identification. A "B" should be added to read Exhibit "B".

Susan K. Philp, Director
Comprehensive Planning



BROWARD COUNTY PLANNING COUNCIL
115 SOUTH ANDREWS AVENUE, ROOM 3-307, FORT LAUDERDALE, FLORIDA, 33301
Telephone: (305) 357-6695

March 15, 1985

Mr. Dave Cerrato
Malcolm Pirnie, Inc.
2 Corporate Park Drive
White Plains, NY 10602

Dear Mr. Cerrato:

Re: Zoning and Land Use Plans - Route 441 Resource Recovery Site

Pursuant to your request regarding the Route 441 Resource Recovery Site, this letter contains land use and zoning information.

The Broward County Planning Council is the local planning agency for the preparation and administration of the Broward County Land Use Plan pursuant to the requirements of Chapter 163, F.S. The Broward County Land Use Plan was adopted by the Board of County Commissioners on November 9, 1977 in compliance with Chapter 163, F.S. and the Broward County Charter. Exhibit A is the ordinance adopting the Broward County Land Use Plan. Pursuant to the provisions included in the County Land Use Plan text, local governments in Broward County can prepare their own land use plans. Once a local plan is certified by the Planning Council and is adopted by the unit of local government in accordance with the requirements of Chapter 163, it becomes the effective land use plan.

Exhibit B is a map entitled "Land Uses For Broward County 1983." As indicated this is a conceptual map of land use plans and is not to be considered the official Land Use Plan map for Broward County. Because of technical and legal problems, there is not a map showing the composite effective land use designation. However, the Broward County Planning Council has on file all of the certified and effective land use plans.

The site is currently within the Unincorporated Area. Within the 5 mile radius there are 13 Land Use Plans adopted pursuant to Chapter 163 which must be complied with. These plans are:

1. Unincorporated Area Land Use Plan
2. Plantation Land Use Master Plan
3. Sunrise Land Use Element
4. City of Lauderhill Comprehensive Plan, Land Use Element
5. Land Use 2000 (City of Fort Lauderdale)
6. City of Dania Future Land Use Plan Element
7. Pembroke Pines Land Use Plan
8. Cooper City Comprehensive Plan
9. Town of Davie Future Land Use Element
10. Miramar Land Use Plan
11. Hacienda Village Future Land Use Plan (Note: The Town of Davie has incorporated Hacienda Village by State Legislation but the Hacienda Village Future Land Use Plan still applies.)
12. Comprehensive Plan, City of Hollywood and
13. Broward County Land Use Plan for the area covered by City of Hollywood as Hollywood's plan has not been certified, Hollywood's and Broward County Land Use Plan's must both be complied with as both were adopted pursuant to Chapter 163, F.S.

The Site

Pursuant to an agreement between the Planning Council and the County Commissioners, the County's Office of Planning reviews developments for consistency with the Unincorporated Area. The Office of Planning has reviewed rezonings to effectuate the development of the Route 441 site and signed off that the development conforms to the land use plan at the time it reviewed the rezoning for this area. Exhibit C provides the documentation. The Planning Council staff concurs with this determination. The site is covered by the uses permitted in the Industrial Land Use classification. Exhibit D is an excerpt from the Unincorporated Area Land Use Plan enumerating the uses permitted in its Industrial Land Use classification. Utility uses are allowed in areas designated industrial. Solid waste and sewage disposal facilities and structures are considered, among others, as legitimate utility permitted uses by the County Land Use Plan.

The Surrounding Area

The land use categories shown on the County Land Use Plan and on the effective Land Use Plans are fairly broad. However, no development permit may be issued that is not in compliance with the effective land use plan. Local governments were also required to bring zoning into compliance with the effective land use plan within a reasonable time. If the zoning category placed on the land, consistent with the land use provisions, does not allow the existing use, the existing use falls within the local government's non-conforming provision of its zoning code. There is no requirement that an existing use be removed within any time period.

In the preparation of the County Land Use Plan, local governments were required to submit to the Planning Council an existing land use plan map, a zoning map, and a proposed land use plan map. For all of Broward County, the Broward County Land Use Plan provisions reflected existing land uses to a great extent. Further, local governments oftentimes made use of County Land Use Plan flexibility rules to further refine its local plan to accurately reflect existing uses. Consequently, within the 5 mile Study Area existing uses are permitted by the effective land use plan designation with few exceptions. The most notable exception in this area, are the mobile home parks west of Ravenswood Road and north of the Dania Cut-Off Canal which are not permitted by the Industrial land use classification on these parks.

Based on our present knowledge, we do not find any abnormal or undesirable trends in the area. We expect the remaining vacant industrially designated areas to be developed or plans refined for these areas in the near future. In addition, we expect that the past industrial type of construction in the area consisting of a relatively unplanned heavy commercial and storage uses will change to create a development pattern more compatible with the goals and objectives of the County Land Use Plan. This perception is due to the fact that construction of I-595 is imminent and that the Town of Davie has incorporated the area previously under the Hacienda Village Corporate limits. The Town is expending a considerable amount of time and effort to plan and insure that the industrial areas are developed appropriately.

Please let us know if you need additional information.

Sincerely,

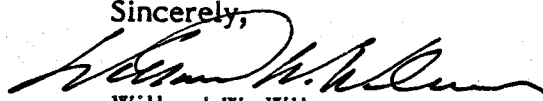

Willard W. Wilson
Administrator

EXHIBIT "A"

Perry

ORDINANCE NO. 77-66

AN ORDINANCE RELATING TO THE AREA OF LAND USE PLANNING: PROVIDING FOR THE ADOPTION OF THE BROWARD COUNTY LAND USE PLAN AS THE FUTURE LAND USE PLAN ELEMENT FOR BROWARD COUNTY, FLORIDA; PROVIDING FOR THE DESIGNATION OF THE PROPOSED FUTURE GENERAL DISTRIBUTION, LOCATION AND EXTENT OF THE USES OF LAND FOR HOUSING, BUSINESS, INDUSTRY, AGRICULTURE, PARKS, RECREATION, CONSERVATION, EDUCATION, PUBLIC BUILDINGS AND GROUNDS, OTHER PUBLIC FACILITIES AND OTHER CATEGORIES OF THE PUBLIC AND PRIVATE USES OF LAND; PROVIDING STANDARDS, PROCEDURES AND MINIMUM REQUIREMENTS TO BE FOLLOWED IN THE CONTROL AND DISTRIBUTION OF POPULATION DENSITIES AND BUILDING AND STRUCTURE INTENSITIES OF BROWARD COUNTY; PROVIDING FOR THE CERTIFICATION OF LOCAL LAND USE PLANS WHICH ARE IN SUBSTANTIAL CONFORMITY WITH THE COUNTY LAND USE PLAN; PROVIDING STANDARDS, PROCEDURES AND MINIMUM REQUIREMENTS FOR THE REVIEW OF APPLICATIONS FOR DEVELOPMENT PERMITS AND FOR THE ADOPTION OF DEVELOPMENT ORDERS; PROVIDING THAT THIS ORDINANCE SHALL PREVAIL OVER MUNICIPAL ORDINANCES WHEN IN CONFLICT; PROVIDING FOR SEVERABILITY OF INVALID PORTIONS AND PROVIDING FOR AN EFFECTIVE DATE.

WHEREAS, the Broward County Charter provides for the preparation and adoption of a County Land Use Plan; and,

WHEREAS, the Broward County Charter provides that the County Land Use Plan shall prevail over municipal ordinances when they are in conflict; and

WHEREAS, the Broward County Charter provides that the County Land Use Plan shall be the effective land use plan for Broward County and shall control land uses throughout Broward County immediately after its adoption except that zoning as to permitted uses and densities need not comply until one (1) year following the date of its adoption; and

WHEREAS, the passage by a municipality or other governmental unit of a land use plan less restrictive than the County Land Use Plan is an ultra vires act and as such prohibited by the Broward County Charter; and

WHEREAS, the Local Government Comprehensive Planning Act

1 of 1975 provides that each unit of local government shall prepare,
2 adopt and implement a comprehensive plan including a future land
3 use plan element; that Charter counties may exercise such addi-
4 tional authority over municipalities or districts as is provided
5 for in its Charter, and that the planning responsibilities between
6 a Charter county and the several municipalities therein shall be
7 stipulated in the Charter; NOW, THEREFORE,

8 BE IT ORDAINED BY THE BOARD OF COUNTY COMMISSIONERS OF
9 BROWARD COUNTY, FLORIDA:

10 Section 1. INTENT AND PURPOSE

11 1.01 The purpose of this Ordinance is to enable the
12 County Commission to implement Sections 6 and 8 of the Broward
13 County Charter. This Ordinance is intended:

- 14 (a) To plan for the future development and growth of
15 Broward County;
- 16 (b) To designate the proposed future general distribu-
17 tion, location and extent of the uses of land for
18 housing, business, industry, agriculture, parks,
19 recreation, conservation, education, public build-
20 ings and grounds, other public facilities and other
21 categories of the public and private uses of land.
- 22 (c) To establish standards, procedures and minimum re-
23 quirements to be followed in the control and dis-
24 tribution of population densities and building and
25 structure intensities within Broward County.
- 26 (d) To establish standards, procedures and minimum re-
27 quirements for the review of applications for de-
28 velopment permits and for the adoption of develop-
29 ment orders.
- 30 (e) To allow local government within Broward County to
31 plan for future development and growth within its
32 boundaries through the adoption and implementation
33 of land use plans which have been certified as
being in substantial conformity with the County
Land Use Plan.

29 Section 2.

30 2.01 That the attached County Land Use Plan Map to-
31 gether with the attached volume entitled "Broward County Land Use
32 Plan 1977" are incorporated by reference herein and hereby adopted
33 by the Board of County Commissioners of Broward County, Florida.

1 as the Broward County Land Use Plan pursuant to its authority.
2 under the Broward County Charter and in compliance with the
3 requirements of the Local Government Comprehensive Planning Act
4 of 1975.

5 Section 3.

6 3.01 Pursuant to the Broward County Charter this Ordi-
7 nance shall prevail in the event of conflict between this Ordi-
8 nance and municipal ordinances.

9 Section 4. SEVERABILITY

10 4.01 If any section, sentence, clause or phrase of this
11 Ordinance or the attached County Land Use Plan Map or the attached
12 "Broward County Land Use Plan 1977" is held to be invalid or
13 unconstitutional by any Court of competent jurisdiction, then said
14 holding shall in no way affect the validity of the remaining por-
15 tions of this Ordinance.

16 Section 5. EFFECTIVE DATE

17 5.01 This Ordinance shall become effective as provided
18 by law.

19
20 ENACTED this 9th day of November, A.D., 1977.

21
22 FILED WITH DEPARTMENT OF STATE this 17th day of November, A.D., 1977.

23
24 EFFECTIVE on this 22nd day of November, A.D., 1977.

25
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33 BL:ed
11/16/77
1086-402

EXHIBIT "B"

Map entitled "LAND USES FOR BROWARD COUNTY 1983: Conceptual Map of Land Use Plans for Municipalities and Unincorporated Area.

Map too large to be included with letter. Document included in separate package.

EXHIBIT "C"

VERIFICATION OF COMPLIANCE OR NON-COMPLIANCE WITH THE UNINCORPORATED AREA

LAND USE PLAN MAP



Office of Planning

609 S. Andrews Avenue

2nd Floor

Fort Lauderdale, Florida 33301

DATE: January 5, 1984

FILE NUMBER: 6-Z-84

TYPE:

REZONING

X

PLAT

SITE PLAN

ADMINISTRATIVE REPORT

OTHER

PETITIONER OR NAME: Broward County Resource Recovery Office

LAND USE PLAN DESIGNATION Industrial

REQUESTED: PUD - Special Complexes

X

CONFORMS TO LAND USE PLAN MAP

DOES NOT CONFORM TO LAND USE PLAN MAP

COMMENTS:

STUDY AREA 21 FLEX ZONE 58

ADJACENT LAND USES: NORTH - Industrial
SOUTH - Industrial
EAST - Hacienda Village; Utility
WEST - Hacienda Village; Industrial

ANY CONCURRENCE OR APPROVAL STATED HEREON IS BASED SOLELY ON THE TERMS OF THE UNINCORPORATED LAND USE PLAN MAP AND SHALL NOT BE CONSTRUED TO BE AN APPROVAL OR WAIVER OF REQUIREMENTS OF ANY OTHER CODE, ORDINANCE OR LAW.

Cyrena Rodgers
Authorized Signature

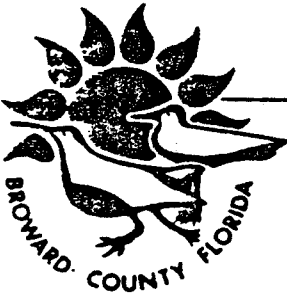
LAND USE IMPLEMENTATION SECTION
OFFICE OF PLANNING

BROWARD COUNTY BOARD OF COUNTY COMMISSIONERS

Marcia Beach Scott I. Cowan Howard Craft Howard C. Forman Jack Fried Nicki Englander Grossman Gerald F. Thompson
An Equal Opportunity Employer

VERIFICATION OF COMPLIANCE OR NON-COMPLIANCE WITH THE UNINCORPORATED AREA

LAND USE PLAN MAP



Office of Planning

609 S. Andrews Avenue

2nd Floor

Fort Lauderdale, Florida 33301

REZONING X

PLAT

SITE PLAN, _____

DATE: January 5, 1984

TYPE:

FILE NUMBER: 5-Z-84

ADMINISTRATIVE REPORT

OTHER

PETITIONER OR NAME: Broward County Resource Recovery Office

LAND USE PLAN DESIGNATION Industrial

REQUESTED: PUD - Special Complexes

X CONFORMS TO LAND USE PLAN MAP

DOES NOT CONFORM TO LAND USE PLAN MAP

COMMENTS: STUDY AREA 21 FLEX ZONE 58

ADJACENT LAND USES: NORTH - Industrial
SOUTH - Hacienda Village
EAST - Utility
WEST - Hacienda Village; Industrial

ANY CONCURRENCE OR APPROVAL STATED HEREON IS BASED SOLELY ON THE TERMS OF THE UNINCORPORATED LAND USE PLAN MAP AND SHALL NOT BE CONSTRUED TO BE AN APPROVAL OR WAIVER OF REQUIREMENTS OF ANY OTHER CODE, ORDINANCE OR LAW.

Cyrene Rodgers
Authorized Signature

LAND USE IMPLEMENTATION SECTION
OFFICE OF PLANNING

BROWARD COUNTY BOARD OF COUNTY COMMISSIONERS

Marcia Beach Scott J. Cowan rd Craft Howard C. Forman Jack Fried Nicki Englander Grossman Gerald F. Thompson
An Equal Opportunity Employer

EXHIBIT "D"

c. Each parcel of land within an area which is designated in an industrial land use category by the Unincorporated Area Land Use Plan must be zoned in a zoning district which permits one or more of the following specific uses:

1. Industrial uses;
2. Heavy commercial uses;
3. Commercial, office or business uses that are determined to be major employment centers;
4. Utilities, transportation and communication facilities and easements;
5. Parks and recreation, cemeteries, and commercial recreation facilities as the location of these uses does not preclude or adversely affect the future use of surrounding areas for industry;
6. Community facilities as long as the location of these uses does not preclude or adversely affect the future use of surrounding areas for industry.
7. Non-residential agricultural uses permitted until the area is converted to an urban use;
8. The following uses shall be permitted in areas designated industrial on the Unincorporated Area Land Use Plan Map so long as the total area of these uses does not exceed 20 percent of the industrial land on the County Land Use Plan in a flexibility zone and as long as the location of these areas does not preclude or adversely affect the future use of surrounding areas for industry:
 - i. Commercial and retail uses other than major employment centers;
 - ii. Hotel, motel and other tourist accommodations;

The above 20 percent limitation shall be implemented through the zoning process.

d. Each parcel of land within an area which is designated in a transportation land use category by the Unincorporated Area Land Use Plan Map must be zoned in a zoning district which permits the type of transportation use designated. No land use or structure which substantially alters the character of the land may be permitted within any portion of a proposed expressway or major interchange.

e. Each parcel of land within an area which is designated in a utility land use category by the Unincorporated Area Land Use Plan Map must be zoned in a zoning district which permits one or more of the following uses:

1. Water and wastewater treatment plants, pumping stations, electrical power plants and substations, solid waste disposal and transfer sites;

Florida



BOB GRAHAM
GOVERNOR

Department of Transportation

Haydon Burns Building, 605 Suwannee Street, Tallahassee, Florida 32301-8064, Telephone (904) 488-8541

PAUL N. PAPPAS
SECRETARY

March 25, 1985
CLO0068

Mr. Thomas M. Henderson
Director, Broward County Resource Recovery
Room 521
115 S. Andrews Avenue
Ft. Lauderdale, FL 33301

RE: S.P. 86095-1403
I-595/State Road 7

Dear Tom:

It was a pleasure meeting you in your offices this past February and discussing with you the "needs and wants" of our respective projects. It goes without saying that we will both be very busy for the next several years.

That fact notwithstanding, I'd like to take a few minutes to clarify my understanding of the items that we touched upon.

So far as State Road 7 is concerned, the Department intends to construct a six-lane typical section with a 22 foot wide raised median between the South New River Canal and the I-595/SR7 interchange. The east side of the six-lane roadway will be flanked by a paved shoulder draining into an open ditch. Provision will be made at the entrance to the resource recovery area for turning movements into and out of your property. In consideration of anticipated traffic volumes along SR7 and of the character of vehicles ingressing and egressing the County's resource recovery area, the Department will plan for and install a traffic signal on SR7 at the resource recovery area access road.

To accomplish the proposed improvements on SR7, it is my understanding that Broward County will make available for State roadway use a 50 foot wide strip of land adjacent to the east right of way line of State Road 7 extending from the South New River Canal north along existing SR7 to a point of intersection with the limited access right of way line in the southeast quadrant of the I-595/SR7 interchange as that LA R/W line is now drawn.

During our discussion, you mentioned that future landfill sites 2 and 3 could be made available to the Department's I-595 construction contractors for temporary use as staging areas or laydown areas. I have reviewed your offer with our Construction Manager, RKE/HNTB, and believe that the availability of these areas for temporary contractor use would be beneficial to both the Department and the County. As such we would like to instruct our Construction Manager to plan the construction activities with these sites available.

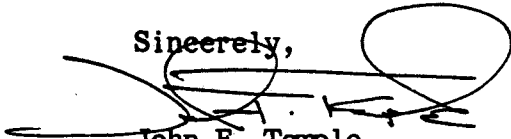
During our telephone conversation Friday, March 15th, I advised you that the need for certain design modifications in the southeast quadrant of the I-595/SR7 interchange has recently been brought to the Department's attention. Adjustments to ramp and turning lane alignments may indicate minor redefinition of the limited access right of way line between the interchange area and your resource recovery area. We will keep you advised as the magnitude of these changes become known to us.

I'm taking this opportunity to transmit various drawings and conceptual plans that graphically illustrate the foregoing verbiage. Included is a 200-scale plan showing the widening of SR7 with an assumed location of your access road, the approximate location of the contractor staging areas, and anticipated modifications to the limited access right of way line in the southeast quadrant of the interchange. Also included is a sketch of our typical section for State Road 7 and a preliminary layout of the SR7/access road intersection. We, of course, would appreciate your comments so that our Design Consultants can efficiently continue their activities.

Our respective projects obviously impact other entities within the community, particularly within the project area. As such I believe that it is in our mutual best interests to resolve any questions between us at our earliest convenience so that clear direction can be given in a timely manner to those directly associated with our projects. Should the need exist, we can meet in your offices for further planning and discussion.

Again, it was the pleasure of Mr. Heiman and myself to meet with you. We look forward to continued communication and the successful completion of our public work efforts.

Sincerely,



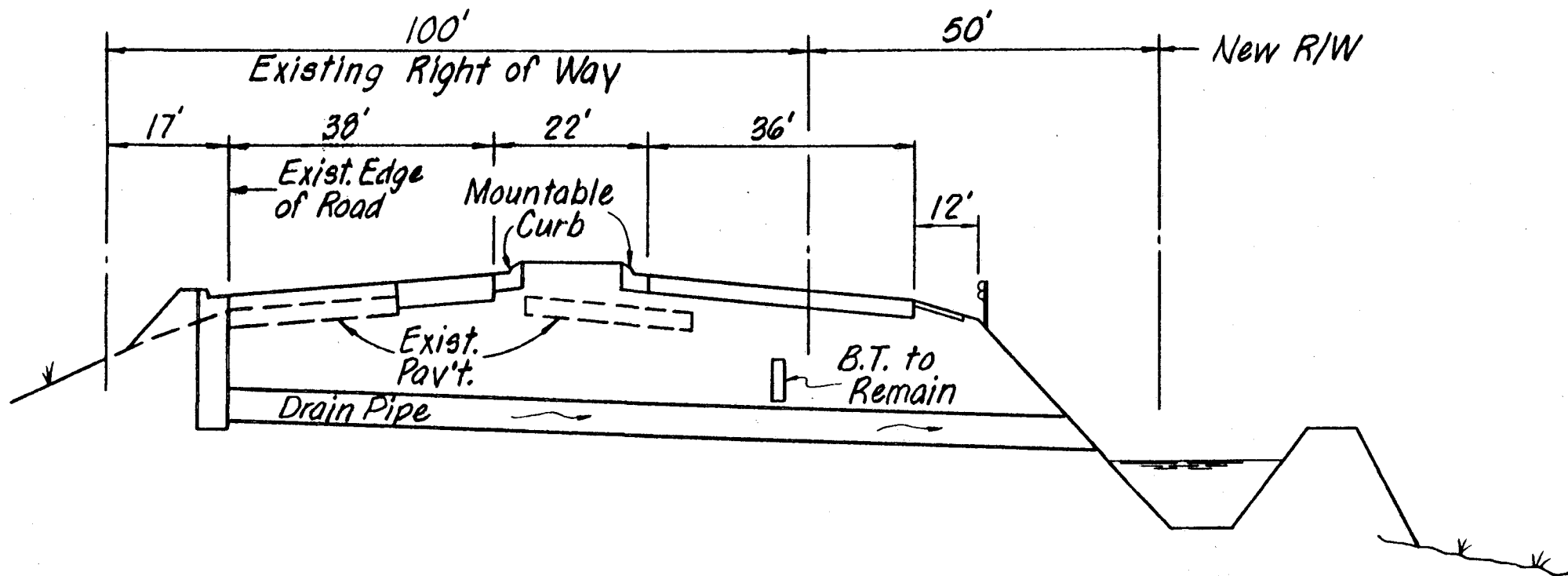
John F. Temple

I-595 Project Manager-Design

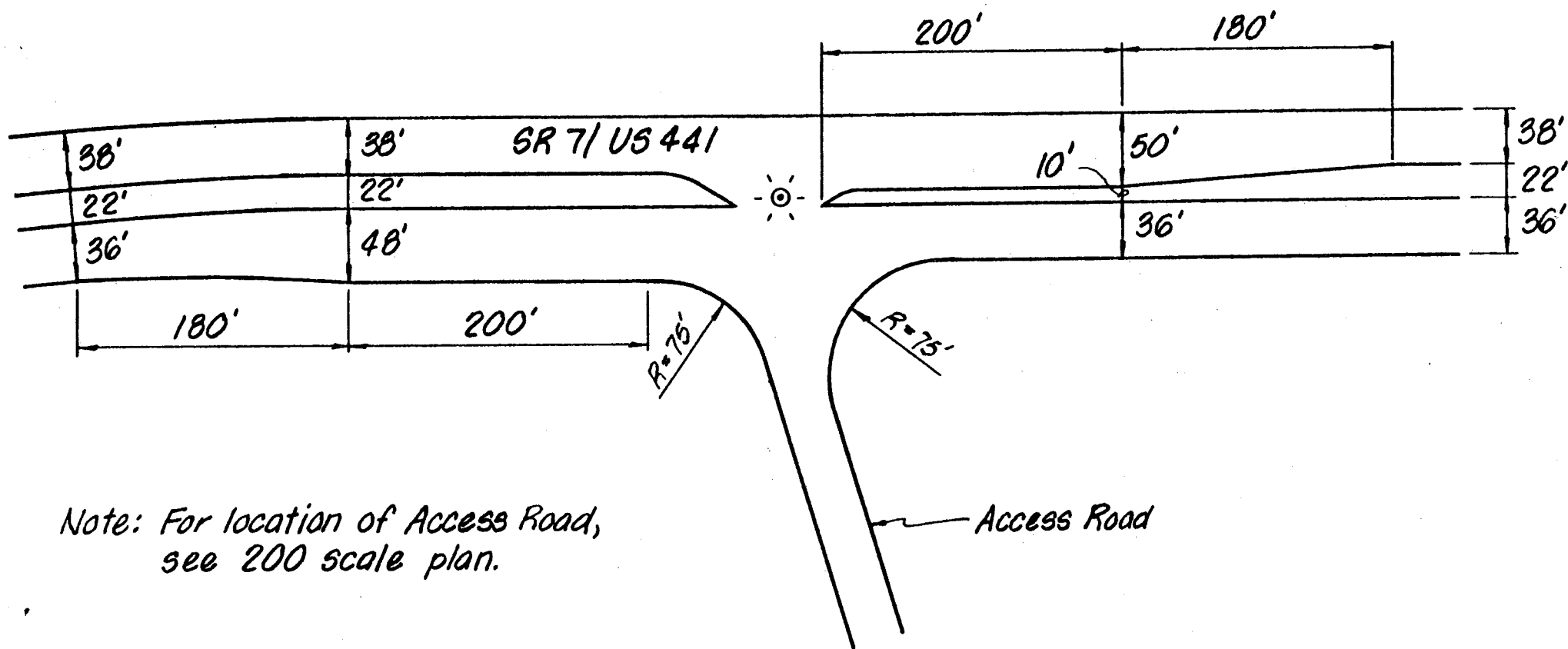
JFT/FWH:bd
Enclosures

cc: Mr. Ray Carson
Mr. Frank Frey
Mr. M. R. Flanagan
Mr. Bruce Seiler w/encl.

Mr. Peter Robinson w/encl.
Mr. R. E. Alexander w/encl.
Mr. Bryan L. Duke



STATE ROAD 7 TYPICAL SECTION
LOOKING NORTH



Note: For location of Access Road,
see 200 scale plan.

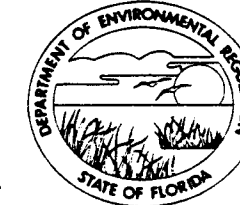
SR 7 ACCESS ROAD
TO BROWARD COUNTY
RESOURCE RECOVERY SITE
1" = 100'

EXISTING STATE PERMITS

84-51

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32301-8241



BOB GRAHAM
GOVERNOR
VICTORIA J. TSCHINKEL
SECRETARY

September 14, 1984

Broward County (Phyllis Korab)
c/o Peter E. Robinson
5950 Washington Street
Hollywood, Florida 33023

Dear Mr. Robinson:

File No. 060781749, Broward County
Broward County Resource Recovery Facility (U.S. 441 site)

Pursuant to Section 403.815, Florida Statutes, and Florida Administrative Code Rule 17-103.150, you are required to publish (at your own expense) the attached notice. This notice should be published, one time only, in the legal ad section of the Broward Review as soon as possible.

The Department, in accordance with Florida Administrative Code Rule 17-103.150, is required to have proof that the public notice was given. Therefore, please have the newspaper prepare an affidavit of publication to submit to the Department of Environmental Regulation, Bureau of Permitting, 2600 Blair Stone Road, Twin Towers Office Building, Tallahassee, Florida 32301-8241.

Sincerely,

Beverly F. Birkitt
Environmental Supervisor
Standard Permitting Section

BB/jk

Enclosure

cc: U. S. Army Corps of Engineers, Jacksonville

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION
NOTICE OF PROPOSED AGENCY ACTION

The Department of Environmental Regulation gives notice of its intent to issue a permit (File No. 060781749) to Broward County to prepare a site for the construction of an unprocessible waste landfill and a retention pond by: excavating 527,600 cu. yds. of muck and limerock landward of the mean high water line (MHW) from a 157 acre site including 133 acres of wetlands, placing fill for the base of the landfill to an elevation of +5 ft. MSL (mean sea level), constructing earthen berms and grassed swales around the landfill and conducting restoration/enhancement activities at five wetland areas in Broward County. The landfill site is located between U.S. 441 and S.R. 84 in Section ³ ~~12~~ ^{Sections 24 and 25}, Township 50 South, Range 41 East, ^{and Sections 19 and 30, Township 50 South, Range 42} East. The five wetland areas proposed for restoration/enhancement are located in Section ¹⁹ ~~21~~, Township 50 South, Range ⁴² ~~41~~ East; Section ¹⁹ ~~19~~ ^{and 30}, Township 50 South, Range 42 East; Section 29, Township 50 South, Range 41 East; and Section 26, Township 50 South, Range 39 East in Broward County. The affected waters are the South Fork of the New River (South New River) designated Class III Waters, not in an aquatic preserve.

The file is available for public inspection Monday through Friday, except for legal holidays, 8 a.m. to 5 p.m., at the Department of Environmental Regulation, 2600 Blair Stone Road, Twin Towers Office Building, Tallahassee, Florida 32301-8241.

Persons whose substantial interests are affected by the above

proposed agency action have a right pursuant to Section 120.57, Florida Statutes, to petition for an administrative determination (hearing) on the proposed action. The petition must conform to the requirements of Florida Administrative Code Rules 17-103.155 and 28-5.201, and must be filed (received) with the Department's Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32301-8241 within fourteen (14) days of publication of this notice. Failure to file a petition within the fourteen (14) days constitutes a waiver any such person has to an administrative determination (hearing) pursuant to Section 120.57, Florida Statutes.

The administrative hearing process is designed to formulate agency action. Accordingly, if a petition is filed, the Department's final action may be different from the proposed agency action. Therefore, persons who may not wish to file a petition may wish to intervene in the proceeding. A petition for intervention must be filed pursuant to Rule 28-5.207, at least five (5) days before the final hearing and must be filed with the hearing officer, if one has been assigned, at the Division of Administrative Hearings, 2009 Apalachee Parkway, Tallahassee, Florida 32301. If no hearing officer has been assigned, the petition is to be filed with the Department's Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32301-8241. Failure to petition to intervene within the allowed time frame constitutes a waiver of any right such person has to request a hearing under Section 120.57, Florida Statutes.

RULES OF THE ADMINISTRATIVE COMMISSION
MODEL RULES OF PROCEDURE
CHAPTER 28-5
DECISION DETERMINING SUBSTANTIAL INTERESTS

PART II
FORMAL PROCEEDINGS

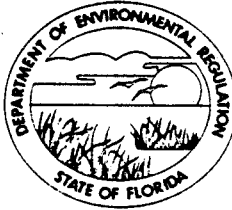
28-5.201 Initiation of Formal Proceedings.

- (1) Initiation of formal proceedings shall be made by petition to the agency responsible for rendering final agency action. The term petition as used herein includes any application or other document which expresses a request for formal proceedings. Each petition should be printed, typewritten or otherwise duplicated in legible form on white paper of standard legal size. Unless printed, the impression shall be on one side of the paper only and lines shall be double-spaced and indented.
- (2) All petitions filed under these rules should contain:
 - (a) The name and address of each agency affected and each agency's file or identification number, if known;
 - (b) The name and address of the petitioner or petitioners, and an explanation of how his/her substantial interests will be affected by the agency determination;
 - (c) A statement of when and how petitioner received notice of the agency decision or intent to render a decision;
 - (d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
 - (e) A concise statement of the ultimate facts alleged, as well as the rules and statutes which entitle the petitioner to relief;
 - (f) A demand for relief to which the petitioner deems himself entitled; and
 - (f) Other information which the petitioner contends is material.

A petition may be denied if the petitioner does not state adequately a material factual allegation, such as a substantial interest in the agency determination, or if the petition is untimely. (Section 28-5.201(3)(a), FAC)

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32301-8241



BOB GRAHAM
GOVERNOR
VICTORIA J. TSCHINKEL
SECRETARY

September 14, 1984

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Broward County (Phyllis Korab)
c/o Peter E. Robinson
5950 Washington Street
Hollywood, Florida 33023

Dear Mr. Robinson:

File No. 060781749, Broward County
Broward County Resource Recovery Facility (U.S. 441 site)

Enclosed is the Intent to Issue for your project. In the event that an administrative hearing is not requested, the staff will present the application to the Secretary of the Department with a recommendation for issuance. Please contact me at (904) 488-0130 if there are any questions concerning your file.

Sincerely,

Beverly F. Birkitt
Environmental Supervisor
Standard Permitting Section

BFB/jk

Enclosures

cc: Broward County, c/o Phyllis Korab
Roy Duke, West Palm Beach
U. S. Army Corps of Engineers, Jacksonville (83B-3304)
Florida Game and Fresh Water Fish Commission
DER, Office of General Council
Senator Tom McPherson
Representative Ann Mackenzie
Commissioner Nikki Englander, Broward County
Mrs. S. William Grassi
Mr. G. Counts
Wilfred A. Bost, c/o Arthur B. Parkhurst, Esq.
Sandra Kohernost, Broward County Audubon Society
S. T. Hogg
Steve Simmons
DNR, Marine Patrol

BEFORE THE STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

In the matter of:)File No. 060781749, Broward County
Application for Permit:)Broward County Unprocessable
Waste Landfill (U.S. 441 site)

Broward County (Phyllis Korab)
c/o Peter E. Robinson
590 Washington Street
Hollywood, Florida 33023

INTENT TO ISSUE

The Division of Environmental Permitting hereby gives notice of its Intent to Issue, and proposed order of issuance for, a permit pursuant to Chapters 253 and 403, Florida Statutes, and Public Law 92-500 for the proposed project as detailed in the application specified above. The Division is issuing this Intent to Issue for the reasons stated below.

The applicant, Broward County, applied on November 9, 1983 to the Department of Environmental Regulation for a permit/water quality certification to prepare a site for the construction of an unprocessable waste landfill and a retention pond by: excavating 527,600 cu. yds. of muck and limerock landward of the mean high water line (MHW) from a 157 acre site including 133 acres of wetlands, placing fill for the base of the landfill to an elevation of +5 ft. MSL (mean sea level), constructing earthen berms and grassed swales around the landfill and conducting restoration/enhancement activities at five wetland areas in Broward County. The landfill site is located between U.S. 441 and S.R. 84 in Section ^{s 24 and 25} 21, Township 50 South, Range 41 East. The ^{and Sections 19 and 30,} Township 50 ^{South, Range 42} five wetland areas proposed for restoration/enhancement are ^{East.} located in Section ¹⁹ 21, Township 50 South, Range ⁴² 41 East; Sections ^{and 30} 19, Township 50 South, Range 42 East; Section 29, Township 50 South, Range 41 East; and Section 26, Township 50 South, Range 39 East in Broward County. The affected waters are the South Fork of the New River (South New River) designated Class III Waters, not in an aquatic preserve.

The Department has permitting jurisdiction under Chapters

253 and 403, Florida Statutes, Florida Administrative Code Rules 17-4.28 and 17-4.29 and Public Law 92-500 over dredge and fill activities conducted in or connected to certain waters of the State. The wetlands referenced within the landfill site, the restoration areas and the South New River constitute navigable waters of the State over which the Department has dredge and fill permitting jurisdiction. The project is not exempt from permitting procedures. The applicant was officially notified by the Department that a dredge and fill permit was required for the proposed work.

The field appraisal of the project site was conducted by the Department on March 6, 1984. The project site is surrounded by land currently zoned for light industry or residential development. The site is adjacent to the South New River and several existing transportation arteries. South of the site, lies an area designated for a resource recovery facility which is the subject of File No. 060781739, Broward County, being processed concurrently with this permit application. The river adjacent to the site has been channelized. Several acres of disturbed wetlands exist between the river and the project site.

The landfill will consist of two large cells (Cells 1 and 2/3) which along with a Florida Power and Light utility easement incorporate 133 acres of wetlands. The area for Cell 1 is located to the south within the project site and is vegetated by wax myrtle, exotic and jurisdictional herbaceous plants including sawgrass and cattails. To the north and in the west half of the area for Cell 2/3, the vegetation consists of a mixture of cypress, maple, buttonbush, willow, exotics, cattails and sawgrass. The surface hydrological flow and drainage in the area for Cell 1 and the west half of Cell 2/3 has been severely restricted by an earthen road which bisects the area of Cell 2/3. Drainage by ditches along U.S. 441, S.R. 84 and berms along the South New River have also affected flow regimes and water levels in the areas for Cells 1 and 2/3. This condition has resulted in progressive infestation by melaleuca, Australian pine and Brazilian pepper.

The east half of the area of Cell 2/3 is wetter and predominantly vegetated by sawgrass, cattails, swamp lilly, pickeral weed and arrowhead. However, melaleuca is also encroaching in the westernmost fringe of this area. The berm which borders the Cell 1 area also restricts surface connection and exchange between the east half of Cell 2/3 area and the South New River.

The proposed construction is expected to eliminate 133 acres of mixed healthy and disturbed wetlands which currently provide some pollutant assimilation and contribute detrital or dissolved organic material to the South New River system. A stormwater management plan consisting of grassed swales and retention ponds will convey and treat stormwater runoff generated from the landfill site. The effect of the proposed stormwater treatment system on surface water will be evaluated by the South Florida Water Management District (SFWMD). The effects of the proposed landfill construction on groundwater and other aspects of this project will be evaluated by the Department separately under the required Solid Waste permits.

Wetlands areas at five specific sites will be restored or enhanced to provide positive environmental benefits to the South New River system. Site No. 1 consists of 18 acres located between the South New River and the landfill site. This area currently consists of disturbed wetlands and spoil mounds supporting exotic vegetation. Water exchange with the river is restricted and the area exhibits poor water quality conditions and habitat value. Site No. 2 involves 15 acres located between the proposed Cell 2/3 and forested wetlands (Ann Kolb Park). Site No. 2 consists of an existing wetlands habitat, is 250 to 550 ft. wide and extends to the South New River. An additional 50 ft. strip located along the east side of the proposed landfill berm will be planted in cypress trees as part of the restoration activities at Site No. 2. Site No. 3 consists of 16 acres near Hacienda Flores. Site No. 3 is proposed to be cleared of exotic vegetation and replanted in native species. Site No. 4 consists of 15 acres named Tree Tops

Park. Restoration work will consist of grading and enhancing hydrological conditions creating 13 acres of sawgrass and 2 acres of hydric hammock. Site No. 5 consists of 74 acres located several miles west of the proposed landfill site. Site No. 5 is a historic marsh area which has been severely drained but which still supports some wetlands vegetation. This area will be flooded from the South New River Canal by pumps as required to maintain the area as a healthy wetland area.

The five wetlands areas proposed for restoration/enhancement are expected to result in 138 acres of high quality forested and submerged wetlands. The restoration proposed at each site will provide benefits to water quality including detrital reserves for faunal elements, baffling and treatment of runoff and erosion control. The restoration at Sites Nos. 1 and 4 is expected to enhance water quality by improving the hydrological regime thereby reducing stagnant areas. In addition, wetland habitat value and aquatic resources are expected to be significantly increased at each of the areas.

The applicant has provided affirmative reasonable assurance that the immediate and long-term impacts of the project will not result in the violation of water quality standards pursuant to Florida Administrative Code Rules 17-4.28(3), and 17-4.29. To ensure that the State Water Quality Standards will be maintained, the following conditions and monitoring requirements shall be made part of the permit:

 1. Within 60 days of permit issuance, the permittee shall submit a restoration/revegetation plan for the 5 wetlands areas to the Department for evaluation and approval. The plan shall include the commencement and completion dates of all anticipated restoration/revegetation work, dredge and fill volumes, elevations, methods of construction and planting schedules, pumping schedules and methods to ensure vegetative survival for each area.

2. Within sixty days of issuance of the permit and prior to the commencement of any activities herein authorized, the Permittee

shall file and have recorded, in the same manner as any other instrument affecting the title to real property, a conservation easement pursuant to Section 704.06, Florida Statutes, in the office of the Clerk of the Circuit Court, Broward County for the five general areas:

1. Site No. 1, 18 acres in Section ¹⁹~~27~~, Township 50 South, Range ⁴²~~41~~ East;
2. Site No. 2, 15 acres in Sections ^{19 and 30}~~27~~, Township 50 South, Range ⁴²~~41~~ East;
3. Site No. 3, 16 acres (Hacienda Flores) Section 19, Township 50 South, Range 42 East;
4. Site No. 4, 15 acres (Tree Tops Park), Section 29, Township 50 South, Range 41 East and;
5. Site No. 5, 74 acres, Section 26, Township 50 South, Range 39 East.

The Permittee shall pay all recording fees. The conservation easement shall be in favor of the Department of Environmental Regulation and shall restrict any activity including dredging and filling of land, cutting, eradicating or pruning of endemic vegetation beyond the scope of the approved restoration plan indicated in Condition No. 1. A draft conservation easement and a certified survey with a legal description shall be submitted to the Bureau of Permitting in Tallahassee for review and approval before it is filed (by the Permittee) with the Clerk of the Circuit Court, Broward County.

3. Written notice from the Department indicating that Conditions Nos. 1 and 2 have been satisfied shall be obtained by Broward County prior to beginning any construction on the landfill site. All work in the restoration sites shall be completed within one year of commencement of construction on the landfill site.

4. If the proposed work within the jurisdictional area has not been completed within 5 years of the date of permit issuance, a permit application shall be resubmitted to the Department for evaluation and shall be accompanied by the appropriate fee.

MONITORING:

Surface water monitoring:

Parameter: Dissolved oxygen, temperature (C°), pH, fecal coliform bacteria.

Frequency: Quarterly throughout the year except that the samples shall be collected monthly for April, June, August and September. Sampling shall continue for a period of 5 years. Sampling shall, begin 30 days prior to initial construction for background levels. Thereafter, sampling shall be initiated within 2 months of beginning operation of the facility. All samples shall be taken for a 24 hour period, at 4 hour intervals beginning one hour before sunrise.

Sampling

Location: 150 meters downgradient from the retention pond discharge point in the river at the surface, mid-depth and 1 ft. above the bottom.

Parameter: Iron, lead, copper, mercury, cadmium, zinc, silver.

Frequency: Quarterly throughout the year except that the samples shall be collected monthly for April, June, August and September. Sampling shall continue for a period of 5 years. Sampling shall begin 30 days prior to initial construction for background levels. Thereafter, sampling shall be initiated within 2 months of beginning operation of the facility. All samples shall be taken for a 24 hour period, at 4 hour intervals beginning one hour before sunrise.

Sampling

Location: 150 meters downgradient from each of the retention ponds' discharge points in the river 1 ft. above the bottom.

If a violation occurs for any sampled parameter, the permittee shall, after notifying the Department, institute corrective action to abate the violation. Corrective action may include modifications to the types of waste collected in the landfill, the methods of disposal or physical modifications to the landfill or resource recovery plant. Any modifications shall be coordinated with the Department's Solid Waste Section in West Palm Beach. Department approval shall be obtained prior to any action constituting a modification to this permit.

All monitoring reports shall be submitted to the Bureau of Permitting, Tallahassee and the Southeast Florida District, West Palm Beach, under a cover letter containing the following information: (1) permit number; (2) handling, storage and analysis of the samples; (3) a map indicating the sampling locations; and (4) a statement by the individual responsible for implementation of the sampling program concerning the authenticity, precision, limits of detection and accuracy of the data. Monitoring reports shall also include the following information for each sample that is taken:

- (1) time of day samples taken;
- (2) depth of water body;
- (3) depth of sample;
- (4) antecedent weather conditions;
- (5) tidal stage and direction of flow; and
- (6) wind direction and velocity.

Monitoring reports shall be submitted to the Department within 2 weeks of completion of analysis for each sampling period.

This Intent to Issue shall be placed before the Secretary for final action, unless an appropriate petition for a hearing pursuant to the provisions of Section 120.57, Florida Statutes, is

filed within fourteen (14) days from receipt of this letter or publication of the public notice (copy attached) required pursuant to Florida Administrative Code Rule 17-103.150, whichever occurs first. The petition must comply with the requirements of Florida Administrative Code Rules 17-103.155 and 28-5.201 (copies attached) and be filed pursuant to Rule 17-103.155(1) in the Office of General Counsel of the Department of Environmental Regulation at 2600 Blair Stone Road, Tallahassee, Florida 32301-8241. Petitions which are not filed in accordance with the above provisions are subject to dismissal by the Department.

In the event a formal hearing is conducted pursuant to dection 120.57(1), all parties shall have an opportunity to respond, to present evidence and argument on all issues involved, to conduct cross-examination of witnesses and submit rebuttal evidence, to submit proposed findings of facts and orders, to file exceptions to any order or hearing officer's recommended order, and to be represented by counsel. If an informal hearing is requested, the agency, in accordance with its rules of procedure, will provide affected persons or parties or their counsel an opportunity, at a convenient time and place, to present to the agency or hearing officer, written or oral evidence in opposition to the agency's action or refusal to act, or a written statement challenging the grounds upon which the agency has chosen to justify its action or inaction, pursuant to Section 120.57(2), Florida Statutes.

The administrative hearing process is designed to formulate agency action. Accordingly, if a petition is filed, the Department's final action may be different from the proposed agency action. Therefore, persons who may not wish to file a petition, may wish to intervene in the proceeding. A petition for intervention must be filed pursuant to Model Rule 28-5.207 at least five (5) days before the final hearing and be filed with the hearing officer if one has been assigned at the Division of Administrative Hearings, 2009 Apalachee Parkway, Tallahassee, Florida 32301. If no hearing officer has been assigned, the

petition is to be filed with the Department's Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32301-8241. Failure to petition to intervene within the allowed time frame constitutes a waiver of any right such person has to request a hearing under Section 120.57, Florida Statutes.

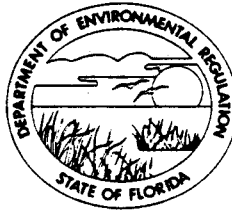
Executed this 14th day of September, 1984, Tallahassee, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL REGULATION

Suzanne P. Walker
Suzanne P. Walker, Chief
Bureau of Permitting
2600 Blair Stone Road
Twin Towers Building
Tallahassee, Florida 32301-8241

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32301-8241



BOB GRAHAM
GOVERNOR

VICTORIA J. TSCHINKEL
SECRETARY

September 14, 1984

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Broward County (Phyllis Korab)
c/o Peter E. Robinson
5950 Washington Street
Hollywood, Florida 33023

Dear Mr. Robinson:

File No. 060781739, Broward County
Broward County Resource Recovery Facility (U.S. 441 site)

Enclosed is the Intent to Issue for your project. In the event that an administrative hearing is not requested, the staff will present the application to the Secretary of the Department with a recommendation for issuance. Please contact me at (904) 488-0130 if there are any questions concerning your file.

Sincerely,

Beverly F. Birkitt
Beverly F. Birkitt
Environmental Supervisor
Standard Permitting Section

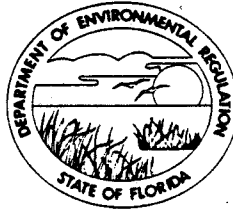
BFB/jk

Enclosures

cc: Broward County, c/o Phyllis Korab
Roy Duke, West Palm Beach
U. S. Army Corps of Engineers, Jacksonville (83B-3304)
Florida Game and Fresh Water Fish Commission
DER, Office of General Council
Senator Tom McPherson
Representative Ann Mackenzie
Commissioner Nikki Englander, Broward County
Mrs. S. William Grassi
Mr. G. Counts
Wilfred A. Bost, c/o Arthur B. Parkhurst, Esq.
Sandra Kohernost, Broward County Audubon Society
S. T. Hogg
Steve Simmons
DNR, Marine Patrol

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32301-8241



BOB GRAHAM
GOVERNOR
VICTORIA J. TSCHINKEL
SECRETARY

September 14, 1984

Broward County (Phyllis Korab)
c/o Peter E. Robinson
5950 Washington Street
Hollywood, Florida 33023

Dear Mr. Robinson:

File No. 060781739, Broward County
Broward County Resource Recovery Facility (U.S. 441 site)

Pursuant to Section 403.815, Florida Statutes, and Florida Administrative Code Rule 17-103.150, you are required to publish (at your own expense) the attached notice. This notice should be published, one time only, in the legal ad section of the Broward Review as soon as possible.

The Department, in accordance with Florida Administrative Code Rule 17-103.150, is required to have proof that the public notice was given. Therefore, please have the newspaper prepare an affidavit of publication to submit to the Department of Environmental Regulation, Bureau of Permitting, 2600 Blair Stone Road, Twin Towers Office Building, Tallahassee, Florida 32301-8241.

Sincerely,

Beverly F. Birkitt
Environmental Supervisor
Standard Permitting Section

BFB/jk

Enclosure

cc: U. S. Army Corps of Engineers, Jacksonville

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION
NOTICE OF PROPOSED AGENCY ACTION

The Department of Environmental Regulation gives notice of its intent to issue a permit (File No. 060781739) to Broward County to prepare a site for the construction of a resource recovery facility and two retention ponds by: excavating 221,600 cu. yds. of muck and limerock landward of the mean high water line (MHW) from 18 acres including 15.6 wetland acres, placing fill to an elevation of +7 ft. MSL (mean sea level) and excavating 38,400 cu. yds. (51 cu. yds. waterward of MHW) to restore a 15 acre strip of disturbed wetland in the South Fork of the New River. The project site is located between U.S. 441 and S.R. 84 in Section 25 ~~21~~, Township 50 South, Range 41 East in Broward County. The affected waters are the South Fork of the New River (South New River) designated Class III waters, not in an aquatic preserve.

The file is available for public inspection Monday through Friday, except for legal holidays, 8 a.m. to 5 p.m., at the Department of Environmental Regulation, 2600 Blair Stone Road, Twin Towers Office Building, Tallahassee, Florida 32301-8241.

Persons whose substantial interests are affected by the above proposed agency action have a right pursuant to Section 120.57, Florida Statutes, to petition for an administrative determination (hearing) on the proposed action. The petition must conform to the requirements of Florida Administrative Code Rules 17-103.155 and 28-5.201, and must be filed (received) with the Department's

Public Notice
File No. 060781739
Page 2

Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32301-8241 within fourteen (14) days of publication of this notice. Failure to file a petition within the fourteen (14) days constitutes a waiver any such person has to an administrative determination (hearing) pursuant to Section 120.57, Florida Statutes.

The administrative hearing process is designed to formulate agency action. Accordingly, if a petition is filed, the Department's final action may be different from the proposed agency action. Therefore, persons who may not wish to file a petition may wish to intervene in the proceeding. A petition for intervention must be filed pursuant to Rule 28-5.207, at least five (5) days before the final hearing and must be filed with the hearing officer, if one has been assigned, at the Division of Administrative Hearings, 2009 Apalachee Parkway, Tallahassee, Florida 32301. If no hearing officer has been assigned, the petition is to be filed with the Department's Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32301-8241. Failure to petition to intervene within the allowed time frame constitutes a waiver of any right such person has to request a hearing under Section 120.57, Florida Statutes.

RULES OF THE ADMINISTRATIVE COMMISSION
MODEL RULES OF PROCEDURE
CHAPTER 28-5
DECISION DETERMINING SUBSTANTIAL INTERESTS

PART II
FORMAL PROCEEDINGS

28-5.201 Initiation of Formal Proceedings.

- (1) Initiation of formal proceedings shall be made by petition to the agency responsible for rendering final agency action. The term petition as used herein includes any application or other document which expresses a request for formal proceedings. Each petition should be printed, typewritten or otherwise duplicated in legible form on white paper of standard legal size. Unless printed, the impression shall be on one side of the paper only and lines shall be double-spaced and indented.
- (2) All petitions filed under these rules should contain:
 - (a) The name and address of each agency affected and each agency's file or identification number, if known;
 - (b) The name and address of the petitioner or petitioners, and an explanation of how his/her substantial interests will be affected by the agency determination;
 - (c) A statement of when and how petitioner received notice of the agency decision or intent to render a decision;
 - (d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
 - (e) A concise statement of the ultimate facts alleged, as well as the rules and statutes which entitle the petitioner to relief;
 - (f) A demand for relief to which the petitioner deems himself entitled; and
 - (f) Other information which the petitioner contends is material.

A petition may be denied if the petitioner does not state adequately a material factual allegation, such as a substantial interest in the agency determination, or if the petition is untimely. (Section 28-5.201(3)(a), FAC)

BEFORE THE STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

In the matter of:)File No. 060781739, Broward County
Application for Permit:)Broward County Resource Recovery
Facility (U.S. 441 site)

Broward County (Phyllis Korab)
c/o Peter E. Robinson
5950 Washington Street
Hollywood, Florida 33023

INTENT TO ISSUE

The Division of Environmental Permitting hereby gives notice of its Intent to Issue, and proposed order of issuance for, a permit pursuant to Chapters 253 and 403, Florida Statutes, and Public Law 92-500 for the proposed project as detailed in the application specified above. The Division is issuing this Intent to Issue for the reasons stated below.

The applicant, Broward County, applied on November 9, 1983 to the Department of Environmental Regulation for a permit/water quality certification to prepare a site for the construction of a resource recovery facility and two retention ponds by: excavating 221,600 cu. yds. of muck and limerock landward of the mean high water line (MHW) from 18 acres including 15.6 wetland acres, placing fill to an elevation of +7 ft. MSL (mean sea level) and excavating 38,400 cu. yds. (51 cu. yds. waterward of MHW) to restore a 15 acre strip of disturbed wetland in the South Fork of the New River. The project site is located between U.S. 441 and S.R. 84 in Section ²⁵~~27~~, Township 50 South, Range 41 East in Broward County. The affected waters are the South Fork of the New River (South New River) designated Class III waters, not in an aquatic preserve.

The Department has permitting jurisdiction under Chapters 253 and 403, Florida Statutes, Florida Administrative Code Rules 17-4.28 and 17-4.29 and Public Law 92-500 over dredge and fill activities conducted in or connected to certain waters of the State. The wetlands referenced within the resource recovery site and in the South New River constitute navigable waters over which the Department has dredge and fill permitting jurisdiction.

The project is not exempt from permitting procedures. The applicant was officially notified by the Department that a dredge and fill permit was required for the proposed work.

The field appraisal of the project site was conducted by the Department on March 6, 1984. The project site is surrounded by land currently zoned for light industry or residential development. The site is adjacent to the South New River and several existing transportation arteries. North of the site lies an area designated for a 150 acre landfill which is the subject of File No. 060781749, Broward County, being processed concurrently with this permit application. The river adjacent to the site has been channelized. Several acres of disturbed wetlands exist between the river and the project site.

The specific resource recovery site consists predominately of muck soils supporting a mixture of jurisdictional and nonjurisdictional submerged and transitional vegetation intermixed with exotic vegetation. Prior to the Department's statutory authority, the hydrologic regime of this historically forested wetland was severely impacted by ditching and diking. Presently, this area provides filtration of runoff that is discharged to the South New River by a series of ditches and culverts through the berm that is parallel to the river. Exchange of surface water with the river is minimal.

The proposed construction is expected to eliminate 15.6 acres of mixed healthy and disturbed wetlands which currently provide some pollutant assimilation and contribute detrital or dissolved organic material to the South New River system. The stormwater management plan consisting of grassed swales and retention ponds will convey and treat stormwater runoff generated from the resource recovery site. The effect of the proposed stormwater treatment system on surface water will be evaluated by the South Florida Water Management District (SFWMD). The effects of the proposed resource recovery facility on groundwater and other aspects of this project will be evaluated by the Department separately under the required Resource Recovery permit.

A 300 ft. swath of severely altered wetlands along the west

bank of the South New River and east of the project site will be restored to a functional wetland system by excavating, grading and revegetating with native wetland species. This site consists of a shallow ditch and penninsular uplands vegetated by exotic and native submerged and transitional wetland species. The shallow ditches are restricted from full hydrologic exchange with the river creating stagnant conditions. Existing habitat value and water quality are marginal.

The proposed restoration construction is expected to provide 15 acres of high quality forested and submerged wetlands. The restoration is expected to increase significantly wetlands habitat and wildlife populations, increase aquatic productivity, enhance water quality and improve hydrologic exchange between the area and the river.

The applicant has provided affirmative reasonable assurance that the immediate and long-term impacts of the project will not result in the violation of water quality standards pursuant to Florida Administrative Code Rules 17-4.28(3), and 17-4.29. To ensure that the State Water Quality Standards will be maintained, the following conditions and monitoring requirements shall be made part of the permit:

1. Within 60 days of permit issuance, the permittee shall submit a restoration plan to the Department for the 15 acre parcel for evaluation and approval. The plan shall include the commencement and completion dates of all anticipated work, dredge and fill volumes, elevations, methods of construction, planting schedules and methods to ensure vegetative survival.

2. Within sixty days of issuance of the permit and prior to the commencement of any activities herein authorized, the Permittee shall file and have recorded, in the same manner as any other instrument affecting the title to real property, a conservation easement pursuant to Section 704.06, Florida Statutes, in the office of the Clerk of the Circuit Court, Broward County, for the

following general area: the 15 acre riverine restoration area adjacent to the resource recovery facility in Section 27, ²⁵ Township 50 South, Range 41 East, Broward County. The Permittee shall pay all recording fees. The conservation easement shall be in favor of the Department of Environmental Regulation and shall restrict any activity, including dredging and filling of land, cutting, eradicating or pruning of endemic vegetation, beyond the scope of the approved restoration plan indicated in Condition No. 1. A proposed conservation easement and a certified survey with legal description shall be submitted to the Bureau of Permitting in Tallahassee for review and approval before it is filed (by the Permittee) with the Clerk of the Circuit Court, Broward County.

3. The provisions in Conditions Nos. 1 and 2 shall be approved by the Department by written notice prior to beginning any construction on the resource recovery site. All restoration activities shall be completed within one year of commencement of construction on the resource recovery site.

4. To prevent the discharge of turbid water (greater than 29 NTU's above background) from the site during construction, a temporary berm with 3H:1V side slopes and an elevation of +9 ft. NGVD shall be constructed around the resource recovery site prior to commencement of work.

5. If the proposed work within the jurisdictional areas has not been completed within 5 years of the date of permit issuance, a permit application shall be resubmitted to the Department for evaluation and shall be accompanied by the appropriate fee.

MONITORING:

Surface water monitoring:

Parameter: Dissolved oxygen, temperature (C°), pH, fecal coliform bacteria.

Frequency: Quarterly throughout the year except that the samples shall be collected monthly for April, June, August and

September. Sampling shall continue for a period of 5 years. Sampling shall begin 30 days prior to initial construction for background levels. Thereafter, sampling shall be initiated within 2 months of beginning operation of the facility. All samples shall be taken for a 24 hour period, at 4 hour intervals beginning one hour before sunrise.

Sampling

Location: 150 meters downgradient from each of the retention ponds' discharge points in the river at the surface, mid-depth and 1 ft. above the bottom.

Parameter: Iron, lead, copper, mercury, cadmium, zinc, silver.

Frequency: Quarterly throughout the year except that the samples shall be collected monthly for April, June, August and September. Sampling shall continue for a period of 5 years. Sampling shall begin 30 days prior to initial construction for background levels. Thereafter, sampling shall be initiated within 2 months of beginning operation of the facility. All samples shall be taken for a 24 hour period, at 4 hour intervals beginning one hour before sunrise.

Sampling

Location: 150 meters downgradient from each of the retention ponds' discharge points in the river 1 ft. above the bottom.

If a violation occurs for any sampled parameter, the permittee shall, after notifying the Department, institute corrective action to abate the violation. Corrective action may include modifications to the types of waste collected in the landfill, the methods of disposal or physical modifications to the

landfill or resource recovery plant. Any modifications shall be coordinated with the Department's Solid Waste Section in West Palm Beach. Department approval shall be obtained prior to any action constituting a modification to this permit.

All monitoring reports shall be submitted to the Bureau of Permitting, Tallahassee and the Southeast Florida District, West Palm Beach, under a cover letter containing the following information: (1) permit number; (2) handling, storage and analysis of the samples; (3) a map indicating the sampling locations; and (4) a statement by the individual responsible for implementation of the sampling program concerning the authenticity, precision, limits of detection and accuracy of the data. Monitoring reports shall also include the following information for each sample that is taken:

- (1) time of day samples taken;
- (2) depth of water body;
- (3) depth of sample;
- (4) antecedent weather conditions;
- (5) tidal stage and direction of flow; and
- (6) wind direction and velocity.

Monitoring reports shall be submitted to the Department within 2 weeks of completion of analysis for each sampling period.

This Intent to Issue shall be placed before the Secretary for final action, unless an appropriate petition for a hearing pursuant to the provisions of Section 120.57, Florida Statutes, is filed within fourteen (14) days from receipt of this letter or publication of the public notice (copy attached) required pursuant to Florida Administrative Code Rule 17-103.150, whichever occurs first. The petition must comply with the requirements of Florida Administrative Code Rules 17-103.155 and 28-5.201 (copies attached) and be filed pursuant to Rule 17-103.155(1) in the Office of General Counsel of the Department of Environmental Regulation at 2600 Blair Stone Road, Tallahassee, Florida 32301-8241. Petitions which are not filed in accordance with the above provisions are subject to dismissal by the Department.

In the event a formal hearing is conducted pursuant to

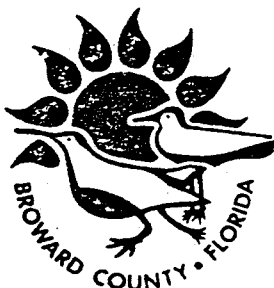
Section 120.57(1), all parties shall have an opportunity to respond, to present evidence and argument on all issues involved, to conduct cross-examination of witnesses and submit rebuttal evidence, to submit proposed findings of facts and orders, to file exceptions to any order or hearing officer's recommended order, and to be represented by counsel. If an informal hearing is requested, the agency, in accordance with its rules of procedure, will provide affected persons or parties or their counsel an opportunity, at a convenient time and place, to present to the agency or hearing officer, written or oral evidence in opposition to the agency's action or refusal to act, or a written statement challenging the grounds upon which the agency has chosen to justify its action or inaction, pursuant to Section 120.57(2), Florida Statutes.

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Executed this 14th day of September, 1984, Tallahassee, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL REGULATION

Suzanne P. Walker
Suzanne P. Walker, Chief
Bureau of Permitting
2600 Blair Stone Road
Twin Towers Building
Tallahassee, Florida 32301-8241



Resource Recovery Office

Room 521, 115 South Andrews Avenue
Fort Lauderdale, Florida 33301
(305) 357-6458

September 24, 1984

Ms. Beverly F. Birkitt
Environmental Supervisor
Standard Permitting Section
State of Florida
Department of Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32301-8241

Re: File Nos. 060781739 and 060781749 - Broward County Resource
Recovery Facility and Unprocessible Waste Landfill (U. S. 441
Site)

Dear Ms. Birkitt:

Please be advised that certain Section, Township and Range numbers cited in the Letters of Intent issued by your agency to Broward County for the above referenced permit applications are incorrect. A listing of the correct Project site numbers is attached for your information and future reference.

Please be advised also that the County included the correct numbers in the Notices of Intent to Permit submitted to the Broward Review for publication. Proofs of these publications were sent to you via certified mail on September 19, 1984. Should you have any questions regarding this matter, please call me at (305) 357-6456.

Sincerely,

Thomas M. Henderson
Resource Recovery Project Director

TMH/bd
Attachment

cc: C. Schulman
S. Schwarz
P. Robinson
J. Hudgens
Corps of Engineers, Jacksonville District

BROWARD COUNTY BOARD OF COUNTY COMMISSIONERS

Marcia Beach Scott I. Cowan Howard Craft Howard Forman Jack Fried Nicki Englander Grossman Gerald Thompson
An Equal Opportunity Employer

BROWARD COUNTY
RESOURCE RECOVERY PROJECT
U.S. 441 SITE

File No. 060781739

Facility: Section 25, Township 50 South, Range 41 East

Restoration Area: Section 25, Township 50 South, Range 41 East
(15 acres)

File No. 060781749

Landfill: Sections 24 and 25, Township 50 South, Range 41 East
and Sections 19 and 30, Township 50 South, Range 42
East

Restoration/Enhancement:

Site No. 1: Section 19, Township 50 South, Range 42
East (18 acres)

Site No. 2: Sections 19 and 30, Township 50, Range 42
East (15 acres)

**Broward Review
AND BUSINESS RECORD**

Published daily, Monday through Friday
except legal holidays

Fort Lauderdale, Broward County, Florida

**STATE OF FLORIDA
COUNTY OF BROWARD:**

Before the undersigned authority personally appeared Shirley A. Corwin, who on oath says that she is the Office Manager of the Broward Review and Business Record, a newspaper published at Fort Lauderdale, in Broward County, Florida; that the attached copy of advertisement, being a Legal Advertisement of Notice in the matter of

**NOTICE OF PROPOSED AGENCY ACTION RE:
DEPT OF ENVIRONMENTAL REGULATION ETC.**

In the X X X Court,
was published in said newspaper in the issues of

SEPTEMBER 19, 1984

Affiant further says that the said Broward Review and Business Record is a newspaper published at Fort Lauderdale, in said Broward County, Florida, and that the said newspaper has heretofore been continuously published in said Broward County, Florida, and has been entered as second class mail matter at the post office in Fort Lauderdale, in said Broward County, Florida, for a period of one year next preceding the first publication of the attached copy of advertisement; and affiant further says that she has neither paid nor promised any person, firm or corporation any discount, rebate, commission or refund for the purpose of securing this advertisement for publication in the said newspaper.

Shirley A. Corwin
Sworn to and subscribed before me this

19th day of SEPTEMBER..... A.D. 19..84

(SEAL)

James H. Hendrick

NOTARY PUBLIC STATE OF FLORIDA
MY COMMISSION EXP. AUG 28, 1988
BONDED THRU GENERAL INS. UND.

**STATE OF FLORIDA
DEPARTMENT OF
ENVIRONMENTAL REGULATION
NOTICE OF PROPOSED
AGENCY ACTION**

The Department of Environmental Regulation gives notice of its intent to issue a permit (File No. 060781739) to Broward County to prepare a site for the construction of a resource recovery facility and two retention ponds by: excavating 221,600 cu. yds. of muck and limerock landward of the mean high water line (MHW) from 18 acres including 15.6 wetland acres, placing fill to an elevation of +7 ft. MSL (mean sea level) and excavating 38,400 cu. yds. (51 cu. yds. waterward of MHW) to restore a 15 acre strip of disturbed wetland in the South Fork of the New River. The project site is located between U.S. 441 and S.R. 84 in Section 25, Township 50 South, Range 41 East in Broward County. The affected waters are the South Fork of the New River (South New River) designated Class III waters, not in an aquatic preserve.

The file is available for public inspection Monday through Friday, except for legal holidays, 8 a.m. to 5 p.m., at the Department of Environmental Regulation, 2600 Blair Stone Road, Twin Towers Office Building, Tallahassee, Florida 32301-8241.

Persons whose substantial interests are affected by the above proposed agency action have a right pursuant to Section 120.57, Florida Statutes, to petition for an administrative determination (hearing) on the proposed action. The petition must conform to the requirements of Florida Administrative Code Rules 17-103.155 and 28-5.201, and must be filed (received) with the Department's Office of General Counsel, 2600

Blair Stone Road, Tallahassee, Florida 32301-8241 within fourteen (14) days of publication of this notice. Failure to file a petition within the fourteen (14) days constitutes a waiver any such person has to an administrative determination (hearing) pursuant to Section 120.57, Florida Statutes.

The administrative hearing process is designed to formulate agency action. Accordingly, if a petition is filed, the Department's final action may be different from the proposed agency action. Therefore, persons who may not wish to file a petition may wish to intervene in the proceeding. A petition for intervention must be filed pursuant to Rule 28-5.207, at least five (5) days before the final hearing and must be filed with the hearing officer, if one has been assigned, at the Division of Administrative Hearings, 2009 Apalachee Parkway, Tallahassee, Florida 32301. If no hearing officer has been assigned, the petition is to be filed with the Department's Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32301-8241. Failure to petition to intervene within the allowed time frame constitutes a waiver of any right such person has to request a hearing under Section 120.57, Florida Statutes.

9/19

B84-091931

**STATE OF FLORIDA
DEPARTMENT OF
ENVIRONMENTAL REGULATION
NOTICE OF PROPOSED
AGENCY ACTION**

The Department of Environmental Regulation gives notice of its intent to issue a permit (File No. 060781749) to Broward County to prepare a site for the construction of an unprocessable waste landfill and a retention pond by: excavating 527,600 cu. yds. of muck and limerock landward of the mean high water line (MHW) from a 157 acre site including 133 acres of wetlands, placing fill for the base of the landfill to an elevation of +5 ft. MSL (mean sea level), constructing earthen berms and grassed swales around the landfill and conducting restoration/enhancement activities at five wetland areas in Broward County. The landfill site is located between U.S. 441 and S.R. 84 in Sections 24 and 25, Township 50 South, Range 41 East and Sections 19 and 30 of Township 50 South, Range 42 East. The five wetland areas proposed for restoration/enhancement are located in Section 25, Township 50 South, Range 41 East; Sections 19 and 30, Township 50 South, Range 42 East; Section 29, Township 50 South, Range 41 East; and Section 26, Township 50 South, Range 39 East in Broward County. The affected waters are the South Fork of the New River (South New River) designated Class III Waters, not in an aquatic preserve.

The file is available for public inspection Monday through Friday, except for legal holidays, 8 a.m. to 5 p.m., at the Department of Environmental Regulation, 2600 Blair Stone Road, Twin Towers Office Building, Tallahassee, Florida 32301-8241.

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9/19 B84-091932

**Broward Review
AND BUSINESS RECORD**

Published daily, Monday through Friday
except legal holidays
Fort Lauderdale, Broward County, Florida.

**STATE OF FLORIDA
COUNTY OF BROWARD:**

Before the undersigned authority personally appeared Connie Landy, who on oath says that she is the Supervisor of the Broward Review and Business Record, a newspaper published at Fort Lauderdale, in Broward County, Florida; that the attached copy of advertisement, being a Legal Advertisement of Notice in the matter of

NOTICE OF PROPOSED AGENCY ACTION

RE:

DEPT OF ENVIRONMENTAL REGULATION ETC

in theX.....X.....X..... Court,
was published in said newspaper in the issues of

SEPTEMBER 19, 1984

Affiant further says that the said Broward Review and Business Record is a newspaper published at Fort Lauderdale, in said Broward County, Florida, and that the said newspaper has heretofore been continuously published in said Broward County, Florida, and has been entered as second class mail matter at the post office in Fort Lauderdale in said Broward County, Florida, for a period of one year next preceding the first publication of the attached copy of advertisement; and affiant further says that she has neither paid nor promised any person, firm or corporation any discount, rebate, commission or refund for the purpose of securing this advertisement for publication in the said newspaper.

Connie Landy
Sworn to and subscribed before me this

19... day of ...September... A.D. 19. 84..

John A. Carrington
(SEAL)

Notary Public, State of Florida
My Commission Expires Oct. 31, 1987
Bonded by Mincey Agency - 462-3641

public notices

NOTICE OF ADMINISTRATION IN THE CIRCUIT COURT FOR BROWARD COUNTY, FLORIDA PROBATE DIVISION

File Number 84-2928
IN RE: ESTATE OF LOUISE NELSON
Deceased
The administration of the estate of LOUISE NELSON, deceased, File Number 84-2928, is pending in the Circuit Court for Broward County, Florida. Probate Division, the address of which is 201 SE Sixth St., Fort Lauderdale, FL 33301. The names and addresses of the personal representative and the personal representative's attorney are set forth below.

All interested persons are required to file with this court, WITHIN THREE MONTHS OF THE FIRST PUBLICATION OF THIS NOTICE: (1) all claims against the estate and (2) any claim by an interested person to whom this notice was mailed that challenges the validity of the will, the qualifications of the personal representative, venue, or jurisdiction of the court.

ALL CLAIMS AND OBJECTIONS NOT SO FILED WILL BE FOREVER BARRED.

Publication of this Notice has begun on Sept. 19, 1984.

Personal Representative:
Barbara J. Garner
8 Country Club Rd.
Norwalk, CT 06851
Paul H. Nelson
80 Forest Lane Ave.
Stamford, CT 06904

Attorneys for Personal Representative:
By Steven D. Barnes
1500 Edward Bell Bldg.
100 Chopin Plaza
Miami, FL 33131
Telephone: 358-4300
9/19-26 884-091948

IN THE CIRCUIT COURT OF THE SEVENTEENTH JUDICIAL CIRCUIT IN AND FOR BROWARD COUNTY, FLORIDA
CASE NO.: 84-21341 CM
CHASE FEDERAL SAVINGS AND LOAN ASSOCIATION, existing under the laws of the United States, Plaintiff,
vs.
OSCAR FERNANDEZ and BUILDING THREE AT COUNTRY CLUB APARTMENTS at BONAVENTURE 32 CONDOMINIUM ASSOCIATION, INC., Defendants.

TO: OSCAR FERNANDEZ
Circular 3rd 47-52
Medellin, Colombia
YOU ARE HEREBY NOTIFIED that an action to foreclose a mortgage on the following property in Broward County, Florida:

Condominium Unit 310, BUILDING THREE AT COUNTRY CLUB APARTMENTS at BONAVENTURE 32, a Condominium according to the Declaration of Condominium therefor, recorded in Official Records Book 9067, at page 444, of the Public Records of Broward County, Florida, together with an undivided share in the common elements appurtenant thereto.

has been filed against you and you are required to serve a copy of your written defenses, if any, to it on MARTIN P. AVERY, JR., plaintiff's attorney, whose address is P.O. Box 24286, Fort Lauderdale, Florida 33307, on or before Oct. 31, 1984 and to file the original with the clerk of this court before service on plaintiff's attorney or immediately thereafter; otherwise a default will be entered against you for the relief demanded in the complaint or petition.

DATED SEP 17 1984.
ROBERT E. LOCKWOOD
As Clerk of said Court

A TRUE COPY
Circuit Court Seal
By: MARLENE SANTANA
As Deputy Clerk
9/19-26 103-10 884-091957

NOTICE OF ACTION
KING A. WALKER and ETHEL LYONS, (Residence unknown) Defendants.
TO: ETHEL LYONS
(last known residence address)
5308 Northwest 18th Place
Lauderhill, Florida 33313
(present residence address unknown)
OU ARE NOTIFIED that an action regarding foreclosure of a mortgage on the follow-

ing described property in Broward County, Florida:

Lot 21, Block 5, FLAMINGO VILLAGE FIRST ADDITION, according to the Plat thereof, recorded in Plat Book 47, Page 7, of the Public Records of Broward County, Florida, aka/s 2721 Northwest 24th Street, Ft. Lauderdale, Florida, has been filed against you and you are required to serve a copy of your written defenses, if any, to it on MICHAEL J. STYLES, ESQ., COOPER, SHAMADY, FRAZIER, PUGATCH & MEYER, P.A., Attorneys for Plaintiff, whose address is 2455 E. Sunrise Blvd., Suite 1200, Ft. Lauderdale, Florida 33304, on or before Oct. 24, 1984, and file the original with the Clerk of this Court either before service on Plaintiff's attorney or immediately thereafter; otherwise, a default will be entered against you for the relief demanded in the Complaint or petition.

This notice shall be published once each week for four consecutive weeks in the BROWARD REVIEW AND BUSINESS RECORD. WITNESS my hand and seal of said Court at Fort Lauderdale, Florida on this 17 day of Sept. 1984.
ROBERT E. LOCKWOOD
Clerk of Court

A TRUE COPY
Circuit Court Seal
By: JACKIE KAMERON
As Deputy Clerk
COOPER, SHAMADY, FRAZIER, PUGATCH & MEYER, P.A.
Attorneys for Plaintiff
2455 E. Sunrise Blvd., Suite 1200
Ft. Lauderdale, Florida 33304
Telephone: (305) 584-1400
BY: MICHAEL J. STYLES
9/19-26 103-10 884-091951

NOTICE OF ACTION
IN THE CIRCUIT COURT OF THE SEVENTEENTH JUDICIAL CIRCUIT IN AND FOR BROWARD COUNTY, FLORIDA
No. 84-487-0
HOLLYWOOD FEDERAL SAVINGS AND LOAN ASSOCIATION, a corporation under the laws of the United States of America, Plaintiff,
vs.
DONALD C. GIST, et al. Defendants.

TO: DONALD C. GIST
4175 NW 100th Avenue
Coral Springs, Florida
Vivianne F. Walker
4175 NW 100th Avenue
Coral Springs, Florida
YOU ARE HEREBY NOTIFIED that an action to foreclose a mortgage on the following described property in Broward County, Florida:

Lot Three (3), of Block C, of RUNNING BROOK HILLS, according to the plat thereof recorded in Plat Book 70, page 23, of the public records of Broward County, Florida; said lands situate, lying and being in Broward County, Florida; TOGETHER WITH fixtures and equipment therein contained, has been filed against you and you are required to serve a copy of your written defenses, if any, to it on Ellis, Spencer, Butler and Kissel, Plaintiff's attorneys, whose address is P.O. Box 909, Tyler Street, Hollywood, Florida 33322, on or before October 24, 1984, and file the original with the Clerk of this Court either before service on Plaintiff's attorneys or immediately thereafter; otherwise a default will be entered against you for the relief demanded in the Complaint.

WITNESS my hand and the seal of this Court on SEP 17 1984.
ROBERT E. LOCKWOOD,
As Clerk of the Court

A TRUE COPY
Circuit Court Seal
By COLEEN LOCKWOOD
As Deputy Clerk
9/19-26 103-10 884-091939

NOTICE OF ACTION
IN THE CIRCUIT COURT OF THE 17TH JUDICIAL CIRCUIT IN AND FOR BROWARD, FLORIDA
Case No. 84-12900 CP
HOME SAVINGS OF AMERICA, F.A., Plaintiff
vs.
JOHN ENGLISH, et al. Defendants.
TO: JOY ENGLISH, TELEDYNE NEOSHO, JOSEPH PADAWER and GEORGE MAY, AND ALL PARTIES CLAIMING AN INTEREST BY AND THROUGH UNDER OR AGAINST JOY ENGLISH, TELEDYNE NEOSHO, JOSEPH PADAWER and GEORGE MAY, AND ALL PARTIES HAVING OR CLAIMING TO HAVE ANY RIGHT, TITLE, OR INTEREST IN THE PROPERTY HEREIN DESCRIBED:
CIBED: UNKNOWN

YOU ARE NOTIFIED that an action to foreclose a mortgage on the following property in Broward County, Florida:

The East 1/4 of the SE 1/4 of Tract 3 of Section 3 Township 48 South, Range 41 East, EXCEPTING THEREFROM the East 50 feet thereof, and EXCEPTING all that part of said Tract lying within 22 feet of the East line of Section 3, according to the FLORIDA FRUIT LANDS COMPANY'S PLAT thereon, recorded in Plat Book 1, Page 102, of the Public Records of Palm Beach County, Florida.

(Also known as Lot 3 according to an unrecorded Plat of B.B.S. RANCHES, a Subdivision of Tracts 1, 2, 3, and 4 in Section 3, Township 48 South, Range 41 East.)
Together with all structures and improvements now and hereafter on said land and fixtures attached thereto, all furniture, and all rents, issues, proceeds and profits accruing and to accrue from said premises, all of which are included within the foregoing description and the habendum hereof. Also all gas, steam, and electric water and other heating, cooking, refrigerating, lighting, plumbing, ventilating, irrigating, and power system, machines, appliances, fixtures and appurtenances, which are now or may hereafter pertain to or be used with, in or on said premises, even though they be detached or detachable, all of which is hereby agreed as or when installed shall become a part of said real estate.

has been filed against you and you are required to serve a copy of your written defenses, if any, to it on Jeffrey Allan Hirsch, Plaintiff's attorney, whose address is: One Corporate Plaza, 18th Floor, 110 East Broward Boulevard, Fort Lauderdale, Florida 33301, on or before Oct. 24, 84, and file the original with this Court either before service on Plaintiff's attorney or immediately thereafter; otherwise a default will be entered against you for the relief demanded in the Complaint or petition.

WITNESS my hand and the seal of this Court on SEP 14 1984.
ROBERT E. LOCKWOOD
As Clerk of the Court

A TRUE COPY
Circuit Court Seal
By: JACKIE KAMERON
As Deputy Clerk
9/19-26 103-10 884-091940

NOTICE OF ADMINISTRATION IN THE CIRCUIT COURT OF THE SEVENTEENTH JUDICIAL CIRCUIT IN AND FOR BROWARD COUNTY, FLORIDA PROBATE DIVISION
FILE NO. 84-2858
IN RE: ESTATE OF MARION SPAN
Deceased
TO ALL PERSONS HAVING CLAIMS OR DEMANDS AGAINST THE ABOVE ESTATE AND ALL OTHER PERSONS INTERESTED IN SAID ESTATE: YOU ARE HEREBY NOTIFIED that the administration of the estate of MARION SPAN, deceased, late of Broward County, Florida, File Number 84-2858 is pending in the Circuit Court in and for Broward County, Florida, Probate Division, the address of which is 2nd Floor, Broward County Courthouse, 201 S.E. 2nd Street, Ft. Lauderdale, Florida 33301. The names and addresses of the personal representative and the personal representative's attorney are set forth below.

All persons interested in the estate are required to file with this court, WITHIN THREE MONTHS OF THE FIRST PUBLICATION OF THIS NOTICE: (1) all claims against the estate and (2) all objection by an interested person to whom notice was mailed that challenges the validity of the will, the qualifications of the personal representative, venue, or jurisdiction of the court.

ALL CLAIMS, DEMANDS, AND OBJECTIONS NOT SO FILED WILL BE FOREVER BARRED.
Personal Representative:
JULIA MAE SPAN
537 N.W. 18th Avenue
Ft. Lauderdale, Florida
First publication of this notice of administration on the 17th day of Sept., 1984.
Of Law Offices of
Kurt L. Barch, Esq.
1819-A S. Andrews Avenue
Ft. Lauderdale, Florida 33316
Telephone 761-8522
Attorney For Personal Representative
9/19-26 884-091934

NOTICE UNDER FICTITIOUS NAME LAW

NOTICE IS HEREBY GIVEN that the undersigned, desiring to engage in business under the fictitious name of BLUE MARLIN INN at number 4221 North Ocean Blvd., in the City of Ft. Lauderdale, Florida, intends to register the said name with the Division of Comptroller of Broward County, Florida. Dated at Ft. Lauderdale, Florida, this 14 day of Sept., 1984.
LVM INTERNATIONAL, INC.
SEBASTIANO BRANCATO
PRESIDENT
Attorney for Applicant
JOSEPH DE GANCE
1749 N. E. 26 Street
Wilton Manors, Florida 33305
9/19-26 103-10 884-091917

NOTICE OF ACTION — PROPERTY

IN THE CIRCUIT COURT OF THE SEVENTEENTH JUDICIAL CIRCUIT, IN AND FOR BROWARD COUNTY, FLORIDA
CASE NO. 84-21218 CP
ELIZABETH BOWLING, Plaintiff,
vs.
PEDRO GONZALEZ GUTIERREZ, all parties claiming interests by, through, under or against PEDRO GONZALEZ GUTIERREZ, RICHARD ALAN GILMORE, ROYAL FLAGG JONES, individually and as Trustee; WAYNE H. SPATH, beneficiary under the Last Will and Testament of HELENE BRANDY SPATH, deceased; ROSS SPATH, beneficiary under the Last Will and Testament of HELENE BRANDY SPATH, deceased; EDWARD T. STEWART, beneficiary under the Last Will and Testament of HELENE BRANDY SPATH, deceased; EDWARD S. SHEPPARD, as Personal Representative of the Estate of OLIVIA P. SHEPPARD, deceased; EDWARD S. SHEPPARD, beneficiary under the Last Will and Testament of OLIVIA P. SHEPPARD, deceased; WILLIAM I. SHEPPARD, beneficiary under the Last Will and Testament of OLIVIA P. SHEPPARD, deceased; VALARIE M. DIMURO, beneficiary under the Last Will and Testament of OLIVIA P. SHEPPARD, deceased; OLIVIA P. SHEPPARD, deceased; SEYMOUR PLASKER, individually and as Trustee; WALTER R. BLAKE; UNION BANK OF FLORIDA; and JOSEPH L. DAVE, P.A., a Florida corporation; all parties having or claiming to have any right, title and interest in the property.

Defendants.
TO: PEDRO GONZALEZ GUTIERREZ
Address Unknown
ROSS SPATH
300 South Rhodes, West Memphis, Arkansas 72301
ALL PARTIES CLAIMING INTERESTS BY, THROUGH, UNDER OR AGAINST PEDRO GONZALEZ GUTIERREZ AND ALL PARTIES HAVING OR CLAIMING TO HAVE ANY RIGHT, TITLE OR INTEREST IN THE PROPERTY DESCRIBED HEREIN
YOU ARE HEREBY NOTIFIED that an action to remove a cloud from or to quiet title to the following property in Broward County, Florida:

Lots 1, 2, 3, 4 and 10 in Block 17 of MIDWAY SECTION OF CROSSBART PARK, as recorded to the Plat thereof, as according to Plat Book 5, page 83, of the Public Records of Broward County, Florida.

has been filed against you and you are required to serve a copy of your written defenses, if any, to it on J. KAYLOR YOUNG, Plaintiff's attorney, whose address is 4331 North Federal Highway, Suite 206, Fort Lauderdale, Florida, on or before Oct. 22, 1984, and file the original with the Clerk of this Court either before service on Plaintiff's attorney or immediately thereafter; otherwise a default will be entered against you for the relief demanded in the complaint or petition.

DATED ON SEP 14, 1984.
ROBERT E. LOCKWOOD,
As Clerk of the Court

A TRUE COPY
Circuit Court Seal
By MARLENE SANTANA
As Deputy Clerk
J. KAYLOR YOUNG
Attorney for Plaintiff
4331 North Federal Highway
Suite 206
Fort Lauderdale, Florida 33306
Telephone: 771-6313
9/19-26 103-10 884-091928

NOTICE OF ACTION CONSTRUCTIVE SERVICE (NO PROPERTY)

IN THE CIRCUIT COURT OF THE SEVENTEENTH JUDICIAL CIRCUIT OF FLORIDA, IN AND FOR BROWARD COUNTY.
CIVIL ACTION NO. 84-21211 CJ
IN RE: THE MARRIAGE OF DAWN ANN FISHER, Petitioner/Wife, and ERIC ALAN FISHER, Respondent/Husband
PETITION FOR DISSOLUTION OF MARRIAGE
TO: ERIC ALAN FISHER
United States Army Base
Zimora, Germany
YOU ARE HEREBY NOTIFIED that a petition for Dissolution of your Marriage has been filed and commenced in this court and you are required to serve a copy of your written answer and defenses, if any, to it on ANGELINE G. WEIR, attorney for Petitioner, whose address is 4600 Sheridan Street, Suite 401, Hollywood, Florida 33020, 33021, and file the original with the clerk of the above styled court on or before October 28, 1984, otherwise a default will be entered for the relief prayed for in said petition.

This notice shall be published once each week for four consecutive weeks in BROWARD REVIEW AND BUSINESS RECORD.

WITNESS my hand and the seal of said court at Fort Lauderdale, Florida on SEP 14 1984.
ROBERT E. LOCKWOOD
As Clerk, Circuit Court
Broward County, Florida

A TRUE COPY
Circuit Court Seal
By DEBORAH MCNAIR
As Deputy Clerk
ANGELINE G. WEIR
4600 Sheridan Street, Suite 401
Hollywood, Florida 33021
Tele. No. (305) 962-6666
Attorney for Petitioner
9/19-26 103-10 884-091938

NOTICE UNDER FICTITIOUS NAME LAW

NOTICE IS HEREBY GIVEN that the undersigned, desiring to engage in business under the fictitious name of ROYAL MARKET at number 1846 Harrison St., in the City of Hollywood, Florida 33020, intends to register the said name with the County Administrator, Department of Finance, Division of Recording of Broward County, Florida. Dated at Ft. Lauderdale, Florida, this 17th day of September, 1984.

Mr. Royal, Inc., a Florida Corp.
Attorney for Applicant
Nelson and Feldman, P.A.
1135 Kane Concourse
Bay Harbor Islands 33154
921-2380
9/19-26 103-10 884-091912

STATE OF FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION NOTICE OF PROPOSED AGENCY ACTION

The Department of Environmental Regulation gives notice of its intent to issue a permit (File No. 060781749) to Broward County to prepare a site for the construction of an unprocessed waste land fill and a retention pond by: excavating 527,600 cu. yds. of much and limonite landward of the mean high water line (MHW) from a 157 acre site including 133 acres of wetlands, placing fill for the base of the landfill to an elevation of +5 ft. MSL (mean sea level), constructing earthen berms and grassed swales around the landfill and conducting restoration/enhancement activities at five wetland areas in Broward County. The landfill site is located between 19 S. 441 and S.R. 84 in Sections 24 and 25, Township 50 South, Range 41 East and Sections 19 and 30 of Township 50 South, Range 42 East. The five wetland areas proposed for restoration/enhancement are located in Sections 25, Township 50 South, Range 41 East; Sections 19 and 30, Township 50 South, Range 42 East; Section 29, Township 50 South, Range 41 East; and Section 26, Township 50 South, Range 39 East in Broward County. The affected waters are the South New River designated Class III Waters, not in an aquatic preserve.

The file is available for public inspection Monday through Friday, except for legal holidays, 8 a.m. to 5 p.m., at the Department of Environmental Regulation, 2600 Blair Stone Road, Twin Towers Office Building, Tallahassee, Florida 32301-6241. Persons whose substantial interests are affected by the above pro-

posed agency action have a right pursuant to Section 120.57, Florida Statutes, to petition for an administrative determination (hearing) on the proposed action. The petition must conform to the requirements of Florida Administrative Code Rules 17F.103.155 and 28-5.201, and must be filed (received with the Department's Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32301-6241) within fourteen (14) days of publication of this notice. Failure to file a petition within the fourteen (14) days constitutes a waiver any person has to an administrative determination (hearing) pursuant to Section 120.57, Florida Statutes.

The administrative hearing process is designed to formulate agency action. Accordingly, if a petition is filed, the Department's action may be different from the proposed agency action. Therefore, persons who may not wish to file a petition may wish to intervene in the proceeding. A petition for intervention must be filed pursuant to Rule 28-5.207, at least five (5) days before the final hearing and must be filed with the hearing officer, if one has been assigned, at the Division of Administrative Hearings, 2009 Apalachee Parkway, Tallahassee, Florida 32301. If no hearing officer has been assigned, the petition is to be filed with the Department's Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32301-6241. Failure to petition to intervene within the allowed time frame constitutes a waiver of any right such person has to request a hearing under Section 120.57, Florida Statutes.
9/19 884-091932

Foreclosure Sale

NOTICE OF SALE
PURSUANT TO CHAPTER 48 IN THE CIRCUIT COURT OF THE 17TH JUDICIAL CIRCUIT IN AND FOR BROWARD COUNTY, FLORIDA
CASE NO. 82-3867CL 83-11664 CL
BANKERS LIFE COMPANY, Plaintiff
vs.
GERALDINE B. MARTIN, HANA E. UMUR, M.D. P.A. and KMART CORPORATION, JOSEPH F. GOUVEIA and MARIE L. GOUVEIA, his wife, Defendants
and
GERALDINE B. MARTIN, Plaintiff/Cross Claimant.
vs.
ABLE TITLE COMPANY, TULEY INTERNATIONAL, INC., a Florida corporation, JAMES F. HURLEY and JOSEPH S. PORTU, Cross-Defendants.

ABLE TITLE COMPANY, Third-Party Plaintiff,
vs.
JOSEPH F. GOUVEIA and MARIE L. GOUVEIA, Third-Party Defendants.
NOTICE IS HEREBY GIVEN pursuant to an Order or Final Judgment in Foreclosure dated September 12, 1984, and entered in Case No. 82-3867CL, 83-11664 CL of the Circuit Court of the Seventeenth Judicial Circuit in and for Broward County, Florida, wherein Bankers Life Company, Plaintiff and Geraldine B. Martin, Hana E. Umur, M.D. P.A. and KMart Corporation, Joseph F. Gouveia and Marie L. Gouveia, his wife are defendants, I will sell to the highest and best bidder for cash in the lobby of the Broward County Courthouse in Fort Lauderdale, Broward County, Florida, at 11:00 o'clock a.m. on the 11th day of October, 1984, the following described property as set forth in said Order or Final Judgment, to wit:

Lots 14 and 15, Block 29, CARVER RANCHES, according to the Plat thereof recorded in Plat Book 19, Page 2 of the Public Records of Broward County, Florida.
Dated at Fort Lauderdale, Florida this 14 day of September, 1984.
ROBERT E. LOCKWOOD
As Clerk, Circuit Court
Broward County, Florida
A TRUE COPY
Circuit Court Seal
By: CLETA HINC
As Deputy Clerk
THOMAS A. GRAY
Attorney for Plaintiff
FLEMING O'BRYAN & FLEMING
Post Office Drawer 7028
1415 East Sunrise Boulevard
Fort Lauderdale, Florida 33338
Tel: 305-764-3000
9/19-26 884-091920

public notices

NOTICE OF ACTION IN THE CIRCUIT COURT OF THE 17TH JUDICIAL CIRCUIT IN AND FOR BROWARD COUNTY, FLORIDA

Case No. 84-19619 OF
HOWARD S. PHILLIPS, III,
Plaintiff,

vs.
MARILYN ANN PHILLIPS, and
FIRST FEDERAL SAVINGS OF
THE PALM BEACHES,
Defendant.

TO: MARILYN ANN PHILLIPS
3381 Northwest 54 Street
Fort Lauderdale, Florida

YOU ARE HEREBY NOTIFIED
that a civil action has been filed
against you and you are required to
serve a copy of your written
defenses, if any, to it on Steven
W. Davis, Esq., BROAD AND
CASSELL, Attorneys at Law, whose
address is 1108 Kane Con-
course, Bay Harbor Islands, Flori-
da, 33154, on or before Oct. 24,
1984, and file the original with the
clerk of this court either before
service on plaintiff's attorney or
immediately thereafter; otherwise
a default will be entered against
you for the relief demanded in the
complaint.

WITNESS my hand and seal of
this Court on SEP 17 1984.

ROBERT E. LOCKWOOD
As Clerk said Court

A TRUE COPY
Circuit Court Seal
By: JACKIE KAMERON
As Deputy Clerk
9/19-25 103-10 884-091958

Station for Adoption
DOCKET BY 84-1

The People of
the State of New York,
To PAUL PORTER
WHEREAS,

A petition has been presented to
the Surrogate's Court of our
County of Erie, praying for an
ORDER approving the adoption of
ROCHELLE LYNN FARLEY Infant,
by PETITIONERS.

Therefore, YOU, and EACH OF
YOU, are hereby cited to show
cause before the Surrogate's Court
of our said County of Erie, at the
City of Buffalo, in said County of
Erie, on October 22, 1984, ten
o'clock in the forenoon of that day,
why such a decree should not be
made.

In Testimony Whereof, we have
caused the Seal of said Surrogate's
Court to be hereunto affixed.

Witness, Hon. JOSEPH S.
MATTINA, Surrogate of our said
County of Erie, at Buffalo, NY, on
September 6, 1984

George P. Engler
Chief Clerk of the Surrogate's
Court

SEAL
9/19-25 103-10 884-091929

STATE OF FLORIDA
DEPARTMENT OF
ENVIRONMENTAL REGULATION

NOTICE OF PROPOSED
AGENCY ACTION

The Department of Environmen-
tal Regulation gives notice of its
intent to issue a permit (File No.
060781729) to Broward County to
prepare a site for the construction
of a resource recovery facility and
two retention ponds by excavat-
ing 221,600 cu. yds. of muck and
limonoid landward of the mean high
water line (MHW) from 18 acres
including 15.6 wetland acres, plac-
ing fill to an elevation of +7 ft
MSL (mean sea level) and excavat-
ing 38,400 cu. yds. ± cu. yds.
waterward of MHW to restore a
15 acre strip of disturbed wetland
in the South Fork of the New River.
The project area is located between
U.S. 441 and S.R. 84 in Section 25,
Township 50 South, Range 41 East
in Broward County. The affected
waters are the South Fork of the
New River (South New River) desig-
nated Class III waters, not in an
aquatic preserve.

The file is available for public
inspection Monday through Friday,
except for legal holidays, 8 a.m.
to 5 p.m., at the Department of
Environmental Regulation, 2600
Blair Stone Road, Twin Towers
Office Building, Tallahassee, Flori-
da 32301-6241.

Persons whose substantial inter-
ests are affected by the above pro-
posed agency action have a right
pursuant to Section 120.57, Flori-
da Statutes, to petition for an
administrative determination hear-
ing on the proposed action. The
petition must conform to the
requirements of Florida Adminis-
trative Code Rules 17-103.155 and
28-5.201, and must be filed (in-
terviewed) with the Department's
Office of General Counsel, 2600

Blair Stone Road, Tallahassee, Flori-
da 32301-6241 within fourteen (14)
days of publication of this notice.
Failure to file a petition within the
fourteen (14) days constitutes a
waiver any such person has to an
administrative determination hear-
ing pursuant to Section 120.57,
Florida Statutes.

The administrative hearing pro-
cess is designed to formulate
agency action. Accordingly, if a
petition is filed, the Department's
final action may be different from
the proposed agency action. There-
fore, persons who may not wish to
file a petition may wish to
intervene in the proceeding. A peti-
tion for intervention must be filed
pursuant to Rule 28-5.207, at least
five (5) days before the final hear-
ing and must be filed with the
hearing officer, if one has been
assigned, at the Division of Admin-
istrative Hearings, 2000 Apalachee
Parkway, Tallahassee, Florida
32301. If no hearing officer has
been assigned, the petition is to be
filed with the Department's
Office of General Counsel, 2600
Blair Stone Road, Tallahassee, Flori-
da 32301-6241. Failure to petition
to intervene within the allowed time
frame constitutes a waiver of any
right such person has to request
a hearing under Section 120.57,
Florida Statutes.

9/19 884-091931

NOTICE UNDER
FICTITIOUS NAME LAW

NOTICE IS HEREBY GIVEN that
the undersigned, desiring to
engage in business under the fic-
titious name of

SEA THINGS GIFT SHOP
at number
221 N.E. 29th Avenue,
in the City of
Deerfield Beach, Florida,

intends to register the said name
with the County Administrator,
Department of Finance, Division
of Recording of Broward County,
Florida.

Dated at Ft. Lauderdale, Florida,
this 18 day of September, 1984.

THE SWEET GAMES, INC.
By Inna Arms, President
Attorney for Applicant
Edward D. Popkin
Popkin & Sharpin, P.A.
3210 Inverrary Boulevard
Ft. Lauderdale, FL 33319

9/19-25 103-10 884-091914

NOTICE OF SALE
IN THE CIRCUIT COURT OF THE
SEVENTEENTH JUDICIAL CIR-
CUIT OF FLORIDA, IN AND FOR
BROWARD COUNTY.

CIVIL DIVISION
CASE NO. 84-07552 CG
FIRST FEDERAL SAVINGS AND
LOAN ASSOCIATION OF LAKE
WORTH,
Plaintiff,

vs.
IRA L. BROTSPIES, et al
NOTICE IS HEREBY GIVEN pur-
suant to a Final Judgment of Fore-
closure dated the 17 day of Sep-
tember, 1984, entered in Civil Case
No. 84-07552 CG of the Circuit
Court of the Seventeenth Judicial
Circuit in and for Broward Coun-
ty, Florida, wherein FIRST FED-
ERAL SAVINGS AND LOAN
ASSOCIATION OF LAKE WORTH
is Plaintiff and IRA L. BROTSPIES,
a single person and LOCH
LOMOND CONDOMINIUM ASSO-
CIATION, INC., and all parties her-
eto or to said judgment, are De-
fendants, that the title or interest in
and to the property
described herein are Defendants.

I will sell to the highest and
best bidder for cash, at Courthouse
lobby 201 SE 8 St. Ft. Lauderdale,
Florida at 11:00 A.M., on the 15
day of October, 1984, the follow-
ing described property as set forth
in said Final Judgment, to-wit:

Unit No. 108, in Building No.
122 1/2 201 N.W. 32nd Court,
Pompano Beach, Florida
33064, of LOCH LOMOND
GARDEN APARTMENTS I, a
condominium according to the
Declaration thereof, dated the
10th day of May, 1979, and
recorded August 22, 1979, in
Official Records Book 6298,
Page 842, et seq. of the Pub-
lic Records of Broward Coun-
ty, Florida, together with the
grantee undivided share in the
common elements appur-
tenant thereto.

DATED at Ft. Lauderdale, Flori-
da, this 17 day of September, 1984.

ROBERT E. LOCKWOOD
Clerk of Circuit Court

A TRUE COPY
Circuit Court Seal
By: BARBARA A. AHLBRANDT
Deputy Clerk
Attorney for Plaintiff
Stephen R. Koons, Esq.
2601-10th Ave. No., Ste. 314
Lake Worth, FL 33461
305-864-6263

9/19-25 884-091921

NOTICE OF ACTION
IN THE CIRCUIT COURT OF THE
17TH JUDICIAL CIRCUIT IN AND
FOR BROWARD COUNTY,
FLORIDA
CASE NO. 84-21150 CD
FLA. BAR NO. 133287
IN RE: THE MARRIAGE OF:
JAIME GIRALDO
Petitioner

and
MIRYAM GIRALDO
Respondent
TO: MIRYAM GIRALDO
RESIDENCE UNKNOWN
YOU ARE NOTIFIED that an
action for Dissolution of Marriage
has been filed against you and
you are required to serve a copy
of your written defenses, if any,
to it on Howard P. Altman, Esq.,
Petitioner's attorney, whose
address is 700 E. Atlantic Blvd.,
Pompano Beach, FL 33060, on or
before October 28, 1984, and file
the original with the Clerk of this
Court either before service on
Petitioner's Attorney or immedi-
ately thereafter; otherwise a
default will be entered against you
for the relief demanded in the
petition.

WITNESS my hand and seal of
this Court on SEP 13 1984.

ROBERT E. LOCKWOOD
Clerk of the Circuit Court

A TRUE COPY
Circuit Court Seal
By: DEBORAH MCNAIR
Deputy Clerk

9/19-25 103-10 884-091950

NOTICE OF ADMINISTRATION
IN THE CIRCUIT COURT OF THE
SEVENTEENTH JUDICIAL CIR-
CUIT IN AND FOR BROWARD
COUNTY, FLORIDA
PROBATE DIVISION
FILE NO. 84-48113
WILSON, Doris L. Wilson
IN RE: ESTATE OF
DORIS L. WILSON
Deceased

TO ALL PERSONS HAVING
CLAIMS OR DEMANDS AGAINST
THE ABOVE ESTATE AND ALL
OTHER PERSONS INTERESTED
IN SAID ESTATE:
YOU ARE HEREBY NOTIFIED
that the administration of the estate
of DORIS L. WILSON, deceased,
late of Broward County, Florida,
File Number 84-48113 is pending
in the Circuit Court in and for
Broward County, Florida, Probate
Division, the address of which is
2nd Floor, Broward County Cour-
thouse, 201 S.E. 8th Street, Ft.
Lauderdale, Florida 33301. The
personal representative of this estate
is EARL C. WILSON, whose
address is 5901 N.W. 41 St.,
Lauderdale Lakes, FL 33318. The
name and address of the attorney
for the personal representative are
set forth below.

All persons having claims or
demands against this estate are
required to file with me, WITHIN
THREE MONTHS FROM THE DATE OF
PUBLICATION OF THIS NOTICE,
to file with the clerk of the above
court a written statement of any
claim or demand they may have.
Each claim must be in writing and
must indicate the basis for the
claim, the name and address of
the creditor or his agent or attor-
ney, and the amount claimed. If
the claim is not yet due, the date
when it will become due shall be
stated. If the claim is contingent
or unliquidated, the nature of the
contingency shall be stated. If the
claim is secured, the security shall
be described. The claimant shall
deliver sufficient copies of the claim
to the clerk of the above
styled court to enable the clerk to
mail one copy to each personal
representative.

All persons interested in the
estate to whom a copy of this
Notice of Administration has been
mailed are required, WITHIN
THREE MONTHS FROM THE DATE
OF THE FIRST PUBLICATION OF
THIS NOTICE, to file any objec-
tions they may have that challenge
the validity of the decedent's will,
the qualifications of the personal
representative, or the venue or
jurisdiction of the court.

ALL CLAIMS, DEMANDS AND
OBJECTIONS NOT SO FILED WILL
BE FOREVER BARRED.

DATED at Ft. Lauderdale, Flori-
da on this 4th day of September,
1984.

Earl C. Wilson
As Personal Representative
of the Estate of
DORIS L. WILSON
Deceased

First publication of this notice
of administration on the 19 day of
Sept. 1984.

Law Offices of
Medella & Engert, PA
DONALD MEDALL, ESQUIRE
Attorney for Petitioner
1500 E. Atlantic Blvd.,
Pompano Beach, FL 33060
Florida Bar No. 054021
Telephone: (305) 848-6100
Attorney for Personal
Representative

9/19-25 884-091937

NOTICE OF ACTION
IN THE CIRCUIT COURT OF THE
17TH JUDICIAL CIRCUIT IN AND
FOR BROWARD COUNTY,
FLORIDA
CASE NO. 84-21135
IN RE: The Marriage of:
MARC A. SHAFFMAN,
Petitioner/Husband,
and
MARIE-FRANCE SHAFFMAN,
Respondent/Wife,
TO: MARIE-FRANCE SHAFFMAN
Last Known Residence:
Bangkok, Thailand
YOU ARE HEREBY NOTIFIED
that an action for Dissolution of
Marriage has been filed against
you and you are required to serve
a copy of your written defenses,
if any, to it on STUART J. STARR,
Petitioner's attorney, whose
address is 3081 E. Commercial
Boulevard, Fort Lauderdale, Flori-
da, 33308, on or before October
29, 1984, and file the original with
the Clerk of this Court either before
service of Petitioner's attorney or
immediately thereafter; otherwise
a Default will be entered against
you for the relief demanded in the
petition.

DATED on September 17, 1984.

ROBERT E. LOCKWOOD
As Clerk, Circuit Court
Broward County, Florida

A TRUE COPY
Circuit Court Seal
By: LYNN SILVER
As Deputy Clerk

9/19-25 103-10 884-091954

NOTICE OF ADMINISTRATION
IN THE CIRCUIT COURT OF THE
SEVENTEENTH JUDICIAL CIR-
CUIT IN AND FOR BROWARD
COUNTY, FLORIDA
PROBATE DIVISION
FILE NO. 84-4852
WILSON, Bessie Louise Joubert
IN RE: ESTATE OF
BESSIE LOUISE JOUBERT
Deceased

TO ALL PERSONS HAVING
CLAIMS OR DEMANDS AGAINST
THE ABOVE ESTATE AND ALL
OTHER PERSONS INTERESTED
IN SAID ESTATE:
YOU ARE HEREBY NOTIFIED
that the administration of the estate
of BESSIE LOUISE JOUBERT
deceased, late of Broward Coun-
ty, Florida, File Number 84-4852
is pending in the Circuit Court in
and for Broward County, Florida,
Probate Division, the address of
which is 2nd Floor, Broward County
Courthouse, 201 S.E. 8th Street,
Ft. Lauderdale, Florida 33301. The
personal representative of this estate
is JOHN R. HARRINGTON,
whose address is 8712 Lyons Blvd.,
Miramar, Florida 33025. The name
and address of the attorney for the
personal representative are set
forth below.

All persons having claims or
demands against this estate are
required to file with me, WITHIN
THREE MONTHS FROM THE DATE OF
PUBLICATION OF THIS NOTICE,
to file with the clerk of the above
court a written statement of any
claim or demand they may have.
Each claim must be in writing and
must indicate the basis for the
claim, the name and address of
the creditor or his agent or attor-
ney, and the amount claimed. If
the claim is not yet due, the date
when it will become due shall be
stated. If the claim is contingent
or unliquidated, the nature of the
contingency shall be stated. If the
claim is secured, the security shall
be described. The claimant shall
deliver sufficient copies of the claim
to the clerk of the above
styled court to enable the clerk to
mail one copy to each personal
representative.

All persons interested in the
estate to whom a copy of this
Notice of Administration has been
mailed are required, WITHIN
THREE MONTHS FROM THE DATE
OF THE FIRST PUBLICATION OF
THIS NOTICE, to file any objec-
tions they may have that challenge
the validity of the decedent's will,
the qualifications of the personal
representative, or the venue or
jurisdiction of the court.

ALL CLAIMS, DEMANDS AND
OBJECTIONS NOT SO FILED WILL
BE FOREVER BARRED.

DATED at Ft. Lauderdale, Flori-
da on this 13th day of Septem-
ber, 1984.

JOHN R. HARRINGTON
As Personal Representative
of the Estate of
Bessie Louise Joubert,
Deceased

First publication of this notice
of administration on the 19 day of
Sept. 1984.

HARVEY K. MATTEL, ESQ.
FL. Bar No. 123482
Of Law Office of
Harrington & Mattel
524 South Andrews Avenue,
Suite 101N
Fort Lauderdale, Florida 33301
Telephone (305) 463-4118
Attorney for Personal
Representative

9/19-25 884-091946

NOTICE OF ACTION
IN THE CIRCUIT COURT OF THE
SEVENTEENTH JUDICIAL CIR-
CUIT AND FOR BROWARD
COUNTY, FLORIDA
Case No. 84-21278 CL
IN RE: The Marriage of
CARLOS OLIVARES,
Plaintiff/Husband,
and
MARIA ROSA ANDREUZZI de
OLIVARES,
Respondent/Wife,
TO: MARCIA ROSA ANDREUZZI
de OLIVARES
Calle 1, No. 175
San Miguel, Santiago, Chile
YOU ARE NOTIFIED that an
action for DISSOLUTION OF MAR-
riage has been filed against you
and you are required to serve a
copy of your written answer and
defenses, if any, to it on HOWARD
S. GAINES, Esq., plaintiff's attor-
ney, whose address is 5100 North
Federal Highway, Suite 403, Fort
Lauderdale, Florida 33308, on or
before Oct. 26, 1984, and file the
original with the Clerk of this Court
either before service on plaintiff's
attorney or immediately thereafter;
otherwise a default will be entered
against you for the relief demanded
in the complaint or petition.

WITNESS my hand and seal of
this Court on SEP 17 1984.

ROBERT E. LOCKWOOD,
Clerk of the Court

A TRUE COPY
Circuit Court Seal
By: ROBALYN MILLER
As Deputy Clerk

9/19-25 103-10 884-091952

NOTICE UNDER
FICTITIOUS NAME LAW

NOTICE IS HEREBY GIVEN that
the undersigned, desiring to
engage in business under the fic-
titious name of

Atlantic-City
Ambulance Service
at number
6651 N.W. 9th Ave.,
in the City of
Fort Lauderdale, Florida,

intends to register the said name
with the County Administrator,
Department of Finance, Division
of Recording of Broward County,
Florida.

Dated at Hollywood, Florida, this
14 day of September, 1984.

BROWARD AMBULANCE
CORP.
ST: Stuart Temlin
ATLANTIC AMBULANCE
SERVICES CORP.
ST: Stuart Temlin, President
Attorney for Applicant
Joseph L. Schwartz, Esquire
Miller & Schwartz, P.A.
4040 Sheridan Street
Hollywood, Florida 33021

9/19-25 103-10 884-091915

NOTICE OF ADMINISTRATION
IN THE CIRCUIT COURT OF THE
SEVENTEENTH JUDICIAL CIR-
CUIT IN AND FOR BROWARD
COUNTY, FLORIDA
PROBATE DIVISION
FILE NO. 84-4875
IN RE: ESTATE OF
ALICE M. WESCH,
Deceased

TO ALL PERSONS HAVING
CLAIMS OR DEMANDS AGAINST
THE ABOVE ESTATE AND ALL
OTHER PERSONS INTERESTED
IN SAID ESTATE:
YOU ARE HEREBY NOTIFIED
that the administration of the estate
of ALICE M. WESCH, deceased,
late of Broward County, Florida,
File Number 84-4875 is pending
in the Circuit Court in and for
Broward County, Florida, Probate
Division, the address of which is
2nd Floor, Broward County Cour-
thouse, 201 S.E. 8th Street, Ft.
Lauderdale, Florida 33301. The
names and addresses of the per-
sonal representative and the per-
sonal representative's attorney are
set forth below.

All persons interested in the
estate are required to file with me,
WITHIN THREE MONTHS FROM THE
DATE OF THE FIRST PUBLICATION
OF THIS NOTICE, (1) all claims
against the estate and (2) any objection
by an interested person to whom
notice was mailed that challenges
the validity of the decedent's will,
the qualifications of the personal rep-
resentative, or the venue or jurisdiction
of the court.

ALL CLAIMS, DEMANDS, AND
OBJECTIONS NOT SO FILED WILL
BE FOREVER BARRED.

THE FIRST BANKERS, N.A.
By: J. Marvin Smith
Vice President and Trust
Officer
POB 1888, Pompano Beach,
FL 33061

First publication of this notice
of administration on the 18 day of
Sept. 1984.

Of Law Offices of
Robert B. Cochran
2336 E. Atlantic Blvd., Suite 400
Pompano Beach, FL 33062
Attorney for Personal
Representative

9/19-25 884-091944

Wednesday, Sept. 19, 1984

NOTICE OF HEARING
NOTICE OF ACTION
IN THE CIRCUIT COURT OF THE
17TH JUDICIAL CIRCUIT IN AND
FOR BROWARD COUNTY,
FLORIDA
CASE NO. 84-17628 CR
BROWARD COUNTY,
Petitioner,
vs.
THE Z CAR CENTER, INC., et
al,
Respondents.

TO: HERVE BARRE
609 N.W. 7th Street
Dania, Florida
MARGUERITE BARRE
609 N.W. 7th Street
Dania, Florida

YOU ARE NOTIFIED that an
action in eminent domain in con-
nection with the following:
described property in Broward
County, Florida, to-wit:

That portion of the North
100.00 feet of the South
300.00 feet of the Northwest
One-Quarter (NW1/4) of the
Southeast One-Quarter
(SE1/4) of Section 27: Town-
ship 50 South, Range 42
East, lying West of the West
right-of-way line of U.S.
Highway No. 1 and lying
East of the East right-of-way
line of Old Dixie Highway.
Said land situated in Broward
County, Florida, containing
0.38 Acres (15,602 square
feet, more or less.

TOGETHER WITH all right,
title, interest, claim, or
demand, if any, in and to
the North 100.00 feet of the
South 300.00 feet of the
Northwest One-Quarter
(NW1/4) of the Southeast
One-Quarter (SE1/4) of said
Section 27 lying East of the
East right-of-way line of the
Florida East Coast Railway
and West of the East right-
of-way line of Old Dixie
Highway, said land being the
right-of-way of Old Dixie
Highway.

has been filed against you and
you are required to serve a copy
of your written defenses, if any,
to it on SUSAN F. DELEGAL,
General Counsel, Broward Coun-
ty, Florida, and THOMAS E.
BYRD, Special Counsel for
Petitioner, 521 South Andrews
Avenue, Fort Lauderdale, Florida
33301, and file the original with
the Clerk of the above-styled
court on or before October 24,
1984, otherwise a default will
be entered for the relief prayed
for in said petition.

PLEASE TAKE NOTICE that a
Declaration of Taking has been
filed in this action and that the
Petitioner will seek an Order of
Taking and any other order the
Court deems proper at a hear-
ing before the Honorable Gene
Fischer, one of the Judges of
this Court, on October 15, 1984,
at 1:30 o'clock p.m. in his Cham-
bers in the Broward County
Courthouse, at Fort Lauderdale,
Florida. All parties to this action
and all parties interested may
appear and be heard at that
hearing.

This notice shall be published
once each week for four (4) con-
secutive weeks in Broward
Review and Business Record.

WITNESS my hand and seal
of said Court at Fort Lauderdale,
Florida, on this 14 day of Sep-
tember, 1984.

ROBERT E. LOCKWOOD,
As Clerk of the Circuit Court
Broward County, Florida

A TRUE COPY
Circuit Court Seal
By: JACKIE KAMERON
Deputy Clerk

9/19-25 103-10 884-091941

NOTICE UNDER
FICTITIOUS NAME LAW

NOTICE IS HEREBY GIVEN that
the undersigned, desiring to
engage in business under the fic-
titious name of

JOSEPH CORP, db/a
SOTTINI'S SUB SHOP
at number
1441 South Dixie Highway,
in the City of
Pompano Beach, Florida,

intends to register the said name
with the County Administrator,
Department of Finance, Division
of Recording of Broward County,
Florida.

Dated at Fort Lauderdale, Flori-
da, this 28th day of August, 1984.

JOSEPH CORP.
PETER A. ROSE, Esquire
Attorney for Applicant
2101 North Andrews Avenue
Suite 400
Fort Lauderdale, Florida 33311
Telephone: (305) 541-6000

9/5-12-19-25 884-090538



State of Florida
DEPARTMENT OF NATURAL RESOURCES

DR. ELTON J. GISSENDANNER
Executive Director
Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard, Tallahassee, Florida 32303

BOB GRAHAM
Governor
GEORGE FIRESTONE
Secretary of State
JIM SMITH
Attorney General
GERALD A. LEWIS
Comptroller
BILL GUNTER
Treasurer
DOYLE CONNER
Commissioner of Agriculture
RALPH D. TURLINGTON
Commissioner of Education

January 16, 1984

Hazen & Sawyer, P.C.
5950 Washington Street
Hollywood, Florida 33023

Gentlemen:

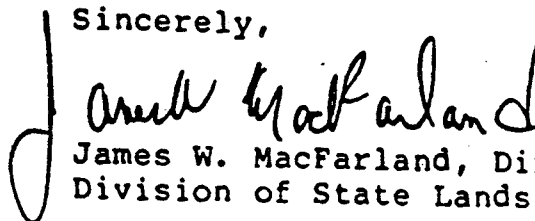
File No. 06-78173-9E
Applicant: Broward County

This office has no objection to your project as proposed in Department of Environmental Regulation's permit application number 06-78173-9E, dated November 4, 1983, showing the location in Section 25, Township 50 South, Range 41 East, in Broward County.

Consider this the authority sought under Section 253.77, Florida Statutes, to pursue this project.

This letter in no way waives the authority and/or jurisdiction of any governmental entity nor does this letter disclaim any title interest that the State may have in this project site.

Sincerely,


James W. MacFarland, Director
Division of State Lands

JWM/lmf

cc: Department of Environmental Regulation



State of Florida
DEPARTMENT OF NATURAL RESOURCES

DR. ELTON J. GISSENDANNER
Executive Director
Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard, Tallahassee, Florida 32303

BOB GRAHAM
Governor
GEORGE FIRESTONE
Secretary of State
JIM SMITH
Attorney General
GERALD A. LEWIS
Comptroller
BILL GUNTER
Treasurer
DOYLE CONNER
Commissioner of Agriculture
RALPH D. TURLINGTON
Commissioner of Education

January 16, 1984

Hazen and Sawyer
5950 Washington Street
Hollywood, Florida 33023

Gentlemen:

File No. 06-78174-9E

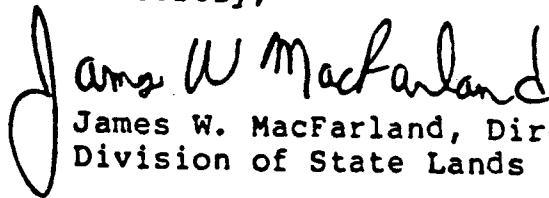
Applicant: Southern Broward Residue/Unprocessable Waste Landfill

This office has no objection to your project as proposed in Department of Environmental Regulation's permit application number 06-78174-9E, dated November 7, 1983, showing the location in Sections 24 and 25, Township 50 South, Range 41 East; and in Sections 19 and 30, Township 50 South, Range 42 East, in Broward County.

Consider this the authority sought under Section 253.77, Florida Statutes, to pursue this project.

This letter in no way waives the authority and/or jurisdiction of any governmental entity nor does this letter disclaim any title interest that the State may have in this project site.

Sincerely,


James W. MacFarland, Director
Division of State Lands

JWM/lmf

cc: Department of Environmental Regulation

STATE OF FLORIDA
DEPARTMENT OF
COMMUNITY AFFAIRS

BOB GRAHAM
Governor



JOHN M. DeGROVE
Secretary

December 12, 1983

Mr. F. T. Johnson
County Administrator
Room 248
201 S. E. 6th Avenue
Ft. Lauderdale, FL 33301

Dear Mr. Johnson:

Re: Binding Letter of Development
of Regional Impact Status
File No. BLID-1184-003
Broward County Resource Recovery Project

We have evaluated your application for a Binding Letter dated July 29, 1983 and received August 1, 1983. Based on the information contained in the application, we enter the following Findings of Fact, Conclusions of Law and Order:

FINDINGS OF FACT

1. The proposed development will consist of two resource recovery plants located in unincorporated Broward County. One plant will be located in the northern portion of the County on a 130 acre site at the northeast corner of the intersection of Copans Road and the Florida Turnpike. This plant is expected to generate 20 megawatts. The other plant will be located in the southern portion of the county, adjacent to the South Fork of the New River, on a 240 acre site at the southeast corner of the intersection of State Road 84 and U.S. 441. This plant is expected to generate 35 megawatts. In addition, both sites will contain a residue/unprocessable waste landfill and transmission lines to connect the plants with the existing electrical grid system.

2. The Copans Road development site is located in Section 21, Township 48 South, Range 42 East in Broward County, Florida. This site is approximately four miles from Palm Beach County, the

Mr. F. T. Johnson
December 12, 1983
Page Two

nearest adjacent county. The Route 441 development site is located in Sections 24 and 25, Township 50 South, Range 41 East, and Sections 19 and 30, Township 50 South, Range 42 East, in Broward County, Florida. This site is approximately six miles from Dade County, the nearest adjacent county.

3. The proposed resource recovery plants will not be developed in conjunction with a Development of Regional Impact (DRI) of any kind.

4. The applicant is Mr. F. T. Johnson, the authorized representative of Broward County which proposes to develop the Broward County Resource Recovery Project.

5. On August 12, 1983, notice of receipt of this request for a Binding Letter of Determination was published in the Florida Administrative Weekly.

CONCLUSIONS OF LAW

1. The proposed development as described in the Findings of Fact is an electrical generating facility. These facilities are one of the 12 types of development included in Chapter 27F-2, Florida Administrative Code, and therefore, electrical generating facilities have, in the past, been subject to Section 380.06, Florida Statutes. However, an amendment to this Section 380.06(24), F.S., became law on July 1, 1983 which states:

"Any proposed electrical transmission line or electrical power plant shall be exempt from the provisions of this section, except any steam or solar electrical generating facility of less than 50 megawatts in capacity attached to a development of regional impact."

2. It is the opinion of the Department that by passing this amendment, the intent of the legislature was to exclude electrical generating facilities from DRI review except when they are proposed along with a DRI. Therefore, the Department finds that the Broward County Resource Recovery Project is not a type of development that may be considered to be a development of regional impact and is not subject to Section 380.06, Florida Statutes.

ORDER

1. The Broward County Resource Recovery Project as described in this letter is not required to comply with the review requirements of Section 380.06, Florida Statutes.

2. The development described in this binding letter shall be considered cumulatively with any future additional development on this or adjacent property owned by this developer in terms of

Mr. F. T. Johnson
December 12, 1983
Page Three

Chapter 380, F.S., the presumptive guidelines and standards contained in Chapter 27F-2, Florida Administrative Code, and the regional impacts associated with the development. Should any of the above representations made by the applicant be substantially changed, further review of the project may be required.

This binding letter of interpretation has been issued pursuant to the procedural requirements of Subsection 120.57(2), Florida Statutes, and constitutes final agency action appealable within 30 days to a District Court of Appeal pursuant to Section 120.68, Florida Statutes. If you wish to present oral or written evidence, or a written statement in opposition to this agency action, you must file with the Department a written request for an opportunity to do so within 30 days from this date. Such a request for a reconsideration shall be made in accordance with Rule 9B-16.16, Florida Administrative Code, and will be responded to by the Department pursuant to Subsection 120.57(2)(a), Florida Statutes.

This determination does not obviate the need to comply with other applicable state or local permitting procedures. Any questions regarding this determination may be directed to Mr. Blaine Oliver in the Bureau of Land and Water Management at (904) 488-4925.

Sincerely,



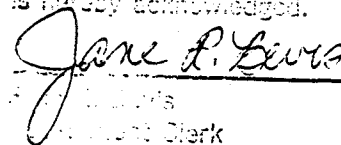
Nancy G. Linnan
Assistant Secretary

NGL/obs

cc: Mr. Ron Mills✓
Ms. Diane Moore
Mr. Martin Singer

FILING AND ACKNOWLEDGEMENT

FILED, on this date, with the designated
Department Clerk, receipt of which
is hereby acknowledged.

 12/12/83
Date
Department Clerk

MONITORING PROGRAMS

APPENDIX 10.5
MONITORING PROGRAMS

APPENDIX 10.5
MONITORING PROGRAMS

Information pertaining to specific monitoring programs, i.e., Data Gathering, Construction, and Operation have been addressed in their respective subsections of Volume I, Technical Submittal. In addition, specific information on monitoring capabilities are provided in Appendix 10.9, 10.10, and 10.13. However, because vendor selection is not complete at this time, the South Broward County Resource Recovery Project, Inc. elects to exercise its option and provide specific monitoring information at least six months prior to the plant start-up target date.

PETITION FILED WITH PUBLIC SERVICE COMMISSION IN MARCH 1985

BEFORE THE STATE OF FLORIDA PUBLIC SERVICE COMMISSION

IN RE:

Broward County, Florida,
Petitioner.

Docket No. _____

**PETITION FOR DETERMINATION OF NEED FOR A
SOLID-WASTE-PIRED ELECTRICAL POWER PLANT**

Under section 403.519 of the Florida Statutes and section 25-22.80 of the Florida Administrative Code, PETITIONER BROWARD COUNTY requests a determination of need for a solid-waste-fired electrical power plant, and in support of the request states as follows:

1. The name of Petitioner is Broward County, whose address is Resource Recovery Office, Room 521, 115 South Andrews Avenue, Fort Lauderdale, Florida 33301. The Petitioner is acting on behalf of South Broward County Resource Recovery Project, Inc., a Florida corporation, which will be the owner and operator of the proposed solid waste fired electrical power plant. The names and the address of the attorneys representing Broward County are Clifford A. Schulman, Esq., and Timothy A. Smith, Esq., Greenberg, Traurig, Askew, Hoffman, Lipoff, Rosen & Quentel, P.A., 1401 Brickell Avenue, Miami, Florida 33131.

2. Broward County files this Petition as an "electric utility" as defined by section 403.503(4) of the Florida Statutes. Broward County proposes to construct and operate a solid-waste-fired electrical generating facility that initially will generate approximately 68.5 megawatts, using solid waste as fuel and located as is more fully shown in paragraph 3 below. In anticipation of expected future needs, Broward County seeks certification for ultimate electrical generating capacity of 96.1 megawatts (gross) for the proposed facility. Broward County intends to file with the Florida Department of

Environmental Regulation (DER) a "A Power Plant Site Certification Application" under sections 403.501-.517 of the Florida Statutes, in approximately April 1985.

3. The utility affected will be the Florida Power and Light Company (FPL), which owns a power plant across the New South River Canal immediately to the southeast of the County's proposed resource recovery facility (the facility), which will be located on a tract of 248 acres in unincorporated Broward County immediately east of U.S. 441 and south of State Road 84, along the New South River Canal. The diagram attached to this Petition as Exhibit A shows the sites of the facility and the FPL power plant. The County and FPL are presently discussing the details and means of providing an interconnection with FPL's system and the rates to be paid to the County or the contractor operating the County's proposed facility. Based on FPL's preliminary investigation of electrical interconnection requirements, there does not appear to be a need for new transmission line corridors or any other long narrow siting corridors (e.g., rail lines, or influent or effluent pipelines) that would leave the area near the proposed facility. Because the site of the proposed facility lies just across the canal from the FPL plant, transmission lines will not cross any land that is not the property of the County or FPL. The transmission line crossing of the canal will be designed so as to have no adverse impact on the existing use and characteristics of the river. FPL will bring transmission power to the facility substations. The design and installation of all electrical interconnections, meters, plant distribution systems, and protective equipment will comply with the requirements and standards imposed by FPL. FPL will make the connections to the electrical substations in the facility. The electrical interconnections proposed by FPL are shown in Exhibit B attached to this Petition. FPL will extend a 69 KV transmission line westward across the canal from FPL's Lauderdale Power Plant Sub-

station to the substation at the proposed facility. The routing of this line will be coordinated with the development of the facility. The facility has been designed to accommodate future conversion of the 69 KV service voltage to 138 KV.

4. The electrical energy distribution system for the facility shall include the following features. Each turbo-generator and associated power generation equipment will have its own bus, which will be at the same voltage level as the generator. Synchronizing and protective relays will be provided on each generator breaker. Interconnect transformers will each be sized for the full output of the plant. Complete indoor relay and control switchboards will be provided for each facility's electrical systems. The distribution systems at each facility will have 4.16 KV and 400 volt systems with switchgear and related accessories housed in the processing section of the facilities.

5. The electrical output of the turbine-generator sets will operate within the interconnection system established by FPL. The turbine-generator sets will be capable of operating in the full condensing mode, at maximum steam flow, even on the hottest day of the year, and still provide an efficient and adequate quantity of electrical energy.

6. The County and FPL are presently projecting the costs of this interconnection. They estimate that the cost of the basic interconnection will be approximately \$300,000, including the cost of modifications to offsite substations and transmission lines but not the transformers or the circuit breaker or other protective equipment required at the site. Moreover, the basic estimate does not include the following additional costs:

- monthly telephone company charges for the FPL dispatcher communication channel, which has been estimated by FPL at \$175 per month at each site;

- maintenance and operation fees to FPL for inter-connection facilities;
- metering costs;
- suitable arrangements for termination of FPL lines, including adjustment of service points if desirable to provide suitable line terminations;
- costs of all fees and permits, if applicable.

7. FPL has also provided the County with a preliminary schedule of the avoided fuel costs that FPL would pay for the recovered electric energy. A copy of that schedule is attached to this Petition as Exhibit C. Although the final determination of the rates to be paid must await completion of the contract negotiations between the County and FPL, it is important to note that some savings on the cost of electricity will probably be passed on to consumers of electricity residing in Broward County, in addition to the savings to the County's taxpayers and users of the resource recovery facility for the disposal of solid waste, which will result from the offsetting of capital and other costs by FPL's payment for the energy generated by the County's facility.

8. The proposed electrical power plant will be a resource recovery facility (the facility) that converts unprocessed solid waste (SW) into electricity through mass burning of the SW, use of the heat from the incineration to transform water into steam, and generation of electricity through steam turbines. The facility will receive unprocessed SW as its fuel collected primarily from the southern half of Broward County. Processible SW is simply that portion of the total incoming waste stream to the facility that can be burned in stoker-fired furnaces and in waterwall boilers and includes: all forms of garbage, commercial waste, rubbish, leaves and brush, paper and cardboard, plastics,

wood and lumber, rags, carpeting, a small amount of tires, wood furniture, mattresses, stumps, wood pallets, tree limbs, railroad ties, logs, and minor amounts of pathological and biological wastes. The facility will process the SW in three incinerator units, each consisting of a storage bin for the incoming waste, a charging hopper, a stoker-fired incinerator, a water-walled boiler and superheater, and a turbine generator, in pertinent part. A conceptual drawing of the facility and a diagram of an individual incinerating unit appear in Composite Exhibit D attached to this Petition.

9. The facility is slated to have an initial installed capacity of 2,352 tons per day and an estimated projected ultimate capacity of approximately 3,300 tons per day, while the generating capacity will increase from approximately 68 megawatts to 96.1 megawatts (gross). Since the proposed facility will use mass-burn technology, there will be no preprocessing of wastes at the facility before combustion. SW will be truck-delivered to the facility, and ash residue will be removed by the same mode of transport. Transfer trailers and packer trucks will dump SW directly into the refuse bunker (or storage pit) inside the building. All waste will be stored inside the building; no waste will be visible from the outside. Two overhead cranes will lift SW from the storage bin to the charging hoppers of the incinerators. The dual crane system will enable one crane to feed refuse into the charging hopper while the other crane mixes the waste and removes oversized bulky wastes from the pit. The crane operators will sort combustible bulky materials from the storage bin and put them in the bulk shear shredder at the end of the bin. The processible waste will move down the charging hopper toward the stoker-fired incinerator. A hydraulically operated arch-breaker at the throat of the feedhopper will dislodge objects that might otherwise interrupt the flow. A hydraulic ram feed will force SW onto the stoker, where moving

grates first will pass the waste through a drying zone and then will move it into the combustion zone of the incinerator. The stoker system will agitate the waste, providing the proper mixture of air and fuel to complete the combustion process. Provision for over- and underfire air, regulated at approximately 85 to 115 percent of excess combustion air, will ensure optimal conditions for complete combustion of most of the materials and for prolonging grate bar life. From the combustion zone, the hot gasses will move through the boiler and superheater, where heat from the incinerator will be transferred to water-filled tubes in the boiler walls, producing steam. The steam will then be directed to the turbine generator to produce electricity. The gasses will continue to the economizer, which serves to preheat the feed water that will be converted to steam in the boiler and superheater. The combustion gasses then will pass through the electrostatic precipitators for particulate removal before discharge through the stack. Mass burning of the processible waste will reduce its volume by approximately 90 percent and its weight by 75 percent. Conveyors will remove the ash residue to a disposal area, from which trucks will take it to the nearby landfill.

10. The design of the power generating equipment will ensure that no loss of energy production (either thermal or electrical) will occur throughout the lifetime of each facility unit. The turbines will be designed for continuous operation, and the facility will use alternating current synchronous generators. Each facility incinerating unit will be able to process SW at full capacity even during scheduled and unscheduled outages of the turbine-generator sets.

11. The projected in-service date for the facility is July 1988, with construction scheduled to begin in January 1986. The projected capital cost for the initial project is approximately \$266 million.

12. The need for this facility rests on several grounds. First, construction and operation of the facility will satisfy the state and federal policy of encouraging such plants. See Fla. Stat. § 377.709 (Supp. 1984). Second, this policy depends in turn on the goal of energy efficiency, met by this facility because it will use only SW, a nonfossil fuel. In an age of scarce resources, the efficient use of nonfossil fuel assumes great importance. Based on conservative assumptions, the proposed facility will save at least 730,000 barrels of crude oil each year and more than 14.6 million barrels over the life of the project (20 years). Third, the proposed facility will increase the reliability and total capacity of the generating system in South Florida, while avoiding the need to construct other generating facilities using fossil or nuclear fuel to achieve the same goal. The facility will generate approximately 328 million kilowatt hours (kWh) of electricity per year, enough electricity to serve more than 50,000 homes. Fourth, the sale of the energy recovered by the facility will substantially offset the cost of disposing of the SW in Broward County. Because the energy revenues will offset capital, operating, and maintenance costs of the facility, the energy recovery will reduce the disposal fees that the municipalities must bear. Finally, the facility will prolong the useful life of the landfill accompanying the facility, by substantially reducing the volume and weight of the SW converted to energy and residue ash.

13. As for the generating or nongenerating alternatives considered by the County in arriving at the decision to construct the proposed facility, the County first evaluated available resource recovery technologies and determined that a mass-burning facility was the only available means of disposal of SW and generation of energy for the County at the selected site. The County then evaluated the major available generating alternatives for this type of facility. The two types of avail-

able generating alternatives were steam and electricity. Because there was and still is only one viable steam customer (FPL) in all of Broward County, electric energy generation became the only practical alternative available to the County (rather than piping steam across the canal). Based on a conservative estimate the facility will produce 6000 pounds of steam for every ton of SW processed. Thus, for each ton processed the steam (6000 lbs) produced will be converted to approximately 450 kWh of electrical energy. The only nongenerating alternative open to the facility would be to release the steam into the atmosphere. If this were done, the public would suffer a loss of one million kWh of electrical energy per day. Such a loss would require the electrical company to find another means of supplying power to approximately 50,000 homes.

14. The adverse consequences that would result if the facility could not be constructed as proposed reflect the clear need for this facility and mandate a determination recognizing that need. Preclusion of the facility would result in the loss of the enhanced capacity and reliability of the generating system, as noted in paragraph 12 above. Loss of the facility's capacity to generate approximately one million kWh per day and serve 50,000 homes would require FPL to find an alternative means of achieving that capacity, as noted in paragraph 13 above, probably compelling a reliance on nuclear or fossil fuels. The County's consumers of electricity would lose the savings that would result from the recovery of energy from SW. The public would also lose the potential savings of 14.6 million barrels of crude oil that would result from the operation of the facility. Finally, preclusion or delay of the facility would pose a serious threat to the public health, safety, and welfare, because the County's present means of disposing SW will no longer be adequate after 1986.

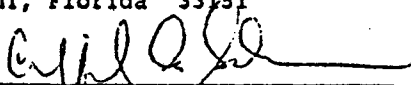
THEREFORE, Broward County respectfully requests that the Public Service Commission expeditiously review this petition and the exhibits attached to it, put this matter on the agenda for a meeting of the Commission at the earliest available date, and enter an order, which will constitute the report of the Public Service Commission required by section 403.507(1)(b) of the Florida Statutes, finding that there is a need for the proposed Broward County solid-waste-fired electrical power plant as proposed.

Respectfully submitted,

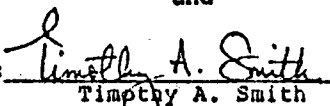
Susan F. Delegal
Broward County
General Counsel
Room 423
115 South Andrews Avenue
Fort Lauderdale, Florida 33301

- and -

GREENBERG, TRAURIG, ASKEW
HOFFMAN, LIPOFF, ROSEN &
QUENTEL, P.A.
Special Counsel to Broward
County
1401 Brickell Avenue
Miami, Florida 33131

By: 
Clifford A. Schulman

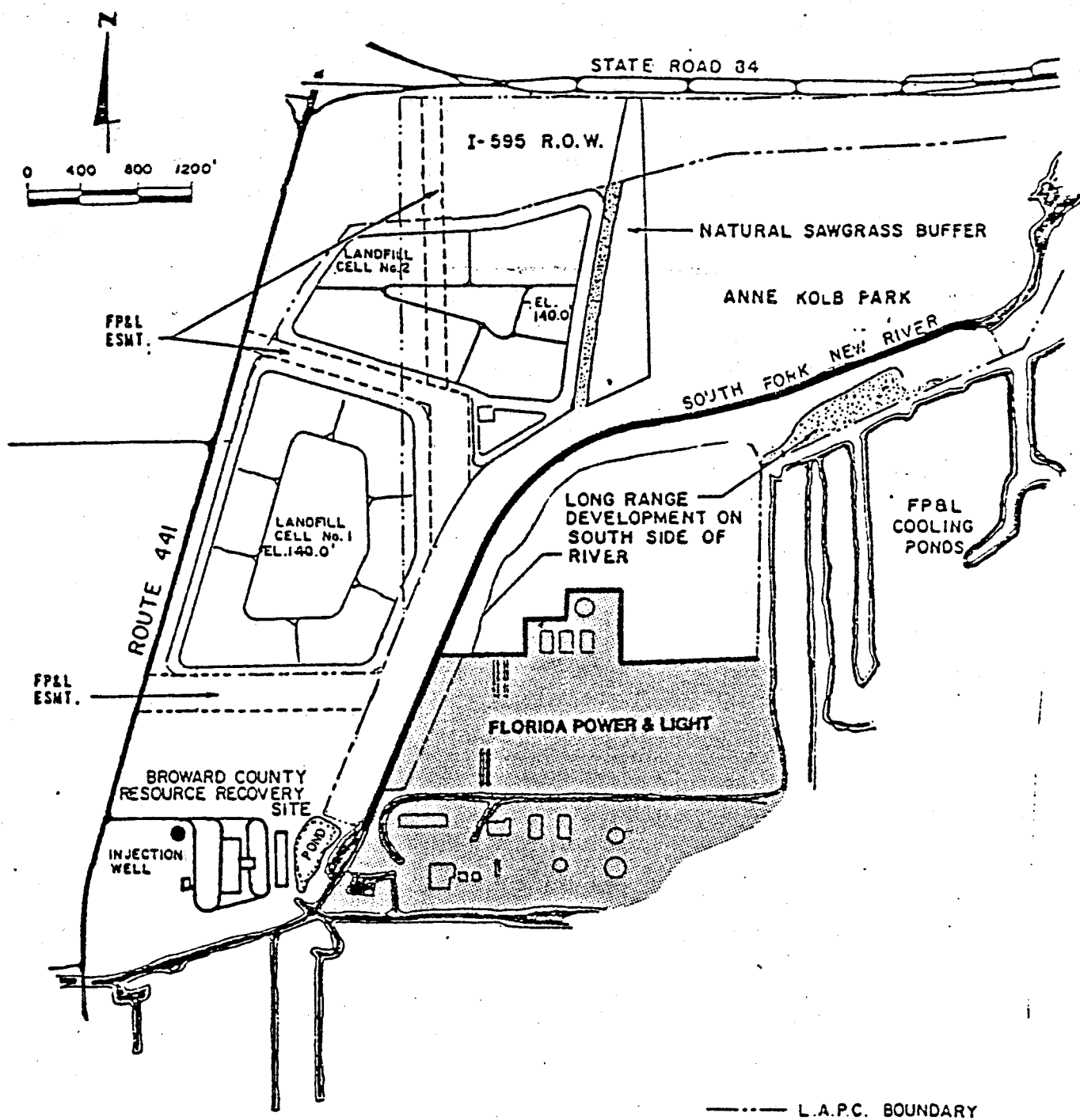
- and -

By: 
Timothy A. Smith

CERTIFICATE OF SERVICE

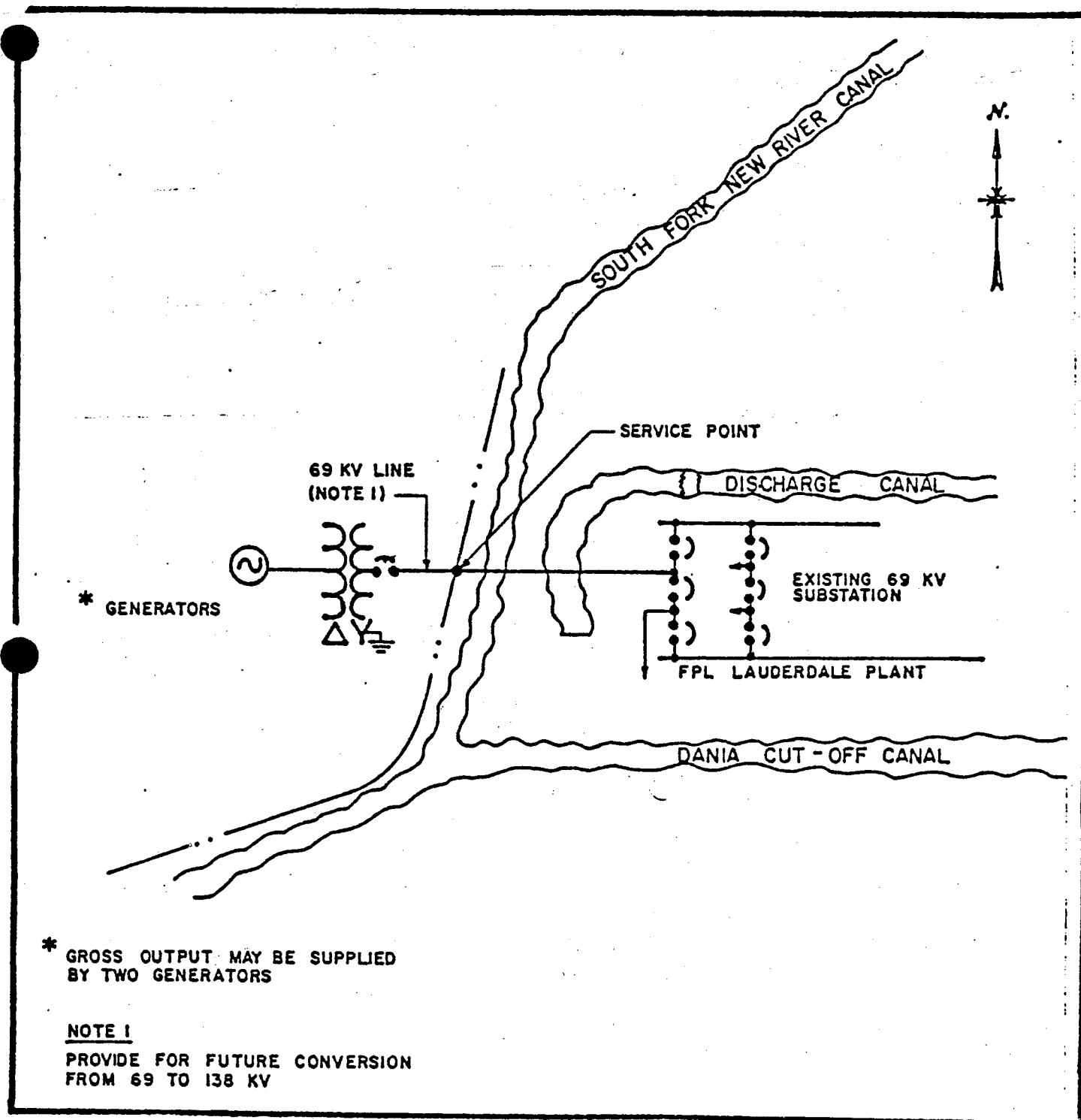
I certify that a true copy of the foregoing petition was hand delivered to William S. Bilenky, General Counsel, Public Service Commission, Fletcher Building, 101 East Gaines Street, Tallahassee, Florida 32301, on this 13th day of March 1985.


Timothy A. Smith



BROWARD COUNTY
RESOURCE RECOVERY
SITE AND UTILITY LOCATIONS

FIGURE 6.1.2



BROWARD COUNTY
RESOURCE RECOVERY
ELECTRICAL INTERCONNECTION SCHEMATIC
ROUTE 441 SITE

**STANDARD RATE FOR PURCHASE OF AS-AVAILABLE ENERGY
FROM QUALIFYING COGENERATION AND
SMALL POWER PRODUCTION FACILITIES
(QUALIFYING FACILITIES)**

SCHEDULE

COG-1, As-Available Energy

AVAILABLE

Entire Service Area. The Company will purchase energy offered by any Qualifying Facility within the territory served by the Company under the provisions of this schedule or at contract negotiated rates. The Company will negotiate and may contract with a Qualifying Facility outside the Company's service territory where such negotiated contracts are in the best interest of the Company's ratepayers.

APPLICABLE

To any cogeneration or small power production Qualifying Facility producing energy for sale to the Company on an As-Available basis. As-Available Energy is described by the Florida Public Service Commission (FPSC) Rule 25-17.825, F.A.C. and is energy produced and sold by a Qualifying Facility on an hour-by-hour basis for which contractual commitments as to the time, quantity, or reliability of delivery are not required. Criteria for achieving Qualifying Facility status shall be those set out in FPSC Rule 25-17.80, F.A.C.

CHARACTER OF SERVICE

Purchase shall be, at the option of the Company, single or three phase, 60 hertz, alternating current at any available standard Company voltage.

LIMITATION:

All service pursuant to this schedule is subject to the Company's "General Standards for Safety and Interconnection of Cogeneration and Small Power Production Facilities to the Electric Utility System" and to FPSC Rules 25-17.80 through 25-17.87, F.A.C.

RATE FOR PURCHASES BY THE COMPANY**A. Capacity Rates**

Capacity payments to Qualifying Facilities will not be paid under this Rate Schedule. Capacity payments to Qualifying Facilities may be obtained under Rate Schedule COG-2, Firm Capacity and Energy.

B. Energy Rates

As-Available Energy is purchased at a unit cost, in cents per kilowatt-hour, based on the Company's actual hourly avoided energy costs which are calculated by the Company in accordance with FPSC Rule 25-17.825, F.A.C. Customer charges directly attributable to the purchase of As-Available Energy from the Qualifying Facility are deducted from the Qualifying Facility's total monthly energy payment.

Avoided energy costs include incremental fuel, identifiable operation and maintenance expenses, and an adjustment for line losses reflecting delivery voltage. The calculation of the Company's avoided energy costs reflects the delivery of energy to the region of the Company in which the Qualifying Facility is located. When economy transactions take place, the incremental costs are calculated after the purchase or before the sale of the economy energy. All sales shall be adjusted for losses from the point of metering to the point of interconnection.

C. Negotiated Rates

Upon agreement by both the Company and the Qualifying Facility, an alternate contract rate for the purchase of As-Available Energy may be separately negotiated.

(Continued from Sheet No. 10.100)

ESTIMATED AS-AVAILABLE AVOIDED ENERGY COST

For informational purposes only, the estimated incremental avoided energy costs for the next four semi-annual periods are as follows. These estimates include a 0.1 ¢/KWH credit pursuant to FPSC Order No. 13247 representative of an avoided variable operation and maintenance expense.

ESTIMATED AS-AVAILABLE AVOIDED ENERGY COST

<u>Applicable Period</u>	<u>On-Peak ¢/KWH</u>	<u>Off-Peak ¢/KWH</u>	<u>Average ¢/KWH</u>
October 1, 1984 - March 31, 1985	4.354	4.018	4.085
April 1, 1985 - September 30, 1985	4.306	4.017	4.094
October 1, 1985 - March 31, 1986	4.348	4.141	4.196
April 1, 1986-September 30, 1986	4.479	4.204	4.278

A MW block size ranging from 42 MW to 78 MW has been used to calculate the estimated avoided energy cost.

DELIVERY VOLTAGE ADJUSTMENT

The Company's actual hourly avoided energy costs shall be adjusted according to the delivery voltage by the following multipliers:

<u>Delivery Voltage</u>	<u>Adjustment Factor</u>
Transmission Voltage Delivery	1.0000
Primary Voltage Delivery	1.0180
Secondary Voltage Delivery	1.0367

For informational purposes the Company's projected annual generation mix and fuel prices are as follows:

PROJECTED ANNUAL GENERATION MIX AND FUEL PRICES

<u>Year</u>	<u>Generation by Fuel Type (%)</u>					<u>Price by Fuel Type (\$/MMBTU)</u>			
	<u>Nuclear</u>	<u>Oil</u>	<u>Gas</u>	<u>Coal</u>	<u>Purchased Power</u>	<u>Nuclear</u>	<u>Oil</u>	<u>Gas</u>	<u>Coal</u>
1984	34	33	18	-	15	0.55	4.55	3.35	-
1985	37	18	17	-	28	0.64	4.78	3.91	-
1986	38	21	14	-	27	0.66	5.15	4.48	-
1987	34	24	13	2	27	0.70	6.56	5.65	2.76
1988	33	27	11	4	25	0.74	8.01	6.91	2.93
1989	34	27	10	5	24	0.76	8.24	7.36	3.11
1990	31	31	9	5	24	0.79	8.45	7.54	3.30
1991	29	33	9	5	24	0.88	8.86	7.91	3.50
1992	30	34	8	5	23	0.96	9.29	8.29	3.71
1993	28	45	8	4	15	1.03	9.74	8.69	3.92

NOTE: The Company's forecasts are for illustrative purposes, and are subject to frequent revision.

(Continued from Sheet No. 10.101)

METERING REQUIREMENTS

The Qualifying Facility shall be required to purchase from the Company the metering equipment necessary to measure its energy deliveries to the Company.

Hourly recording meters shall be required for Qualifying Facilities with an installed capacity of 100 kilowatts or more. Where the installed capacity is less than 100 kilowatts, the Qualifying Facility may select any one of the following options: (a) an hourly recording meter, (b) a dual kilowatt-hour register time-of-day meter, or (c) a standard kilowatt-hour meter.

For Qualifying Facilities with hourly recording meters, monthly payments for As-Available Energy shall be calculated based on the product of: (1) the Company's actual avoided energy rate for each hour during the month; and (2) the quantity of energy sold by the Qualifying Facility during that hour.

For Qualifying Facilities with dual kilowatt-hour register time-of-day meters, monthly payments for As-Available Energy shall be calculated based on the product of: (1) the average of the Company's actual hourly avoided energy rates for the on-peak and off-peak periods during the month; and (2) the quantity of energy sold by the Qualifying Facility during each respective period.

For Qualifying Facilities with standard kilowatt-hour meters, monthly payments for As-Available Energy shall be calculated based on the product of: (1) the average of the Company's actual hourly avoided energy rate for the off-peak periods during the month; and (2) the quantity of energy sold by the Qualifying Facility during the month.

For a time-of-day metered Qualifying Facility, the on-peak hours occur Monday through Friday except holidays, April 1 - October 31 from 12 noon to 9:00 P.M.; and November 1 - March 31 from 6:00 A.M. to 10:00 A.M. and 6:00 P.M. to 10:00 P.M. All hours not mentioned above and all hours of the holidays of New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day are off-peak hours.

BILLING OPTIONS

The Qualifying Facility may elect to make either simultaneous purchases and sales or net sales. The decision to change billing methods can be made once every twelve (12) months coinciding with the next Fuel and Purchased Power Cost Recovery Factor billing period providing the Company is given at least thirty days written notice before the change is to take place. In addition, allowance must be made for the installation or alteration of needed metering or interconnection equipment for which the Qualifying Facility must pay; and such purchases and/or sales must not abrogate any provisions of the tariff or contract with the Company.

A statement covering the charges and payments due the Qualifying Facility is rendered monthly, and payment normally is made by the twentieth business day following the end of the billing period.

CHARGES TO QUALIFYING FACILITY**A. Customer Charges**

Monthly customer charges for meter reading, billing and other applicable administrative costs by Rate Schedule are:

<u>Rate Schedule</u>	<u>Customer Charge(\$)</u>	<u>Rate Schedule</u>	<u>Customer Charge(\$)</u>
GS-1	9.00	CST-1	115.00
GST-1	12.30	GSLD-2	170.00
GSD-1	35.00	GSLDT-2	170.00
GSDT-1	41.50	CS-2	170.00
RS-1	5.65	CST-2	170.00
RST-1	8.95	GSLD-3	400.00
GSLD-1	41.00	CS-3	400.00
GSLDT-1	41.00	CST-3	400.00
CS-1	110.00	GSLDT-3	400.00

(Continued on Sheet No. 10.103)

(Continued from Sheet No. 10.102)

B. Interconnection Charge for Non-Variable Utility Expenses:

The Qualifying Facility shall bear the cost required for interconnection including the metering. The Qualifying Facility shall have the option of payment in full for interconnection or making equal monthly installment payments over a thirty-six (36) month period together with interest charged at the rate then prevailing for the thirty (30) days highest grade commercial paper rate; such rate to be determined by the Company thirty (30) days prior to the date of each payment.

C. Interconnection Charge for Variable Utility Expenses:

The Qualifying Facility shall be billed monthly for the cost of variable utility expenses associated with the operation and maintenance of the interconnection. These include (a) the Company's inspections of the interconnection and (b) maintenance of any equipment beyond that which would be required to provide normal electric service to the Qualifying Facility if no sales to the Company were involved.

In lieu of payments for actual charges, the Qualifying Facility may pay a monthly charge equal to a percentage of the installed cost of the interconnection facilities. The applicable percentages are as follows:

<u>Equipment Type</u>	<u>Charge</u>
Metering Equipment	0.440%
Distribution	0.557%
Transmission Equipment	0.229%

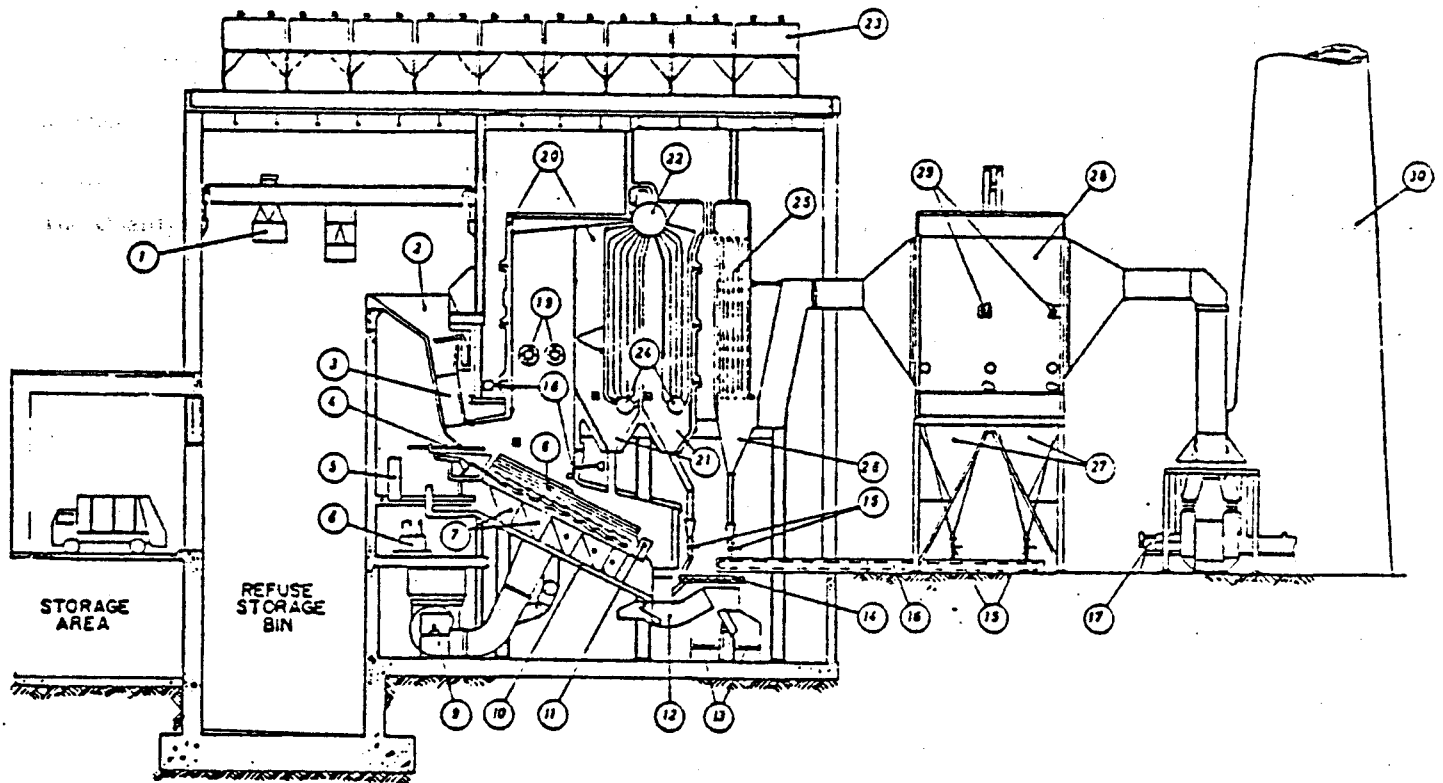
D. Taxes and Assessments

The Qualifying Facility shall be billed monthly an amount equal to the taxes, assessments, or other impositions, if any, for which the Company is liable as a result of its purchases of As-Available Energy produced by the Qualifying Facility.

TERMS OF SERVICE

- (1) It shall be the Qualifying Facility's responsibility to inform the Company of any change in its electric generation capability.
- (2) Any electric service delivered by the Company to the Qualifying Facility shall be metered separately and billed under the applicable retail rate schedule and the terms and conditions of the applicable rate schedule shall pertain.
- (3) A security deposit will be required in accordance with FPSC Rules 25-17.82(5) and 25-6.97, F.A.C. and the following:
 - A. In the first year of operation, the security deposit shall be based upon the singular month in which the Qualifying Facility's projected purchases from the Company exceed, by the greatest amount, the Company's estimated purchases from the Qualifying Facility. The security deposit should be equal to twice the amount of the difference estimated for that month. The deposit shall be required upon interconnection.
 - B. For each year thereafter, a review of the actual sales and purchases between the Qualifying Facility and the Company shall be conducted to determine the actual month of maximum difference. The security deposit shall be adjusted to equal twice the greatest amount by which the actual monthly purchases by the Qualifying Facility exceed the actual sales to the Company in that month.
- (4) The Company shall specify the point of interconnection and voltage level.
- (5) The Qualifying Facility must enter into an interconnection agreement with the Company which will, among other things, specify safety and reliability standards for the interconnection to the Company's system. In most instances, the Company's filed Interconnection Agreement for Qualifying Facilities will be used; however, special features of the Qualifying Facility or its interconnection to the Company's facilities may require modifications to the agreement or the safety and reliability standards contained therein.

(Continued on Sheet No. 10.104)

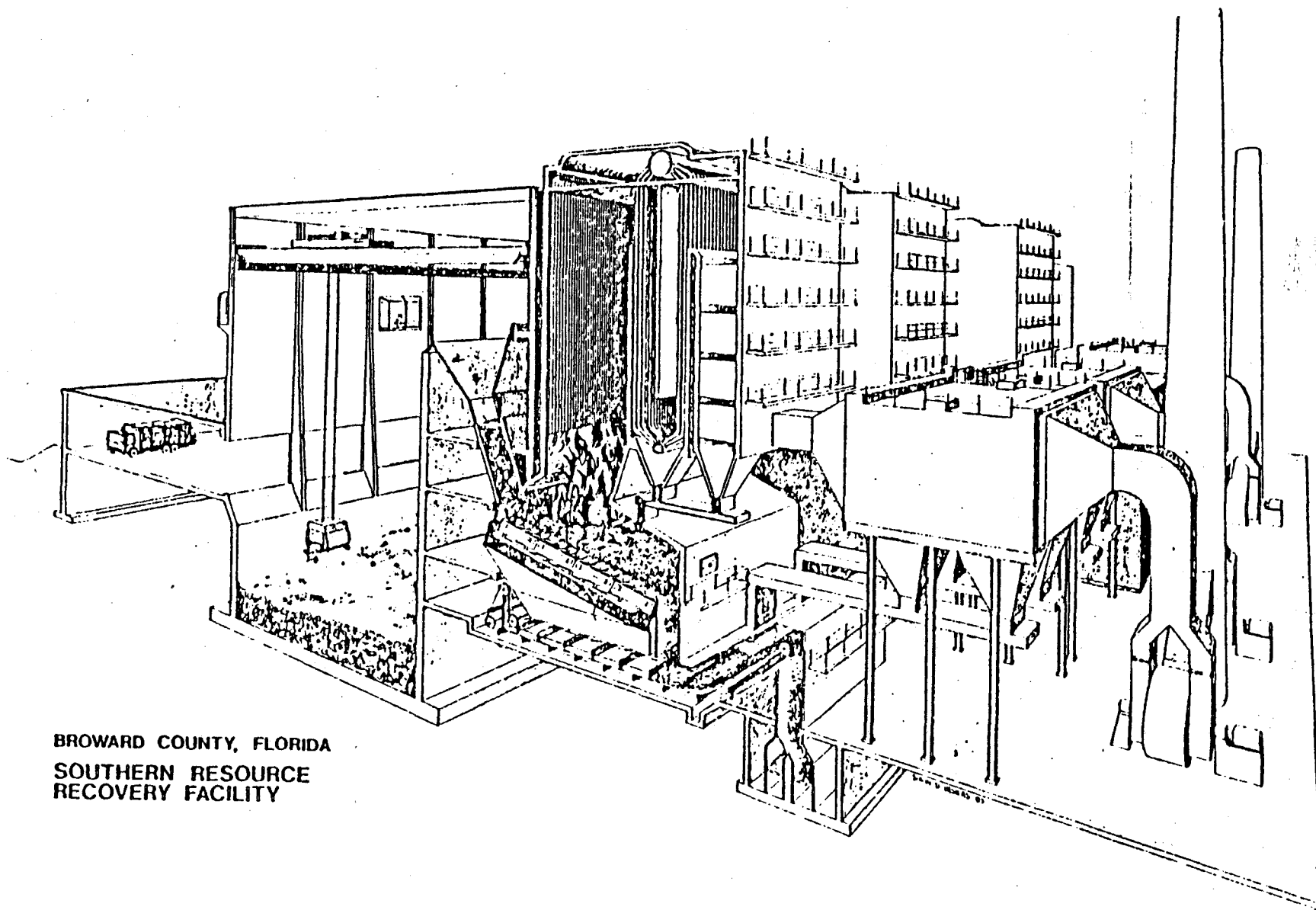


LEGEND

- | | | |
|-----------------------------------|--|---|
| 1) Crane | 9) Forced Draft Fan | 20) Radiant Waterwalls. (Welded Panel Const.) |
| 2) Refuse Hopper | 10) Automatic Siftings | 21) Boiler Fly Ash Hoppers |
| 3) Refuse Chute | 11) Clinker Roll | 22) Steam Drums |
| 4) Refuse Feed | 12) Residue Discharger | 23) Steam Condensers |
| 5) Stoker Control Panel | 13) Residue Conveyor | 24) Bottom Boiler Drums |
| 6) Reverse Reciprocating Stoker | 14) Fly-Ash Conditioning Screw | 25) Economizer |
| 7) Undergrate Air Plenum Chambers | 15) Rotary Valves for Fly-Ash Discharger | 26) Economizer Fly-Ash Hopper |
| 8) Hydraulic Pump | 16) Fly-Ash Flight Conveyor | 27) Fly-Ash Hoppers for Electrostatic Precipitators |
| | 17) Induced Draft Fan | 28) Electrostatic Precipitators |
| | 18) Overfire Air Nozzles | 29) Rappers for Fly-Ash Collector Plates |
| | 19) Auxiliary Burners. (100% capacity) | 30) Chimney |

Typical Mass Burning System
(IBW-Martin)

3



BROWARD COUNTY, FLORIDA
SOUTHERN RESOURCE
RECOVERY FACILITY

MITIGATION PLANS

ADDITIONAL INFORMATION DESCRIBING THE DEVELOPMENT OF THE
MITIGATION PLAN IS COVERED IN APPENDIX 10.1.4



General Counsel's Office

Room 248, Broward County Courthouse
Fort Lauderdale, Florida 33301
(305) 765-5105

March 19, 1984

Our File: 84-157

MEMORANDUM

TO: Phyllis Korab, Resource Recovery Office
FROM: Noel M. Pfeffer, Assistant General Counsel
RE: Proposed Resource Recovery Facility and
Establishment of Mitigation Area.

In response to your memorandum of March 9, 1984 requesting an opinion of this office relating to the creation of a mitigation area, this office has examined the available alternatives. It is possible to assure the Environmental Protection Agency that the mitigation/enhancement area will remain as such by one of two methods.

First, the County may consider conveying this property to the State or other not-for-profit public agencies who shall be charged with the responsibility of maintaining the property consistent with EPA requirements. As a second alternative, the County may impose covenants and deed restrictions on the land which would bind the County, its successors and assigns and require that the land be maintained according to the requirements imposed by the EPA. By utilizing the second alternative, it would be possible for the County to retain ownership of the property and still give full assurance to the EPA as to the future purpose and use of the land. The covenants and deed restrictions would provide that unless consent was obtained by EPA, there would be no circumstances under which the County could remove or eliminate these covenants and deed restrictions.

Should you require any further information relating to this matter, please feel free to contact this office.

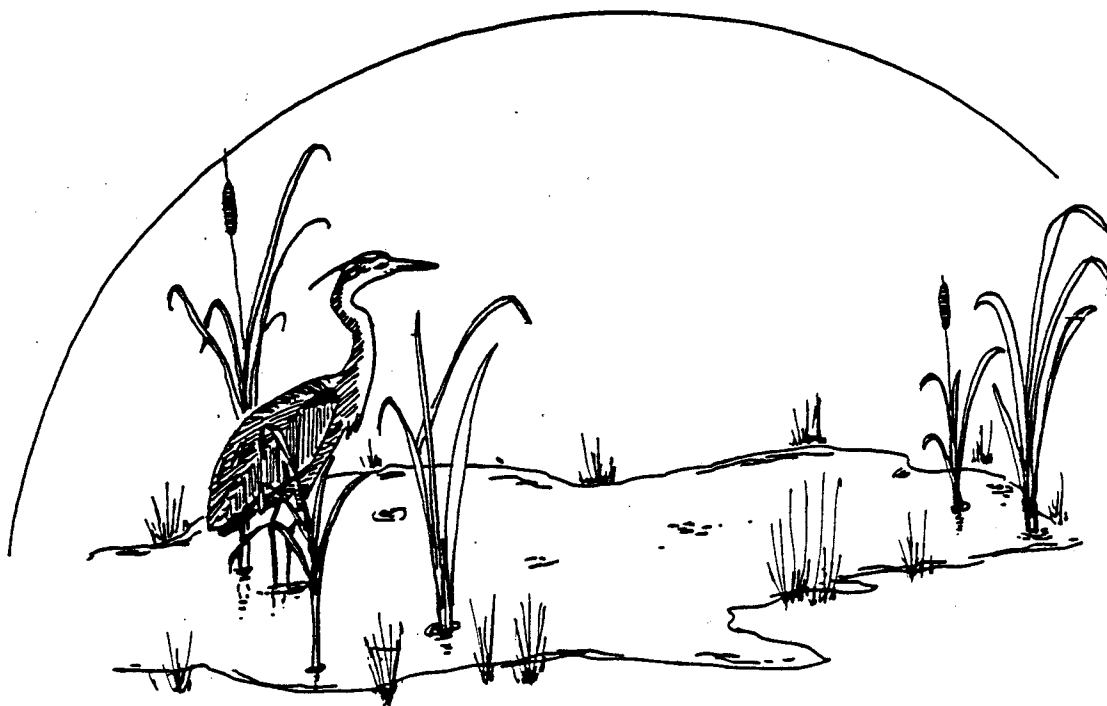
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BROWARD COUNTY BOARD OF COUNTY COMMISSIONERS

Marcia Beach Scott I. Cowan Howard Craft Howard C. Forman Jack Fried Nicki Englander Grossman Gerald F. Thompson
An Equal Opportunity Employer

MITIGATION PLANS

SOUTHERN BROWARD RESOURCE RECOVERY FACILITY AND RESIDUE / UNPROCESSIBLE WASTE LANDFILL



CZR, INCORPORATED

HAZEN AND SAWYER, P.C.

CZR, INCORPORATED
Coastal Zone Resources

1001 US HIGHWAY 1
SUITE 305
JUPITER, FL 33458

305/747-7455

23 March 1984

Ms. Phyllis Korab
Resource Recovery Office
Governors Club, Room 526
236 S.E. First Avenue
Fort Lauderdale, Florida 33301

Dear Phyllis:

Enclosed for your use are 10 copies of the mitigation plans for the Southern Broward Resource Recovery Facility and Residue/Unprocessable Waste Landfill. As you are aware, site development requires consumption of wetland resources, and approval of dredge and fill permit application is contingent upon mitigation of wetland losses. The plans described in the attached document provide the required mitigation to placate reviewing agencies. The plans have been reviewed by biologists from U.S. Fish and Wildlife Service, Florida Game and Freshwater Fish Commission, U.S. Environmental Protection Agency, Florida Department of Environmental Regulation, South Florida Water Management District, and Broward County. We feel that the mitigation plans more than offset the wetland losses and that acceptance of the plan is a true demonstration of the spirit of enlightenment.

We look forward to continued involvement in refining the plans and assisting in implementation of the plans. We believe that the people of Broward County will reap the long term benefits of the resource recovery project and its associated mitigation. Should you have any questions regarding this report, please contact either Jim Hudgens or myself.

Sincerely,

CZR, INCORPORATED



Rhodes Robinson
Vice President

/kc

Enclosures

SUMMARY OF MITIGATION

FOR

SOUTHERN BROWARD

RESOURCE RECOVERY FACILITY

AND

RESIDUE/UNPROCESSIBLE WASTE LANDFILL

A. INTRODUCTION

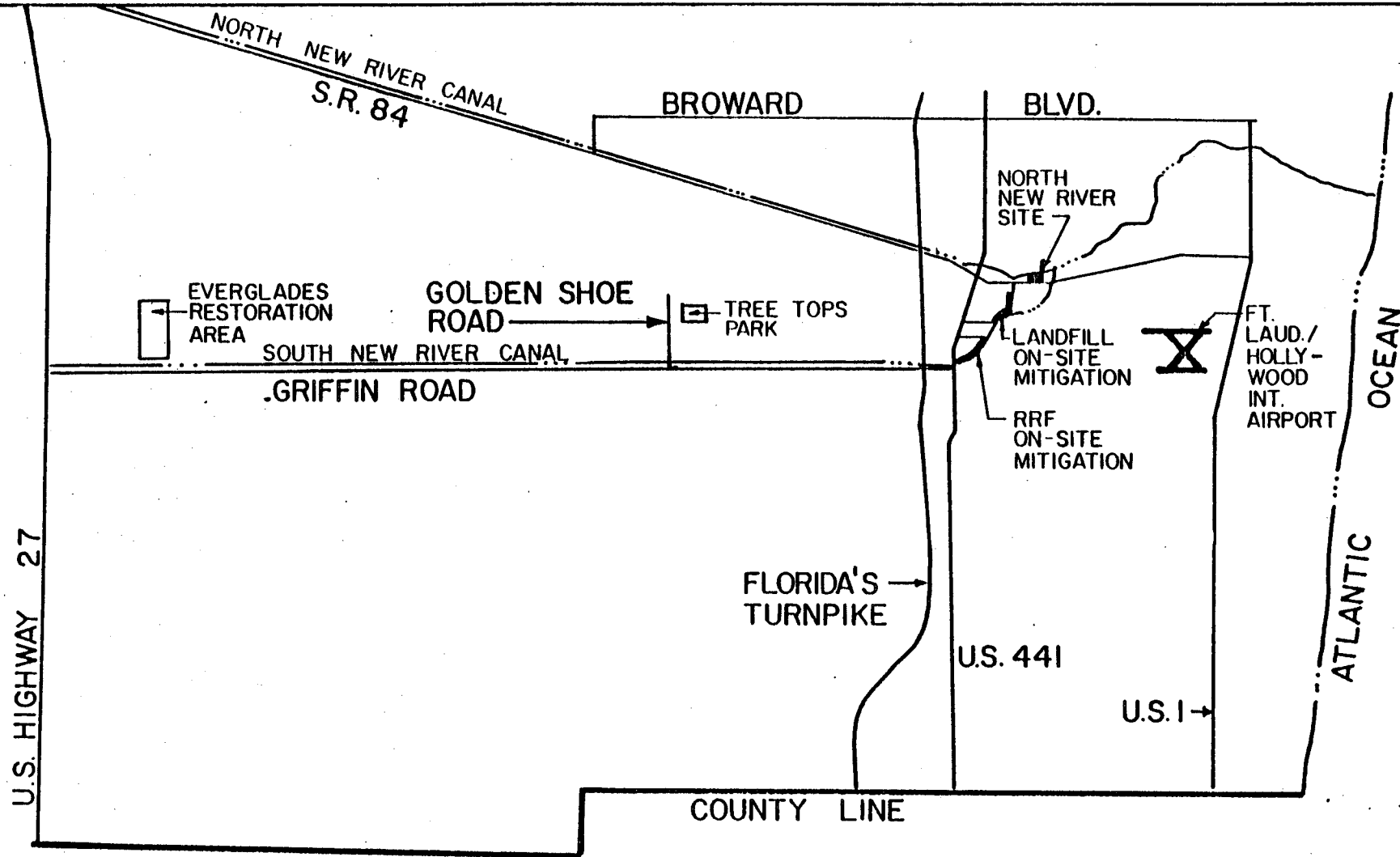
The following report summarizes mitigation plans for the Southern Broward Resource Recovery Facility and Residue/Unprocessable Waste Landfill. Mitigation for the project comprises several parcels including:

- o 15 acres onsite at the Resource Recovery Facility
- o 33 acres onsite at the Residue/Unprocessable Waste Landfill
- o 16 acres adjacent to North Fork New River
- o 15 acres at Tree Tops Park, and
- o 74 acres in the Everglades Restoration Area (Figure 1)

Detailed discussion of plans for each of these is provided in the following sections.

Mitigation site selection was a complex process because of the number of acres required for the project and lack of suitable areas in the urbanized vicinity of the project. Additionally, efforts were complicated by differing points of view on mitigation strategy by reviewing agencies. Major parameters in the site selection process included:

- 1 - Location in Project Vicinity - One-for-one mitigation on the project site was impossible although the project site does comprise 48 acres of mitigation (15 acres at the Resource Recovery Facility and 33 acres at the Residue/Unprocessable Waste Landfill). An additional 16 acres of existing bottomland forest adjacent to North New River and within one-half mile of the landfill will be purchased and preserved. Attempts were made to purchase the swamp forest on the south side of South Fork New River opposite Ann Kolb Park, but the owner was unwilling to sell. Broward



MITIGATION SUMMARY

RESOURCE RECOVERY FACILITY (ON-SITE)	15 acres
LANDFILL (ON-SITE)	33 acres
NORTH NEW RIVER CANAL	16 acres
TREE TOPS PARK	15 acres
EVERGLADES RESTORATION AREA	74 acres

MITIGATION AREA VICINITY MAP

County General Counsel advised that condemnation for mitigation would be tenuous at best. No other major parcels meeting the required size criteria exist in the vicinity.

- 2 - Mitigation will result in wetlands of substantive value - Potential mitigation areas had to have reasonable potential for wetland creation or preservation. The number of contiguous acres in a parcel was a major consideration and attempts were made to avoid numerous small parcels. The immediate project vicinity is heavily urbanized and lacks potential mitigation areas other than those described above. The search for suitable mitigation area was forced west into the Davie vicinity.
- 3 - Costs - Real estate in Broward County is very expensive and efforts were made to locate mitigation lands in areas which already belonged to the County. Several 4 to 6 acre tracts were available but, were rejected due to small size. Tree Tops Park provided the only reasonable mitigation area on County owned lands. The Tree Tops Park area will not only provide quality mitigation, but is also compatible with the County's Park program. Because no suitable areas were located in the project vicinity, the major mitigation parcel (74 acres) was chosen in consideration of potential, size, costs, and proximity to New River Canal. Land acquisition costs for mitigation are summarized in Table 1 below.

TABLE 1

LAND COSTS FOR PROJECT MITIGATION

<u>Area</u>	<u>Acres</u>	<u>Costs/Acre</u>
Onsite	48	\$100,000+
North New River	16	75,000
Tree Tops Park	15	None-already in County Ownership
Everglades Restoration Area	74	12,000
Approximate land acquisition cost		<u>\$6,888,000</u>

In consideration of all factors, the proposed mitigation plan has received positive review from all agencies involved and will

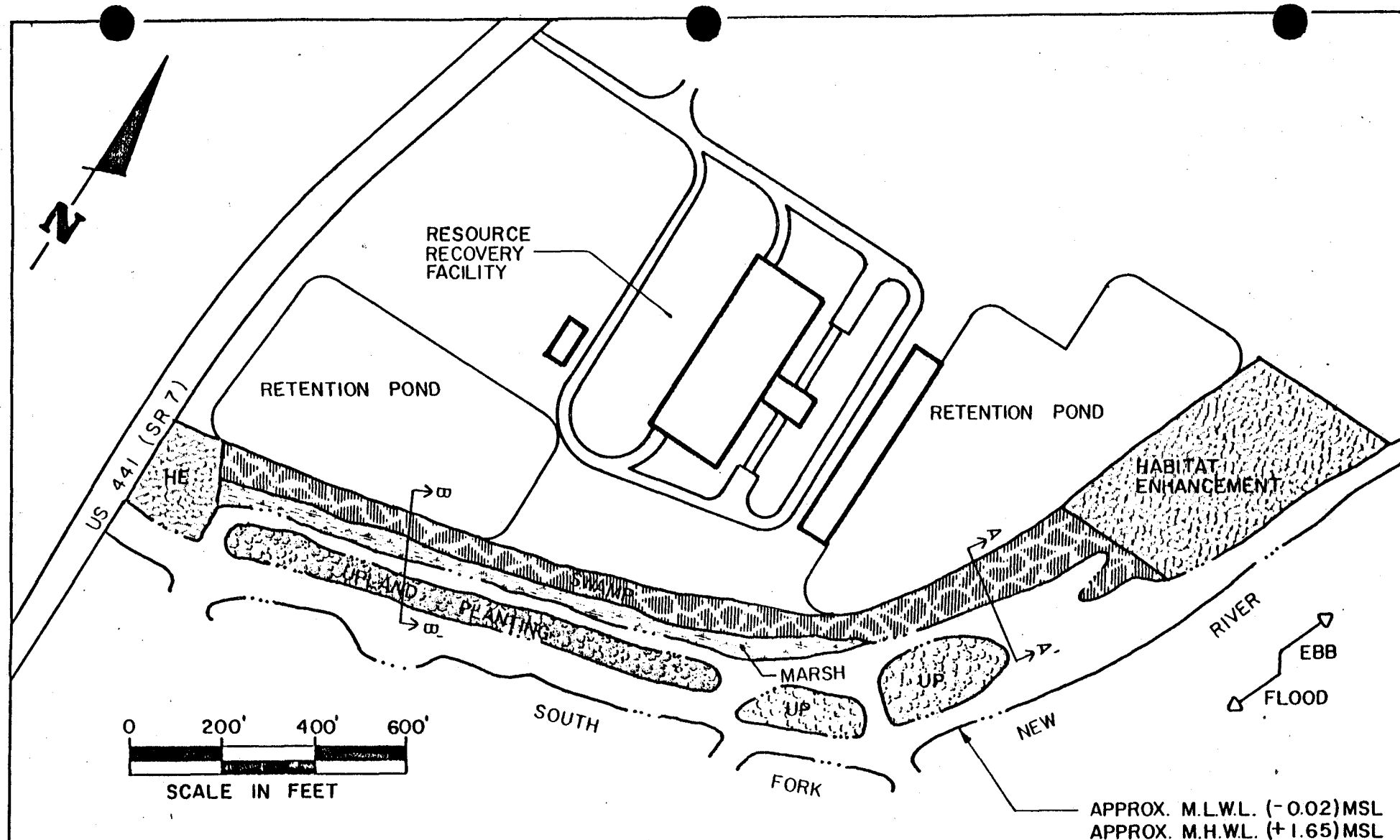
- 1) result in one-to-one replacement of wetlands lost, 2) produce

wetlands of greater overall value per unit area than those lost to development (the onsite wax myrtle wetlands are of very low value), 3) satisfy the requirements of reviewing agencies, and 4) provide beneficial values to the people, wildlife and water resources of Broward County.

E. RESOURCE RECOVERY FACILITY MITIGATION

Development of the resource recovery facility will require that approximately 15.6 acres of wetlands be removed and filled. To compensate for the wetland losses, a mitigation plan has been developed as an integral part of the development. Mitigation will be accomplished on-site adjacent to and contiguous with South Fork New River Canal and will comprise 15.0 acres (Figure 2). The existing wetlands are dominated by wax myrtle and are being used as pasture; these wetlands are of marginal value. Because the mitigation plan will create wetlands of greater value per unit area than those which will be lost and effectively extends the Urban Wilderness Area, the mitigation more than offsets the losses at the Resource Recovery Facility.

In order to assist the development of the mitigation plan, a special tree survey of the site was conducted. For the purpose of the survey, trees were identified as woody vegetation with a diameter breast height (dbh) of a minimum of 3-inches and an overall height of 7 feet. The tree survey enabled a plan to be developed which would minimize impact to the more significant vegetation in the mitigation area. Landscaping will be done



MITIGATION SITE PLAN SOUTHERN BROWARD RESOURCE RECOVERY FACILITY

around existing trees. Large clumps of native trees such as those found at the northeastern and southwestern end of the mitigation area will be preserved. As appropriate, these areas will be enhanced by removal of discarded construction materials, selective removal of exotic species, and planting of native species.

On-site mitigation/enhancement will be accomplished in a strip adjacent to South Fork New River Canal. This mitigation will extend the riverfront natural area from the south end of the Urban Wilderness Area (northeastern corner of project site) to the US 441 bridge over South Fork New River Canal. The width of the strip will be 300 feet in the Urban Wilderness Area and 200 feet wide south of the Urban Wilderness Area to the US 441 bridge.

The first phase of the mitigation plan entails environmental enhancement by removing the discarded construction materials and equipment which litter the area. The other major elements of the on-site mitigation plan include:

- o removal of parts of the dredge spoil berm and associated exotic vegetation.
- o reshaping the land to establish more valuable wetland habitat similar to that which originally occurred adjacent to New River including: (1) swamp at or above average high water level; (2) marsh between average high water level and average low water level; and (3)

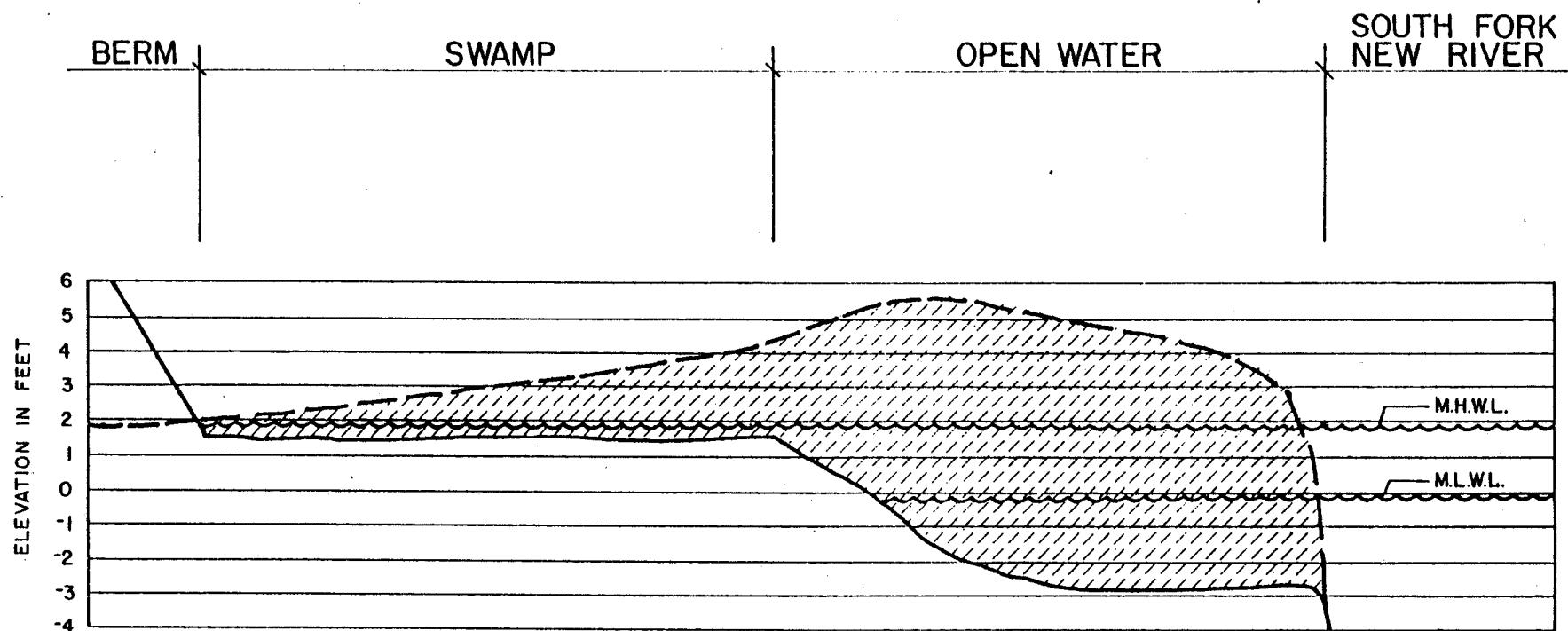
shallow water at depths two to three feet below mean sea level.

- o planting the marsh and swamp with species originally extant in the New River Swamp. Plantings for the marsh would include species such as pickerel weed, duck potato, sawgrass, etc., and plantings for the swamp would include species such as cypress, red maple, pond apple, and cabbage palms.
- o controlling exotic plants such as cajeput, Australian pine, and Brazilian pepper on an as needed basis until the plantings become well established.

A typical section showing the elevations in the mitigation area is shown in Figures 3, 4, 5 and 6. Elevation of swamp will be slightly above average highwater (+1.65 MSL) and marsh elevation will be slightly below average low water (-0.02 MSL). Open water areas will be excavated to approximately -2.5 MSL. Swamp areas will be planted with cypress, red maple, pond apple, and sabal palms (Figure 6). Marsh areas are expected to quickly regenerate naturally, but they will also be planted with pickerel weed and arrow arum. Barren upland areas will be planted with mahogany and gumbo-limbo to create a hardwood hammock environment in an area presently dominated by Australian pine. Planting densities are provided in Figure 7.

The proposed mitigation/environmental enhancement will have several positive benefits which will otherwise likely never be





EXISTING ELEVATION

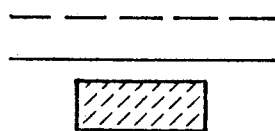
FINAL ELEVATION

AREA OF EXCAVATION

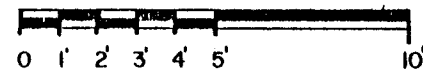
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APPROX. M.L.W.L. (0.02) MSL

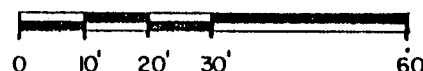
ALL FINAL SLOPES 3:1



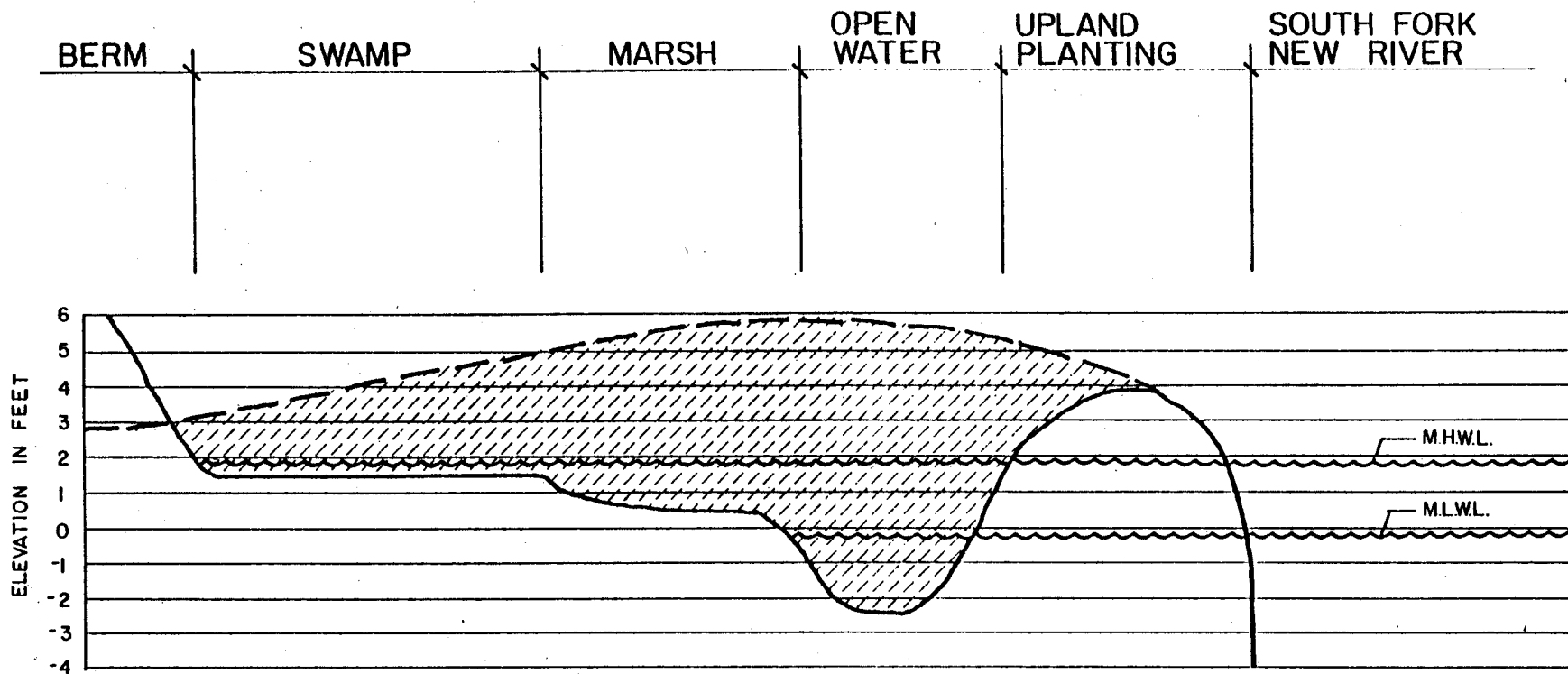
VERTICLE SCALE 1" = 5'0"



HORIZONTAL SCALE 1" = 30'0"



MITIGATION AREA SECTION A-A' SOUTHERN BROWARD RESOURCE RECOVERY FACILITY



EXISTING ELEVATION

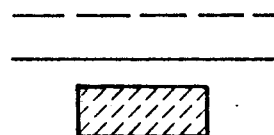
FINAL ELEVATION

AREA OF EXCAVATION

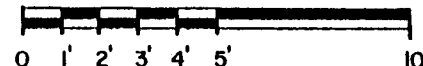
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APPROX. M.L.W.L. (-0.02) MSL

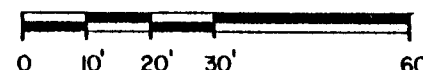
ALL FINAL SLOPES 3:1



VERTICAL SCALE 1" = 5'0"



HORIZONTAL SCALE 1" = 30'0"



MITIGATION AREA SECTION B-B'

SOUTHERN BROWARD RESOURCE RECOVERY FACILITY

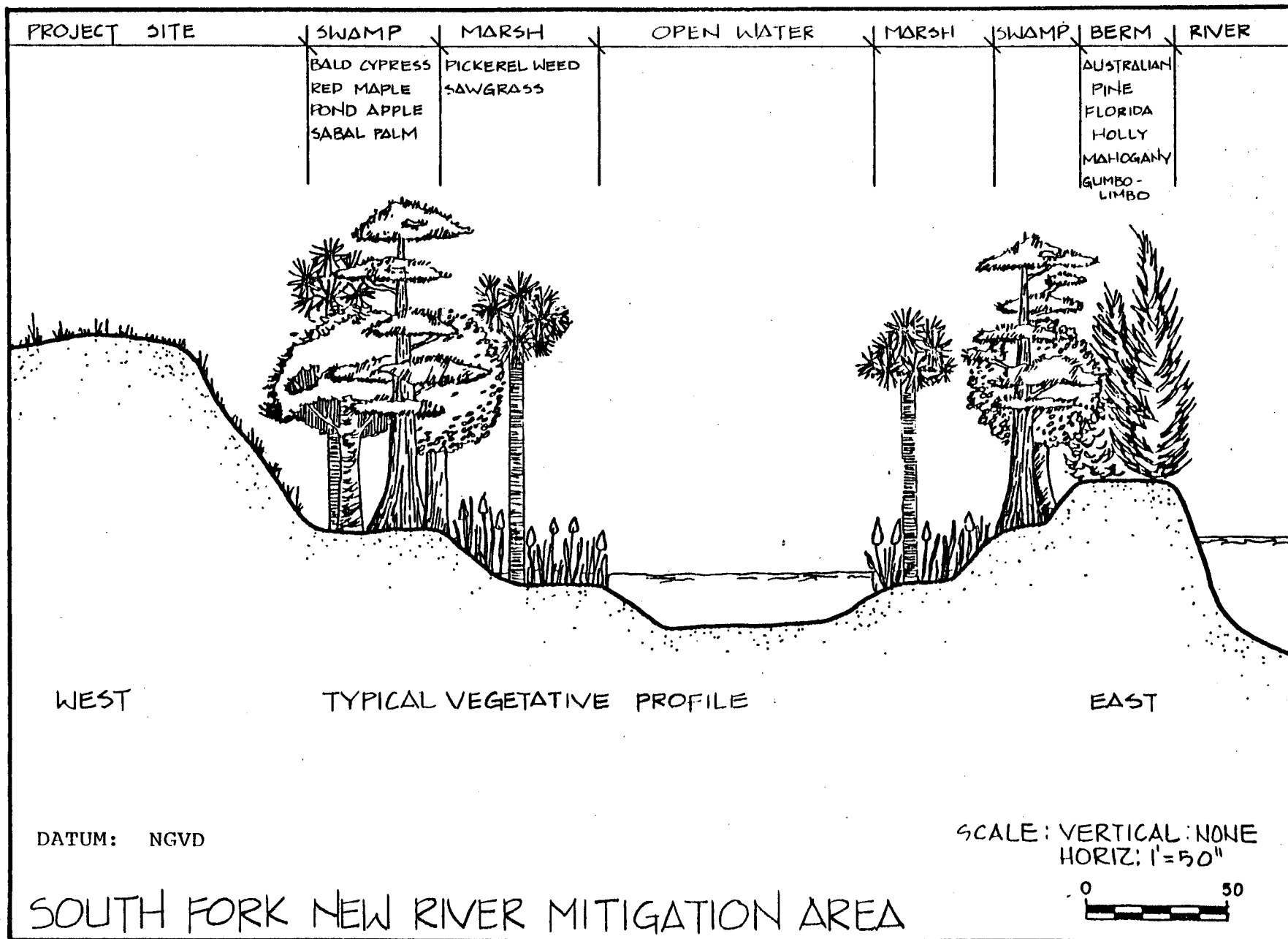


FIGURE 6

AREA	SPECIES	DENSITY
Swamp	Bald Cypress <u>Taxodium distichum</u>	70/acre - seedlings 20/acre - 8' trees
	Red Maple <u>Acer rubrum</u>	70/acre - seedlings 10/acre - 8' trees
	Pond Apple <u>Annona glabra</u>	30/acre - seedlings 10/acre - 8' trees
	Sabal Palm <u>Sabal palmetto</u>	80/acre - seedlings 4/acre - 8' trees
Upland	Mahogany <u>Swietenia mahogani</u>	10/acre - 8' trees
	Gumbo-limbo <u>Bursera simaruba</u>	5/acre - 8' trees
Marsh	Pickerel Weed <u>Pontederia lanceolata</u>	400/acre - culms
	Arrow Arum <u>Sagittaria sp.</u>	400/acre - culms
<u>SOUTH FORK NEW RIVER MITIGATION AREA</u>		

realized by Broward County. The mitigation area effectively extends the Urban Wilderness Area and will provide a wide natural buffer between the river and development. The area will restore wildlife and fish habitat contiguous with New River; thus, wetland values in the mitigation area will be greater per unit area than the wetlands which will be lost. The enhancement area will provide an aesthetic setting for boaters using the New River, and the newly created shallow water habitat will create a new recreational opportunity for shallow draft vessels such as canoes. The area could be developed with a theme title such as "Cypress Slough" and could provide a unique recreational opportunity for the people of Broward County.

C. RESIDUE/UNPROCESSIBLE WASTE LANDFILL MITIGATION

Development of the landfill requires that 133 acres of wetlands be filled. To compensate for wetland losses, a mitigation plan has been developed as an integral part of the landfill development. Mitigation includes on-site and off-site work. On-site mitigation comprises 33 acres of Urban Wilderness Area, and off-site mitigation comprises 16 acres adjacent to North New River, 15 acres in Tree Tops Park, and 74 acres at the Everglades Restoration Area.

The on-site mitigation plan has been developed in careful consideration of a tree survey which was made to comply with the Code of Broward County. The code defines a tree as being woody

vegetation with a diameter breast height (dbh) of 3 inches and an overall height of 7 feet; exotic species--Brazilian pepper, cajeput, and Australian pines--are not counted. Based upon the results of the tree survey, mitigation plans were prepared to conserve existing trees. Excavation to create open water, marsh, and swamp environments has been designed to avoid impacts to existing trees.

A. On-site Mitigation

On-site mitigation entails preservation and enhancement of 33 acres (Figure 8). The area east of landfill cell 2 will be preserved as a buffer between the landfill and the cypress swamp (Ann Kell Park) to the east. The width of the buffer area will be 250 feet wide on the northern end increasing to 550 feet wide on the southern end. A 50-foot strip adjacent to the landfill berm will be planted with cypress trees. Figures 8 and 9 show the mitigation site plan and existing topography. Figures 10 and 11 show cross-sectional views through the area and Figure 12 conceptualizes vegetative cover in the mitigation area. Planting densities are provided in Figure 13.

A small lagoon connecting with South Fork New River Canal will be excavated in the extreme northeastern corner of the site to provide shallow open water habitat from a dredged material berm. The lagoon will be excavated to an elevation of -2.5 MSL; it will enhance the adjacent wetlands by providing the opportunity for natural shallow flooding of adjacent wetlands on

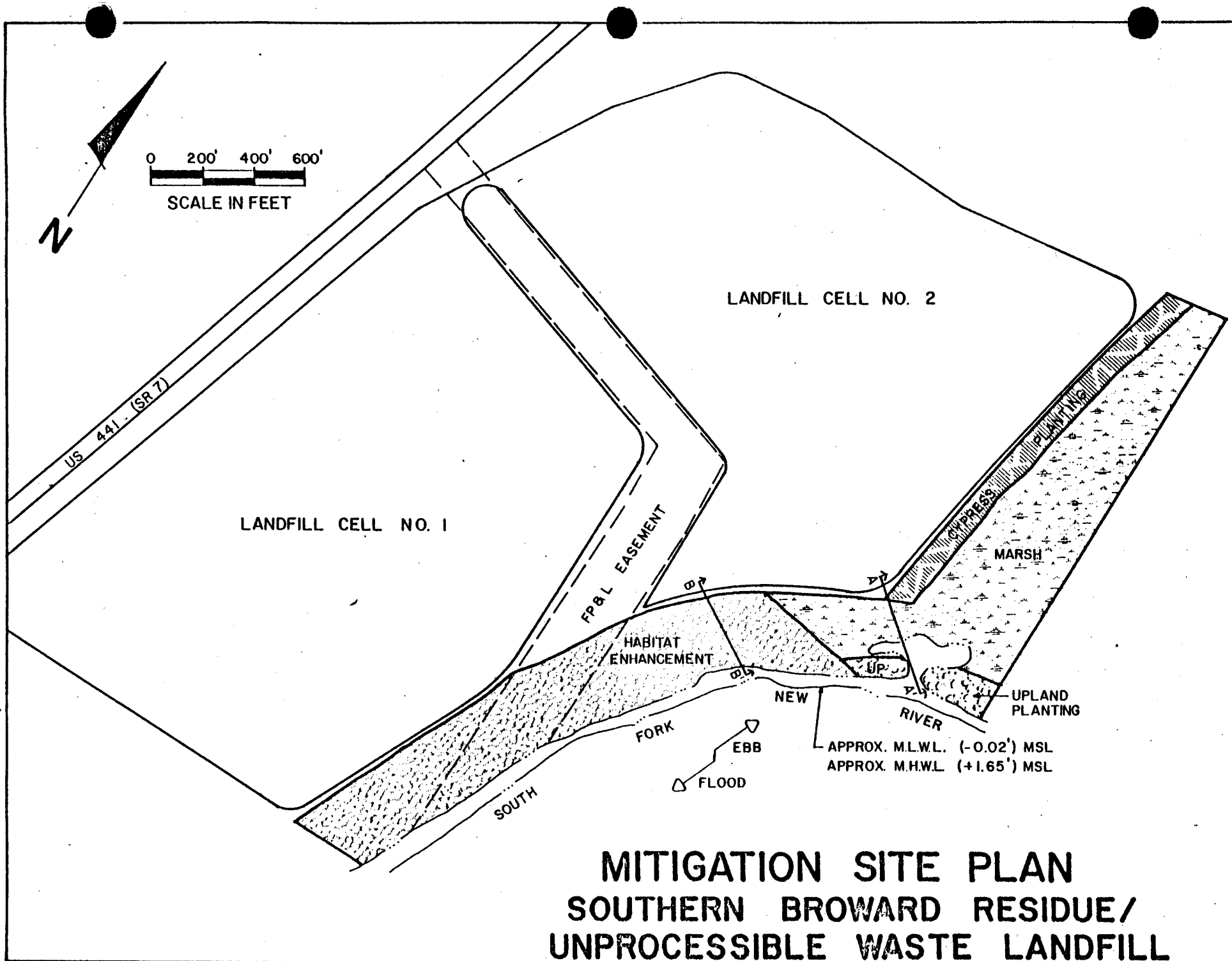
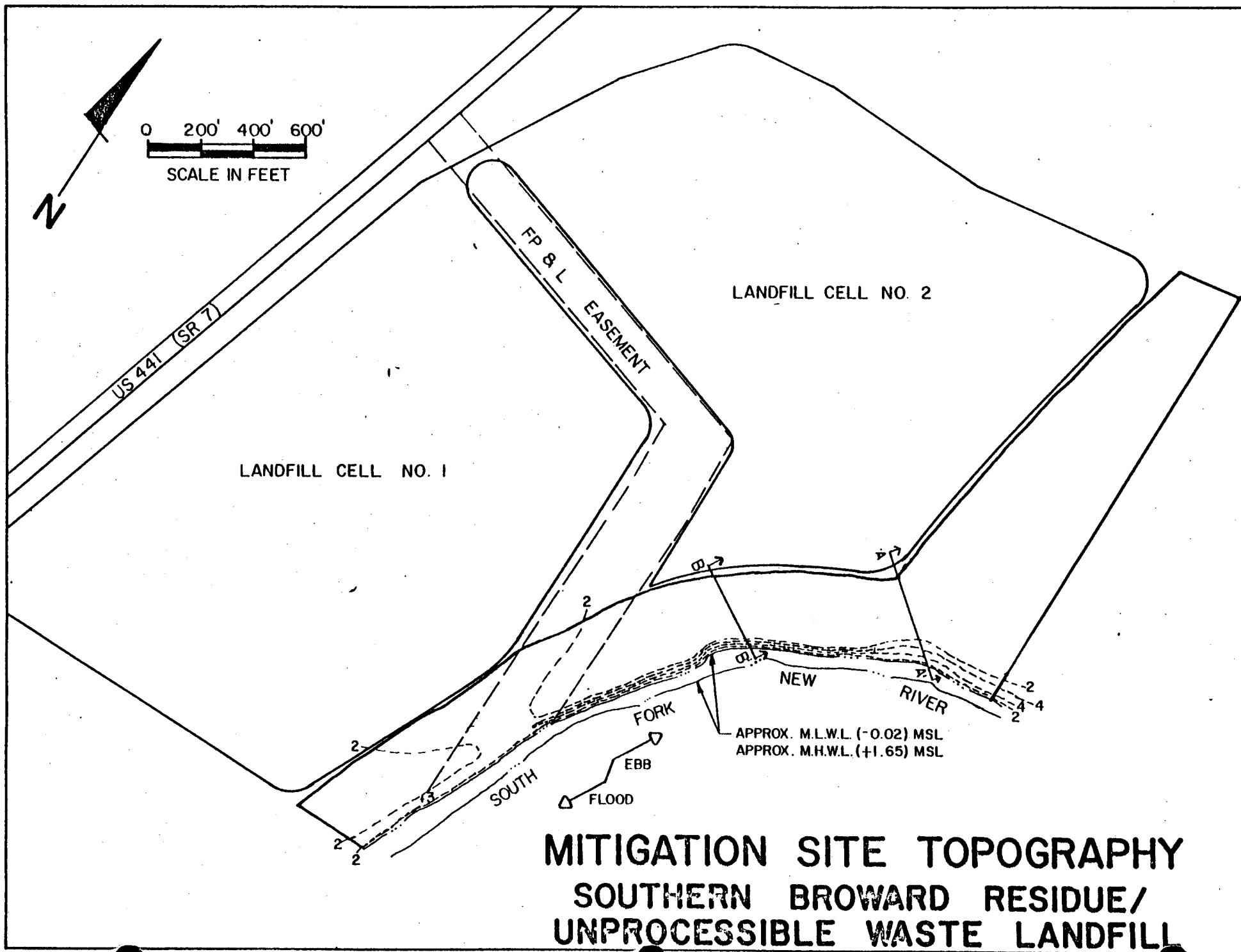
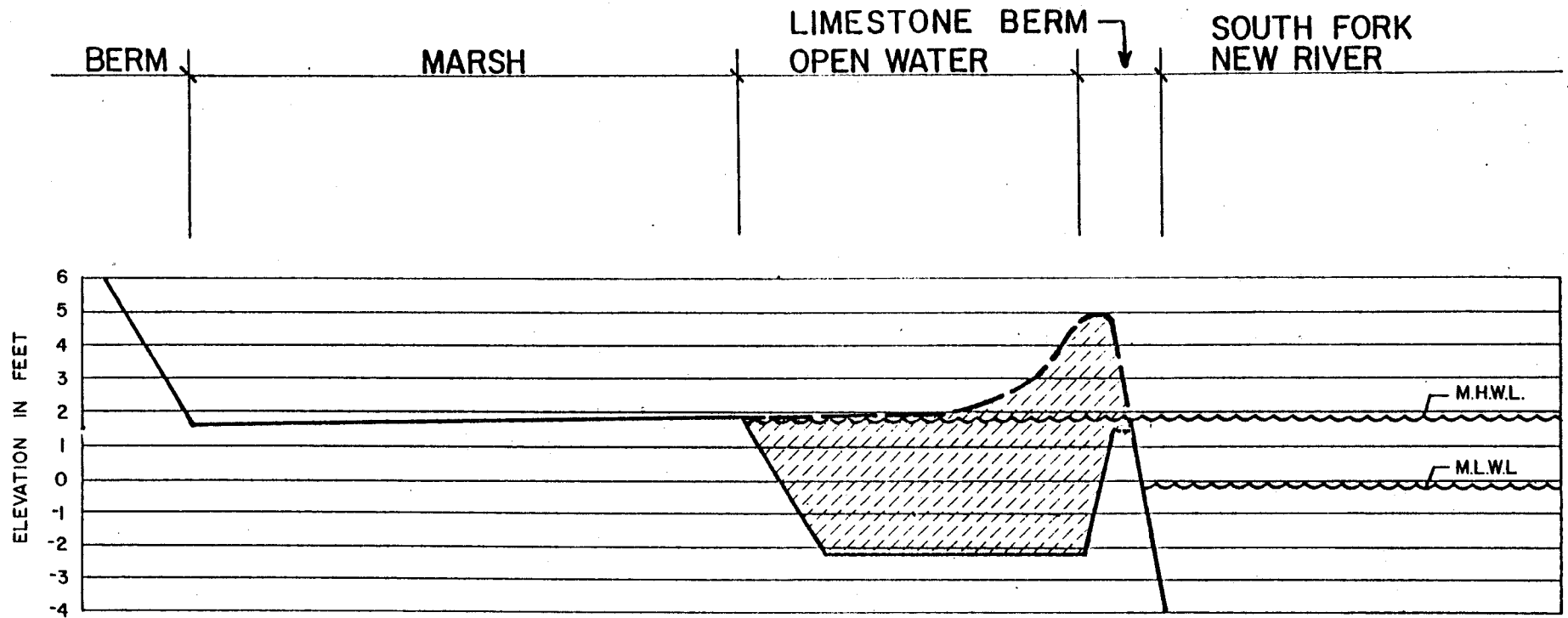


FIGURE 8





EXISTING ELEVATION

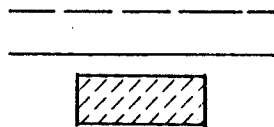
FINAL ELEVATION

AREA OF EXCAVATION

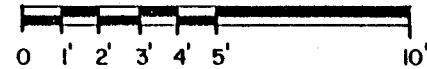
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APPROX. M.L.W.L. (-0.02) MSL

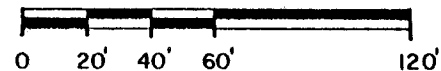
ALL FINAL SLOPES 3:1



VERTICLE SCALE 1" = 5'0"

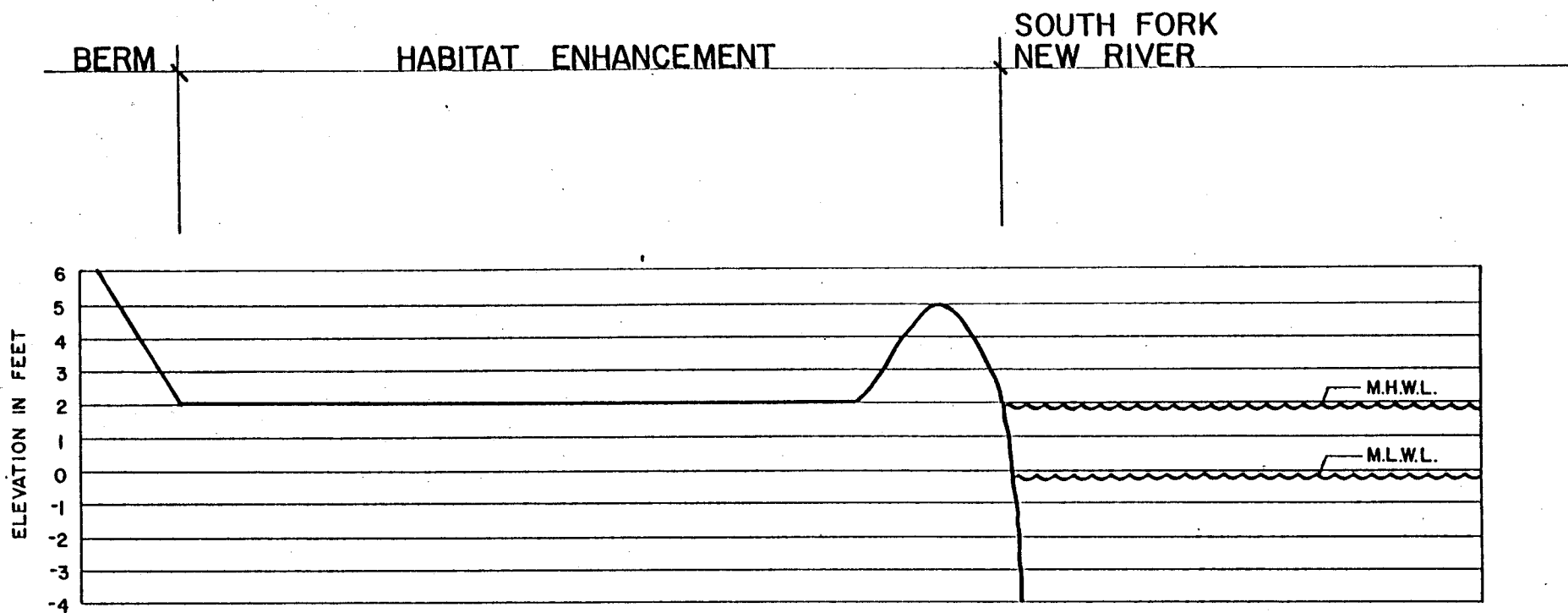


HORIZONTAL SCALE 1" = 60'0"



MITIGATION AREA SECTION A-A'

SOUTHERN BROWARD RESIDUE/UNPROCESSIBLE WASTE LANDFILL



EXISTING ELEVATION
 FINAL ELEVATION
 APPROX. M.H.W.L. (1.65) MSL
 APPROX. M.L.W.L. (0.02) MSL
 ALL FINAL SLOPES 3:1

VERTICLE SCALE 1" = 5'0"
 0 1' 2' 3' 4' 5' 10'

HORIZONTAL SCALE 1" = 60'0"
 0 20' 40' 60' 120'

MITIGATION AREA SECTION B-B'

SOUTHERN BROWARD RESIDUE/UNPROCESSIBLE WASTE LANDFILL

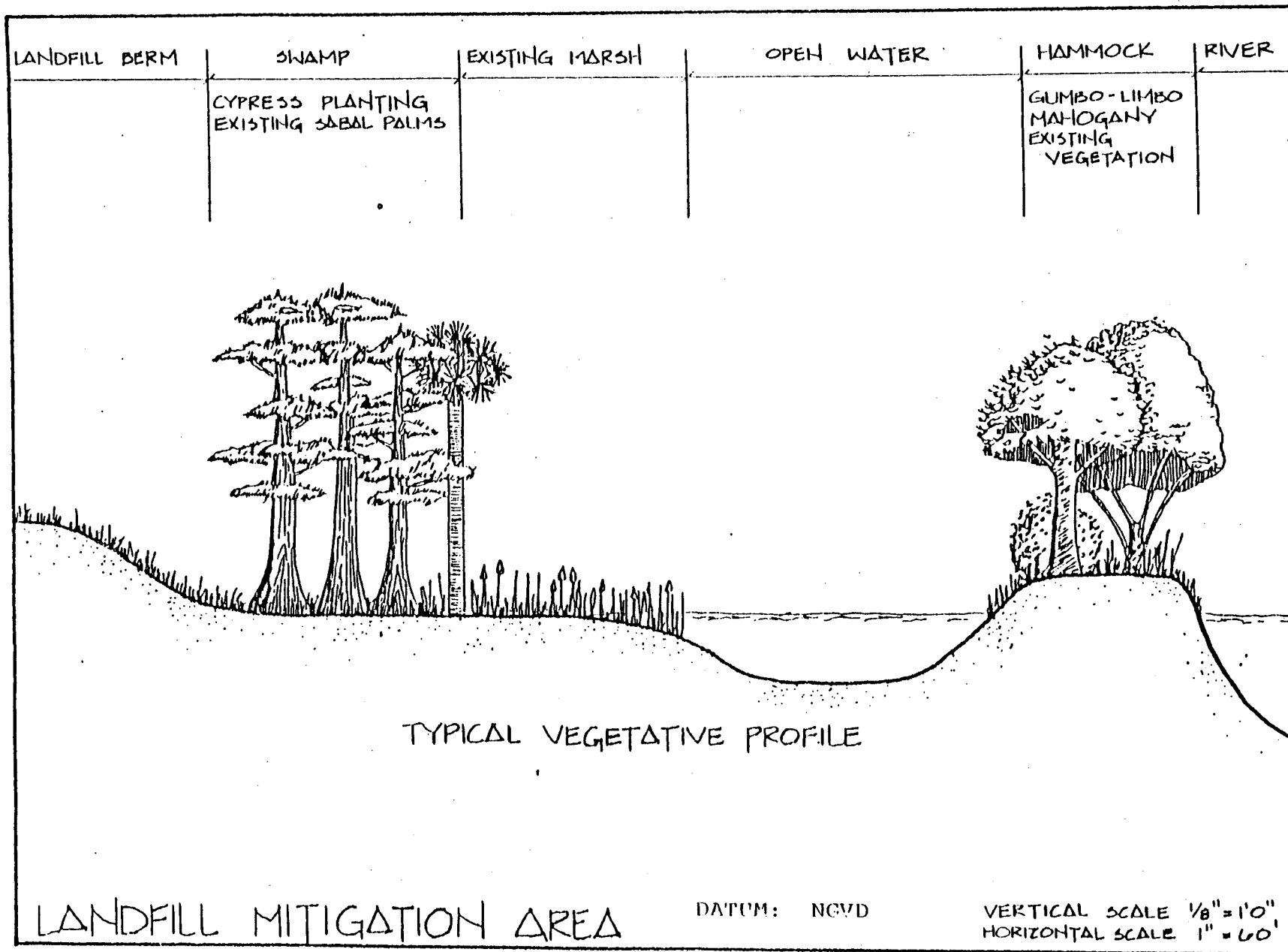


FIGURE 12

AREA	SPECIES	DENSITY
Swamp	Bald Cypress <u>Taxodium distichum</u>	50/acre - 8' trees
Hammock	Gumbo-limbo <u>Bursera simaruba</u>	25/acre - 8' trees
	Mahogany <u>Swietenia mahogani</u>	25/acre - 8' trees
<u>LANDFILL MITIGATION AREA</u>		

an intermittent basis. Flooding, a natural phenomenon which is part of floodplain wetland ecology, has been prevented by the berm of spoil which was placed beside the river when it was dredged. A sill will be left in the mouth of the lagoon to maintain water levels at or near +1.5 MSL, thereby reestablishing a more favorable hydrologic regime in this portion of the New River Flood Plain.

Most of the 300-foot wide Urban Wilderness strip adjacent to the river will be preserved, but it also will be enhanced by (1) removing an accumulation of trash and discarded construction materials, (2) removing exotic vegetation (Australian pine, Brazilian pepper, and cajeput), (3) planting of wetland (cypress, red maple, etc.) and upland species (mahogany, gumbo-limbo, etc.) in selective locations, and (4) routine flooding through the lagoon.

B. Off-Site Mitigation

In order to augment the on-site mitigation at the landfill, three (3) off-site mitigation areas will be utilized. Mitigation at these three areas fulfills the requirement to offset wetland losses associated with project development. Acquisition, mitigation and enhancement activities, and maintenance work to keep exotic vegetation from becoming reestablished, will ensure that all the mitigation areas will remain productive and viable wetlands. The mitigation work will preserve a valuable but disappearing resource for the people of

Broward County.

1. North New River Mitigation Area

The last remnants of the New River Swamp exist in 3 parcels near the confluence of the North and South Forks. The largest piece, Ann Kolb Park is immediately east of the Residue/Unprocessable Waste Landfill (cell 2) and has recently been purchased by Florida DOT as mitigation for I-595. Much of the second remnant piece is within Secret Woods Park, a County maintained nature preserve and educational center.

The third parcel is immediately north of SR 84 and Ann Kolb Park and has frontage on North Fork New River and SR 84 (Figure 14). The total parcel comprises slightly greater than 20 acres of which 16 will be purchased for project mitigation. Besides large cypress trees typifying southern river floodplains, this site contains what may be the largest remaining stand of native laurel oaks in the County, which adds to the uniqueness of this property (Figures 15 and 16).

Mitigation plans for this site include:

1. Removal of invading Australian pines and Brazilian pepper.
2. Routine maintenance in the site to eradicate Australian pine and Brazilian pepper sprouts and seedlings.
3. Removal of trash piles which occur in the interior of the site.

300

MITIGATION AREA

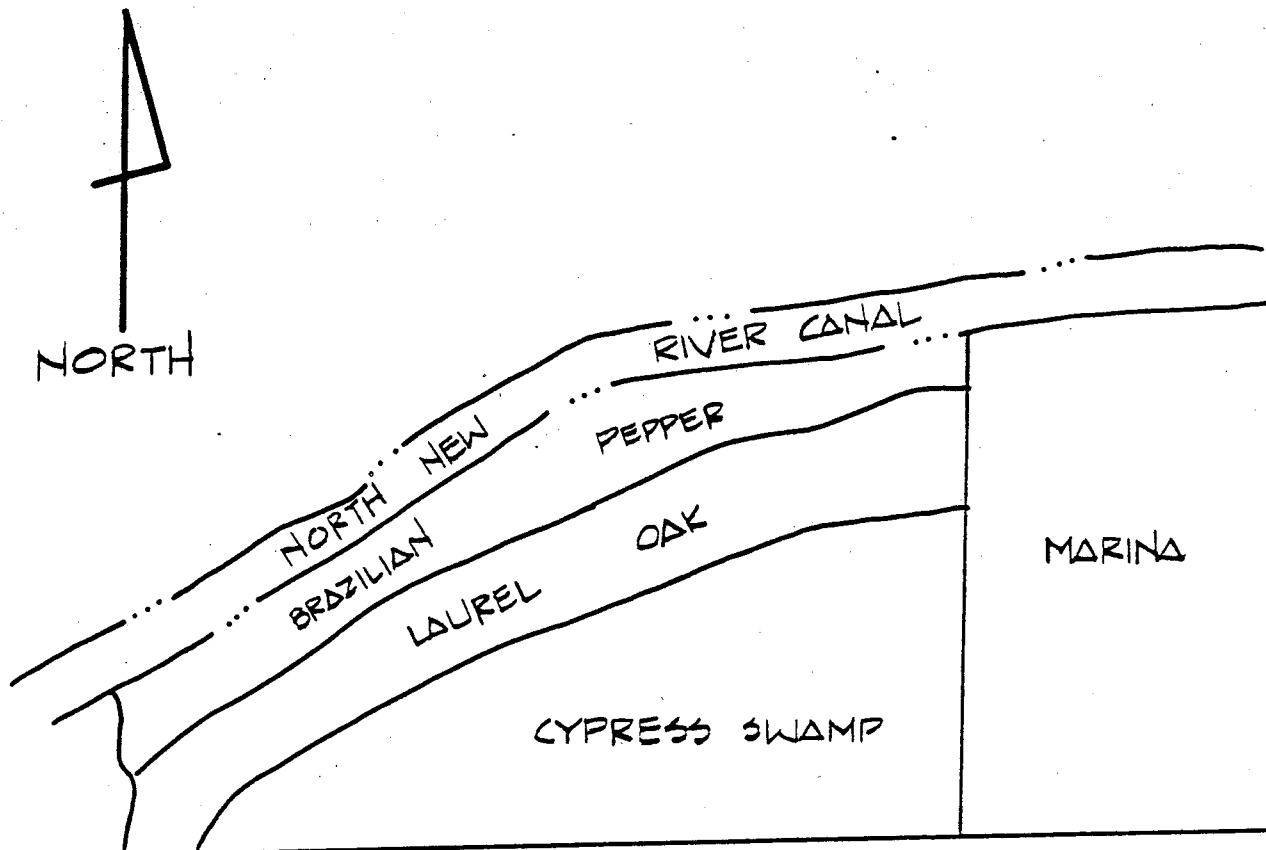
MARINA

S.R. 84

LANDFILL
CELL #2

ANN KOLB PARK

NORTH NEW RIVER CANAL MITIGATION AREA

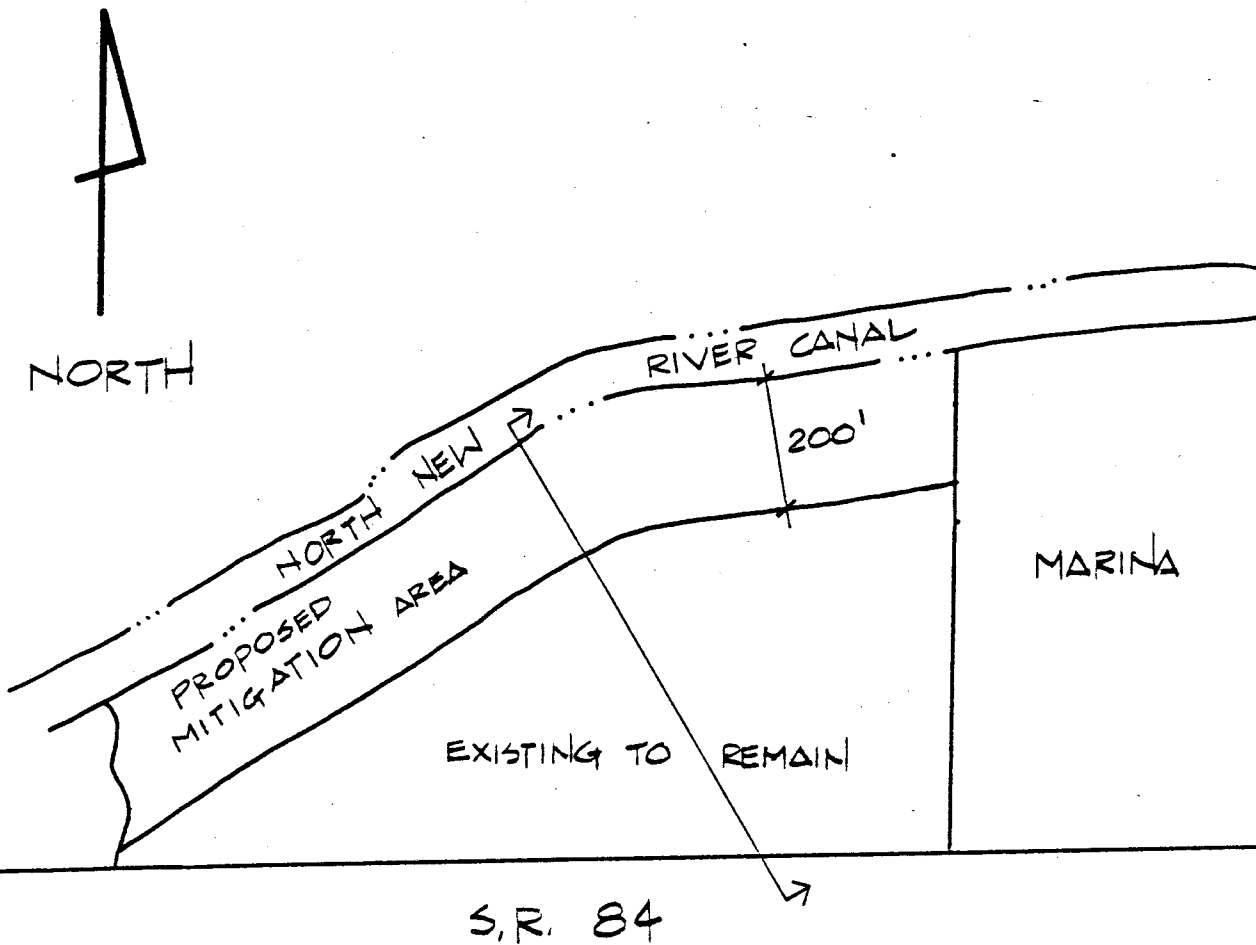


S.R. 84

EXISTING
SITE PLAN
TOTAL AREA - 16 ACRES

NORTH NEW RIVER CANAL MITIGATION AREA

SCALE 1" = 300'



PROPOSED SITE PLAN

SCALE 1"=300'

NORTH NEW RIVER CANAL MITIGATION AREA

4. Stabilizing the north side of the fill area which has been placed adjacent to SR 84.

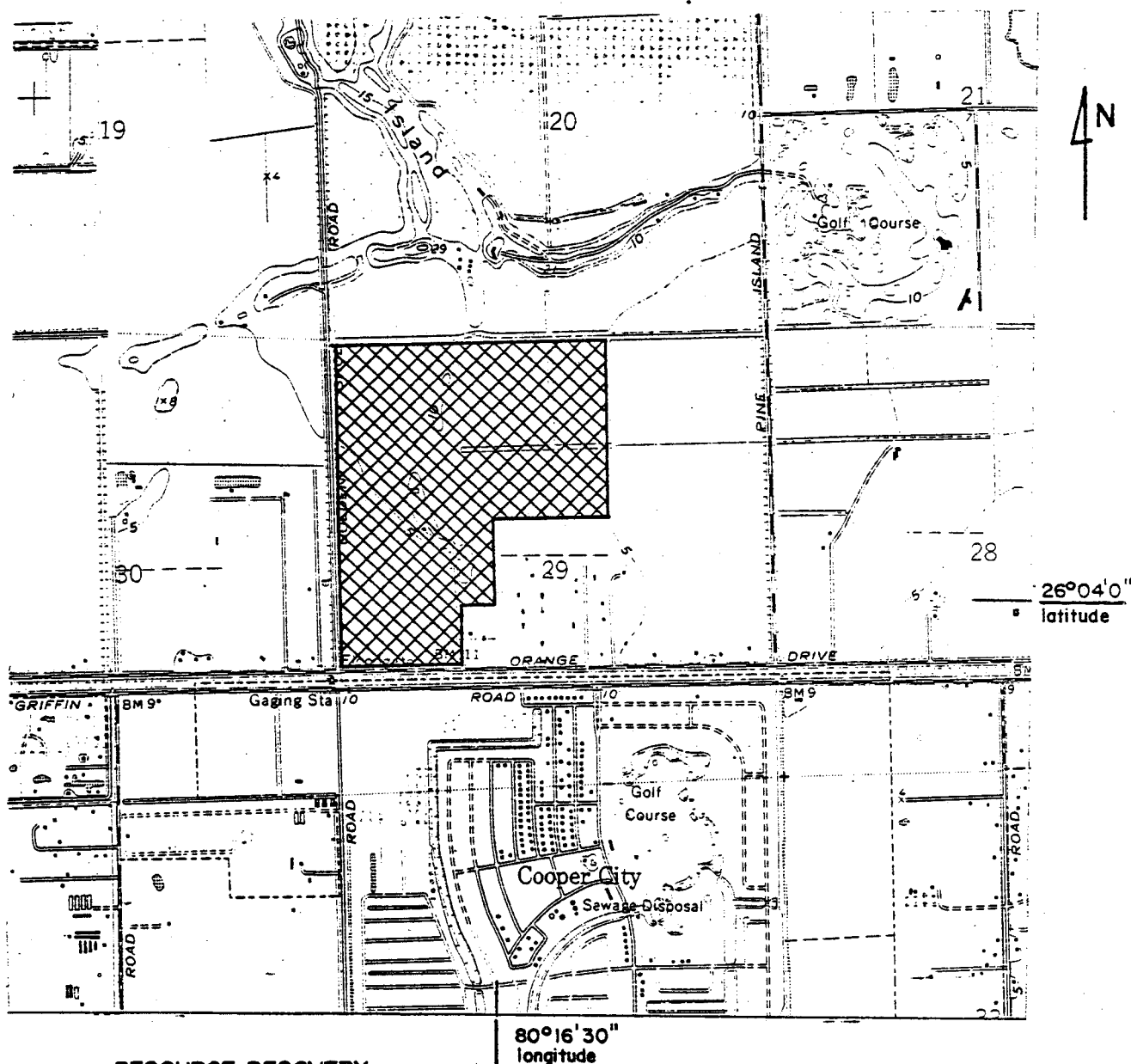
This relatively minor amount of site work will restore the site to a more natural condition and will enhance its functional and aesthetics values.

2. Tree Tops Park

Tree Tops Park, a new County facility located at the corner of Orange Drive and Golden Shoe Road also will be used for the mitigation (Figure 17). The mitigation plans have been developed in close coordination with the Broward County Parks Department. For this project, mitigation entails creating a semi-permanently flooded sawgrass marsh and hardwood hammock from an existing wax myrtle-saltbush shrub thicket (Figure 18). The mitigation area comprises a total of 15.5 acres, 13.3 acres of which will be sawgrass marsh and 2.2 acres of which will be hardwood hammock. A site plan and associated drawings are attached hereto. Figure 18 is a plan view of the mitigation area, and Figure 19 shows a sectional view of final elevations. Figure 20 is a rendering of the site after planting. Planting details are described in Figure 21.

The water level in the pond will be maintained approximately +2.5 feet (msl) although the water level may occasionally rise to +3.0 feet during wet periods because the park is within one of SFWMD's retention areas. Marsh habitat will be created around the lake by lowering the surrounding

FIGURE 17



PURPOSE: RESOURCE RECOVERY
FACILITY MITIGATION

VICINITY MAP

SOURCE: USGS QUAD. N2600 COOPER CITY, FL
1" = 2000'



IN: TREE TOPS PARK

AT: ORANGE DR. & GOLDEN
SHOE RD.
COUNTY OF BROWARD STATE FL

APPLICATION BY BROWARD COUNTY.

DATE 8-19-83

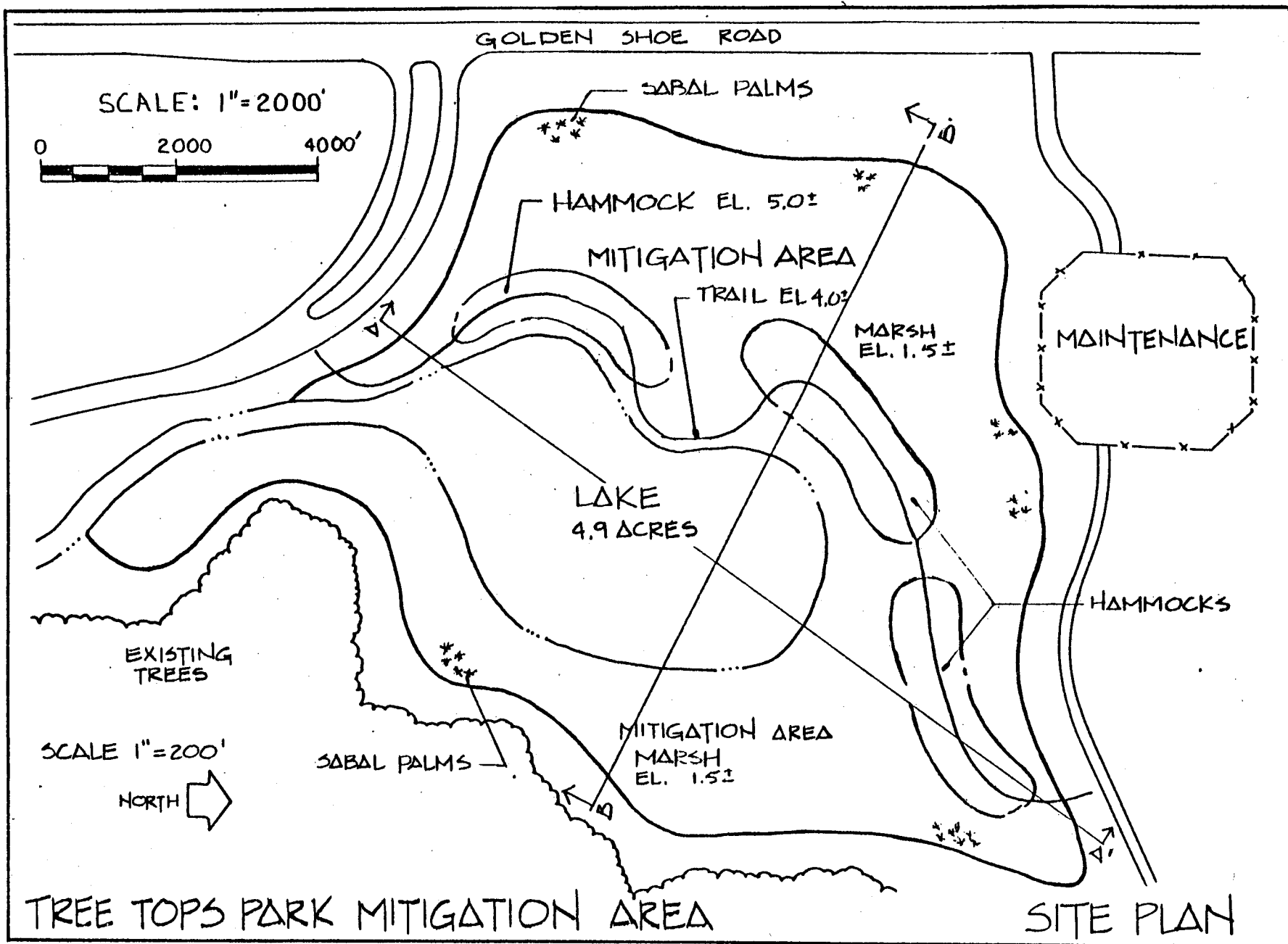
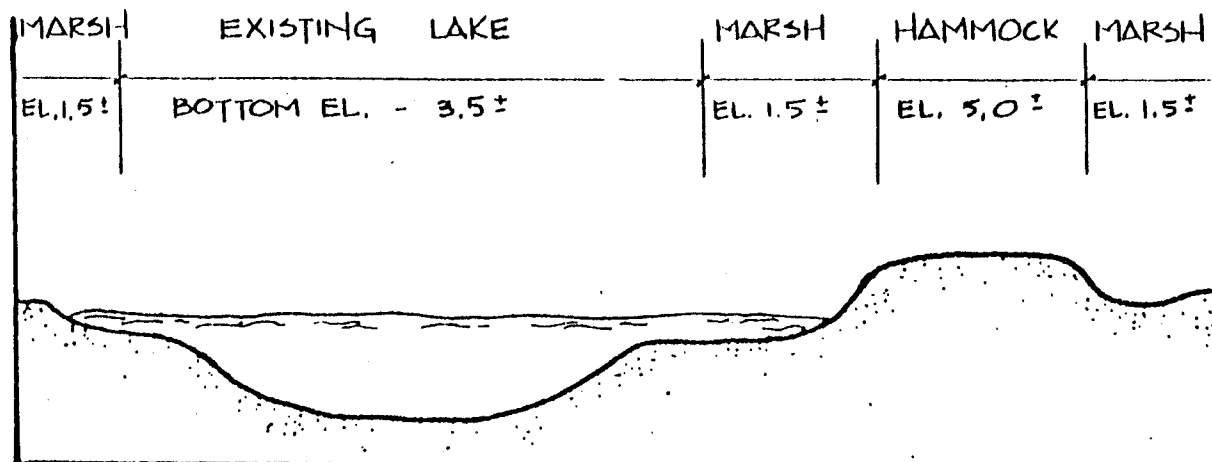
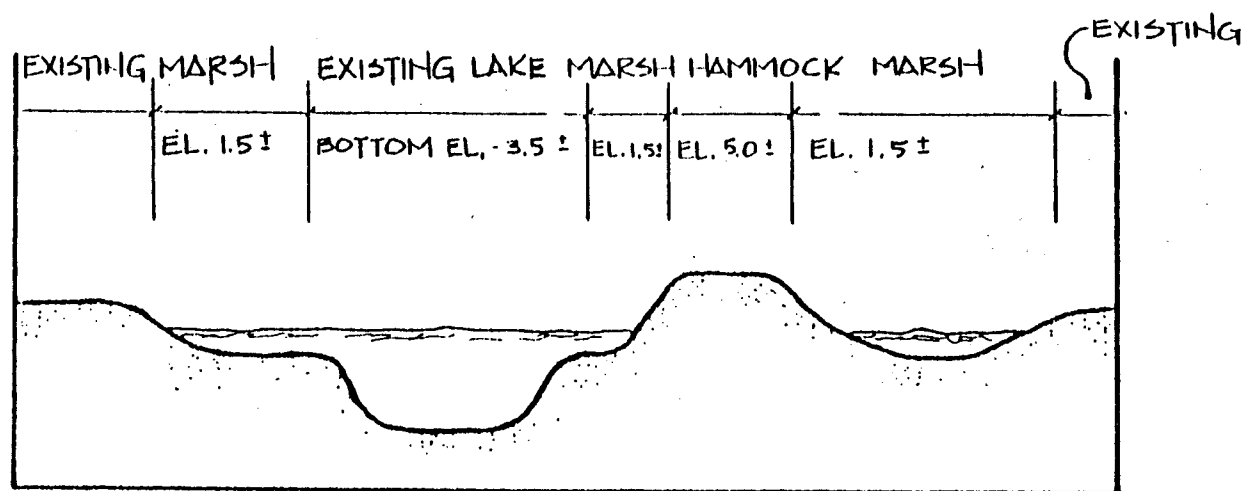


FIGURE 18



SECTION A-A'



SECTION B-B'

TREE TOPS PARK MITIGATION AREA

DATUM: NGVD HORIZONTAL SCALE 1"=200'
VERTICAL SCALE 1"=8'0"

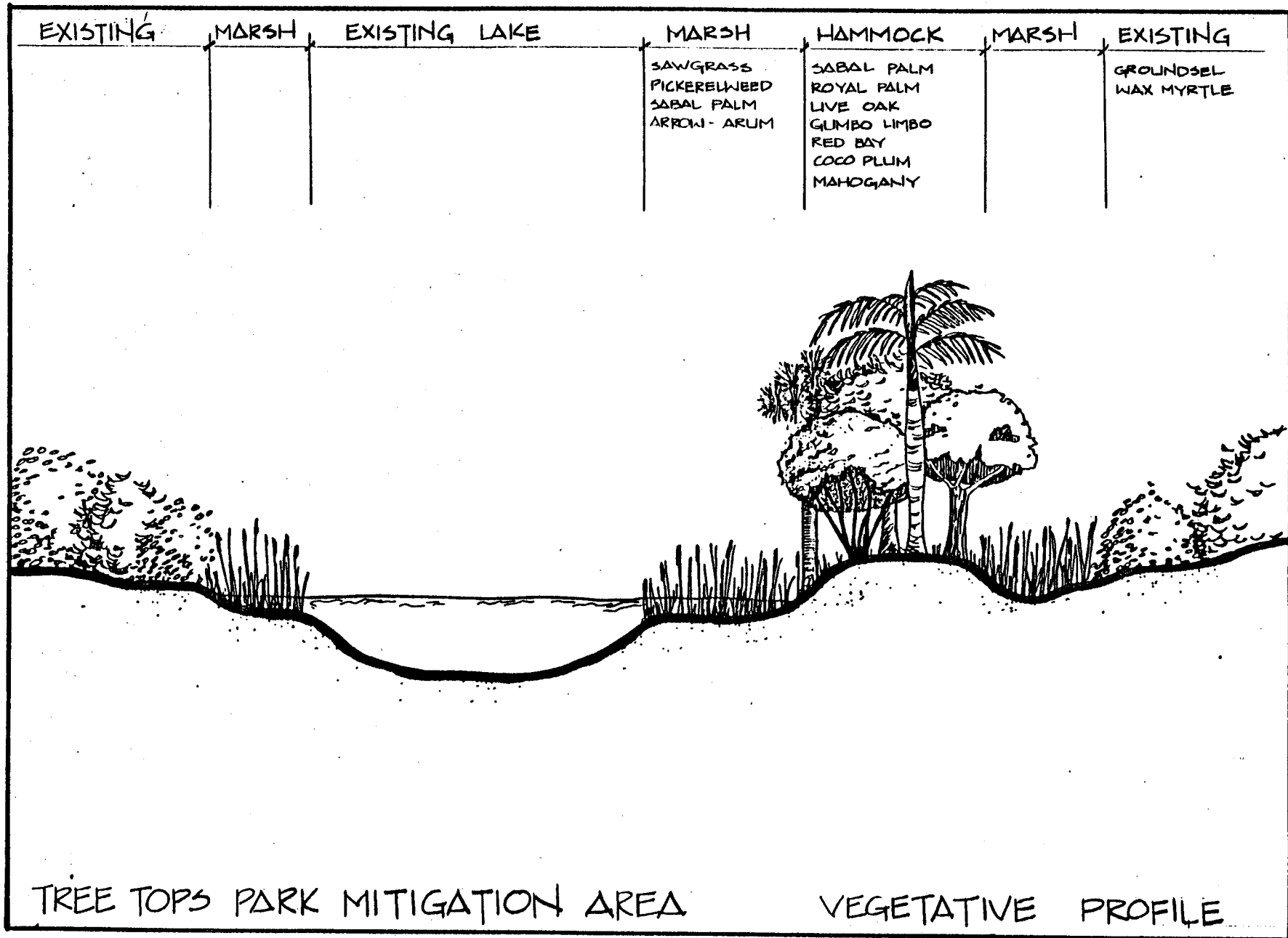


FIGURE 20

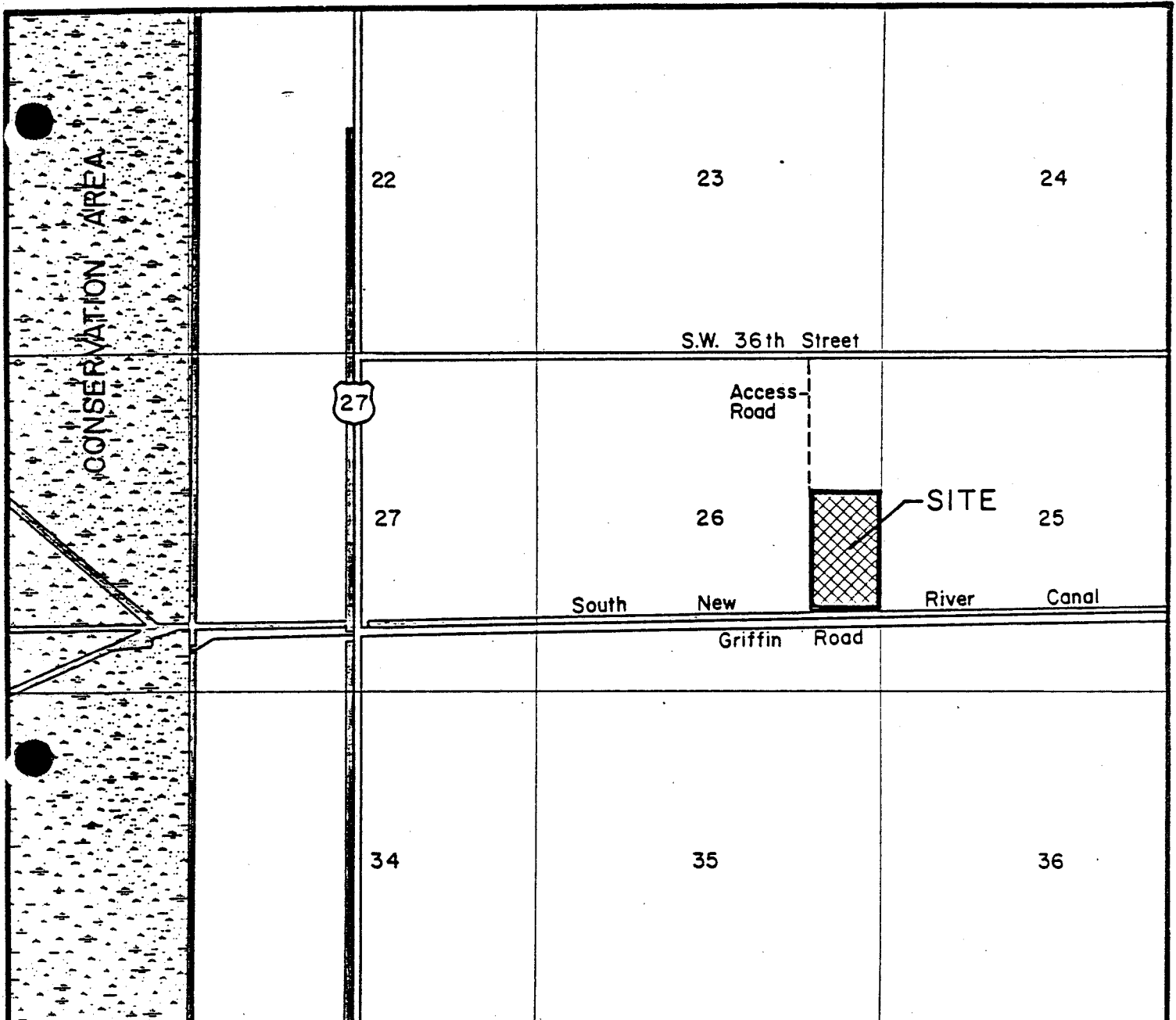
AREA	SPECIES	DENSITY
Marsh	Sawgrass <u>Cladium jamaicense</u> Pickerel Weed <u>Pontederia lanceolata</u> Arrow Arum <u>Sagittaria sp.</u> Sabal Palm <u>Sabal Palmetto</u>	Clumps of 3 culms on 8' centers Colonies of 5 plants, 5 colonies/acre, random spacing Colonies of 5 plants, 5 colonies/acre, random spacing 3/acre, random spacing
Hammock	Sabal Palm <u>Sabal Palmetto</u> Royal Palm <u>Roystonea elata</u> Live Oak <u>Qurecus virginiana</u> Gumbo-limbo <u>Bursera simaruba</u> Red Bay <u>Persea borbonia</u> Coco Plum <u>Chrysobalanus icaco</u> Mahogany <u>Swietenia mahogani</u>	1/50 feet of perimeter, in clumps of 3 at elevation of 3.0' or 4.0' Equal mixture, random spacing, 1 tree/ 300 square feet
<u>TREE TOPS PARK MITIGATION AREA</u>		

area's elevation. Essentially, the edge of the lake will be a broad, shallow marsh with several tree islands (hammocks). The topography of the marsh area will range from +1.5 to +3.0. Hammocks will be at a slightly higher elevation (+5.0). Except on hammocks, the trail will be at (+4.0) and will incorporate culverts to insure water interchange throughout the marsh.

Creation of 15.5 acres of marsh and hammocks in Tree Tops Park provides mitigation to supplement on-site mitigation for the wetlands utilized in development of the Southern Residue/Unprocessable Waste Landfill. The Tree Tops Park mitigation area will result in a high quality wetland/open water/hammock environment similar to the Everglades. Besides serving as a more valuable functioning wetland, the Tree Tops Park area will provide a valuable educational opportunity for the people of Broward County.

3. Everglades Restoration Area

The largest mitigation site (74 acres) for the landfill is the Everglades Restoration Area, located immediately north of South New River Canal and Griffin Road, approximately 1-1/4 miles east of US 27 (Figure 22). This site is former Everglades marsh which is no longer flooded. The site has been impacted by drainage on all sides, but Everglades conditions will be restored by reflooding the site. The site has been reviewed by biologists from South Florida Water Management District, U.S. Fish and Wildlife Service, Florida Game and Freshwater Fish Commission,



— SITE LOCATION MAP —

EVERGLADES RESTORATION AREA

SITE DATA

- 74 ACRES
- SECTION 26, TOWNSHIP 50S, RANGE 39 E
- AGRICULTURAL ZONING
- INDIAN TRACE DRAINAGE DISTRICT

0 1000' 3000'

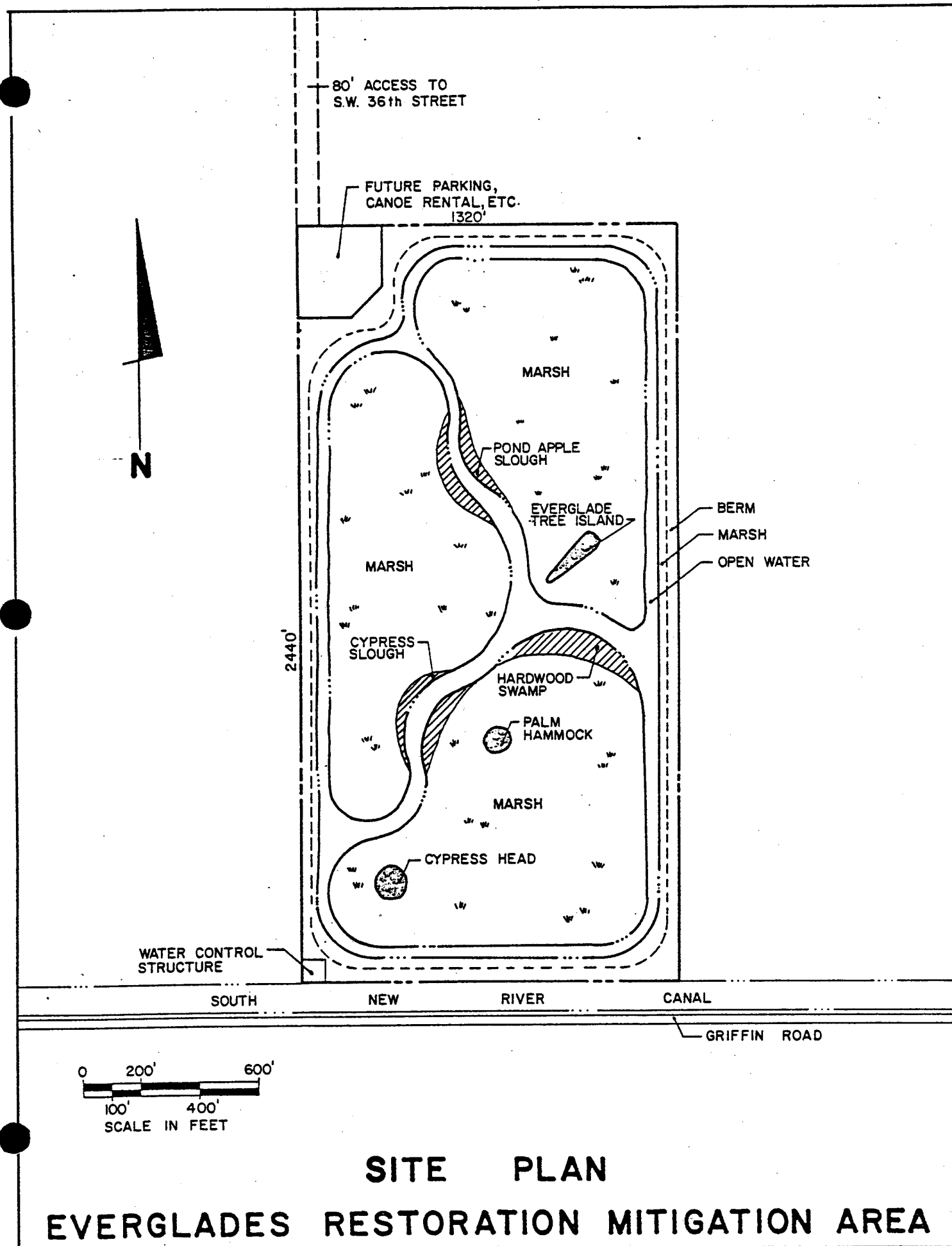
Scale in Feet

CZR, INCORPORATED
1001 U.S. HIGHWAY 1
JUPITER, FL 33458

and U.S. Environmental Protection Agency. All agencies concur that a viable, functioning marsh can be recreated at this 74 acre site.

Specific restoration methodology is currently being studied in a joint planning effort with the project consultants and SFWMD, FGFWFC, and USFWS. Current plans are to berm the site and flood it by pumping. A preliminary site plan is shown in Figure 23, and Figures 24 - 35 show typical sections through created habitats and planting details. Although the details are not yet confirmed development will include the following elements:

1. The site will be flooded with 12-18" of water during the regular wet season, and water levels will be allowed to drop during the normal dry season.
2. During the first 2-3 years, the site will be continuously flooded to kill transitional species which have invaded the site.
3. Removal of all melaleucas prior to flooding and regular control to prevent their reestablishment.
4. Creation of permanently flooded shallow water habitat, Everglades marsh, and examples of other wetland plant communities (eg. cypress head, palm hammock, cypress slough, Everglade tree island, pond apple, slough and hardwood swamp (Figures 23-32)).



EVERGLADE TREE ISLAND

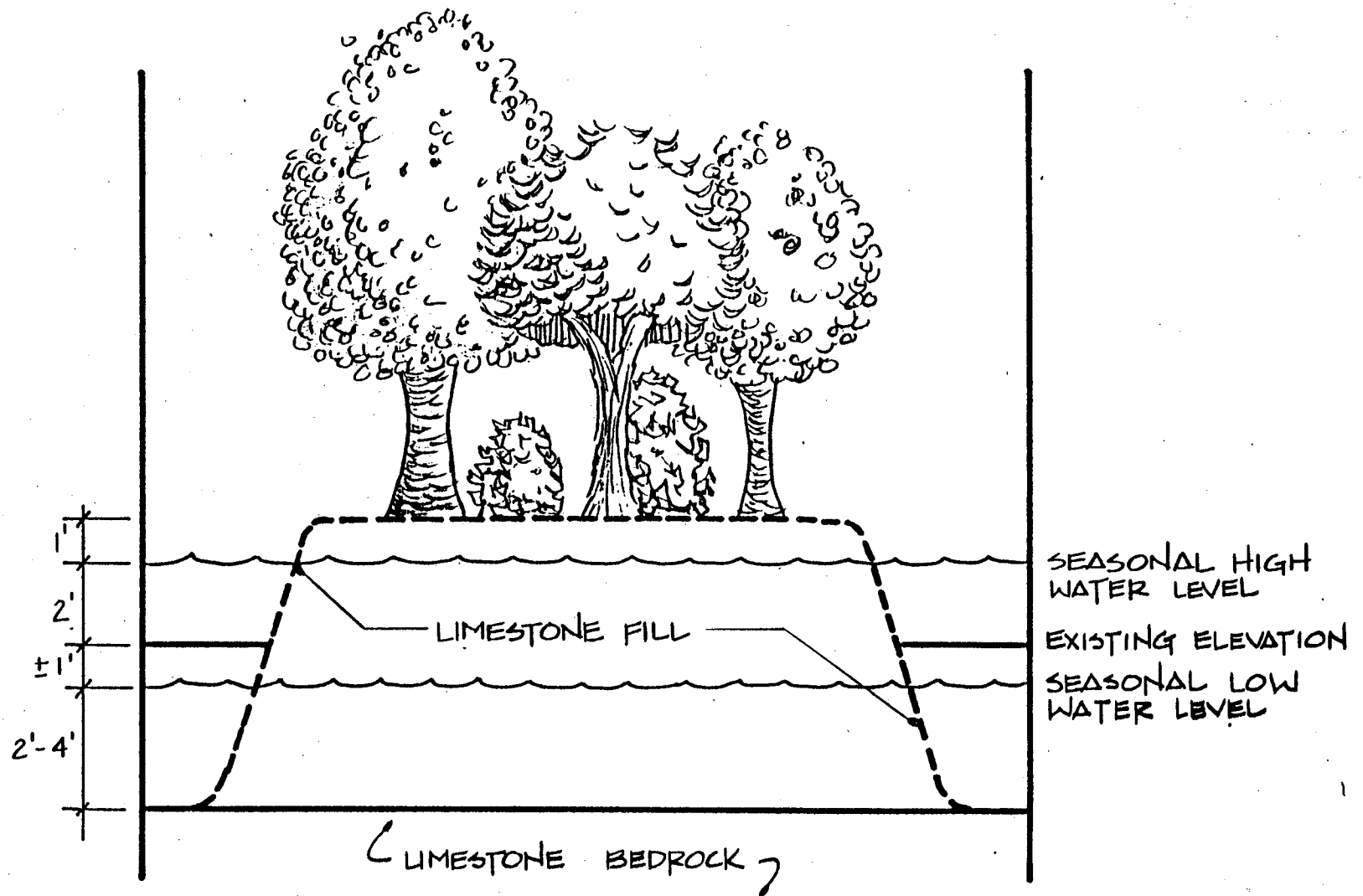
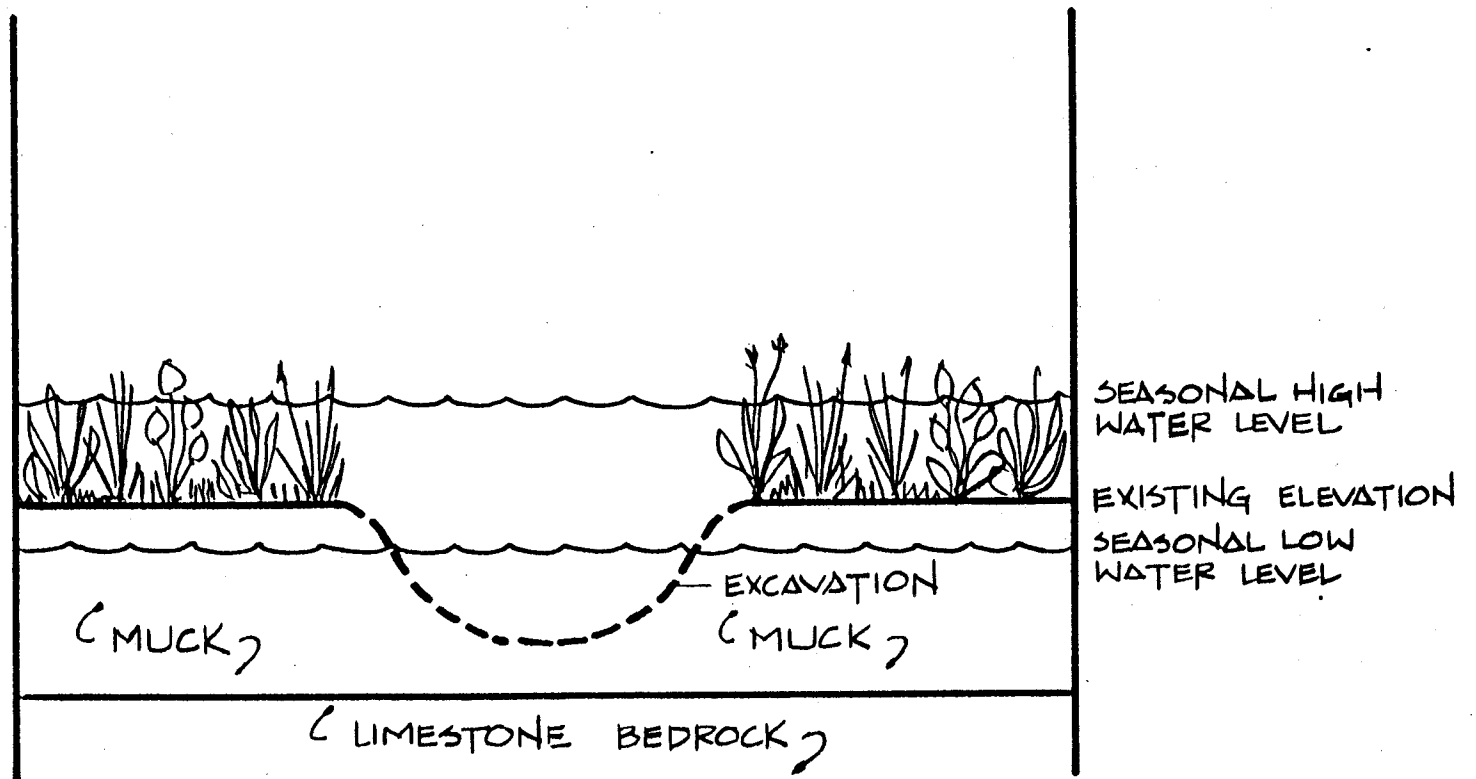
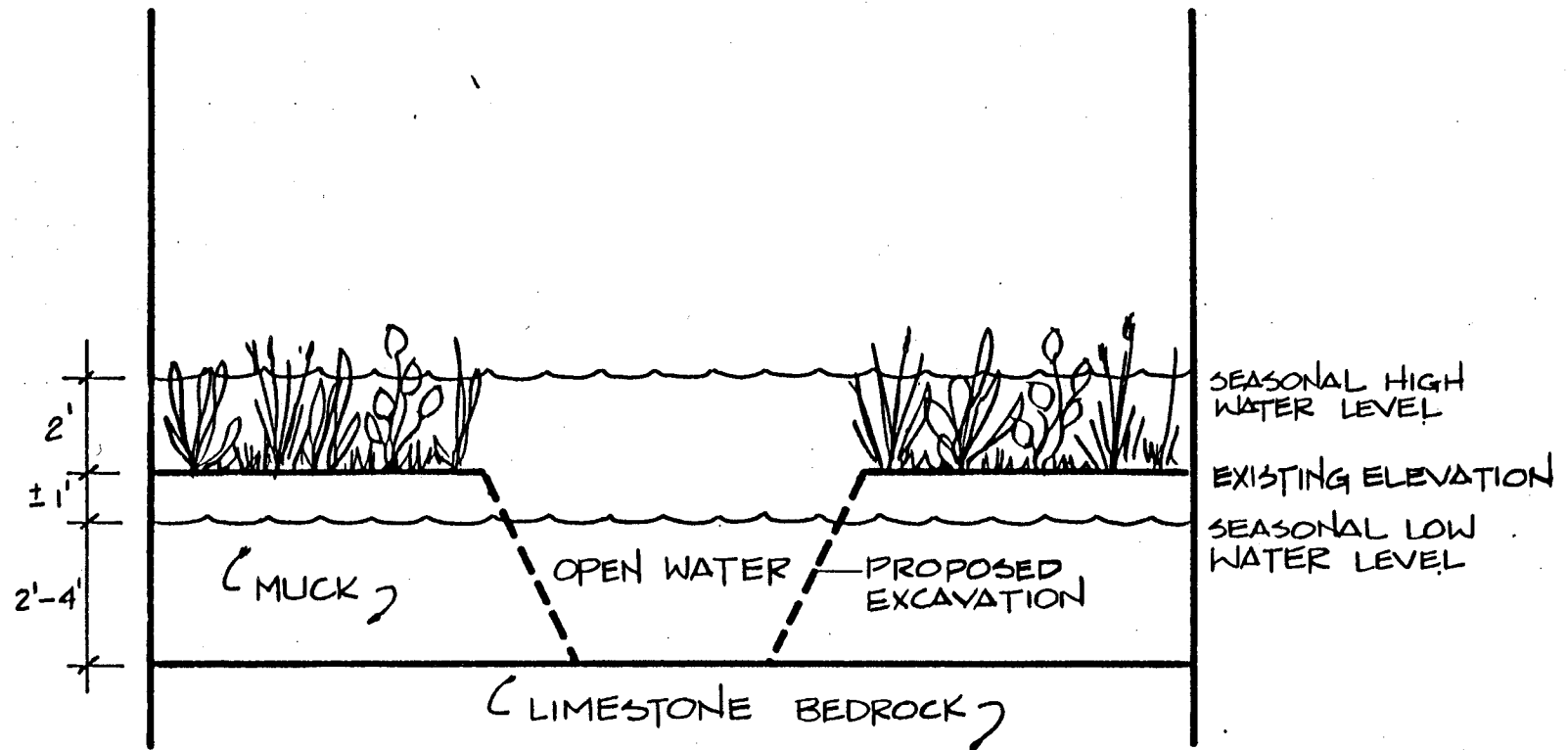


FIGURE 24

POND



OPEN WATER



PALM HAMMOCK

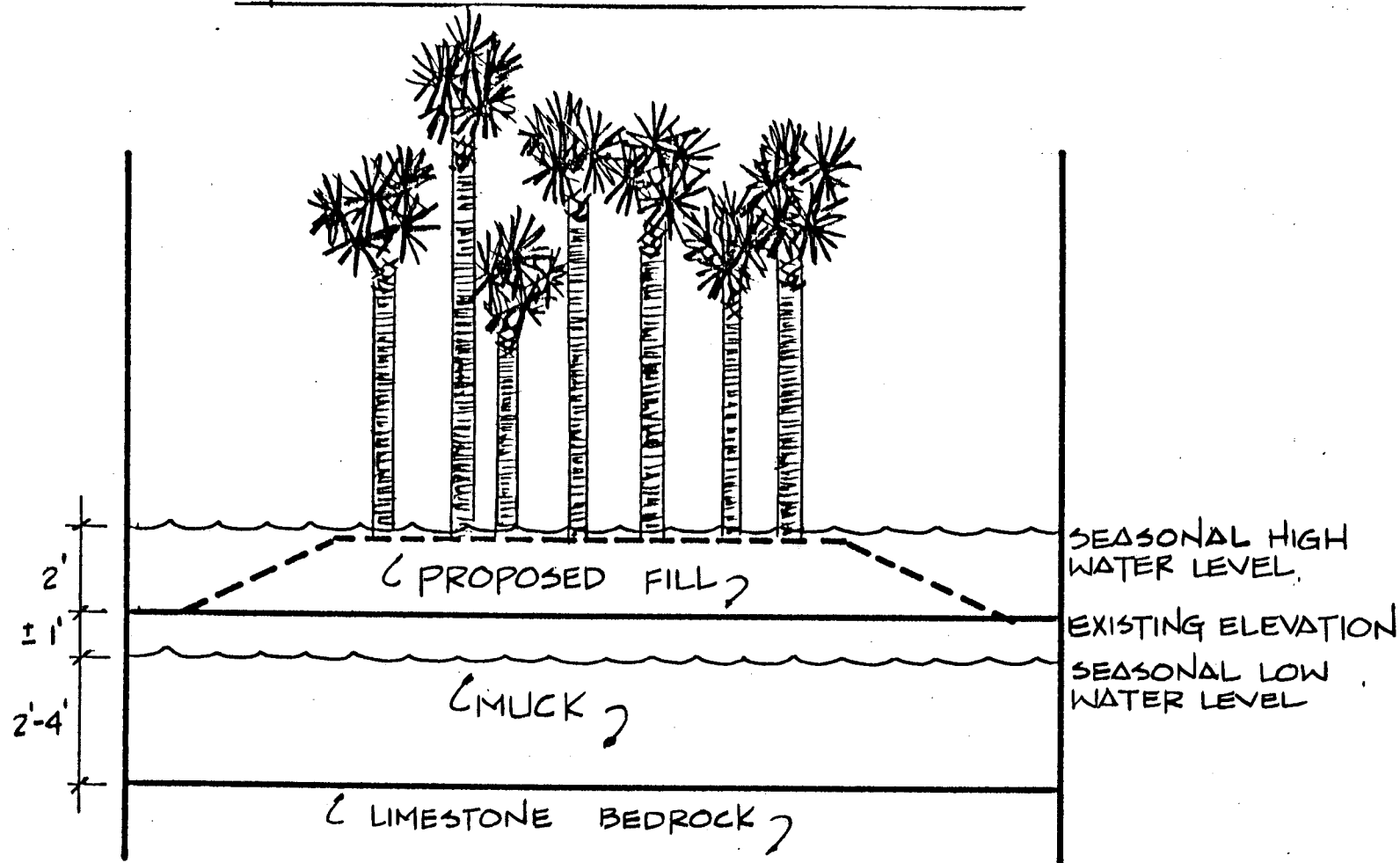
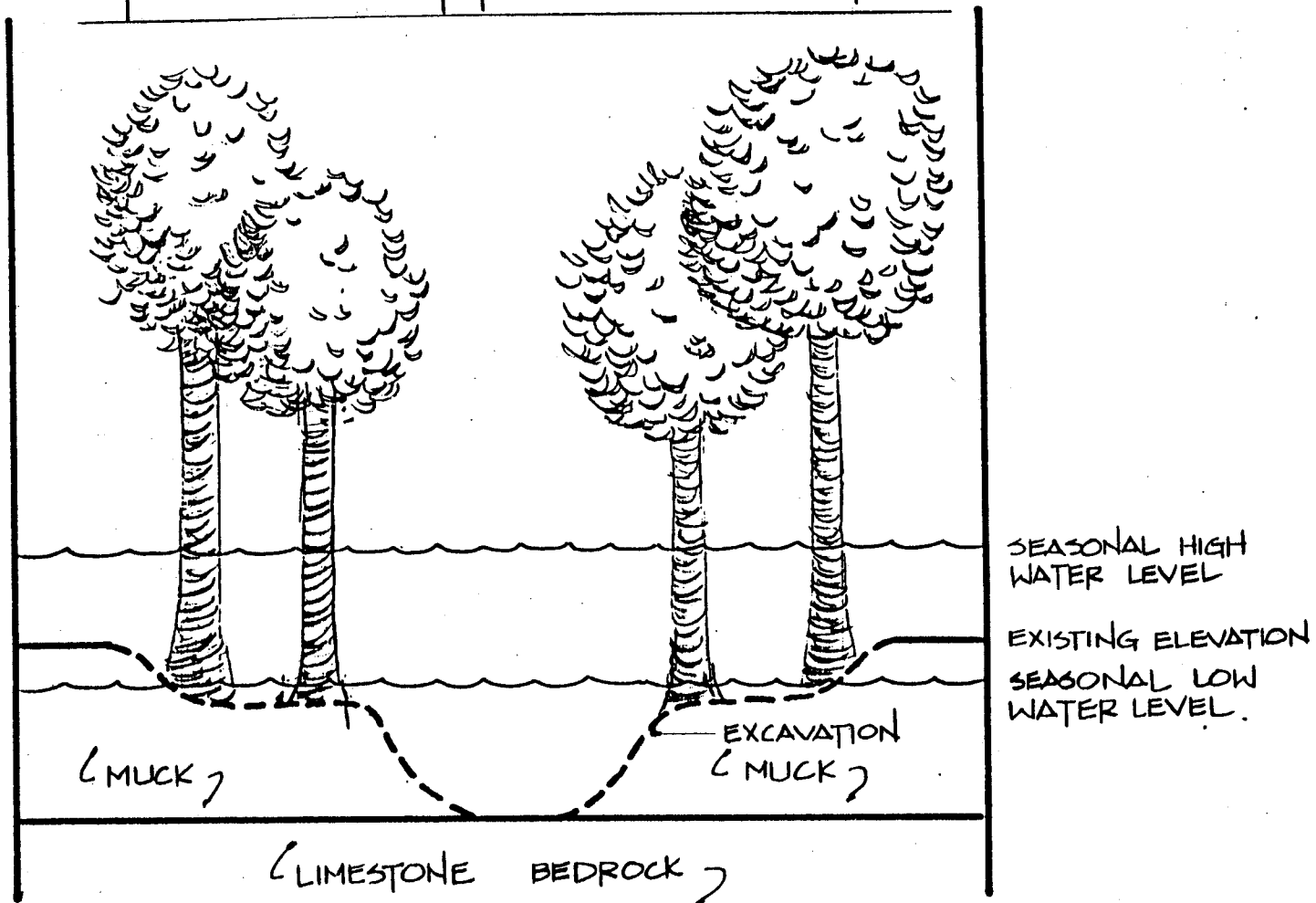
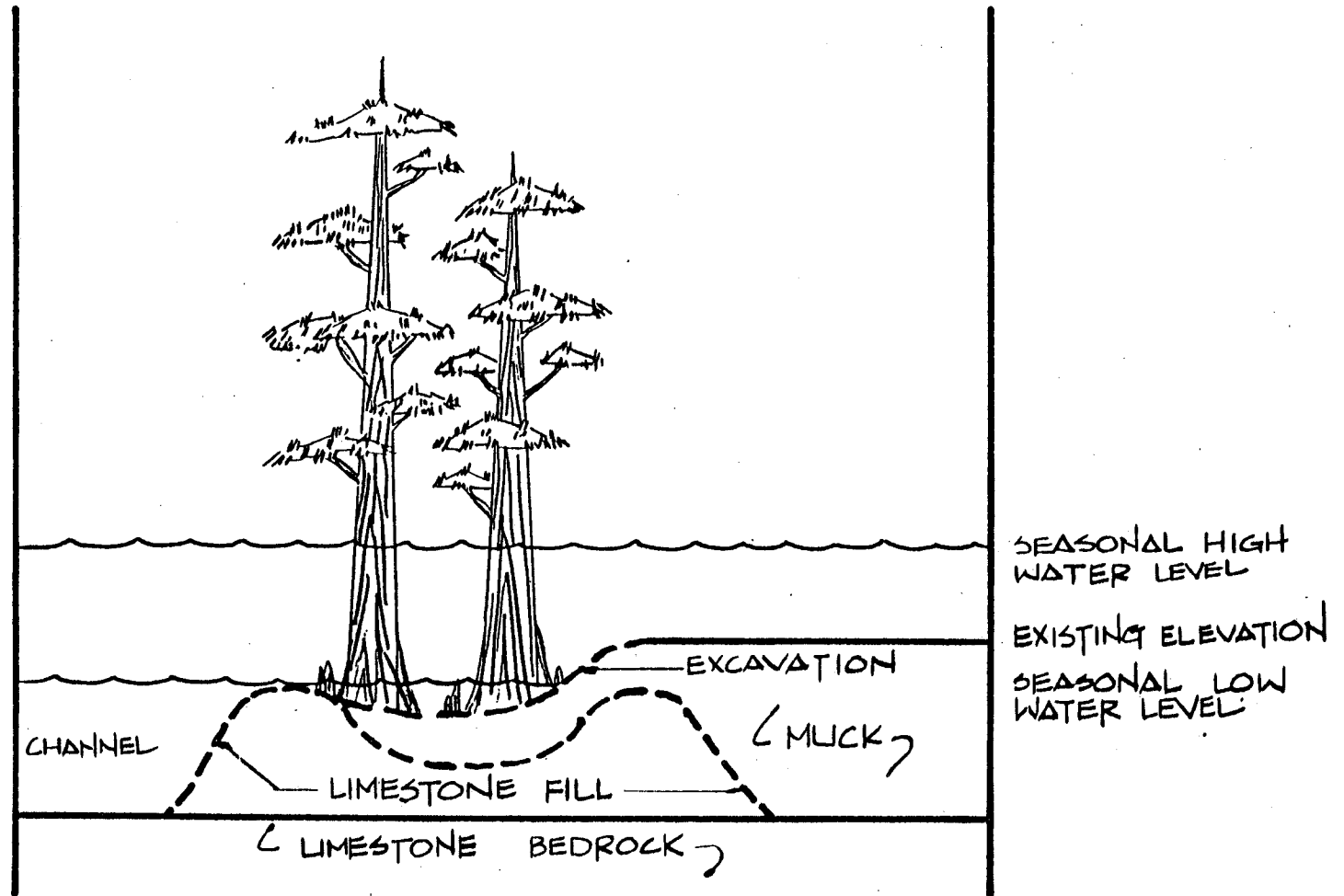


FIGURE 27

POND APPLE SLOUGH

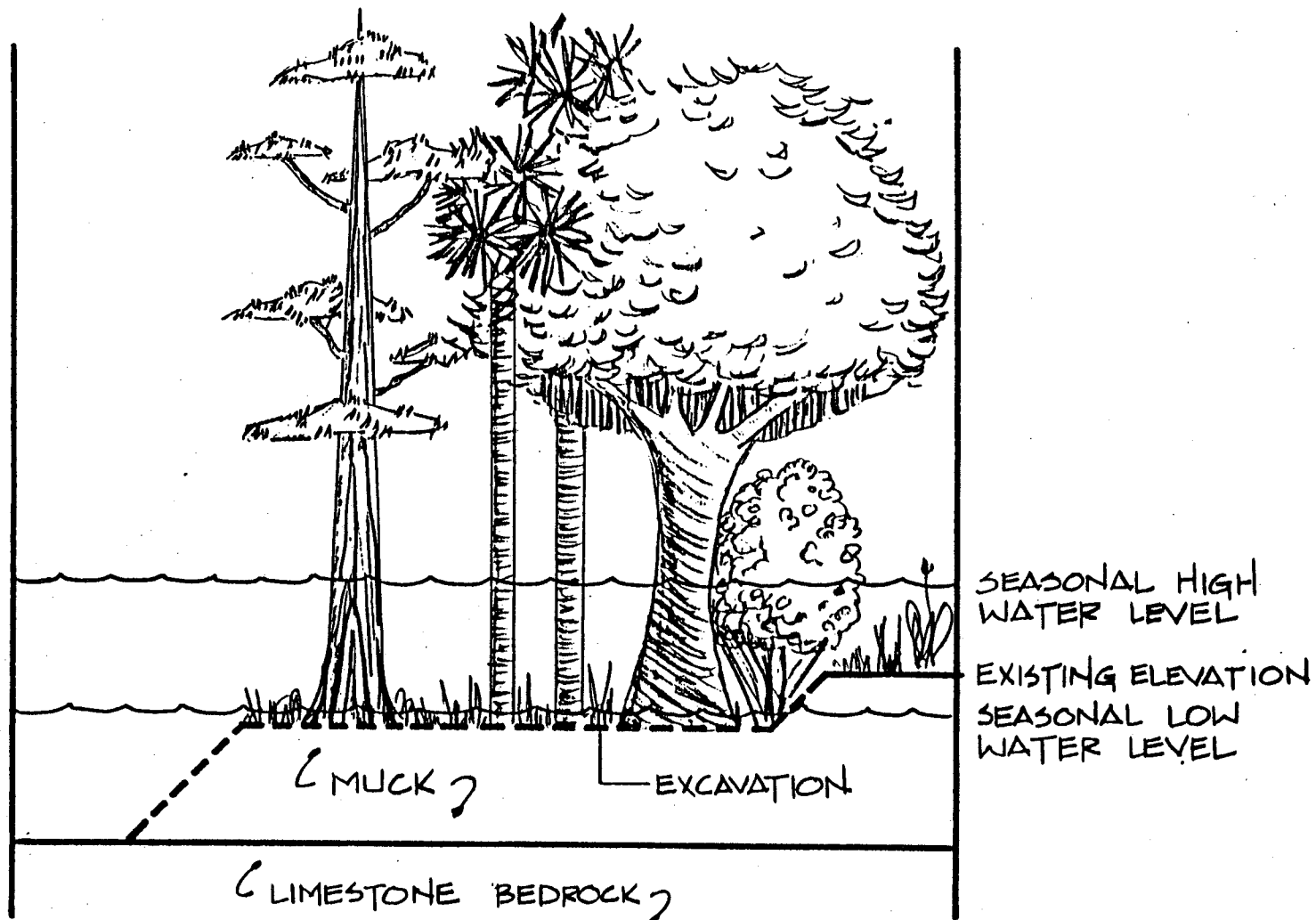


CYPRESS SLOUGH

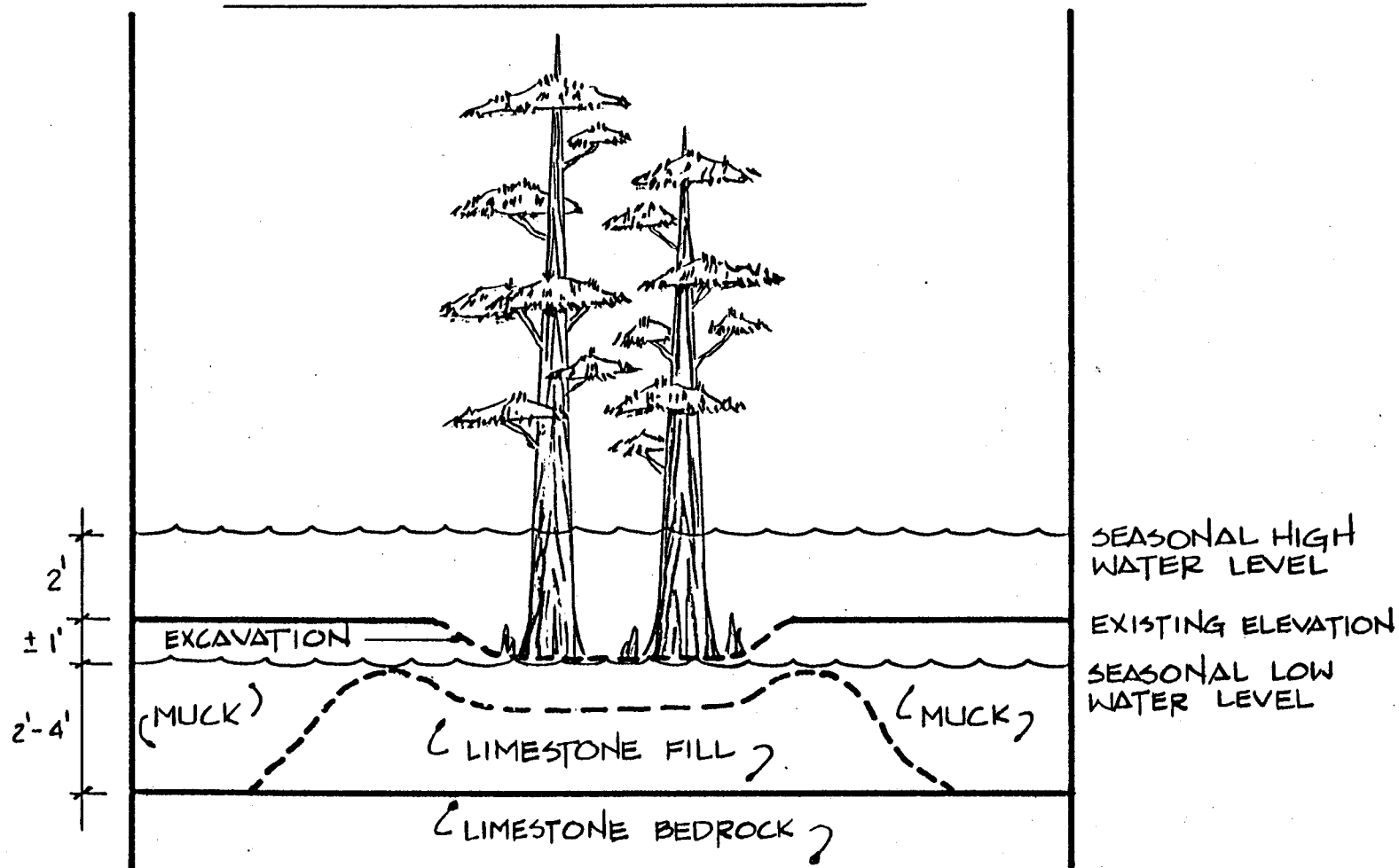


NOTE: SAME FORMATION ON
OPPOSITE SIDE OF CHANNEL

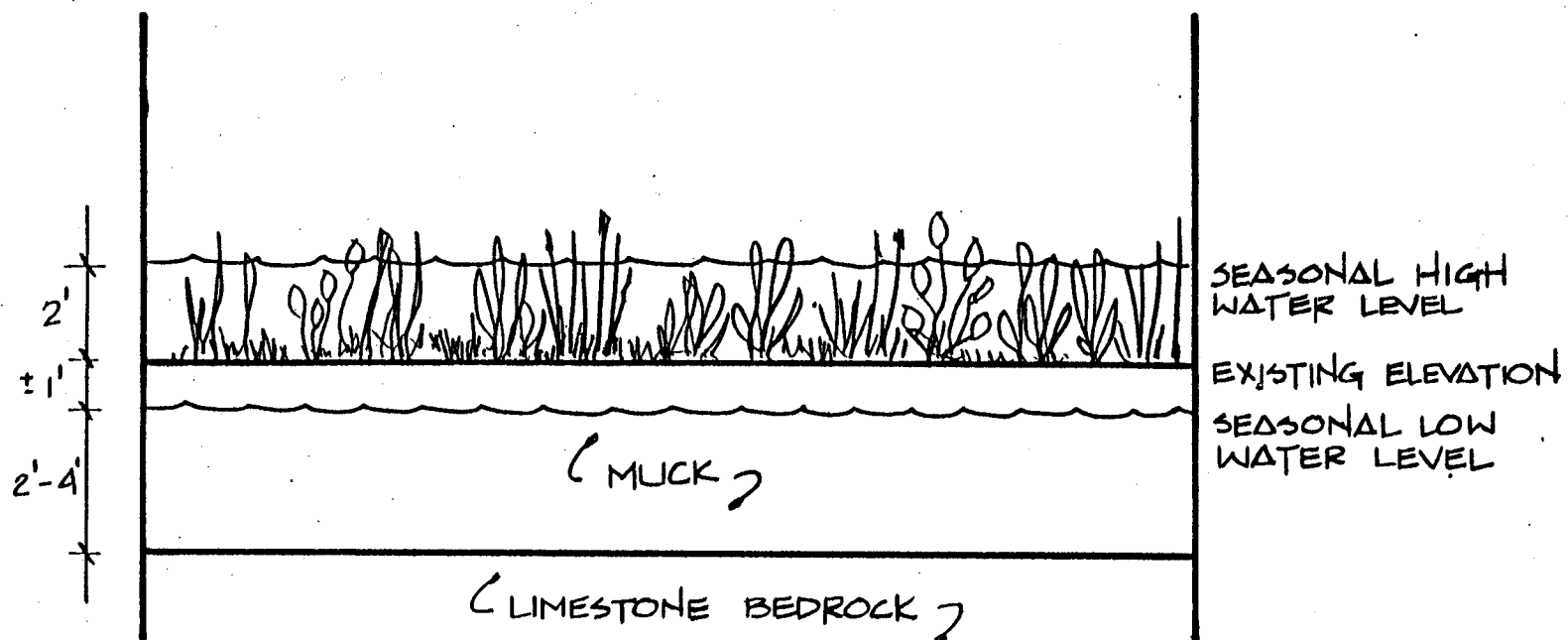
MIXED HARDWOOD SWAMP



CYPRESS HEAD



EVERGLADES MARSH



AREA	SPECIES	DENSITY
Everglades Marsh	Sawgrass <u>Cladium jamaicense</u>	Existing vegetation to remain
	Pickereel Weed <u>Pontederia lanceolata</u>	"
	Arrowhead <u>Sagittaria sp.</u>	"
	Spatardock <u>Nuphar luteum</u>	"
	Swamp Lily <u>Crinum americanum</u>	"
	Arrow Arum <u>Peltandra virginica</u>	"
Pond	Same as marsh at waters edge; dominance by emergent and floating species.	Existing vegetation to remain
Open Water	Same as marsh at waters edge; dominance by emergent and floating species.	Existing vegetation to remain
Palm Hammock	Cabbage Palm <u>Sabal palmetto</u>	80/acre - seedlings 4/acre - 8' trees
Pond Apple Slough	Pond Apple <u>Annona glabra</u>	30/acre - seedlings 10/acre - 8' trees
Cypress Slough	Bald Cypress <u>Taxodium distichum</u>	70/acre - seedlings 20/acre - 8' trees
Mixed Hardwood Swamp	Water Tupelo <u>Nyssa aquatica</u>	Equal mixture, random spacing, 1 tree/ 300 square feet
	Bald Cypress <u>Taxodium distichum</u>	"
<u>EVERGLADES RESTORATION AREA</u>		

AREA	SPECIES	DENSITY
Mixed Hardwood Swamp (continued)	Pop Ash <u>Fraxinus caroliniana</u>	Equal mixture, random spacing, 1 tree/ 300 square feet
	Sweet Bay <u>Magnolia virginiana</u>	"
	Red Maple <u>Acer rubrum</u>	"
	Loblolly Bay <u>Gordonia lasianthus</u>	"
	Florida Elm <u>Ulmus floridana</u>	"
	Cabbage Palm <u>Sabal palmetto</u>	"
	Sugarberry <u>Celtis laevigata</u>	Equal mixture, random spacing, 1 shrub/ 200 square feet
	Button Bush <u>Cephalanthus occidentalis</u>	"
	Coco Plum <u>Chrysobalanus icaco</u>	"
Cypress Head	Pond Cypress <u>Taxodium ascendens</u>	70/acre - seedlings 20/acre - 8' trees
Everglades Tree Island	Live Oak <u>Quercus virginiana</u>	Equal mixture, random spacing, 1 tree/ 300 square feet.
	Gumbo-limbo <u>Bursera simaruba</u>	"
	Lysiloma <u>Lysiloma latisiliquum</u>	"
<u>EVERGLADES RESTORATION AREA</u>		

Because a variety of marsh plants are still present though stressed and an abundant seed supply is available in the soil, marsh areas will not be planted. Other communities will be created by planting.

5. The feasibility of using the marsh to cleanse water from adjacent drainage ditches is being evaluated. If practical, the marsh will be used for this application.
6. A two acre area in the northeastern corner of the site will be used as a parking area and access point.

This site provides a unique opportunity to reclaim Everglades habitat which is rapidly disappearing east of the conservation area. The area will function as a water retention area, wildlife and fish habitat, and recreational and educational area. Deed restrictions will ensure that it will remain as wetlands in perpetuity for the people of Broward County.

GEOTECHNICAL REPORTS

**DATA AND INFORMATION
FOR THE**

**ROUTE 441 SITE
ENVIRONMENTAL REVIEW FORM
BROWARD COUNTY OFFICE OF PLANNING**

BROWARD COUNTY RESOURCE RECOVERY

BROWARD COUNTY, FLORIDA

JULY, 1983

APPENDIX A



**Report of Geotechnical Study, Sludge Management Plan
Compost Facility, Fort Lauderdale, Florida**

**Classification of Soils for Engineering Purposes, Powell
Brothers Industrial Park**

Test Borings for Griffey Tract

**HAZEN AND SAWYER, P.C.
C.Z.R., INCORPORATED
MALCOLM PIRNIE, INC.**

APPENDIX

TEST BORINGS AND GEOTECHNICAL STUDY
VARIOUS LOCATIONS WITHIN PROCESS AREA

APPENDIX

SECTION 1

**REPORT OF GEOTECHNICAL STUDY
SLUDGE MANAGEMENT PLAN
COMPOST FACILITY
FORT LAUDERDALE, FLORIDA**

Prepared For:

Hazen and Sawyer, P.C.
5950 Washington Street
Hollywood, Florida 33023

Prepared By:

KBC Consultants, Inc.
3341 Cornelia Drive
Post Office Drawer 1580
Coconut Grove, Florida 33133

March 18, 1983

City of Fort Lauderdale Project No: 7191
EPA Project No.: C120474-320
Hazen and Sawyer Project No.: 8082
KBC Project No.: 8202

KBC

March 18, 1983

THOMAS J. KADERABEK, P.E.
DAVID BARREIRO, P.E.
MARTIN A. CALL, P.E.

Mr. Peter E. Robinson, P.E.
Hazen and Sawyer, P.C.
5950 Washington Street
Hollywood, FL 33023

Re: Report of Geotechnical Study
Sludge Management Plan
Compost Facility
City of Fort Lauderdale, Florida
KBC Project No. 8202

Dear Mr. Robinson:

We have completed the geotechnical exploration for the above referenced project in general accordance with the scope of geotechnical services outlined in KBC Consultants' Proposal No. 82-101, dated November 19, 1982. We initiated work on this project based on your verbal authorization of December 13, 1982 and receipt of our professional services agreement which was executed on February 7, 1983. This report contains modifications as a result of your review of our initial report dated March 4, 1983.

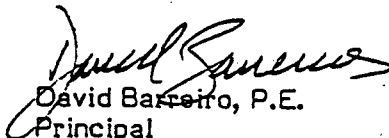
This report outlines our understanding of the project, discusses our exploratory procedures, presents the data obtained and provides our geotechnical recommendations.

It has been our pleasure to provide geotechnical engineering services for you and look forward to assisting you during the construction phase of this project. If you have any questions, or if we may be of further assistance, please contact the writers.

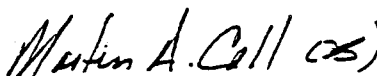
Sincerely,
KBC CONSULTANTS, INC.



Thomas J. Kaderabek, P.E.
Principal
Florida Registration No. 26023



David Barreiro, P.E.
Principal
Florida Registration No. 31901



Martin A. Call, P.E.
Principal
Florida Registration No. 31913

TJK/DB/MAC/wpc
xc: (4) Addressee
Attachments: Final Invoice

TABLE OF CONTENTS

<u>CHAPTER</u>	<u>PAGE</u>
TRANSMITTAL LETTER	ii
TABLE OF CONTENTS	iii
1.0 FOREWARD	1
2.0 FURNISHED DATA	3
3.0 SITE RECONNAISSANCE	6
4.0 LOCAL GEOLOGY	8
4.1 Site Geologic Conditions	9
4.2 Groundwater Conditions	11
5.0 GEOTECHNICAL EXPLORATION	12
5.1 Evaluation of Field Test Data	12
5.2 Evaluation of Laboratory Test Data	14
6.0 GEOTECHNICAL EVALUATION	16
6.1 Geotechnical Mechanisms	16
6.1.1 Peat Consolidation	16
6.1.2 Limestone Supporting Ability	22
6.2 Foundation Systems	23
6.2.1 Shallow Foundations	23
6.2.2 Drilled Shafts	23
6.2.3 Augercast Piles	24
6.2.4 Pressure Injected Footings	24
6.3 Tolerable Settlement	25
6.4 Site Preparation	25
6.5 In-Situ Soil Blend	27
6.6 Groundwater Fluctuations	28
6.7 Embankment Slopes	29
7.0 GEOTECHNICAL RECOMMENDATIONS	30
7.1 Site Preparation/Shallow Foundation Construction	30
7.2 Deep Foundations	33
8.0 REPORT QUALIFICATIONS	36

TABLE OF CONTENTS (Cont.)

<u>CHAPTER</u>	<u>PAGE</u>
 <u>APPENDIX</u>	
Site Vicinity Map (Drawing No. 1)	A-1
Site Layout Plan (Drawing No. 2)	A-2
Test Locations (Drawing No. 3)	A-3
Compressible Soil Thickness (Drawing No. 4)	A-4
Subsurface Profiles (Drawings No's. 5, 6, 7 and 8)	A-5
Field Exploration Procedures	A-9
Standard Penetration Test	
Hand-Augur Boring	
Flat Plate Dilatometer	
Vane Shear Test	
Undisturbed Sampling	
Undisturbed Block Samples	
Field Consolidation Test	
Laboratory Testing Procedures	A-13
Soil Classification	
Grain Size Distribution	
Atterberg Limits Test	
Organic Content Test	
Moisture Content Test	
Determination of Unit Weight, Moisture Content and Void Ratio	
Consolidation Test	A-16
Legend to Record of Test Borings	A-17
Record of Test Borings	A-23
Record of Hand-Augur Borings	A-34
Report of Plate Dilatometer Tests	A-42
Report of Field Vane Shear Tests	A-46
Record of Laboratory Soil Identification Tests	A-48
Record of Field Consolidation Tests	A-50
Record of Laboratory Consolidation Tests	A-52
Summary of Undisturbed Block Samples	

10 FOREWORD

The purpose of our geotechnical study at the Compost Facility site was to collect data concerning existing site, geologic and groundwater conditions. Comprehensive field and laboratory testing programs were performed during our study. The test data was evaluated and provided the bases for our geotechnical recommendations.

This report summarizes our testing programs, presents our engineering evaluations and conclusions, and outlines our geotechnical recommendations for this project. The following details are included in this report:

- o The results of a hand-auger boring exploration program. A total of 76 hand-auger borings were performed to depths varying from about 4 to 6 feet below existing grade.
- o The results of a field vane shear testing program. A total of 117 vane shear tests were performed at selected locations adjacent to hand-auger boring locations. Generally, 2 to 3 vane shear tests were performed at each location, to a maximum test depth of about 2.5 below existing grade.
- o The results of 6 soil test borings performed within the proposed compost/drying area. The borings were sampled using the Standard Penetration Test (SPT). Each soil test boring was advanced to a depth of about 30 feet below existing grade.
- o The results of flat dilatometer testing performed at selected locations throughout the project area. Tests were performed at 15 different locations adjacent to hand-auger boring locations. At each test location the near surface organic and cohesive soils were tested in 0.5 foot depth increments to a maximum depth of about 4.5 feet below existing grade.
- o The results of soil laboratory tests performed on selected soil samples recovered during out field testing program. The following laboratory tests were performed: 33 moisture content, 20 percent organics, 5 Atterberg Limits, 11 gradation, and 2 consolidation.
- o The results of 5 field consolidation tests performed at selected locations within the project area. Data from these tests will continue to be collected and evaluated subsequent to the submission of this report.
- o A review of our field and laboratory test procedures
- o Site Vicinity, Proposed Construction, and Test Location Plans. These plans indicate the geographic project location, the property boundaries, the proposed location of structures and other construction, and the approximate geotechnical test locations.

- o A plan drawing of the project area showing the estimated compressible soil thicknesses at each test location. The test locations in all the plan drawings are indicated in reference to previously established project area coordinates.
- o Generalized Subsurface Profiles summarizing our estimated geologic conditions at the project site, as encountered at the hand-auger boring and soil test boring locations.
- o A discussion of observed site topographic features.
- o A discussion of local and site geologic conditions.
- o An estimate of the engineering properties of the soil and rock encountered during the geotechnical exploration. Both field and laboratory test data was evaluated in preparing the soil and rock strength estimates.
- o Location of the groundwater level and possible fluctuations which may occur prior to and during construction.
- o A discussion of foundation systems concerning their technical feasibility for this project. Foundations system evaluated included augercast piles, drilled shafts, pressure injected footings and shallow foundations.
- o An estimate of foundation performance based on the available data.
- o A discussion of geotechnical site preparation techniques that may be technically feasible considering the near surface geologic conditions. The following schemes were evaluated: excavation/replacement of the near surface organic and cohesive soils, fill placement over in-situ profile, and fill placement in conjunction with the use of geotextile fabric.
- o A discussion of the feasibility of blending in-situ organic soils with borrow fill soils for use as construction materials.
- o Recommendations for foundation design, foundation construction, and geotechnical site preparation considering the in-situ geologic conditions encountered during our geotechnical study.
- o A discussion of costs associated with fill placement, foundation construction and geotechnical site preparation.

2.0 FURNISHED DATA

The following project information was initially furnished to us in the form of a written request for proposal dated November 15, 1982 and prepared by Mr. Robinson of Hazen and Sawyer's Hollywood office. Additional project information was obtained in telephone conversations and meetings with the following Hazen and Sawyer representatives: Messrs. Peter Robinson, Louis C. Barnhart, Tony Wypych and Alfred A. Gilbert. The information was used by our office in initially drafting a scope of geotechnical services, and subsequently preparing our geotechnical recommendations.

We were provided the following documents, and used them in the planning and execution of our geotechnical exploration:

1. A preliminary survey prepared by the City of Ft. Lauderdale, dated June 15, 1982.
2. A Hazen and Sawyer drawing entitled "A Compost Site Plan, Plate 3", dated August 18, 1982.
3. A Hazen and Sawyer drawing entitled "Covered Compost Building, Plan and Section, Plate 4", dated August 18, 1982.
4. A Report of Classification of Soils for Engineering Purposes, prepared by East Coast Testing and Engineering, Inc., dated July 7, 1982. This report contains results of 5 Standard Penetration Test borings to a depth of 20 feet and 27 hand-auger borings to a depth of 5 feet. In addition, classification tests were performed on 6 samples.

The project site is located adjacent to and east of State Road 7, west of I-95 and north of Griffin Road in Ft. Lauderdale, Florida. State Road 84 is north of the site, with the Powell Brothers Industrial Park being located immediately to the north of the site. The project site is bounded on the east by the South Fork of the New River. Powell Brothers Construction Company is located just south of the site. Drawing No. 1 in the Appendix of this report shows the approximate site location.

The project site covers an approximate plan area of 30.3 acres. The entire site is planned to be developed except the eastern portions where an approximately 300 feet

right-of-way, extending westward from the South Fork of the New River, will be reserved for urban wilderness area. This reserved area covers approximately 4.8 acres of the eastern section of the project site.

The furnished site survey indicates ground surface elevations on the site to vary from about +0.5 to +1.5 feet MSL (the elevation datum is not indicated in the furnished survey and we have assumed mean sea level). An FPL access road, running east-west through the project site, is indicated with ground surface elevations varying from about +2 to +3.5 feet MSL.

The proposed site development will consist of several different components. These various components are discussed in the following paragraphs.

Stormwater detention areas are indicated in 8 separate areas on the furnished Plate 3 drawing. We understand these stormwater detention areas will have a depth of 3 to 4 feet and are anticipated to be dry during portions of the year. These areas will hold stormwater prior to discharge or subsurface seepage. The entire project site is planned to be generally filled to elevation +5 to +7 feet MSL, resulting in fill thicknesses of 5 to 6 feet. Stormwater detention areas will be depressed areas within the general filled areas.

Other areas of the site will consist of stockpiled material storage. These stockpiles will include compost and bulking agent storage. We understand that areas under storage stockpiles will be paved with asphaltic pavement. The four storage areas indicated on Plate 3 drawing generally have plan areas of about 100 by 300 feet. Compost and bulking agent stockpiles will have a maximum height of 10 feet and a unit weight of 1,000 pounds per cubic yard (37 PCF). The pug mill and screening area will have stockpiles about 10 foot high with a unit weight of 1700 pounds per cubic yard (63 PCF).

A proposed maintenance building will have a plan area of about 50 by 100 feet. This one-story structure will have column or wall-loads generally less than 50 kips per individual column, or less than 3 kips per lineal foot of wall.

A one-story administration building is also planned and will cover an approximate area of 20 by 40 feet. Wall-loads less than 3 kips per lineal foot are anticipated.

An exhaust scrubber pad is planned on the eastern portion of the site and will have plan dimensions of about 50 feet square. We were not provided specific loading conditions for this structure, however, for the purpose of our geotechnical evaluation, we have assumed loading conditions similar to the maintenance building discussed above.

The structure with the most significant loading conditions will be the compost hall. We understand that this will be a pre-manufactured building with an eave height of 20 feet and spans of about 120 feet. Uplift and horizontal loads of 75 kips each are anticipated for this structure. Compression loads will be about 120 kips.

The overall dimensions of the compost/drying area are 250 by 420 feet. Two individual buildings will be located within this plan area, having a total of 60 columns. We understand the purpose of this structure will be to keep the wood chip and sludge mix dry. Within this structure, approximately 10 feet of the wood chip/sludge mixture (unit weight of 1700 pounds per cubic yard will be stored. We also understand that the area beneath this stockpile will be paved with asphaltic pavement.

A pug mill screening building will cover an area of about 110 by 250 feet. This building will be adjacent to the compost hall and will have column loads similar to the compost hall.

3.0 SITE RECONNAISSANCE

The project site was visited by Messers. David Barreiro, Martin A. Call and Thomas J. Kaderabek of KBC Consultants during the course of our geotechnical exploration. The site is located in Broward County, Florida as indicated on the appended Drawing No. 1.

The present site topography is generally level with surveyed elevations indicated from about +5 to +1.5 feet MSL. An FPL easement was observed to run approximately in an east-west direction through the entire project site. The easement width is about 230 feet. An FPL access road was observed, approximately midway through the easement. Generally, ground surface elevations along the access road were observed to be 2 to 3 feet higher than the surrounding virgin terrain.

Except for the area bounded by the FPL easement, most of the site is densely overgrown with vegetation. Vegetation within the easement area generally consists of clumps of grasses and weeds, and some low shrubs. The vegetation in the densely overgrown areas generally consisted of Florida Holly, a few pine trees, some Cypress trees and various other stemmy trees.

In general, the site terrain may be classified as swampy. Initial visits to the site, prior to heavy rainfall, revealed spongy and moist surficial soil conditions. However, after heavy rainfalls, large portions of the site were observed to be under several inches of water and surficial soils were very soft. The portions of the project site west of the New River and within the reserved wilderness area were observed to be swampy with open water areas.

Surficial soils over the entire site were observed to consist of black, silty, fine fibrous peat to depths of 1.5 feet below existing grade. The consistency of these surficial organic soils was very soft. The composition of the fill soils along the FPL access road was not readily apparent.

Man-made structures within the project site include FPL overhead, high voltage power lines and some perimeter barbed wire fencing. A small feeding shed was observed within the FPL easement area and towards the east portion of the site. During the course of our field exploration cattle were seen throughout the property.

Other noticeable features include: a small body of water slightly south and west of the property, several large limestone boulders along FPL access road (probably a result of FPL power line construction), several one-story CBS buildings several hundred feet south of the property, and the fact that the average project site ground surface elevation appears to be 4 to 7 feet lower than existing adjacent roads.

4.0 LOCAL GEOLOGY

Peninsular Florida may be divided into two major geomorphic provinces, the Central Highlands and the Coastal Lowlands. The Central Highlands region consists of rolling topography which forms a ridge running down the center of the peninsula and offset slightly to the west. The Coastal Lowlands, which include all of South Florida, rim the peninsula extending far south of the Central Highlands. This region consists of plains representing marine terraces which have occasionally been modified by erosion.

The Coastal Lowlands of South Florida have been divided into several physiographic provinces. These are the Everglades, the Big Cypress Swamp, the Mangrove and Coastal Glades, the Sandy Flatlands and the Atlantic Coastal Ridge. The Sandy Flatlands and the Everglades Provinces are represented in the Compost Facility project site.

The Sandy Flatlands province is located immediately inland from the Coastal Ridge, and is bordered on the west and south by the Everglades. It consists of southward slopping topography underlain by sand and limestone deposits. In this region of Broward County, the Everglades physiographic province fingers eastward into the Sandy Flatlands region. Surficial soils that generally characterize the Everglades province are predominately peats and organic silts. Based on the near surface geologic conditions encountered during our geotechnical study, the presence of Everglades soils is apparent at the project site.

The general area of the project site is underlain by about 150 feet of alternating deposits of limestone, sandstone and quartz sands. These sediments were deposited during the glacial and interglacial stages of the Pleistocene Epoch (10,000 to 2,000,000 years before present). Sediments of different geologic character, Pliocene and Miocene Epoch, underlie the project site at depths greater than 150 feet.

4.1 Site Geologic Conditions

The geologic conditions at the project site were explored utilizing a variety of geotechnical tools; specifically, 76 hand-auger borings and 6 soil test borings which used standard penetration testing. The approximate test locations are shown on Drawing No. 3 in the Appendix of this report. All the boring locations were suggested by KBC Consultants' engineering personnel.

The actual boring locations were staked in the field by KBC Consultants engineering personnel using a cloth tape and compass, and measuring from existing property markers. A description of the hand-auger and soil test boring procedures is included in the Appendix of this report.

The detailed geologic conditions encountered at the hand-auger and soil-test boring locations are presented on the appended Records of Test Boring and Records of Hand-Auger Boring. These records represent our interpretation of the field logs based on engineering examination of the soil and rock samples recovered, and laboratory testing performed on selected samples. The interfaces shown between various soil and rock strata represent approximate boundaries, and the actual transition between soil and rock types may be gradual.

The Generalized Subsurface Profiles, included in the Appendix of this report, were developed through geological interpretation of the boring data. These profiles should be considered an accurate representation of the subsurface soil and rock conditions at the specific test locations only.

Generally, a surficial layer of silty, fine fibrous peat was encountered at all the test locations. The peat was observed to be dark brown to black and varied in thickness from about 1.2 to 4.4 feet, with an average layer thickness of about 2.5 feet. An average standard penetration resistance (blows/foot) was not obtained for the peat. In all cases the split-spoon sampler penetrated the peat layer under the weight of the drill rods only.

Test results, including dilatometer and hand-auger boring, also indicate that the peat in the upper one foot of the layer has a higher preconsolidation stress, undrained strength and modulus than the underlying peat. These test results are indicative of a near surface drying crust which appears to be reasonable in view of the potential surface air-drying and the desiccation resulting from surface plants.

Underlying the surficial peat, we encountered a layer of tan, slightly sandy to sandy calcareous silt with occasional shells and fine roots. The average thickness of the silt stratum was about 0.8 foot and varied from about 0.1 to 2.2 feet. Standard penetration resistance values were also not obtained for the calcareous silt for similar reasons as the peat. The silt was encountered underlying the surficial peat at all but one test location. At test location No. 38 a layer of quartz sand was observed sandwiched between the peat and the silt.

A gray-tan, quartz medium to fine sand was generally encountered underlying the silt. The sand varied in thickness from about 0.2 to 3.8 feet and averaged about 1.9 feet. At various test locations the sand was observed to be slightly silty. The Standard Penetration test sampler was advanced by weight of drill rods through the sand stratum. In many instances the lower portions of the sand stratum consisted of a similar sandy material with limestone fragments. The sand with limestone fragments was encountered with an average thickness of about 1.2 feet with observed variations from 0.1 to 3.6 feet. In places, the sand with limestone fragments comprised the entire thickness of the sandy layer.

The majority of the hand-auger borings (approximately 60 percent) were terminated at refusal on the limestone surface. The depth to the top of this near surface limestone unit, as encountered in the borings, varied from about 3 to 7 feet and averaged about 4.5 feet below existing grade. As evidenced by the conditions encountered at the hand-auger boring locations, the near-grade limestone unit has an irregular surface and vertical solution channels, the latter probably a characteristic of only the upper 2 to 3 feet of the formation.

The limestone encountered during our geotechnical exploration is part of the Fort Thompson Formation. The limestone was generally observed to be a tan-gray, soft to medium, porous to very porous, quartz sandy limestone. It is probable that sand zones exist within the limestone matrix due to the sandy character of the rock and local areas of weak cementation. One such sand zone was encountered in the soil test boring at test location No. 77, at a depth of about 25 feet below existing grade.

The limestone unit was encountered continuous from the depths of first encounter to the soil test boring termination depths. All six soil test borings were terminated at a depth of about 31 feet below existing grade. Standard penetration resistance values (blows/foot) in the limestone varied from 8 to 37 and averaged about 21.

4.2 Ground Water Conditions

The groundwater level was encountered at all the test locations. Variations in the groundwater levels measured can be attributed to: levels measured immediately after the termination of the borings which do not allow sufficient time for the groundwater to stabilize in the open borehole, variations in ground surface elevations and rainfall.

The groundwater level was measured at depths varying from about ground surface to 3.5 feet below existing grade. The average groundwater level at the project site, based on our measurements, is estimated to be at about 1 foot below existing grade.

Fluctuations of the groundwater level may occur seasonally due to rainfall, surface runoff, construction activity and other factors. In fact, following heavy rainfalls during our geotechnical exploration, the groundwater level throughout the project site was observed to be either at ground surface or 2 to 8 inches above the existing grade.

5.0 GEOTECHNICAL EXPLORATION

The geotechnical exploration for this project included both field and laboratory testing programs. Several field exploratory tools were used to collect statistically significant geotechnical data at the project site. Soil and rock strength and modulus values were estimated using the results of standard penetration tests, vane shear tests, and flat plate dilatometer tests.

The laboratory testing program provided data which was used in the identification of the soils encountered, and in the estimation of soil and rock consolidation and strength parameters. Laboratory tests included moisture content, organic content, gradation, Atterberg Limits, and consolidation tests.

The field and laboratory testing procedures are discussed in the Appendix of this report. Summaries and records of the laboratory and field tests are also presented in the Appendix.

5.1 Evaluation of Field Test Data

The field test results were correlated to the engineering properties of the soil and rock encountered at the project site. Elastic and strength properties of the sandy soils were determined from the correlation for Standard Penetration Test (SPT) shown below.

Standard Penetration Test (Blows/Foot)	Modulus of Elasticity <u>E(ksf)</u>
5	260
10	360
15	460
20	560

These correlations to moduli were presented by Webb, D. L., "Settlement of Structures on Deep Alluvial Sandy Sediments in Durban, South Africa", Conference on In-situ Behavior of Soil and Rock, Institute of Civil Engineers, London, 1969.

Field consolidation tests were initiated and are presently being monitored in an effort to collect data for estimation of the engineering strength parameters for the surficial cohesive and organic soils encountered at the project site. Field consolidation tests were initiated to supplement the limited amount of laboratory consolidation test data. Undisturbed thin-walled tube samples could not be obtained (without severe disturbance) from these surficial organic soils. The very soft consistency, as well as the high fibrous and moisture content, of these soils resulted in significant compression, and therefore disturbance, of the soils during thin-walled tube sampling.

A number of vane shear tests were performed within the near surface organic and silty soils at the project site. The vane shear test is used to determine the in-place shearing resistance of soft soils that are so sensitive to disturbance that laboratory tests might provide misleading data. In general, tests were performed only in the surficial organic soils. Our estimated average soil shear strength values at depths of up to two feet below existing grade are shown below.

<u>Depth Below Existing Grade (feet)</u>	<u>Average Shear Strength (psf)</u>
0.5 - 1.0	520
1.0 - 1.5	550
1.5 - 2.0	460
0.5 - 2.0	500 (average for the stratum)

Plate dilatometer tests were performed at selected locations throughout the project site. The dilatometer test is used to collect in-situ soil strength, stress and settlement. The tests were performed to further supplement the laboratory consolidation test data. A description of the dilatometer test procedures, graphs of test results, and test data evaluation and conclusions are presented in the appended mini-report no. 1 prepared by Schmertmann and Crapps, Inc., dated January 24, 1983.

5.2 Evaluation of Laboratory Test Data

The strength and compressibility characteristics of the near surface organic and silty soils were evaluated considering laboratory test data (moisture content, organic content, Atterberg Limits, gradation, field consolidation and laboratory consolidation). Our geotechnical knowledge and past experience with similar soil types was also utilized in estimating the consolidation characteristics of the site soils. A summary of these engineering properties and characteristics is presented below.

Peat

<u>Engineering Property</u>	<u>Range of Values</u>
Moisture Content	209 to 1,319% (average = 800%)
Organic Content	6 to 29% (average = 13%)
Specific Gravity	1.6
Saturated Unit Weight	60 to 67 pcf
Void Ratio	7 to 19 (average = 15)
On Drained Shear Strength	240 to 850 psf (average = 500 psf)
Compression Index	4 to 11
Coefficient of Consolidation	0.85 to 2.4 sq. ft/day
Coefficient of Secondary Compression	0.04

Calcareous Silt

<u>Engineering Property</u>	<u>Range of Values</u>
Plastic Limit	37 to 62% (average = 48%)
Void Ratio	2
Saturated Unit Weight	94 pcf
Compression Index	0.5
Organic Content	2%
Moisture Content	80%

Based on our geotechnical knowledge and experience, the limestone encountered during our exploration program, is mostly porous to very porous, generally difficult to dewater and has strength properties that vary with depth and degree of porosity. Based on the results of standard penetration testing and our past experience with similar materials, we estimate the following strength parameters for the limestone.

<u>Limestone Description</u>	<u>Strength Modulus (KSF)</u>	<u>Ultimate Unconfined Compressive Strength (ksf)</u>	<u>Ultimate Shear Strength (ksf)</u>
Medium to Moderately Hard, Porous	10,000 - 15,000	18	16
Soft to Medium, Very Porous	2,000 - 7,000	8	6

6.0 GEOTECHNICAL EVALUATION

Two major geotechnical considerations will be discussed in the evaluation portion of this study. Six feet of general fill soils placed over the site will cause compression of the near surface peat strata. Buildings constructed on top of the general fill soils will require foundations capable of resisting anticipated design loads.

6.1 Geotechnical Mechanisms

6.1.1 Peat Consolidation - The placement of a 6 foot thick general fill over the existing site soils will result in settlement: both immediate and long term. Initial and primary (immediate) settlement will occur coincidental with fill placement. Long term or secondary consolidation will occur at an ever decreasing rate over the life of the structure. Secondary consolidation appears to be the result of plastic readjustment of the soil particles, progressive fracture of the soil particles, and of released adsorbed water under contact pressure.

The amount of near surface peat strata compression which eventually occurs is a function of the following: amount of fill placed, amount of compost stockpiled, variation in layer thickness, and variations in the peat deposit itself. The veneer of surface compressible soil ranged in thickness from 1.2 to 4.4 feet with the average thickness being 2.5 feet. The data is distributed as shown below.

<u>Compressable Soil Thickness, Peat.</u>	<u>Percentage For Each Thickness, Based On 76 Data Points</u>
1.5 - 2.0	4%
2.0 - 2.5	32%
2.5 - 3.0	30%
3.0 - 3.5	16%
3.5 - 4.0	13%
4.0 - 4.5	5%

This distribution of data indicates that about 78% of the compressable soil strata thickness is between 2.0 and 3.5 feet thick.

The first portion of peat consolidation is immediate and will occur coincidental with load application. Figure 1 on page 18 indicates that the amount of immediate compression depends on the applied stress and the compressable soil layer thickness. Placing 6 feet of fill soils that have an applied stress of 720 PSF will result in immediate settlement ranging from 5 to 9 inches for respective compressive layer thicknesses of 24 and 42 inches.

Secondary compression will continue at an ever decreasing rate indefinitely. Beyond a time period of 20 years this amount of compression is small. Secondary compression can be estimated from the following formula:

$$\frac{\Delta H}{H} = C \propto \log_{10} \left(\frac{t_2}{t_1} \right)$$

The coefficient of secondary compression in this equation has been estimated to be equivalent to .04. This number was selected from experience from other projects and correlated well with laboratory data collected on this project. Data shown on Figure 2 on page 19 was collected during a one week long laboratory consolidation test cycle. When this data is plotted on a log scale it becomes linear. The data collected in a one week period was extrapolated over a 20 year design life. In order to increase confidence in the long term prediction data collected from a test fill in Homestead, Florida is presented in Figure 3. Settlement monitoring of this test fill indicated that the majority of differential settlement occurred during the immediate portion of layer compression. Differential settlement over a distance of 40 feet for a time interval of 2 to 7 years was on the order of .01 inch.

Using the formula for secondary compression presented above results in an estimated layer compression of 1½ to 2½ inches over the time interval of 2 to 12 weeks

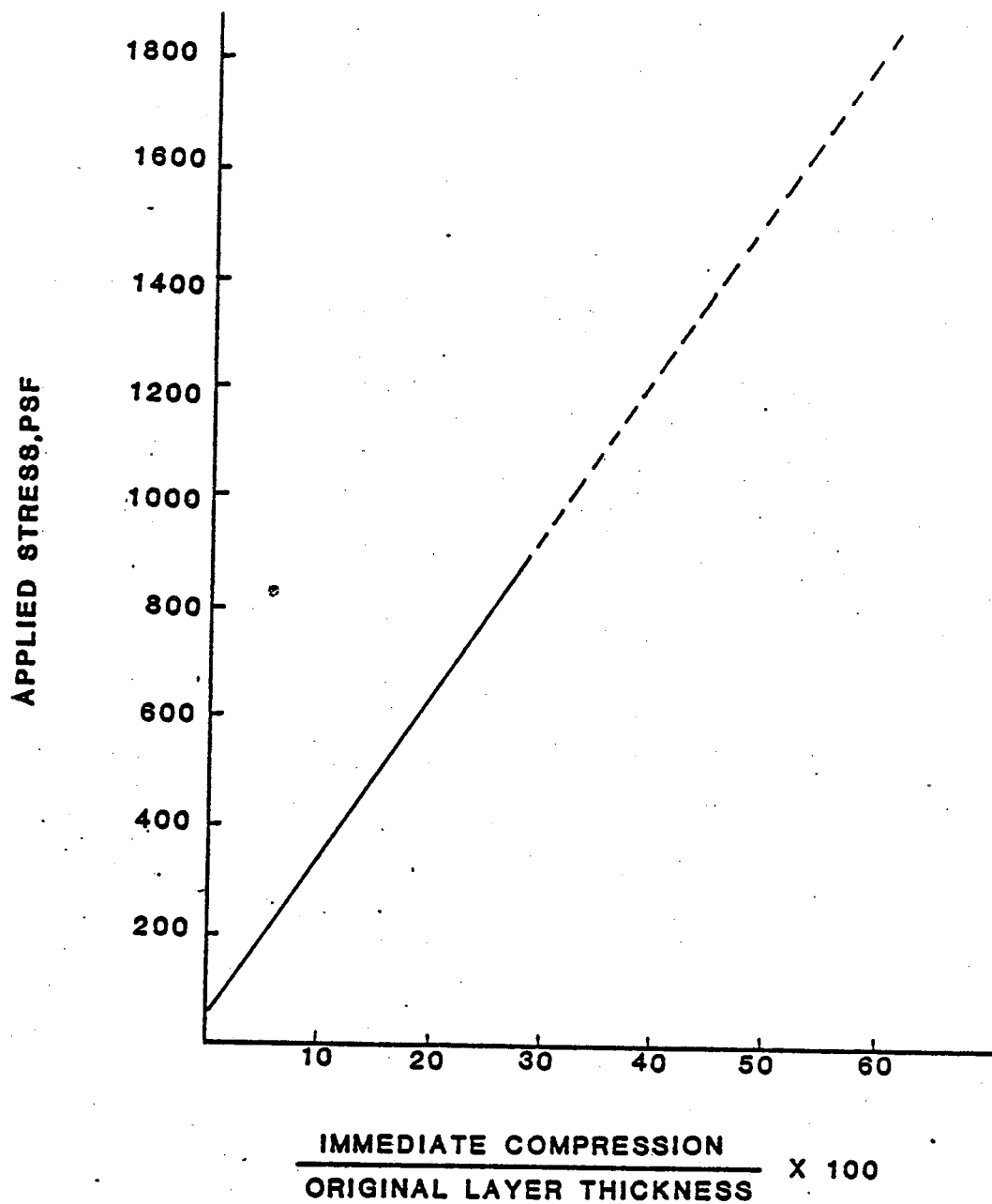


Figure 1 - Immediate compression for an applied load increment; extrapolated from laboratory consolidation tests on peat samples.

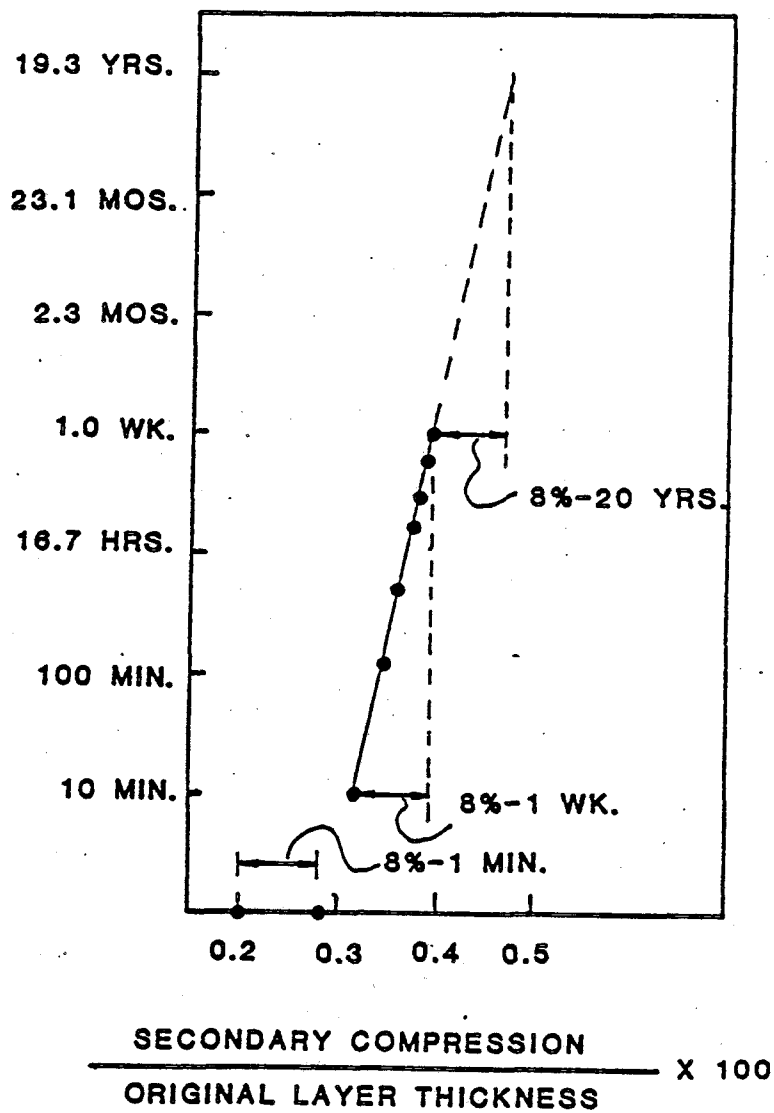
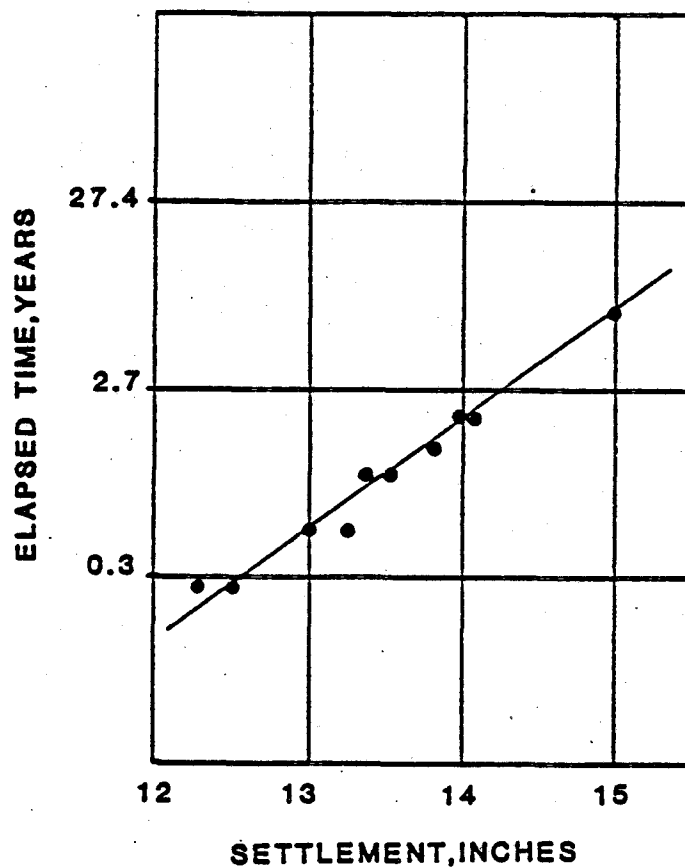


Figure 2 - Secondary compression extrapolated from laboratory consolidation tests on peat samples. Semilog plot of time versus secondary compression.



Notes:

1. Data from Test Fill No. 3 Homestead, $3\frac{1}{2}'$ fill
Placed over $7\frac{1}{2}'$ peat.
2. Measured settlement:

0-3 mos.	--	$12\frac{1}{2}"$
3-12 mos.	--	$1"$
1-7 years	--	$1\frac{1}{2}"$
3. Predicted settlement 7-20 years -- $\frac{3}{4}"$

Figure 3 - Secondary compression recorded for a test fill in Homestead Florida.

for a variation in layer thickness of 24 to 48 inches (layer thickness range encountered 78% of the time.) We further estimate that over the time interval of 3 months to 10 years layer compression would vary from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches with the corresponding variation in layer thickness of 24 to 42 inches. An additional $\frac{1}{2}$ inch of settlement is anticipated over the period 10 to 20 years. The estimates of secondary consolidation presented above considered the loading condition of 720 PSF or 6 feet of fill.

Field consolidation tests using a platform 3.8 feet square indicated immediate settlement similar to that predicted from laboratory tests. A load equivalent to about $3\frac{1}{2}$ feet of fill soil or a pressure of 425 PSF was placed on the square platform. Immediate settlement of the platform over a time period of 2 to 3 days ranged from 1.7 to 3.2 inches at test locations with respective layer thicknesses of 2.1 and 3.6 feet.

During the design life of the compost facility above grade storage is anticipated for bulking agent, finished product, within the pug-mill and screening area and within the compost hall. Placement of long term surface loads will result in additional settlements. Settlements from long term above grade storage will be both immediate and long term. A stored compost height of 15 feet is anticipated with a unit weight of 63 pounds per cubic foot. Or, stored compost will exert an additional 945 PSF of load.

Settlement which will occur as a result of compost storage can be reduced by placing preload soils over storage areas in order to cause immediate and a portion of the long term settlements to happen prior to asphalt paving. A preload height of 8 feet of compacted fill will be equivalent to compost storage. This preload should be kept in place for a minimum of one month. Leaving the preload fill in place for a longer period of time will reduce the predicted amounts of secondary compression. It would be desirable to leave preload in place for a period of 3 months.

We anticipate that differential settlements resulting from long term compression will be on the order of $1\frac{1}{2}$ inches over a distance of about 50 feet where a uniform loading condition is applied. Critical differential settlements will occur where abrupt

changes in applied stress occur. Examples of such areas would be transition between an undercut and non-undercut profile, transition between a storage and non-storage area, and a transition between a drilled shaft supported structure and the surrounding soil.

A summary of the estimated settlements are presented in the table below.

**SETTLEMENT ESTIMATES FOR
PEAT CONSOLIDATION, INCHES***

<u>LOADING CONDITION</u>	<u>0 - 2 WEEKS</u>	<u>2 - 12 WEEKS</u>	<u>1/3 - 10 YEARS</u>	<u>10 - 20 YEARS</u>
6 foot of fill (720 psf)	7 ± 2	$2 \pm \frac{1}{2}$	$2 \pm \frac{1}{2}$	$\frac{1}{2}$
15 foot of compost storage (945 psf), no preload	6 ± 2	$2 \pm \frac{1}{2}$	$2 \pm \frac{1}{2}$	$\frac{1}{2}$
Fill and Preload (1665 psf)	13 ± 4	$2 \pm \frac{1}{2}$	NA	NA
Compost Hall Floor, Following Compost Storage, Preload Utilized	Small	$2 \pm \frac{1}{2}$	$2 \pm \frac{1}{2}$	$\frac{1}{2}$

* Calculations are for average layer thickness (30 inches). Tolerances shown consider variations in layer thickness over a range of 24 to 42 inches which represents 78% of the data collected.

6.1.2 Limestone Supporting Ability - Beneath the near surface peat deposit the predominant strata is cemented limestone. This limestone strata has been known to support column loads on the order of 1,000 kips while undergoing small amounts of settlement. Contact pressure on the order of 4KSF have been typical for the limestone formation. Considering the anticipated magnitudes of load on this project we generally estimate about $\frac{1}{2}$ inch of compression within the limestone formation as a result of individual column loads and stock piled compost.

The limestone formation has also demonstrated its ability to transfer shear forces on other projects. We estimate the limestone to have an ultimate shear capacity of about 8KSF. Foundation elements grouted into the limestone formation should be capable of an ultimate shear transfer of about 3KSF over the entire length of embedment.

6.2 Foundation Systems

6.2.1 Shallow Foundations - Shallow foundations may be utilized for the administration and maintenance building, pug-mill/screening structure provided one of the following: 1) Peat soils are undercut and removed and replaced with granular backfill, 2) Preload soils are placed over the peat deposits simulating twice the building weight. Preload soils above building areas should remain in place a minimum of 3 months in order to reduce the magnitude of secondary consolidation. This preload scheme should reduce secondary settlements to about 3 inches over a period of 3 months to 20 years. Differential settlement utilizing this preload scheme should be on the order of $1\frac{1}{2}$ inches over a distance of 50 feet. Shallow foundations were evaluated with allowable soil contact pressure of 3,000 PSF.

6.2.2 Drilled Shafts - Drilled shafts derive their axial load capacity from 2 components: Shear transfer (skin friction) between the concrete and rock interface and end bearing or point resistance at the base of the shaft. The amount of drilled shaft movement required to fully mobilize shear strength transfer is usually on the order of $\frac{1}{4}$ inch, and typically, independent of drilled shaft diameter.

The end bearing or point resistance, however, is mobilized upon tip movements on the order of 5 to 25% of the shaft diameter when bearing in soils or weak rocks. In our evaluation we have only considered the shear transfer capacity. Stress from a drilled shaft foundation on this project would be transferred to the limestone unit. Shear stresses near the top of the embedment area will be high with only reduced stresses being

transferred near the tip of the shaft. As the stress is distributed down the shaft, portions of the drilled shaft near the surface of the embedment will exceed the allowable shear stress and then mobilize some residual strength.

Our evaluation considered a 36 inch diameter shaft. A factor of safety of 2.5 was used to establish a working capacity. We estimate that each drill shaft will have an ability to resist tension forces in the amount of $\frac{1}{2}$ the compression load capacity. We estimate that a drilled shafts constructed to a tip elevation of -24 feet (a total limestone embedment of about 20 feet) will have a compression and tension (uplift) capacities of 150 and 75 tons respectively. The lateral load capacity of a drilled shaft is derived from a combination of structural shaft rigidity and passive soil resistance. We estimate an allowable soil passive force acting over a 3 foot diameter drilled shaft to be about 1.5 tons acting at an elevation of +5 feet, or approximately 2 feet below finish grade. The drilled shaft should be designed considering a point of fixity at the limestone surface or about elevation -4 feet.

We estimate that each drill shaft will settle about $\frac{1}{2}$ inch under the compression loads of 150 tons.

6.2.3 Augercast Piles - Augercast piles develop their load carrying capacity primarily in skin friction. We estimate the compression and tension (uplift) capacity of a 14 inch diameter augercast pile to be 75 and 30 tons, respectively. These estimated pile capacities consider a pile embedment (rock socket) into the limestone unit of at least 20 feet (a common tip elevation of about -24 feet.)

6.2.4 Pressure Injected Footings - A pressure injected footint (PIF) consists of a cased or uncased shaft with an expanded base. The base is formed using a drop hammer to ram zero slump concrete into the soil or rock with high impact energy. The concrete shaft transmits the structural loads to the expanded base. It would be possible to construct 1 PIF beneath each column in the compost hall with a 3 foot square concrete cap.

We estimate a pressure injected footing installed to elevation -14 or approximately 10 feet into the limestone surface will have compression and tension capacities of 150 and 30 tons, respectively.

6.3 Tolerable Settlement

The allowable amount of settlement that a structure may tolerate is dependent on many factors including: the uniformity of settlement, the time rate of settlement, the structural dimensions, and properties of structural materials. Generally, total or uniform settlement does not damage a structure but may affect access drainage and utility connections. These can generally tolerate movements in excess of 1 foot. In contrast, differential settlement affects the building's frame and is limited by the building structural flexibility.

The allowable differential settlement of a structure is based on both theory and observations of actual structures which have suffered damage. For a steel frame building, tolerable differential settlement over a distance of 30 feet is about 1 3/4 inches. Generally allowable differential settlements are based on angular distortion between adjacent columns of approximately 1/300 (ratio settlement to span length). Sensitive structures or those containing precision equipment may require limiting angular distortion to 1/500.

6.4 Site Preparation

Site preparation will consist of either removing a veneer of surface peat or placing fill soils directly on top the peat.

Excavation of the peat stratum and replacement with granular fill soils would most likely involve dragline removal of the stratum. Granular soils would be "end-dumped" into standing water. Once fill soils were about 1 foot above static ground water level compaction would begin using a 10 ton vibratory roller. This fill process will result in

some loose soil zones beneath the ground water level which have been considered in our evaluation. Fill soils placed by the end-dumping method will force soft or trapped soils to the leading edge of the fill. Occasional passes of the drag line may be necessary to remove these soft soils being displaced by the fill.

If the peat soils are to be left in place and consolidated careful clearing is necessary. The objective in the clearing process is to leave the peat stratum in a relatively undisturbed state. This objective will require wide track dozers or hand labor be used to clear vegetation. Site vegetation should either be burned on site or removed by truck. When large trees are encountered they should be cut flush with the ground surface in lieu of removing and causing large surface disturbances. During the course of our study we observed full track swamp vehicles operating on the site having a track contact pressure of about 120 PSF.

Fill placement over the existing peat layer would begin by "end-dumping" soils on one edge of the project. These "end-dumped" soils would then be bladed over the site with a dozer in 1 foot lifts. The dozer would work off the surface of the granular sandy fill pushing soil out on to the cleared peat surface. Once the first lift of fill soils are placed the compaction process may begin with a 10 ton vibratory roller. Installing the first lift of fill soils over the carefully cleared peat stratum is the critical portion of the site preparation process.

It is important to: remove the existing surface vegetation without disturbing the peat strata, limit surface disturbance of the peat stratum by construction equipment, and place the first foot of fill soils without disturbing the peat.

Using geotextile fabric on this project is not anticipated, geotextile fabric would serve the function of separating fill soils from the existing peat stratum. Usually geotextile fabric is used when instability occurs in thin fill sections usually less than 3 feet in thickness. Since 6 feet of fill soils will be placed over the existing profile we do not foresee this instability or the need for geotextile fabric during site preparation.

6.5 In-Situ Soil Blend

We have evaluated the feasibility of blending in-situ peat soils with sand in order to economize earth work activities.

Information supplied to us prior to our field exploration indicated surface soils to be fibrous muck and marl. When these general soil descriptions have been used in the past, soil classifications have ranged from black sand to fibrous peat. The soils in central and western Broward County represent fingers of Everglades soils. These soils vary from silty sand to fibrous peat. One earth work project in Tamarac, Florida blended dredge sand with existing silty sands (50% silt, 50% sand) and used this blended mixture for structural fill.

Unfortunately, the soils encountered in our field exploration were not silty sands, rather they were rather uniform peat deposits characterized by their very fibrous nature and high water content. Working with small peat samples in the laboratory indicate that some degree of stability can be achieved when 1 part peat is blended with about 2 to 3 parts sand. While the mixture had some stability in the laboratory it is questionable whether this mixture would be stable under construction traffic. Another disadvantage of blending peat soils with sand would be the long term potential for decomposition since the peat soils would now be above the ground water table.

Blended soils can not be placed directly on the peat profile. If peat soils remain in place, a 2 foot thick working platform of sand would be necessary. A blended mixture of peat and sand can not be "end-dumped" and spread directly on the existing surface soils.

The blending action itself is difficult because of the fibrous nature of the peat. Usually blending of soils during construction is accomplished by motor grader mixing. The fibrous nature of the peat suggests this construction procedure will not be feasible. We envision a special piece of blending equipment, such as that used for asphalt stabilization, would be necessary to accomplish a uniform blend.

The concept of blending fibrous peat with sandy soils was discussed in telephone conversations with 2 earthwork contractors. It was their opinion that any cost savings from this material being used on site would be offset by the effort of the blending action and the high quantities of sand required to produce a stable mixture.

Based on the above discussion it is our opinion that blending of a fibrous peat with off-site sandy soils will not be feasible on this project site.

6.6 Groundwater Fluctuations

The primary source of potable groundwater in Broward County is the Biscayne Aquifer. The Biscayne Aquifer is a very permeable, unconfined hydrologic unit of water bearing rocks ranging in age from latter Miocene to Pleistocene.

The Biscayne Aquifer reaches its maximum thickness of about 200 feet in the Fort Lauderdale area along the Atlantic Coastal Ridge, and wedges out in the western portions of the county. The Biscayne Aquifer is one of the most productive aquifer systems in the nation. The high permeability of the formation is attributed to the solutioned nature of the limestones and sandstones which comprise the major portion of the aquifer.

The Biscayne Aquifer is mainly recharged by local rainfall. Discharge occurs principally by means of evapotranspiration, pumping, and by flow into canals and the ocean. The groundwater level in the unconfined aquifer fluctuates with seasonal rainfall conditions.

During summer months and periods of heavy rainfall, the groundwater level may be encountered at higher than average elevations. At the time of our geotechnical exploration the groundwater level was at a high level due to previous rainfall, and South Florida Water Management District canal level control. For more detailed yearly ranges and averages, reference should be made to groundwater maps published by the South Florida Water Management District (SFWMD), and the United States Geological Survey (USGS), Water Resources Division.

Since groundwater level variations are anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based on the assumption that variations will occur.

6.7 Embankment Slopes

Storm water detention areas are planned throughout the project. The base of storm water detention areas will be similar to existing site grade. These areas will be surrounded by general site fill with a thickness of about 6 feet. The top of fill in the vicinity of the retention areas will receive occasional light vehicle traffic. It is understood that the retention areas will not accumulate standing water during their design life. In other words, the embankments are not being evaluated as water impounding structures. Where storm water detention areas are adjacent to property lines, or other storm water areas the width of embankment at the top of fill varies from 10 to 30 feet.

We have evaluated embankment stability assuming conservative soil conditions; sandy soils with an angle of internal friction of 30 degrees, compacted to 95% of modified proctor maximum dry density. Embankment slopes on both inside and outside slopes can be designed for $1:1\frac{1}{2}(V:H)$. If embankment slopes are not protected from erosion with a vegetative cover, surface sloughing can be expected from rainfall activity and variations in surface moisture content. It may be desirable to flatten embankment slopes to $1:2(V:H)$ if the slopes are to be maintained; this flatter slope will better accommodate maintenance traffic.

7.0 GEOTECHNICAL RECOMMENDATIONS

7.1 Site Preparation/Shallow Foundation Construction

Site preparation will consist of clearing vegetation, placing 6 feet of general fill soils, and preloading the storage and building areas. Alternates to the preloading scheme include removal and replacement of the peat stratum, or utilization of a deep foundation system.

Site preparation will begin with vegetation removal. Vegetation removal should include trees and low brushes found over the majority of the site. Surface grasses may remain in place. We anticipate low pressure or wide track dozers can clear most of the site. Localized soft areas may require hand clearing. Trees larger than 4 inches in diameter should be cut at the base rather than being removed. Removal of large root systems will cause surface disturbance of the near surface peat layer and contribute to the difficulty of placing the first layer of fill. The objective in the clearing process is to minimize surface disturbance so that fill soils will consolidate the peat stratum in a somewhat uniform fashion. The cleared materials should be burned on site or hauled to an environmentally acceptable area.

Following clearing the first lift of fill soil should be placed. The filling operations should progress from an existing stable soil area; such as US 441 right-of-way. Fill soils will be "end-dumped" on the cleared peat stratum. A dozer working off the fill soils will push fill out on to the peat surface; thus minimizing surface disturbance. The first lift of fill soils on the peat stratum should be sandy soils with 100% passing the number 4 sieve and no more than 10% passing the number 200 sieve. Sandy soils provide better drainage paths than crushed limestone; and good drainage paths enhance the consolidation process. After the first lift of fill soils are placed, crushed limestone or sandy soils may be utilized. The first layer of fill should be placed as thin as possible. A 1 foot thickness is desirable, however this lift may be as thick as 2 feet. The objective is to build a thin lift

in order to get compaction but at the same time providing a fill thickness capable of supporting construction and compaction equipment. The first lift, 12 or 24 inches thick, should be compacted with 4 passes of a 10 ton vibratory roller. No minimum density or stability requirements should be specified for this lift. Subsequent lifts of fill soils should have a loose lift thickness of 12 inches and be compacted to 95% of modified proctor maximum dry density. Representative in place density tests should document the fill process.

Following general fill placement we recommend that either: an 8 foot thick preload or a pavement design which can tolerate the settlements presented on page 22; be used in the following storage areas: finished product, long-term bulking agent, short-term bulking agent, and compost hall. The preload should cover a plan area of 5 feet outside the limits of storage. The preload should be left in place a minimum of 1 month; however, it is desirable to leave the preload in place for 3 months or longer in order to reduce the amounts of secondary settlement.

We recommend preloading in the administration/maintenance buildings areas and pugmill/screening building. The preload height in these areas should be equivalent to twice the weight of the full anticipated dead plus live load. The preload should extend 5 feet outside of all building limits. Preload fill soils in these areas should remain in place a minimum of 3 months; with a longer time being desirable in order to reduce some of the predicted long-term settlements. Structures to be placed within preload areas should be designed to resist 3 inches of total settlement and $1\frac{1}{2}$ inches of differential settlement over a distance of 50 feet. We recommend preloads over building areas be monitored. Four settlement monitoring plates should be placed in the administration/maintenance building while 8 plates should be used in the pugmill/screening structure. Settlement plates should be installed prior to the placement of preload fill soils and settlement readings should be taken at the following time intervals: 1 day, 4 days, 1 week, 2 weeks, 4 weeks, 8 weeks, and 12 weeks. Settlement plate elevations should be recorded to the nearest 0.001 foot.

We recommend that arterial road ways and/or utility corridors be preloaded with 2 feet of fill soils in order to reduce a portion of long-term secondary settlements. The preload in these areas should remain in place a minimum of 1 month; with a longer period being desirable in order to reduce additional secondary settlements. The roadways and utility corridors should be designed to resist 3 inches of total settlement and $1\frac{1}{2}$ inches of differential settlement over a distance of 50 feet. A minimum thickness of 24 inches of fill should separate utility inverts and the top of the peat stratum.

As an alternate to preloading we recommend removal of the peat stratum and replacement with granular backfill (either sand or crushed limestone). We anticipate the peat will be removed with either a drag line or a large front-end loader working in 3 to 4 feet of water on top of a sand surface. Fill soils will next be "end-dumped" in the wet. Fill soils will be back dumped from trucks and then bladed into the 3 to 4 foot depth of water. A 10 ton vibratory roller should be used to compact the "end-dumped" soils once the fill surface is about 1 foot above the stabilized ground water level. When undercutting is used on a portion of the project designers should recognize that abrupt differential settlement will occur between the undercut and non-undercut areas.

Another alternate to either preloading or undercutting/replacement schemes would involve using deep foundations for the administration/maintenance buildings and pugmill/screening structure. Abrupt differential settlements will occur between a deep foundation system and a fill which is slowly settling due to long-term consolidation of a peat stratum.

We recommend shallow foundation design in fill soil areas which have either been preloaded or have the peat stratum undercut and replaced with granular fill. Shallow foundations should be designed for a maximum allowable bearing pressure of 3 KSF. Wall foundations should have a minimum width of 18 inches while isolated interior foundations should be designed to be 24 inches square or larger. Shallow foundations should bear 12 inches below outside finished grade.

7.2 Deep Foundations

We have evaluated the following deep foundation systems for this project: pressure injected footings, augercast piles, and drilled shafts. Based on requirements for uplift; possible variations in the final design, discussions with the design team, and economic considerations, it appears that drilled shafts are the best choice for a foundation system on this project.

We recommend drilled shafts for support of the compost hall structure and as an alternate design for the administration/maintenance building and pugmill/screening structure.

We recommend 1 shaft be used for support of each column. Thirty-six inch diameter drilled shafts are recommended with a compression capacity of 150 tons and a tension or uplift capacity of 75 tons. These capacities are recommended for a drilled shaft installed to elevation -24 feet or a total shaft length of about 31 feet. Drilled shaft lateral capacity is obtained from passive fill soil resistance and through shaft rigidity with a shaft being fixed at the top of the limestone or about elevation -4 feet. We estimate the soil will have a passive lateral capacity of about 1.5 tons acting about 2 feet below finish grade or elevation +5 feet. Drilled shafts should utilize a full length reinforcing cage designed by the structural engineer. Concrete strength should be that required to develop structural integrity. A concrete slump of 7 inches plus or minus 2 inches is recommended.

The following construction procedure is recommended. We anticipate utilization of the temporary casing method with concrete being placed in the wet. Temporary casing which is 6 inches larger than the drill shaft diameter, or 42 inch diameter is recommended. It should be installed with vibratory equipment 2 to 5 foot into the limestone surface. The drilled shaft socket should be advanced with cutting tools; with the cuttings being removed with clean out buckets or an airlift. If sand inclusions within the limestone make clean out difficult or time consuming, temporary casing should be advanced to a greater depth. When additional inner casing is used a reduced 36 inch

diameter may be used. We generally anticipate a 5 to 15 foot open vertical rock socket will be possible. Following sand and limestone cleanout the full length reinforcing cage should be placed. Concrete placement should be through a 12 inch diameter gravity tremmie or a 4 inch diameter concrete pump. The tremmie/pump should remain imbedded 10 feet into the concrete surface at all times. Concreting activities within each drill shaft should be completed 2 hours after initiation of concrete placement.

When the concrete overflows onto the surface of the fill the temporary casing may be removed with vibratory equipment. Once the temporary casing is removed the surface cutoff elevation may be adjusted with reinforcing steel and anchor bolts located in their final position. The drilled shaft contractor should be an organization having a minimum of 5 years of experience in drilled shaft construction. This experience should be relevant to the anticipated subsurface and groundwater conditions, shaft sizes and any special techniques required. Experience in South Florida has indicated that a thick bentonitic mixture may reduce skin friction. For this reason we recommend temporary casing be used with no bentonite. The construction procedures outlined above are tentative and will be finalized during the load test installation. In order to comply with the South Florida building code one load test will be required on a production drilled shaft. This load test should be to twice the shaft working design capacity. The test shaft installation procedures should be similar to those that will be used for production shafts. Test and reaction shafts should be instrumented with telltales. The test shaft location should be selected by KBC Consultants. The drilled shaft load test should be performed according to the procedures outlined in ASTM D-1143-74, "Standard Method of Testing Piles Under Axial Compressive Load".

During drilled shaft installation, close inspection by the geotechnical engineer, who is familiar with the subsurface soil conditions at the site, is considered necessary in order to verify the shafts are installed according to design criteria.

We recommend the following allowable tolerances for drilled shaft construction: the maximum permissible variation in horizontal location should be $1/24$ of the shaft diameter or 3 inches whichever is less. Concreted shaft should have an out-of-plumbness of not more than 2% of the length. The variation in the top of shaft elevation should not exceed +1 to minus 3 inches.

8.0 REPORT QUALIFICATIONS

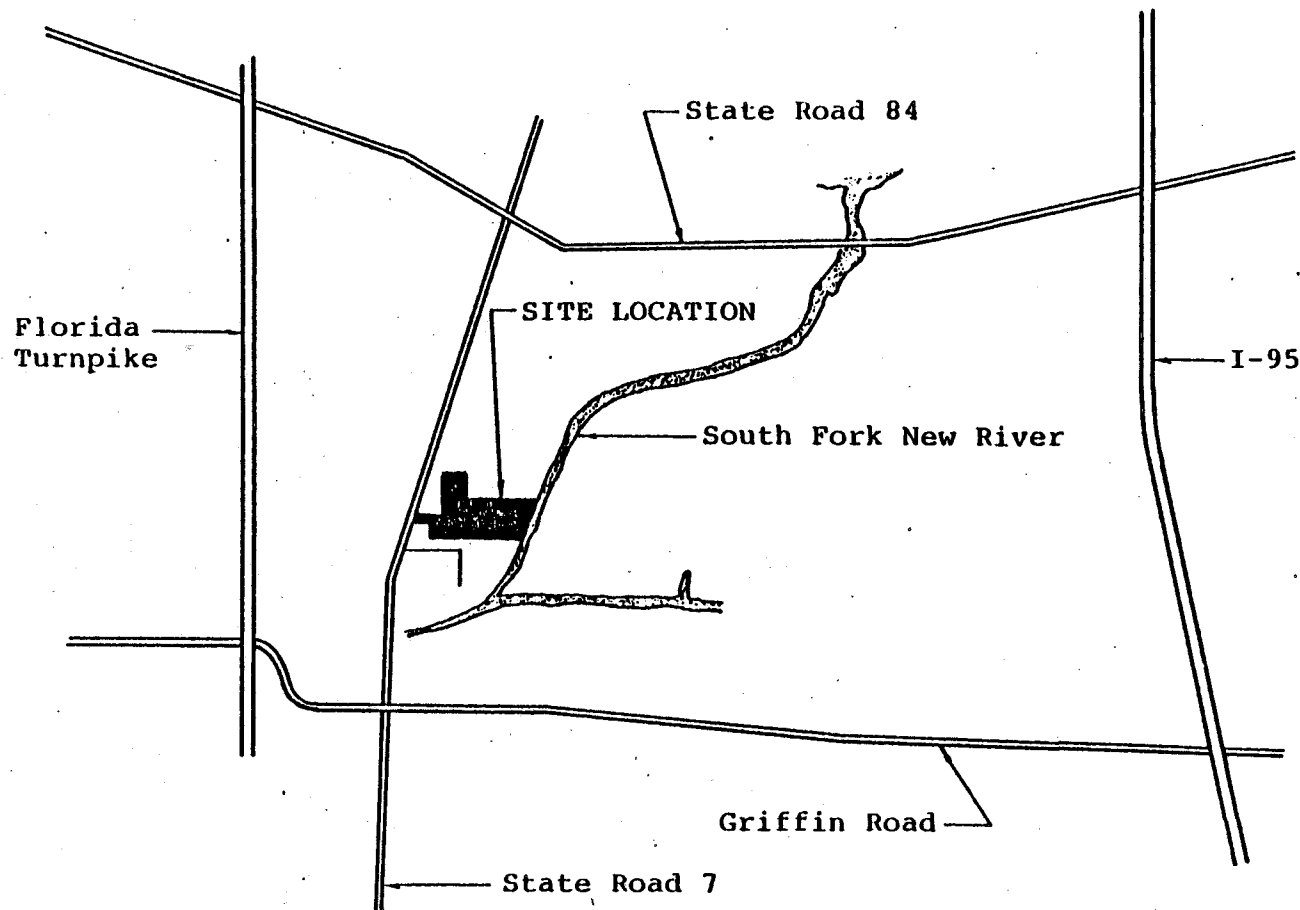
This report has been prepared for the exclusive use of Hazen and Sawyer, P.C. for a specific application to the Compost Facility in Fort Lauderdale, Florida in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

The evaluation and recommendations submitted in this report are based in part upon the data obtained from the field exploration and laboratory tests. The nature and extent of variations between test locations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.

In the event that any changes in the nature, design, or location of the structures are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing.

We should be provided the opportunity to review final foundation design and specifications in order that our recommendations may be properly interpreted and implemented.

APPENDIX



A-1

KBC CONSULTANTS, INC.
GEOTECHNICAL SERVICES

HAZEN & SAWYER, ENGINEERS
HOLLYWOOD, FLORIDA
KBC PROJECT NO. 8202

SITE VICINITY MAP
SLUDGE MANAGEMENT PLAN
DRAWING NO. 1

Dwn.

Ckd.

Date



SCALE: 1" = 140'

LEGEND



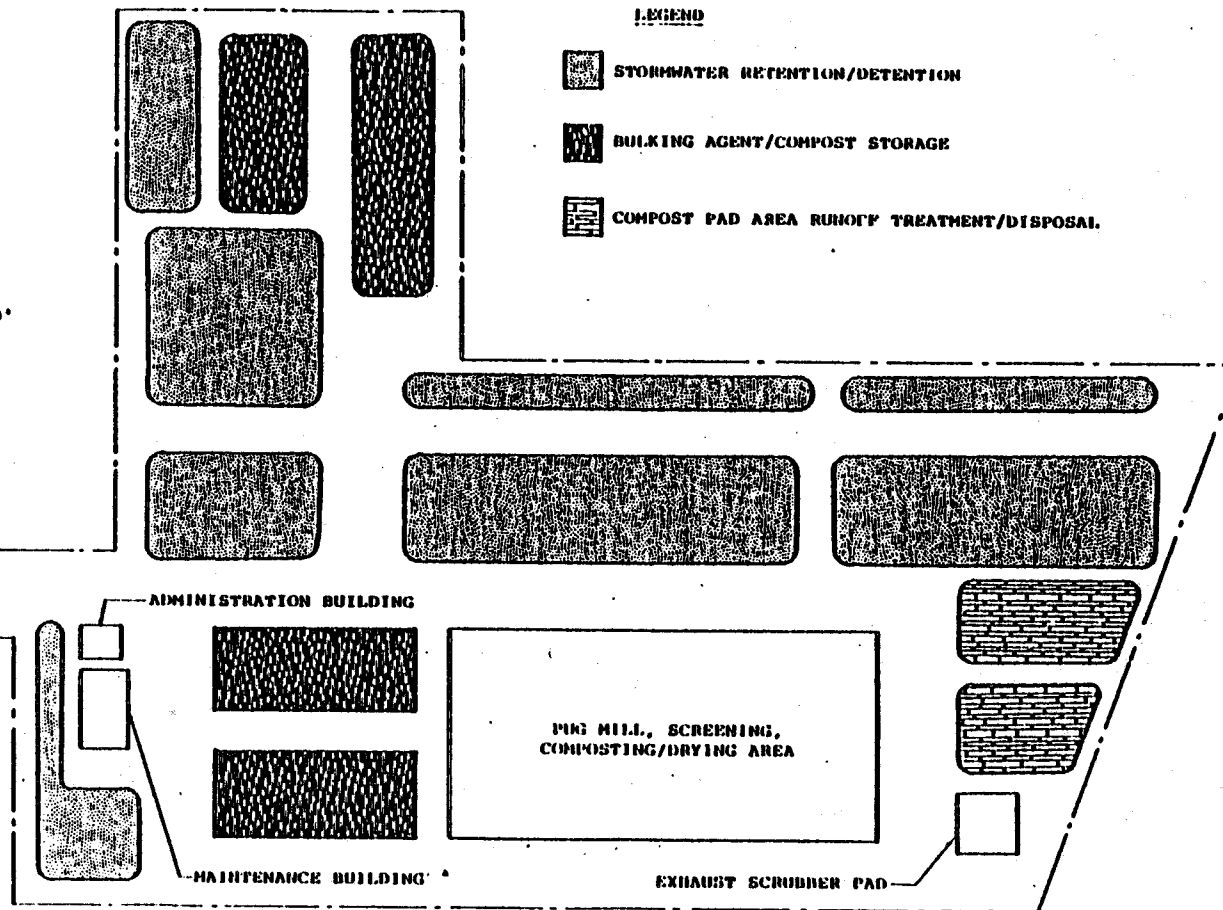
STORMWATER RETENTION/DETENTION



BULKING AGENT/COMPOST STORAGE



COMPOST PAD AREA RUNOFF TREATMENT/DISPOSAL



NOTE: Structure locations are approximate as obtained from Hazen & Sawyer's Compost Site Plan, Plate 3, Aug. 18, 1982.

A-2

KBC CONSULTANTS, INC.
GEOTECHNICAL SERVICES

HAZEN & SAWYER, ENGINEERS
HOLLYWOOD, FLORIDA
KBC PROJECT NO. 8202

SITE LAYOUT PLAN
SLUDGE MANAGEMENT PLAN
DRAWING NO. 2

Rev.	Chd.	Date
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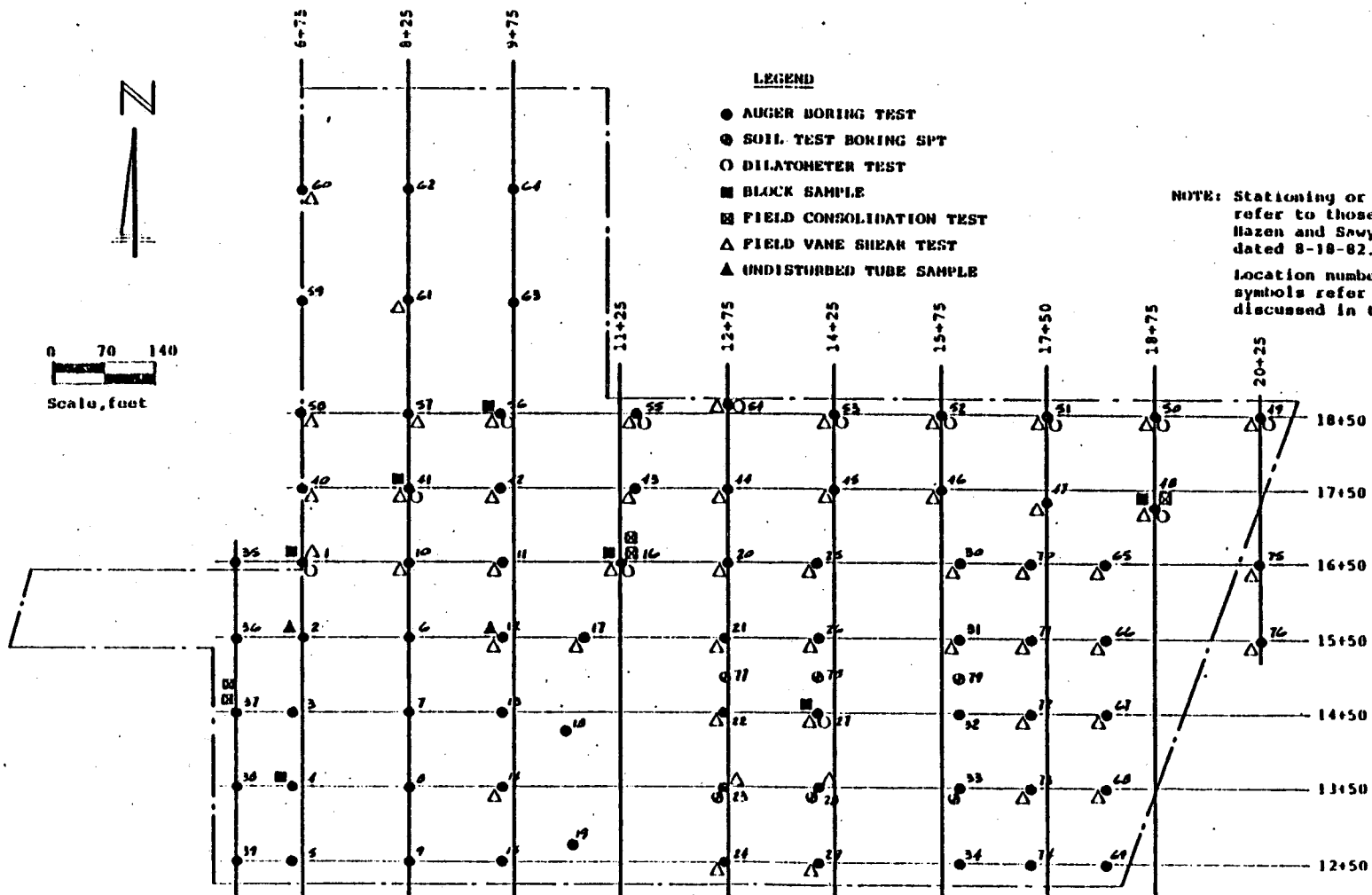
0 70 140
Scale, feet

LEGEND

- AUGER BORING TEST
- ⊙ SOIL TEST BORING SPT
- DILATOMETER TEST
- BLACK SAMPLE
- ▣ FIELD CONSOLIDATION TEST
- △ FIELD VANE SHEAR TEST
- ▲ UNDISTURBED TUBE SAMPLE

NOTE: Stationing or coordinate numbers refer to those shown on Hazen and Sawyer drawing Plate 3, dated 8-18-82.

Location numbers shown by test symbols refer to test numbers discussed in the Appendix of report.



A-3

KBC CONSULTANTS, INC.
GEOTECHNICAL SERVICES

HAZEN & SAWYER, ENGINEERS
HOLLYWOOD, FLORIDA
KBC PROJECT NO. 8202

TEST LOCATIONS
SLUDGE MANAGEMENT PLAN
DRAWING NO. 3

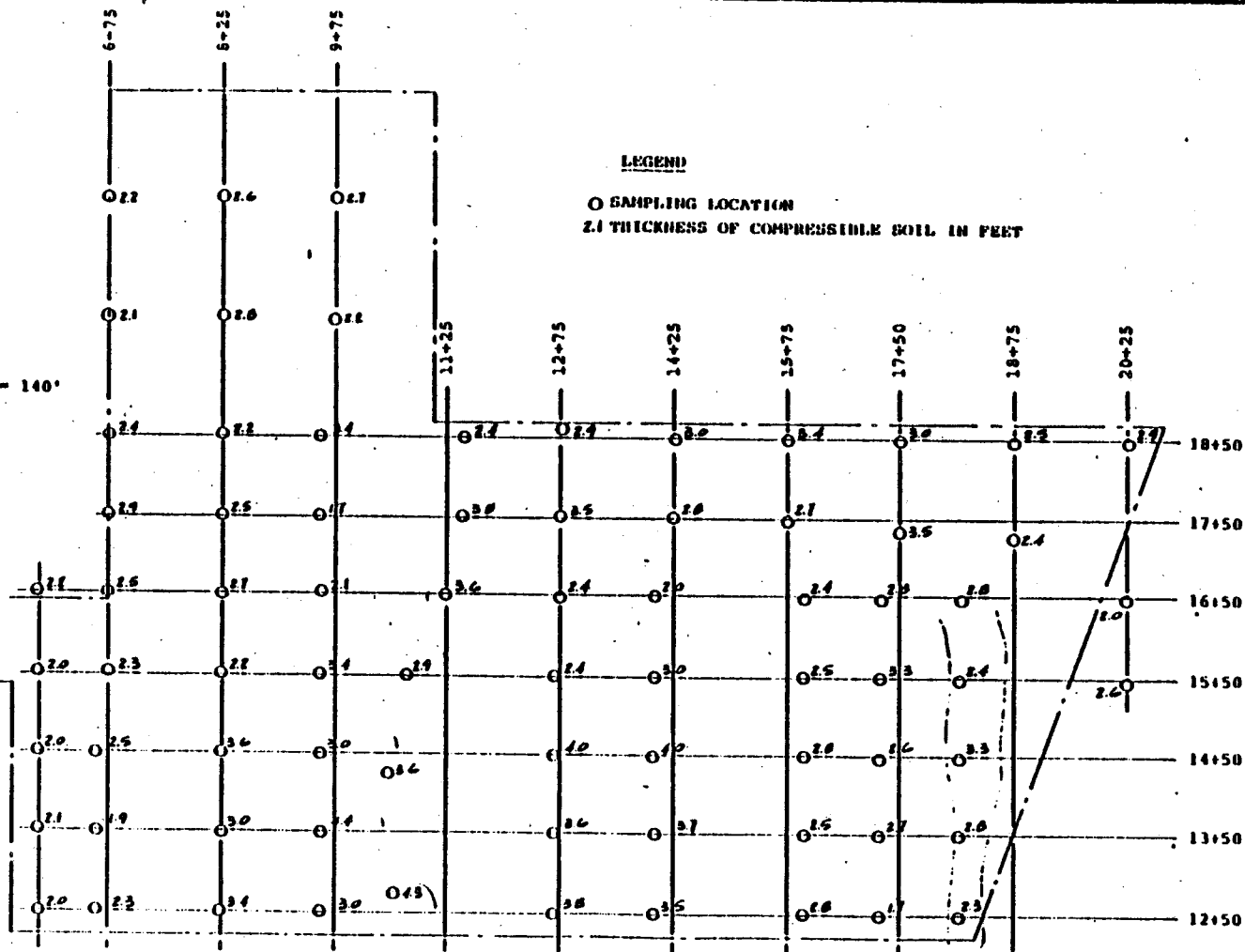
Drawn: _____ Checkd: _____ Date: _____



SCALE: 1" = 140'

LEGEND

○ SAMPLING LOCATION
Z: THICKNESS OF COMPRESSIBLE SOIL IN FEET



A-4

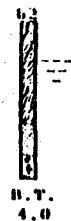
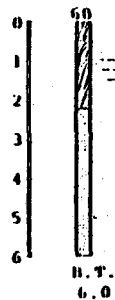
KBC CONSULTANTS, INC.
GEOTECHNICAL SERVICES

HAZEN & SAWYER, ENGINEERS
HOLLYWOOD, FLORIDA
KBC PROJECT NO. 8202

COMPRESSIBLE SOIL THICKNESS
SLUDGE MANAGEMENT PLAN
DRAWING NO. 4

Drawn.	Chkd.	Date
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DEPTH,
FT



LEGEND



BLACK TO BROWN SILTY FIBROUS PEAT



TAN AND GRAY SLIGHTLY SILTY MEDIUM TO FINE QUARTZ SAND

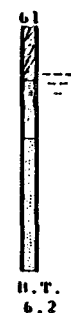
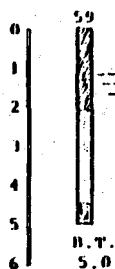


TAN QUARTZ SANDY SILT WITH TRACES OF ORGANICS



TAN SLIGHTLY SILTY MEDIUM QUARTZ SAND WITH LIMESTONE FRAGMENTS

- NOTES: 1) SUBSURFACE CONDITIONS MAY VARY BETWEEN BORING LOCATIONS.
2) THE RESPECTIVE RECORD OF HAND AUGER BORINGS SHOULD BE REVIEWED FOR MORE DETAILED SOIL DESCRIPTIONS AT SPECIFIC BORING LOCATIONS.



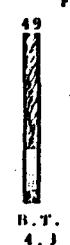
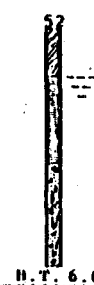
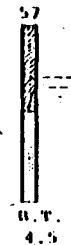
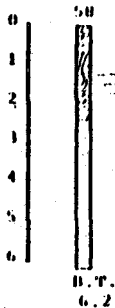
TEST LOCATION NUMBER

GROUNDWATER LEVEL.
(TIME OF BORING)

ESTIMATED STRATA BREAK

BORING TERMINATED
DEPTH TERMINATED

SCALE: HORIZONTAL - 1" = 100'
VERTICAL - 1" = 1.0'



DEPTH,
FT

A-5

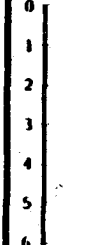
KBC CONSULTANTS, INC.
GEOTECHNICAL SERVICES

HAZEN & SAWYER, ENGINEERS
HOLLYWOOD, FLORIDA
KBC PROJECT NO. 8202

GENERALIZED SUBSURFACE PROFILE
SLUDGE MANAGEMENT PLAN
DRAWING NO. 6

APP. DATE

DEPTH, FT



B.T.
6.2



B.T.
6.0



B.T.
5.0



B.T.
6.0



B.T.
6.0



B.T.
3.5



B.T.
3.9

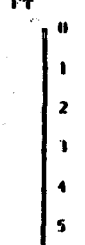


B.T.
3.7



B.T.
6.0

DEPTH, FT



DEPTH, FT



B.T.
6.0



B.T.
5.6



B.T.
5.6



B.T.
2.8



B.T.
5.7



B.T.
6.0



B.T.
6.0



B.T.
2.2



B.T.
6.2

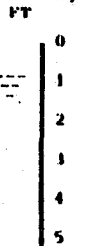


B.T.
4.3

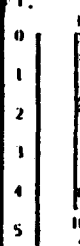


B.T.
5.0

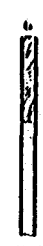
DEPTH, FT



DEPTH, FT



B.T.
4.5



B.T.
5.1



B.T.
6.0



B.T.
4.1



B.T.
5.7



B.T.
4.8



B.T.
6.0



B.T.
3.5

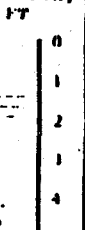


B.T.
4.0



B.T.
3.5

DEPTH, FT



NOTE: Refer to Drawing No. 5 for LEGEND and Notes.

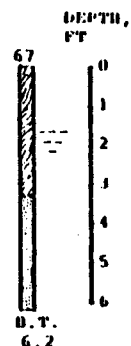
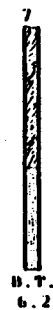
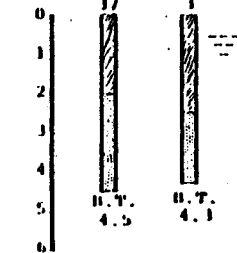
A-6

KBC CONSULTANTS, INC.
GEOTECHNICAL SERVICES

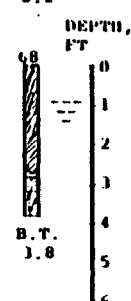
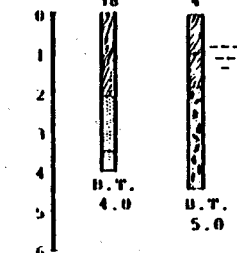
HAZEN & SAWYER, ENGINEERS
HOLLYWOOD, FLORIDA
KBC PROJECT NO. 8202

GENERALIZED SUBSURFACE PROFILE
SLUDGE MANAGEMENT PLAN
DRAWING NO. 6
OWN. APP. DATE

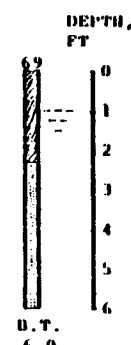
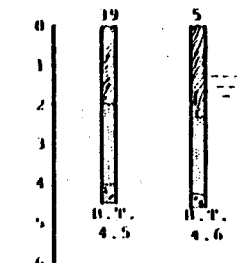
DEPTH,
FT



DEPTH,
FT



DEPTH,
FT



NOTE: Refer to Drawing No. 5
for LEGEND and Notes.

A-7

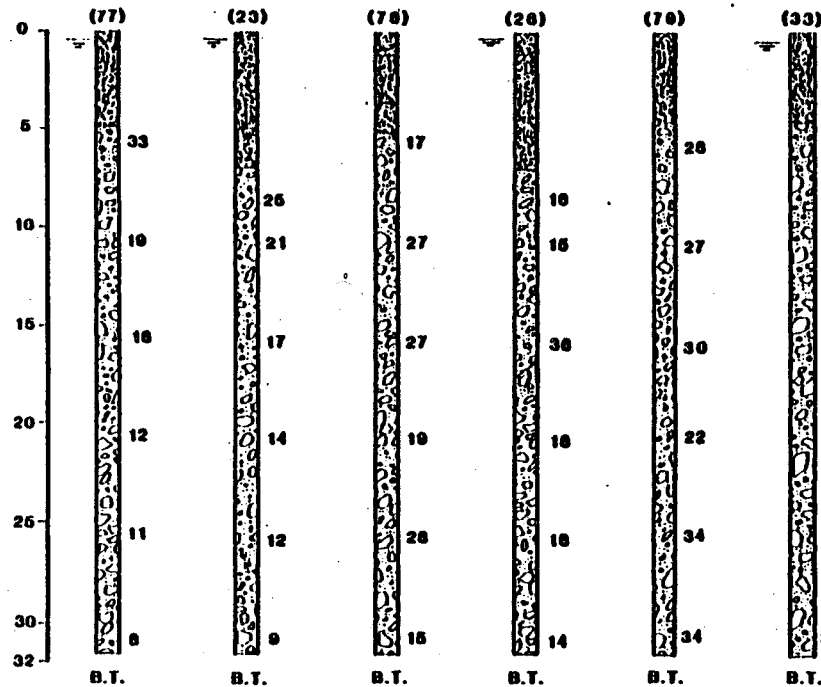
KBC CONSULTANTS, INC.
GEOTECHNICAL SERVICES

HAZEN & SAWYER, ENGINEERS
HOLLYWOOD, FLORIDA
KBC PROJECT NO. 8202

GENERALIZED SUBSURFACE PROFILE
SLUDGE MANAGEMENT PLAN
DRAWING NO. 7

OWN.	APP.	DATE
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DEPTH, FEET



DEPTH, FEET

LEGEND

PEAT/SILT/SAND

LIMESTONE

GROUNDWATER
LEVEL,
TIME OF BORING

(77) TEST LOCATION, REFER
TO DRAWING NO.3
28 STANDARD PENETRATION
RESISTANCE, BLOWS/FOOT
B.T. BORING TERMINATED

NOTES: 1) SUBSURFACE CONDITIONS MAY VARY BETWEEN BORING LOCATIONS.

2) THE RESPECTIVE RECORD OF TEST BORINGS SHOULD BE REVIEWED FOR MORE-
DETAILED SOIL DESCRIPTIONS AT SPECIFIC BORING LOCATIONS.

KBC CONSULTANTS, INC.
GEOTECHNICAL SERVICES

A-6

HAZEN & SAWYER, ENGINEERS.
HOLLYWOOD, FLORIDA
KBC PROJECT NO.8202

GENERALIZED SUBSURFACE PROFILE
SLUDGE MANAGEMENT PLAN
DRAWING NO.8

DATE	APPROVED	DATE
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FIELD EXPLORATION PROCEDURES

The field exploration for the proposed Compost Facility in Fort Lauderdale, Florida consisted of 76 hand-auger borings, 117 vane shear tests, 84 dilatometer tests, and 6 soil test borings. Soil samples and subsurface data were collected to a depth of about 30 feet below existing grade. In addition, 7 hand excavated block samples and two field consolidation tests were performed at the subject project. Standard penetration testing (SPT) was utilized to advance the soil test borings. All boring and field test locations were staked in the field by Messrs. Thomas J. Kaderabek, David Barreiro and Martin A. Call of KBC Consultants. The soil and rock samples recovered were examined by a geotechnical engineer and initially classified in general accordance with the procedures outlined in ASTM specification D-2488 (Unified Classification System).

The Record of Test Borings represent our interpretation of the field conditions based on engineering examination and laboratory testing performed on selected soil samples. These records depict subsurface conditions at the specific boring locations, and it should be noted that subsurface conditions may vary across the project area. The interfaces between soil and rock strata shown on the Record of Test Borings and Generalized Subsurface Profiles represent approximate boundaries. The transition between these materials may be gradual.

The data collection methods used during this study are briefly discussed in the following paragraphs.

Standard Penetration Test - The standard penetration tests were made in accordance with procedures outlined in ASTM D-1586-67 "Penetration Test and Split-Barrel Sampling of Soils". Each boring was advanced by a dynamic drilling process. Steel casing (3" I.D.) was necessary to stabilize the bore holes.

At regular intervals, the drilling tools were removed and soil and rock samples obtained with a standard 1.4" I.D., 2.0" O.D., split-tube sampler. The sampler was first seated 6 inches to penetrate any loose cuttings, and then driven an additional foot with blows of a 140 pound hammer falling 30 inches. The number of blows required to drive the sampler the final 12 inches is designated the "penetration resistance". The penetration resistance, when properly interpreted, is an index to soil or rock strength and relative density.

Representative portions of the soil and rock samples obtained were placed in glass jars and transported to our laboratory. Descriptions of the samples and penetration resistances are shown on the Record of Test Borings.

Hand-Auger Boring - Hand-auger borings were performed by manually rotating a hand auger sampler into the ground. At 6" intervals, the auger was removed from the boring and a geotechnical engineer classified the soils encountered. The auger borings were advanced to a depth of 6 feet, or to auger refusal in the underlying limestone stratum. Soil samples were sealed in glass jars and transported to our laboratory. The Record of Hand-auger Borings indicate the thickness of the subsurface profile along with the soil classifications.

Flat Plate Dilatometer - This field test consists of inserting a special low-strained flat plate with a sharpened bottom edge into the soil. The probe is stopped at suitable depth increments, usually 6 or 8 inches, and the tests are performed. The rods carry an electrical and air line from the surface to a thin, circular, metal membrane on one side of the plate. By use of a control unit with a pressure regulator, a gauge, and audio signals, the operator determines the A-pressure required to initiate movement of the membrane and the B-pressure required to move the membrane 1 mm into the soil to ± 0.05 bar (0.05 tsf).

The dilatometer test obtains in-situ soil strength, stress, and settlement parameters to supplement other field exploration and laboratory testing techniques.

Vane Shear Test - The test consists of placing a 4-bladed vane in the undisturbed soil and rotating it from the surface to determine the torsional force required to cause a cylindrical surface to be sheared by the vane. The maximum torque registered on the torque wrench was recorded at each location and depth. The recorded torsional forces were then converted to a unit shearing resistance over the cylindrical surface. These values are shown on the attached Record of Vane Shear Tests.

Undisturbed Sampling - Thin-walled shelby tubes with a diameter of 3" and a length of 30" were manually pushed into the surficial soils. The tubes were either pushed from the ground surface or a hand-auger boring was performed to allow for a deeper sample to be obtained. Once the tube was advanced to the test depths, a plastic plug was placed in the tube to aid in sample recovery. Upon removing the tube from the hole, it was sealed to prevent moisture loss. The tube was then labeled and transported to our offices. Due to the nature of the organic soils encountered, thin-wall tube sampling did not obtain undisturbed samples and this field testing method was discontinued.

Undisturbed Block Samples - This undisturbed sampling method consisted of excavating a perimeter trench around the sample area to the sample stratum termination. The block sample was trimmed in the excavation to within $\pm 2"$ of the sample size required. The top of the sample area was trimmed and the block sample removed from the excavation. Additional trimming was performed in the field to provide a square sided block sample. The depth of the top and bottom of the block sample along with average volume measurements were recorded. The sample was sealed in plastic and transported to our laboratory.

Field Consolidation Test - The location for these tests were chosen adjacent to hand auger borings previously performed by KBC Consultants. The test set-up and procedures were performed to simulate the laboratory consolidation test procedures (ASTM D-2435).

Approximately 6" of surficial grass and roots were excavated from the test areas. The excavations were cleaned of loose materials and leveled. Clean uniform sand was spread over the excavation at a constant thickness. A pre-fabricated loading platform with mirror and scale attachments was placed on the sand and checked for plumbness. A wire pulley and weight system was placed adjacent to the mirror and scale assemblies for settlement observations. Initial readings were recorded at four locations on the loading platform prior to placement of the initial load. Immediately after the placement of the load increment settlement readings were observed and recorded. Additional readings were obtained until the settlement rate became constant. This procedure was continued until the full load had been applied to the test areas.

LABORATORY TESTING PROCEDURES

Soil Classification - Soil classifications provide a general guide to the engineering properties of various soil types and enable the geotechnical engineer to apply his past experience to current projects. The soils are classified according to relative density (based on standard penetration test resistance) color, mineralogy and texture. These classification descriptions are included on our Record of Test Borings.

The classification system discussed above is primarily qualitative. The following tests were performed for the purpose of detailed soil classification: grain size distribution, Atterberg Limits, moisture content, percent organics, and consolidation tests. Using these test results, the soils were classified according to the Unified Classification System (ASTM D-2487). The in-place physical soil properties provide an index for estimating soil behavior and engineering properties. The soil classification and physical properties obtained are presented in this report.

Grain Size Distribution - Grain size distribution tests are performed to determine the soil classification and the grain size distribution. The soil samples are prepared for testing according to ASTM D-2217 (wet preparation). The sample is first dried and weighed. The sample is then passed over a No. 200 sieve, using the wet method. The material passing the No. 200 sieve is then weighed to determine the percent passing. The grain size distribution of soils coarser than a No. 200 sieve is determined by passing the samples through a standard set of nested sieves. These tests are conducted in accordance with ASTM D-422.

Atterberg Limits Test - A soils Atterberg Limits assist in soil classification and in the evaluation of the soil's engineering properties. The plasticity index (PI) is the range of moisture content over which the soil deforms as a plastic material. The PI is bracketed

by the liquid limit (LL) and the plastic limit (PL). The liquid limit is the moisture content at which the soil becomes sufficiently "wet" to flow as a heavy viscous fluid. The liquid limit is determined in accordance with "ASTM D-423-66." The plastic limit is the lowest moisture content at which the soils are sufficiently plastic so as to be manually rolled into a 1/8" diameter thread. The plastic limit and the plasticity index are determined in accordance with ASTM D-424-59.

Organic Content Test - The amount of organic material in the soil was measured and expressed as a percentage of the samples original wet weight as described by ASTM D-2974. The procedure involves the initial drying of the specimen at 105 degrees centigrade to determine a moisture content. The amount of ash was then determined by heating the sample to 550 degrees centigrade. In this test procedure, the amount of combustible organics in the sample is expressed as a percentage of the initial sample wet weight.

Moisture Content Test - The moisture content is defined as the ratio, expressed as a percent, of the weight of water in a given mass of soil to the weight of the dry solid soil particles. This test was conducted in accordance with ASTM D-2216-71.

Determination of Unit Weight, Moisture Content and Void Ratio - In the laboratory, the undisturbed block sample, still sealed in its plastic wrapper, was weighed. The soil moisture content was determined in accordance with ASTM D-2216. From this data, and the volume measurement determined in the field, the soil wet and dry unit weights and the void ratio were computed. The results of these calculations are included in the Record of Laboratory Soil Identification Tests.

Consolidation Test - Consolidation testing was performed in accordance with the procedures of ASTM D-2435. Test specimens were selected from representative sections

of undisturbed block samples. A test specimen was prepared by trimming the sample section into a disk 2.5" in diameter and 1" thick. The disk was confined around its perimeter by a stainless steel ring and on each end by porous stones. The disk was then subjected to incrementally increasing vertical loads and the resulting deformations were measured with a micrometer dial gauge. The test results are presented as a plot of void ratio versus log of pressure. Unit weight, natural moisture content, and specific gravity of the soil solids are determined in conjunction with the consolidation test. The results of two consolidation tests are presented in the Record of Consolidation Tests.

Data recorded includes sample depths, diameter, length, deflections for load increments, and failure load. The reduced data includes cross sectional area, stress strain curve, modulus elasticity, and unconfined compressive strength.

LEGEND TO RECORDS OF TEST BORINGS

KBC CONSULTANTS, INC.

Standard Penetration (SPT) and Cone Penetration (CPT) Test Values Correlated to Relative Density for Sands and Gravels:

<u>CPT, kg/cm²</u>	<u>SPT, blows/foot</u>	<u>Relative Density</u>
0-16	0-4	Very loose
17-40	5-10	Loose
41-80	11-20	Firm
81-120	21-30	Very Firm
over 120	31-50	Dense

SPT and CPT Test Values Correlated to Consistency for Silts and Clays:

<u>CPT, kg/cm²</u>	<u>SPT, blows/foot</u>	<u>Consistency</u>
0-3	0-1	Very Soft
4-9	2-4	Soft
10-17	5-8	Firm
18-31	9-15	Stiff
32-60	16-30	Very Stiff
Over 60	31-50	Hard

Grain Size Identification Descriptions and Examples:

<u>Name</u>	<u>Size Limits</u>	<u>Familiar Example</u>
Boulder	12 inches or more	Basketball
Cobbles	3 to 12 inches	Grapefruit
Coarse Gravel	3/4 to 3 inches	Orange
Fine Gravel	No. 4 sieve to 3/4 inch	Grape
Coarse Sand	No. 10 to No. 4 sieve	Rocksalt
Medium Sand	No. 40 to No. 10 sieve	Table Salt
Fine Sand	No. 200 to No. 40 sieve	Powdered Sugar
Fines	Smaller Than No. 200	

<u>Fines Content</u>	<u>Adjective</u>
5% to 12%	Slightly Silty, Slightly Clayey
12% to 30%	Silty or Clayey
30% to 50%	Very Silty, Very Clayey

References: K. Terzaghi, R.B. Peck, Soil Mechanics in Engineering Practice, 2nd ed., John Wiley and Sons, Inc., N.Y., 1968, pp. 341 and 347.

G. F. Sowers, Soil Mechanics and Foundations: Geotechnical Engineering, MacMillan Publishing Co., N.Y., 1979, pp. 82.

RECORD OF TEST BORING
KBC PROJECT NO. 8202

PROJECT NAME: Compost Facility
PROJECT LOCATION: State Road 7
Broward County, Florida
BORING START/BORING FINISH: 2-10-83/2-10-83
BORING NUMBER: 23 (Refer to Drawing No. 3)
PAGE NUMBER: 1 of 1
GROUND SURFACE ELEVATION: N/A
SAMPLER ADVANCED BY: 140# hammer falling 30 inches
SAMPLER DESCRIPTION: 1.4 inch I.D., 2.0 inch O.D., 36 inch length
DEPTH TO GROUNDWATER: 0.5 ft.
DRILL DESCRIPTION: TRIPOD/Wash and chop
CASING SIZE: 3 inch O.D.
DRILLING SUBCONTRACTOR: Warren George, Inc., Dick Fife Crew
BORING TERMINATION DEPTH, FEET: 31.5

<u>SAMPLE NO.</u>	<u>DEPTH, FT.</u>	<u>N, BL/FT</u>	<u>DESCRIPTION</u>
1	5.5-7	*	Black silty fibrous <u>PEAT</u>
2	7.5-9	25	Tan soft to medium porous to very porous quartz sandy <u>LIMESTONE</u>
3	10-11.5	21	Tan soft to medium porous to very porous quartz sandy <u>LIMESTONE</u>
4	15-16.5	17	Tan soft porous to very porous weakly cemented quartz sandy <u>LIMESTONE</u>
5	20-21.5	14	Tan soft porous to very porous weakly cemented quartz sandy <u>LIMESTONE</u>
6	25-26.5	12	Tan soft porous to very porous weakly cemented quartz sandy <u>LIMESTONE</u>
7	30-31.5	9	Tan soft porous to very porous weakly cemented quartz sandy <u>LIMESTONE</u>

*Split-spoon sampler advanced by weight of drill rod.

RECORD OF TEST BORING
KBC PROJECT NO. 8202

PROJECT NAME: Compost Facility
PROJECT LOCATION: State Road 7
Broward County, Florida
BORING START/BORING FINISH: 2-10-83/2-11/83
BORING NUMBER: 28 (Refer to Drawing No. 3)
PAGE NUMBER: 1 of 1
GROUND SURFACE ELEVATION: N/A
SAMPLER ADVNACED BY: 140# hammer falling 30 inches
SAMPLER DESCRIPTION: 1.4 inch I.D., 2.0 inch O.D., 36 inch length
DEPTH TO GROUND WATER: 0.5 ft.
DRILL DESCRIPTION: TRIPOD/Wash and chop
CASING SIZE: 3 inch O.D.
DRILLING SUBCONTRACTOR: Warren George, Inc., Dick Fife Crew
BORING TERMINATION DEPTH, FEET: 31.5

<u>SAMPLE NO.</u>	<u>DEPTH, FT.</u>	<u>N, BL/FT</u>	<u>DESCRIPTION</u>
1	7.5-9.0	16	Tan soft porous to very porous weakly cemented quartz sandy <u>LIMESTONE</u>
2	10-11.5	15	Tan soft porous to very porous weakly cemented quartz sandy <u>LIMESTONE</u>
3	15-16.5	36	Tan soft to medium porous to very porous quartz sandy <u>LIMESTONE</u>
4	20-21.5	18	Tan soft porous to very porous weakly cemented quartz sandy <u>LIMESTONE</u>
5	25-26.5	18	Tan soft porous to very porous weakly cemented quartz sandy <u>LIMESTONE</u>
6	30-31.5	14	Tan soft porous to very porous weakly cemented quartz sandy <u>LIMESTONE</u>

RECORD OF TEST BORING
KBC PROJECT NO. 8202

PROJECT NAME: Compost Facility
PROJECT LOCATION: State Road 7
Broward County, Florida
BORING START/BORING FINISH: 2-11-83/2-11-83
BORING NUMBER: 33 (Refer to Drawing No. 3)
PAGE NUMBER: 1 of 1
GROUND SURFACE ELEVATION: N/A
SAMPLER ADVANCED BY: 140# hammer falling 30 inches
SAMPLER DESCRIPTION: 1.4 inch I.D., 2.0 inch O.D., 36 inch length
DEPTH TO GROUNDWATER: 0.5 ft.
DRILL DESCRIPTION: TRIPOD/Wash and chop
CASING SIZE: 3 inch O.D.
DRILLING SUBCONTRACTOR: Warren George, Inc., Dick Fife Crew
BORING TERMINATION DEPTH, FEET: 31.5

<u>SAMPLE NO.</u>	<u>DEPTH, FT.</u>	<u>N,BL/FT</u>	<u>DESCRIPTION</u>
1	5-6.5	27	Tan soft to medium porous to very porous quartz sandy <u>LIMESTONE</u>
2	10-11.5	16	Tan soft porous to very porous weakly cemented quartz sandy <u>LIMESTONE</u>
3	15-16.5	27	Tan soft to medium porous to very porous quartz sandy <u>LIMESTONE</u>
4	20-21.5	37	Tan soft to medium porous to very porous quartz sandy <u>LIMESTONE</u>
5	25-26.5	27	Tan soft to medium porous to very porous quartz sandy <u>LIMESTONE</u>
6	30-31.5	21	Tan soft to medium porous to very porous quartz sandy <u>LIMESTONE</u>

RECORD OF TEST BORING
KBC PROJECT NO. 8202

PROJECT NAME: Compost Facility

PROJECT LOCATION: State Road 7
Broward County, Florida

BORING START/BORING FINISH: 2-9-83/2-9-83

BORING LOCATION: 77 (Refer to Drawing No. 3)

PAGE NUMBER: 1 of 1

GROUND SURFACE ELEVATION: N/A

SAMPLER ADVANCED BY: 140# hammer falling 30 inches

SAMPLER DESCRIPTION: 1.4 inch I.D., 2.0 inch O.D., 36 inch length

DEPTH TO GROUND WATER: 0.5 ft.

DRILL DESCRIPTION: TRIPOD/Wash and Chop

CASING SIZE: 3 inch O.D.

DRILLING SUBCONTRACTOR: Warren George Inc., Dick Fife Crew

BORING TERMINATION DEPTH, FEET: 31.5

<u>SAMPLE NO.</u>	<u>DEPTH, FT.</u>	<u>N, BL/FT</u>	<u>DESCRIPTION</u>
1	0-1.5	*	black silty fibrous <u>PEAT</u>
2	5-6.5	33	tan soft to medium porous to very porous quartz sandy <u>LIMESTONE</u>
3	10-11.5	19	tan soft porous to very porous weakly cemented quartz sandy <u>LIMESTONE</u>
4	15-16.5	18	tan soft porous to very porous weakly cemented quartz sandy <u>LIMESTONE</u>
5	20-21.5	12	tan soft porous to very porous weakly cemented quartz sandy <u>LIMESTONE</u>
6	25-26.5	11	tan slightly silty medium quartz <u>SAND</u> with limestone lenses
7	30-31.5	8	tan slightly silty medium quartz <u>SAND</u> with limestone lenses

*Split-spoon sampler advanced by weight of drill rod.

RECORD OF TEST BORING
KBC PROJECT NO. 8202

PROJECT NAME: Compost Facility
PROJECT LOCATION: State Road 7
Broward County, Florida
BORING START/BORING FINISH: 2-15-83/2-15-83
BORING NUMBER: 78 (Refer to Drawing No.3)
PAGE NUMBER: 1 of 1
GROUND SURFACE ELEVATION: N/A
SAMPLER ADVANCED BY: 140# hammer falling 30 inches
SAMPLER DESCRIPTION: 1.4 inch I.D., 2.0 inch O.D., 36 inch length
DEPTH TO GROUNDWATER: 0.5 ft.
DRILL DESCRIPTION: TRIPOD/Wash and chop
CASING SIZE: 3 inch O.D.
DRILLING SUBCONTRACTOR: Warren George, Inc., Dick Fife Crew
BORING TERMINATION DEPTH, FEET: 31.5

<u>SAMPLE NO.</u>	<u>DEPTH, FT.</u>	<u>N,BL/FT</u>	<u>DESCRIPTION</u>
1	5-6.5	17	Tan soft porous to very porous weakly cemented quartz sandy <u>LIMESTONE</u>
2	10-11.5	27	Tan soft to medium porous to very porous quartz sandy <u>LIMESTONE</u>
3	15-16.5	27	Tan soft to medium porous to very porous quartz sandy <u>LIMESTONE</u>
4	20-21.5	19	Tan soft porous to very porous weakly cemented quartz sandy <u>LIMESTONE</u>
5	25-26.5	28	Tan soft to medium porous to very porous quartz sandy <u>LIMESTONE</u>
6	30-31.5	15	Tan soft porous to very porous weakly cemented quartz sandy <u>LIMESTONE</u>

RECORD OF TEST BORING
KBC PROJECT NO. 8202

PROJECT NAME: Compost Facility
PROJECT LOCATION: State Road 7
Broward County, Florida
BORING START/BORING FINISH: 2-15-83/2-15-83
BORING NUMBER: 79 (Refer to Drawing No. 3)
PAGE NUMBER: 1 of 1
GROUND SURFACE ELEVATION: N/A
SAMPLER ADVANCED BY: 140# hammer falling 30 inches
SAMPLER DESCRIPTION: 1.4 inch I.D., 2.0 inch O.D., 36 inch length
DEPTH TO GROUNDWATER: 0.5 ft.
DRILL DESCRIPTION: TRIPOD/Wash and chop
CASING SIZE: 3 inch O.D.
DRILLING SUBCONTRACTOR: Warren George, Inc., Dick Fife Crew
BORING TERMINATION DEPTH, FEET: 31.5

<u>SAMPLE NO.</u>	<u>DEPTH, FT.</u>	<u>N,BL/FT</u>	<u>DESCRIPTION</u>
1	5-6.5	28	Tan soft to medium porous to very porous quartz sandy <u>LIMESTONE</u>
2	10-11.5	27	Tan soft to medium porous to very porous quartz sandy <u>LIMESTONE</u>
3	15-16.5	30	Tan soft to medium porous to very porous quartz sandy <u>LIMESTONE</u>
4	20-21.5	22	Tan soft to medium porous to very porous quartz sandy <u>LIMESTONE</u>
5	25-26.5	34	Tan soft to medium porous to very porous quartz sandy <u>LIMESTONE</u>
6	30-31.5	34	Tan soft to medium porous to very porous quartz sandy <u>LIMESTONE</u>

RECORD OF HAND AUGER BORINGS
COMPOST FACILITY SITE
BROWARD COUNTY, FLORIDA
KBC PROJECT NO. 8202

KEY SOIL DESCRIPTION:

- (A) Black to brown silty fibrous PEAT
- (B) Tan and gray slightly silty medium to fine quartz SAND
- (C) Tan quartz sandy SILT with traces of organics
- (D) Tan soft to medium porous to very porous quartz sandy LIMESTONE

<u>AUGER BORING NUMBER/ DATE PERFORMED</u>	<u>DEPTH, FEET</u>	<u>DESCRIPTION</u>
AB-1/1-4-83	0-2.5 2.5-5.6 *GWL TOB 0.5'	(A) (B)
AB-2/1-5-83	0-2.3 2.3-4.4 4.4-6.2 GWL TOB 0.5'	(A) (B) (B) with limestone fragments
AB-3/1-5-83	0-2.5 2.5-4.2 4.2-4.3 **AR @4.3' GWL TOB 0.8'	(A) (B) (B) with limestone fragments
AB-4/1-5-83	0-1.9 1.9-4.5 AR @4.5' GWL TOB 1.0'	(A) (B) with limestone fragments
AB-5/1-5-83	0-2.3 2.3-4.3 4.3-4.6 AR @4.6' GWL TOB 1.4'	(A) (B) (B) with limestone fragments
AB-6/1-5-83	0-2.2 2.2-5.1 GWL TOB 1.2'	(A) (B)
AB-7/1-5-83	0-3.6 3.6-6.2 GWL encountered but not measured	(A) (B)
AB-8/1-5-83	0-3.0 3.0-5.0 5.0-5.1 GWL TOB 1.7'	(A) (B) (B) with limestone fragments

Ground water level at time of boring
Auger refusal

Auger boring number is the same as test location number shown on Drawing No. 3.

RECORD OF HAND AUGER BORINGS
COMPOST FACILITY SITE
BROWARD COUNTY, FLORIDA
KBC PROJECT NO. 8202

KEY SOIL DESCRIPTION:

- (A) Black to brown silty fibrous PEAT
- (B) Tan and gray slightly silty medium to fine quartz SAND
- (C) Tan quartz sandy SILT with traces of organics
- (D) Tan soft to medium porous to very porous quartz sandy LIMESTONE

<u>AUGER BORING NUMBER/ DATE PERFORMED</u>	<u>DEPTH, FEET</u>	<u>DESCRIPTION</u>
AB-9/1-5-83	0-3.4 3.4-5.7 5.7-5.8 GWL TOB 1.5'	(A) (B) (B) with limestone fragments
AB-10/1-5-83	0-2.7 2.7-5.4 5.4-5.6 AR @5.6' GWL TOB 1.5'	(A) (B) (B) with limestone fragments
AB-11/1-5-83	0-2.1 2.1-2.8 AR @2.8' GWL TOB 1.7'	(A) (B)
AB-12/1-5-83	0-3.4 3.4-3.7 3.7-6.0 GWL TOB 1.6'	(A) tan very silty fine to medium sand (B)
AB-13/1-5-83	0-3.0 3.0-6.0 6.0-6.2 GWL TOB 1.2'	(A) (B) (B) with limestone fragments
AB-14/1-5-83	0-4.4 4.4-4.7 4.7-6.2 GWL TOB 0.8'	(A) (C) (B)
AB-15/1-5-83	0-3.0 3.0-4.4 4.4-6.0 GWL TOB 1.4'	(A) (C) (B)
AB-16/1-5-83	0-3.6 3.6-5.7 AR @5.7' GWL encountered but not measured	(A) (B)

[] Auger boring number is the same as test location number shown on Drawing No. 3.

RECORD OF HAND AUGER BORINGS
COMPOST FACILITY SITE
BROWARD COUNTY, FLORIDA
KBC PROJECT NO. 8202

KEY SOIL DESCRIPTION:

- (A) Black to brown silty fibrous PEAT
- (B) Tan and gray slightly silty medium to fine quartz SAND
- (C) Tan quartz sandy SILT with traces of organics
- (D) Tan soft to medium porous to very porous quartz sandy LIMESTONE

<u>AUGER BORING NUMBER/ DATE PERFORMED</u>	<u>DEPTH, FEET</u>	<u>DESCRIPTION</u>
AB-17/1-5-83	0-2.9	(A)
	2.9-4.1	(B)
	AR @4.1'	
	GWL TOB 1.6'	
AB-18/1-5-83	0-3.6	(A)
	3.6-4.9	(B)
	AR @4.9	
	GWL TOB 1.5	
AB-19/1-5-83	0-4.3	(A)
	4.3-6.0	(B)
	GWL TOB 1.3'	
AB-20/1-6-83	0-2.2	(A)
	2.2-2.4	(C)
	2.4-4.5	(B)
	4.5-6.0	(B) with limestone fragments
	GWL TOB 0.4'	
AB-21/1-6-83	0-2.4	(A)
	2.4-5.7	(B)
	AR @5.7	
	GWL TOB 0.4'	
AB-22/1-6-83	0-4.0	(A)
	4.0-6.2	(B)
	GWL TOB 0.6'	
AB-23/1-6-83	0-3.6	(A)
	3.6-6.0	(B)
	GWL TOB 0.7'	
AB-24/1-6-83	0-3.8	(A)
	3.8-6.0	(B)
	GWL encountered but not measured	

Auger boring number is the same as test location number shown on Drawing No. 3.

RECORD OF HAND AUGER BORINGS
COMPOST FACILITY SITE
BROWARD COUNTY, FLORIDA
KBC PROJECT NO. 8202

BY SOIL DESCRIPTION:

- (A) Black to brown silty fibrous PEAT
- (B) Tan and gray slightly silty medium to fine quartz SAND
- (C) Tan quartz sandy SILT with traces of organics
- (D) Tan soft to medium porous to very porous quartz sandy LIMESTONE

<u>AUGER BORING NUMBER/ DATE PERFORMED</u>	<u>DEPTH, FEET</u>	<u>DESCRIPTION</u>
AB-25/1-6-83	0-1.5 1.5-2.0 2.0-5.0 5.0-6.0 GWL encountered but not measured	(A) (C) (B) (B) with limestone fragments
AB-26/1-6-83	0-3.0 3.0-4.3 4.3-4.8 AR @4.8' GWL TOB 1.0'	(A) (B) (B) with limestone fragments
AB-27/1-6-83	0-4.0 4.0-5.2 5.2-5.7 AR @5.7' GWL encountered but not measured	(A) (B) (B) with limestone fragments
AB-28/1-6-83	0-3.7 3.7-4.3 AR @5.0' GWL encountered but not recorded	(A) (B)
AB-29/1-6-83	0-3.5 3.5-6.2 GWL encountered but not measured	(A) (B)
AB-30/1-6-83	0-2.4 2.4-3.2 AR @3.2' GWL TOB 0.8'	(A) (B)
AB-31/1-6-83	0-2.0 2.0-2.5 2.5-4.2 4.2-6.0 GWL TOB 0.8'	(A) (C) (B) (B) with limestone fragments
AB-32/1-6-83	0-2.1 2.1-2.8 2.8-3.9 3.9-5.3 GWL TOB 0.7'	(A) (C) (B) (B) with limestone fragments

Auger boring number is the same as test location number shown on Drawing No. 3.

RECORD OF HAND AUGER BORINGS
COMPOST FACILITY SITE
BROWARD COUNTY, FLORIDA
KBC PROJECT NO. 8202

KEY SOIL DESCRIPTION:

- (A) Black to brown silty fibrous PEAT
- (B) Tan and gray slightly silty medium to fine quartz SAND
- (C) Tan quartz sandy SILT with traces of organics
- (D) Tan soft to medium porous to very porous quartz sandy LIMESTONE

<u>AUGER BORING NUMBER/ DATE PERFORMED</u>	<u>DEPTH, FEET</u>	<u>DESCRIPTION</u>
AB-33/1-6-83	0-2.5	(A)
	2.5-4.0	(B)
	4.0-6.0	(B) with limestone fragments
	GWL TOB 0.8'	
AB-34/1-6-83	0-2.8	(A)
	2.8-3.3	(B)
	3.3-4.0	(B) with limestone fragments
	AR @4.0'	
		GWL encountered but not measured
AB-35/1-6-83	0-2.2	(A)
	2.2-4.2	(B)
	4.2-6.0	(C)
	AR @6.0'	
		GWL encountered but not measured
AB-36/1-6-83	0-2.0	(A)
	2.0-3.5	(B)
	3.5-4.5	(B) with limestone fragments
	AR @4.5'	
		GWL encountered but not measured
AB-37/1-6-83	0-2.0	(A)
	2.0-4.5	(B)
	AR @4.5'	
	GWL encountered but not measured	
AB-38/1-6-83	0-2.1	(A)
	2.1-3.5	(B)
	3.5-4.0	(C)
	AR @4.0	
		GWL encountered but not measured
AB-39/1-6-83	0-2.0	(A)
	2.0-4.0	(B)
	4.0-4.5	(B) with limestone fragments
	GWL encountered but not measured	

Auger boring number is the same as test location number shown on Drawing No. 3.

RECORD OF HAND AUGER BORINGS
COMPOST FACILITY SITE
BROWARD COUNTY, FLORIDA
KBC PROJECT NO. 8202

A-28

KEY SOIL DESCRIPTION:

- (A) Black to brown silty fibrous PEAT
- (B) Tan and gray slightly silty medium to fine quartz SAND
- (C) Tan quartz sandy SILT with traces of organics
- (D) Tan soft to medium porous to very porous quartz sandy LIMESTONE

<u>AUGER BORING NUMBER/ DATE PERFORMED</u>	<u>DEPTH, FEET</u>	<u>DESCRIPTION</u>
AB-40/1-7-83	0-2.9 2.9-6.2 AR @6.2' GWL TOB 1.4'	(A) (B)
AB-41/1-7-83	0-2.5 2.5-6.0 AR @6.0' GWL encountered but not measured	(A) (B)
AB-42/1-7-83	0-1.7 1.7-3.0 3.0-5.0 AR @5.0' GWL TOB 0.2'	(A) (B) (B) with limestone fragments
AB-43/1-7-83	0-2.5 2.5-3.8 3.8-5.0 5.0-6.0 GWL encountered but not measured	(A) (C) (B) (B) with limestone fragments
AB-44/1-7-83	0-3.0 3.0-3.5 3.5-6.0 AR @6.0' GWL TOB 1.6'	(A) (C) (B)
AB-45/1-7-83	0-2.2 2.2-2.8 2.8-3.5 AR @3.5 GWL TOB 1.6'	(A) (C) (B)
AB-46/1-7-83	0-1.8 1.8-2.7 2.7-3.5 3.5-3.9 AR @3.9' GWL TOB 2.0'	(A) (C) (B) (B) with limestone fragments
AB-47/1-7-83	0-2.4 2.4-3.5 3.5-3.7 AR @3.7' GWL TOB 3.5'	(A) (C) (B) with limestone fragments

[Auger boring number is the same as test location number shown on Drawing No. 3.

RECORD OF HAND AUGER BORINGS
COMPOST FACILITY SITE
BROWARD COUNTY, FLORIDA
KBC PROJECT NO. 8202

A-29

KEY SOIL DESCRIPTION:

- (A) Black to brown silty fibrous PEAT
- (B) Tan and gray slightly silty medium to fine quartz SAND
- (C) Tan quartz sandy SILT with traces of organics
- (D) Tan soft to medium porous to very porous quartz sandy LIMESTONE

<u>AUGER BORING NUMBER/ DATE PERFORMED</u>	<u>DEPTH, FEET</u>	<u>DESCRIPTION</u>
AB-48/1-7-83	0-1.9 1.9-2.4 2.4-3.5 3.5-6.0 GWL TOB 1.5'	(A) (C) (B) (B) with limestone fragments
AB-49/1-7-83	0-2.9 2.9-4.0 4.0-4.3 AR @4.3' GWL encountered but not measured	(A) (B) (B) with limestone fragments
AB-50/1-7-83	0-2.0 2.0-2.5 2.5-3.5 3.5-3.6 AR @ 3.6 GWL TOB 1.8'	(A) (C) (B) (B) with limestone fragments
AB-51/1-7-83	0-1.8 1.8-3.0 3.0-3.8 AR @3.8' GWL encountered but not measured	(A) (C) (B)
AB-52/1-7-83	0-1.2 1.2-3.4 3.4-4.5 4.5-6.0 AR @6.0' GWL TOB 1.5'	(A) (C) (B) (B) with limestone fragments
AB-53/1-7-83	0-2.0 2.0-3.0 3.0-4.3 4.3-4.5 AR @4.5' GWL TOB 1.0'	(A) (C) (B) (B) with limestone fragments
AB-54/1-7-83	0-2.3 2.3-2.9 2.9-3.1 AR @3.1' GWL TOB 0.0'	(A) (C) (B)

[1] Auger boring number is the same as test location number shown on Drawing No.3.

RECORD OF HAND AUGER BORINGS.
COMPOST FACILITY SITE
BROWARD COUNTY, FLORIDA
KBC PROJECT NO. 8202

KEY SOIL DESCRIPTION:

- (A) Black to brown silty fibrous PEAT
- (B) Tan and gray slightly silty medium to fine quartz SAND
- (C) Tan quartz sandy SILT with traces of organics
- (D) Tan soft to medium porous to very porous quartz sandy LIMESTONE

<u>AUGER BORING NUMBER/ DATE PERFORMED</u>	<u>DEPTH, FEET</u>	<u>DESCRIPTION</u>
AB-55/1-7-83	0-1.2 1.2-2.4 2.4-3.5 AR @3.5' GWL TOB 1.7'	(A) (C) (B)
AB-56/1-7-83	0-3.4 3.4-3.7 3.7-4.2 AR @4.2' GWL TOB 0.7'	(A) (B) (B) with limestone fragments
AB-57/1-7-83	0-2.2 2.2-3.2 3.2-4.5 AR @4.5' GWL TOB 1.6'	(A) (B) (B) with limestone fragments
AB-58/1-7-83	0-2.4 2.4-6.2 GWL TOB 1.5'	(A) (B)
AB-59/1-7-83	0-2.1 2.1-4.5 4.5-5.0 AR @5.0' GWL TOB 1.5'	(A) (B) (B) with limestone fragments
AB-60/1-7-83	0-2.2 2.2-6.0 GWL TOB 1.1'	(A) (B)
AB-61/1-11-83	0-1.3 1.3-2.8 2.8-6.1 6.1-6.2 AR @6.2' GWL TOB 1.5'	(A) (C) (B) (B) with limestone fragments

Auger boring number is the same as test location number shown on Drawing No.3.

RECORD OF HAND AUGER BORINGS
COMPOST FACILITY SITE
BROWARD COUNTY, FLORIDA
KBC PROJECT NO. 8202

KEY SOIL DESCRIPTION:

- (A) Black to brown silty fibrous PEAT
- (B) Tan and gray slightly silty medium to fine quartz SAND
- (C) Tan quartz sandy SILT with traces of organics
- (D) Tan soft to medium porous to very porous quartz sandy LIMESTONE

<u>AUGER BORING NUMBER/ DATE PERFORMED</u>	<u>DEPTH, FEET</u>	<u>DESCRIPTION</u>
AB-62/1-11-83	0-2.5	(A)
	2.5-2.6	(C)
	2.6-3.4	(B)
	3.4-4.0	(B) with limestone fragments
	AR @4.0' GWL TOB 1.8'	
AB-63/1-11-83	0-1.7	(A)
	1.7-2.2	(C)
	2.2-5.0	(B)
	AR @5.0' GWL TOB 1.3'	
AB-64/1-11-83	0-2.0	(A)
	2.0-2.7	(C)
	2.7-5.5	(B)
	GWL TOB 1.4'	
AB-65/1-11-83	0-1.9	(A)
	1.9-2.8	(C)
	2.8-3.9	(B)
	3.9-4.3	(B) with limestone fragments
	AR @4.3' GWL TOB 2.0'	
AB-66/1-11-83	0-2.4	(A)
	2.4-3.8	(B)
	3.8-4.0	(B) with limestone fragments
	AR @4.0' GWL TOB 1.5'	
AB-67/1-11-83	0-3.3	(A)
	3.3-6.2	(B)
	GWL TOB 1.8'	
AB-68/1-11-83	0-2.7	(A)
	2.7-2.8	(C)
	2.8-3.2	(B)
	3.2-3.8	(B) with limestone fragments
	AR @3.8 GWL TOB 1.0'	

Auger boring number is the same as test location number shown on Drawing No.3.

RECORD OF HAND AUGER BORINGS
COMPOST FACILITY SITE
BROWARD COUNTY, FLORIDA
KBC PROJECT NO. 8202

KEY SOIL DESCRIPTION:

- (A) Black to brown silty fibrous PEAT
- (B) Tan and gray slightly silty medium to fine quartz SAND
- (C) Tan quartz sandy SILT with traces of organics
- (D) Tan soft to medium porous to very porous quartz sandy LIMESTONE

<u>[] AUGER BORING NUMBER/ DATE PERFORMED</u>	<u>DEPTH, FEET</u>	<u>DESCRIPTION</u>
AB-69/1-11-83	0-2.3 2.3-5.8 5.8-6.0 AR @ 6.0' GWL TOB 1.0'	(A) (B) (B) with limestone fragments
AB-70/1-11-83	0-2.1 2.1-2.8 2.8-6.2 GWL TOB 1.6'	(A) (C) (B) with limestone fragments
AB-71/1-11-83	0-3.3 3.3-3.5 AR @ 3.5' GWL TOB 2.0'	(A) (B)
AB-72/1-11-83	0-2.6 2.6-3.0 3.0-6.0 AR @ 6.0' GWL TOB 1.6'	(A) (B) (B) with limestone fragments
AB-73/1-11-83	0-2.7 2.7-3.7 3.7-6.2 GWL TOB 0.8'	(A) (B) (B) with limestone fragments
AB-74/1-11-83	0-1.7 1.7-4.0 4.0-4.1 AR @ 4.1' GWL TOB 1.3'	(A) (B) (B) with limestone fragments
AB-75/1-11-83	0-1.5 1.5-2.0 2.0-4.6 4.6-5.0 GWL TOB 1.0'	(A) (C) (B) (B) with limestone fragments

Auger boring number is the same as test location number shown on Drawing No. 3.

RECORD OF HAND AUGER BORINGS
COMPOST FACILITY SITE
BROWARD COUNTY, FLORIDA
KBC PROJECT NO. 8202

KEY SOIL DESCRIPTION:

- (A) Black to brown silty fibrous PEAT
- (B) Tan and gray slightly silty medium to fine quartz SAND
- (C) Tan quartz sandy SILT with traces of organics
- (D) Tan soft to medium porous to very porous quartz sandy LIMESTONE

AUGER BORING NUMBER/
DATE PERFORMED

DEPTH, FEET

DESCRIPTION

AB-76/1-11-83

0-1.5
1.5-2.6
2.6-3.1
3.1-3.5
AR @3.5'
GWL TOB 1.3'

(A)
(C)
(B)
(B) with limestone fragments

[Auger boring number is the same as test location number shown on Drawing No. 3.

SCHMERTMANN & CRAPPS, INC.
—Consulting Geotechnical Engineers—
John M. Schmertmann, Ph.D., P.E.
David K. Crapps, Ph.D., P.E., L.S.

MINI-REPORT No. 1 S&C file: 83-518
To: KBC Consultants, Inc.
Date: 24 Jan 83 by: Schmertmann, FL P.E.6552

Problem: To perform Marchetti dilatometer tests (DMTs) in a surface layer of peat at a proposed sludge disposal site, 1 mile S. of SR84 on US 441, Ft. Lauderdale

Authorization for work: KBC Contract Document dated 28 Dec 82.
Previous reports: None

Work performed

1. On 14 January 83, with assistance from T. Kaderabek, I performed 84 dilatometer tests in 4 hours at 15 locations selected by KBC around the site. Depth of testing varied from 0.5 to 4.5 ft., usually in 0.5 ft depth increments. We advanced the dilatometer by hand pushing guided with a level along the rods to achieve near-plumb penetrations. Sixteen of the 84 tests obtained only partial data (no A-reading because of very low lateral pressure conditions and possibly some side-wobble during penetration). KBC will present the plan locations of these 15 DMT soundings in their report to which they will append this report. We made each sounding about 2 ft adjacent to a previous KBC auger hole and gave it the number of that auger hole.

2. Example settlement estimates based on the DMT results.
3. This report.

Attached Figures/Tables/Appendices

Figure 1: One page summary description of dilatometer test.

Figs. 2-5: Each figure shows superposed data from 3 to 5 soundings with approximately similar depth to ground water at the time of the testing. These figures also show summary lines that illustrate the trend of the data, using solid lines for the peat and dashed lines for the underlying sand and organic silt and sand.

Logs: Detailed field logs from each sounding (in order of location No.) presenting the data obtained in the field and the tabular results computed from these data.

Our findings/opinions

1. The dilatometer equipment performed well for this investigation. However, because of the very near surface and very weak soils tested, the dilatometer

pressure readings obtained were near the limit of sensitivity (most readings fell between 0 and 1 bar in our most sensitive pressure gage (16 bar)).

2. With only a few exceptions, usually associated with a no-A reading condition, the results from the dilatometer tests appear reasonable.

3. The data summarized in Figures 2 to 5 all suggest some common trends with respect to the variation of the peat layer properties with depth:

- (a) The I_D value provides an indicator of soil type that was not originally set up to include peat. It appears that the peat near the surface behaves like a silt with respect to pore pressure and permeability behavior (the factors believed to control I_D). There is some trend for the peat to behave more as a clayey silt with depth. The abruptly higher I_D values, as well as M-values, signal the bottom of the peat and the beginning of silt and sand.
- (b) All the soundings show the same trend of a decrease in pre-consolidation stress (p_c) with depth. This finding of a mini-drying crust seems reasonable in view of the potential surface air-drying and the desiccation produced by the root systems of the surface plants.
- (c) All the undrained strength and modulus profiles in the peat also show a diminishing strength and modulus with depth, consistent with a drying crust. We also made calculations for the plane strain friction angle strength of the underlying sand which we could penetrate using the pushing weight of two men. The results of 11 such determinations fell between about 40 and 49°. These friction angles apply to the very low effective stress levels noted in the detailed field logs. Because of envelope curvature, use of these sands at higher stress levels will require using lower secant friction angles, as will any applications involving stress conditions more merely axisymmetric than plane strain.

4. Our DMT-based settlement calculations for the settlement of a 6 foot fill surcharge over the peat produced estimates of 6 and 18 inches in the peat layer for the conditions shown in Figures 4 and 3, respectively. We have sent you our analyses sheets separately.

Our recommendations

1. Despite the unique, in our experience, nature of these dilatometer soundings we believe that the results can be used to assist you with assessing the reasonableness of similar results from the site as obtained by other methods. We recommend you use these DMT results as a cross-check on the reasonableness of the similar data from other methods, and as a method for extrapolating the results from your more limited but more sophisticated tests to the larger site area covered by the dilatometer testing.

2. It appears to us that the Marchetti dilatometer test provides an efficient and effective method for evaluating many of the engineering properties of surface peat layers.

Copies: 5 encl. & 0 to others.

OUR NEXT STEP: CONTRACT COMPLETED

Signed: _____


John H. Schmertmann
for Schmertmann & Crapps, Inc.

FLAT PLATE DILATOMETER TEST

Our firm, the first in the USA, has obtained dilatometer equipment and uses this unique in-situ test developed in Italy by Prof. S. Marchetti. He briefly introduces the test in: "A NEW IN SITU TEST FOR THE MEASUREMENT OF HORIZONTAL SOIL DEFORMABILITY", Vol. 11, ASCE, Raleigh, 1975 Spec. Conf. on In situ Measurement of Soil Properties, pp. 255-259, and has more details in "IN SITU TESTS BY FLAT DILATOMETER", ASCE, Journal GED, March 1980, pp. 299-321 and the Closure in the June 1981 issue.

The test consists of pushing (we use Dutch cone equipment) or driving (SPT hammer OK) a plate with a sharpened bottom edge into the soil (see photos 1 and 2) and stopping to test at suitable depth increments, usually 20 cm. (8"). The rods carry an air and electrical line from the surface to a thin, circular, expandable metal membrane on one side of the plate. By use of a control box with a pressure regulator and gage, and audio signals, the operator determines the A-pressure required to just begin to move the membrane and the B-pressure required to move it 1 mm into the soil, to ± 0.05 bar (0.05 tsf). The operator can also calibrate the membrane, and test for its proper operation before or after each sounding, by a simple field procedure (see photo 3).

We analyse and plot the dilatometer data by computer with the methods developed by Dr. Marchetti, as described in the above ASCE Journal GED paper and in the USERS MANUAL supplied with the equipment.

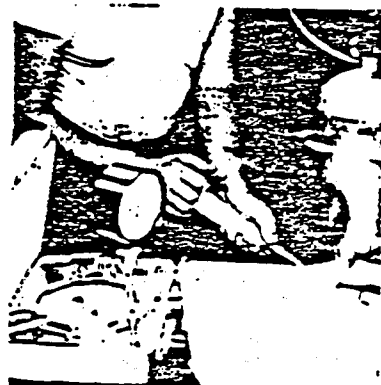
The dilatometer test uniquely obtains in situ soil strength, stress and settlement data quickly (about 1 min/test) and economically, in all penetrable soils, at close depth intervals (20 cm), and with a nearly operator-independent (and therefore reproducible) procedure. Schmertmann & Crapps, Inc. have now used the test for over 1 1/2 yrs with good results. In view of the test's unique advantages, especially for rapid consolidation data, and our favorable experience to date, we use it as a supplement.



1. Dilatometer, with 60 mm membrane in 95 mm plate, about to enter ground.



2. The 14 mm edge and point of dilatometer.



3. Field calibration or check of membrane.

FIGURE 2

GRAPHS OF RESULTS FROM DILATOMETER SOUNDING NO. D-1, -55, -56A, -56B
Sounding location: PROPOSED SLUDGE DISPOSAL SITE, FT. LAUDERDALE
Graphs plotted by: Schmertmann Date: 23 Jan 83

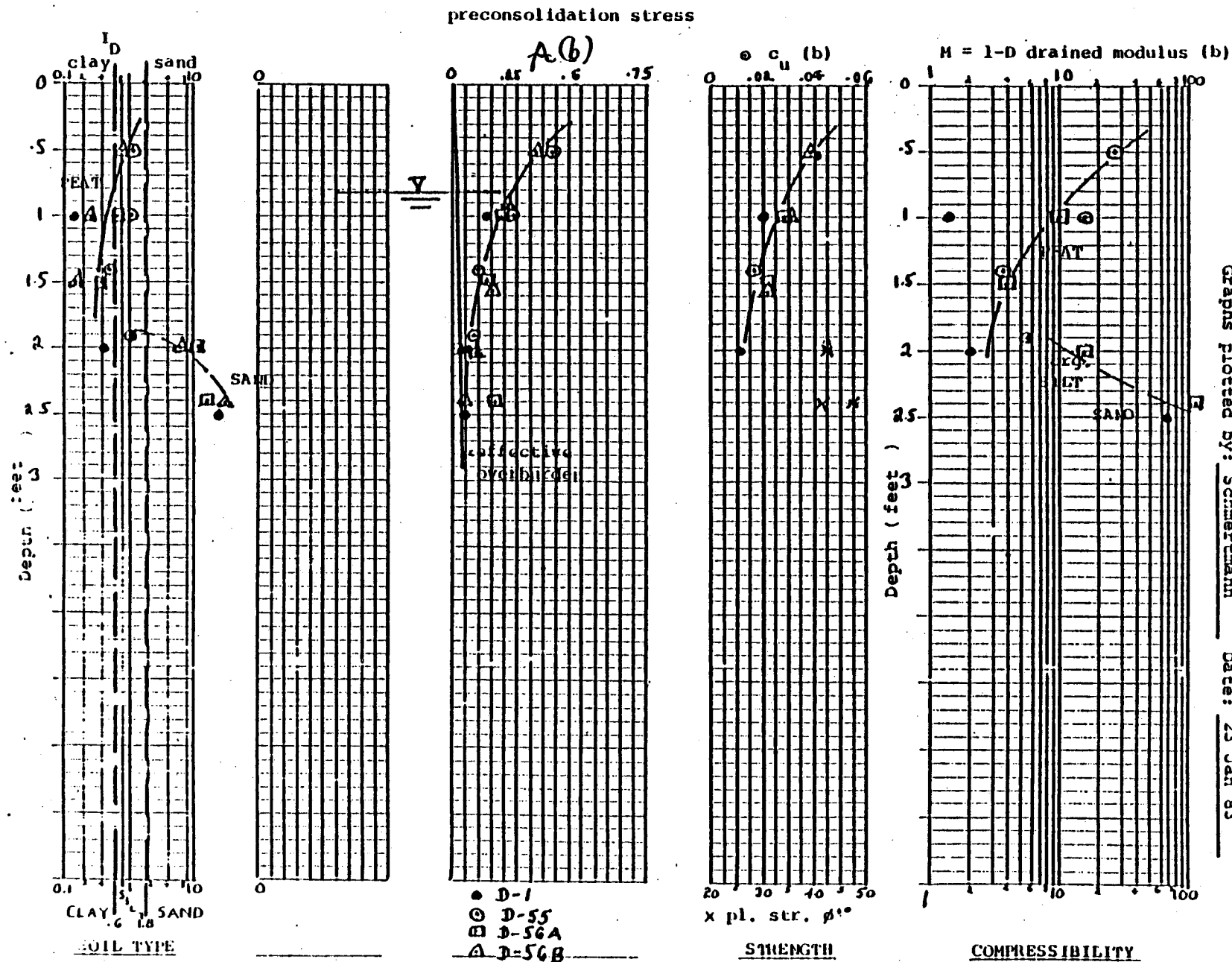
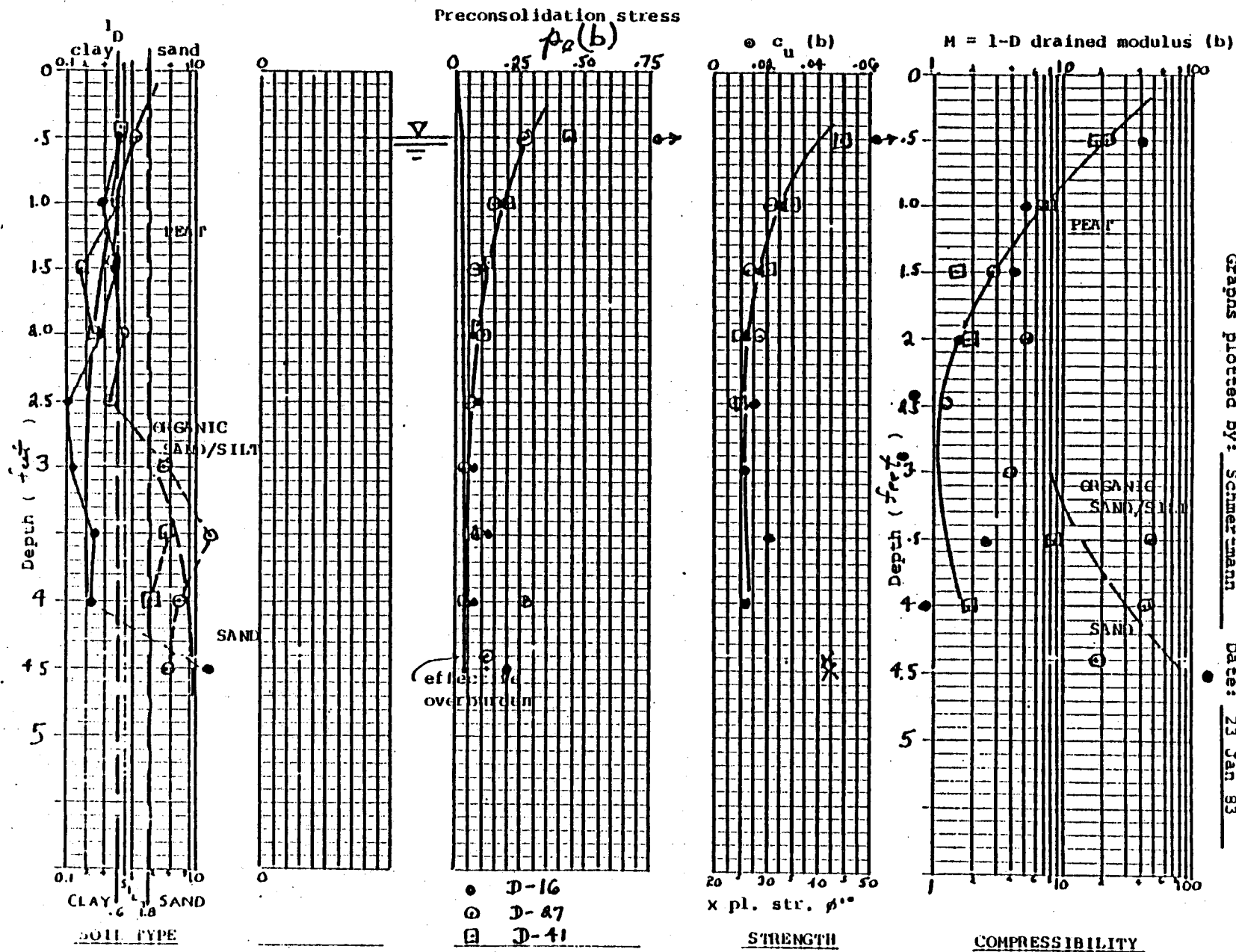


FIGURE 3

GRAPHS OF RESULTS FROM DIATOMETER SOUNDING NO. D-16, -27, -41

Sounding location: PROPOSED SLUDGE DISPOSAL SITE, FT. LAUDERDALE
Graphs plotted by: Schmertmann Date: 23 Jan 83



Schmertmann & Coapps, Inc.
File 83-518.

FIGURE 4

GRAPHS OF RESULTS FROM DILATOMETER SOUNDING NO. D-48A, -48B, -49, -53, -54
Sounding location: PROPOSED SLUDGE DISPOSAL SITE, FT. LAUDERDALE
Graphs plotted by: Schmertmann Date: 23 Jan 83

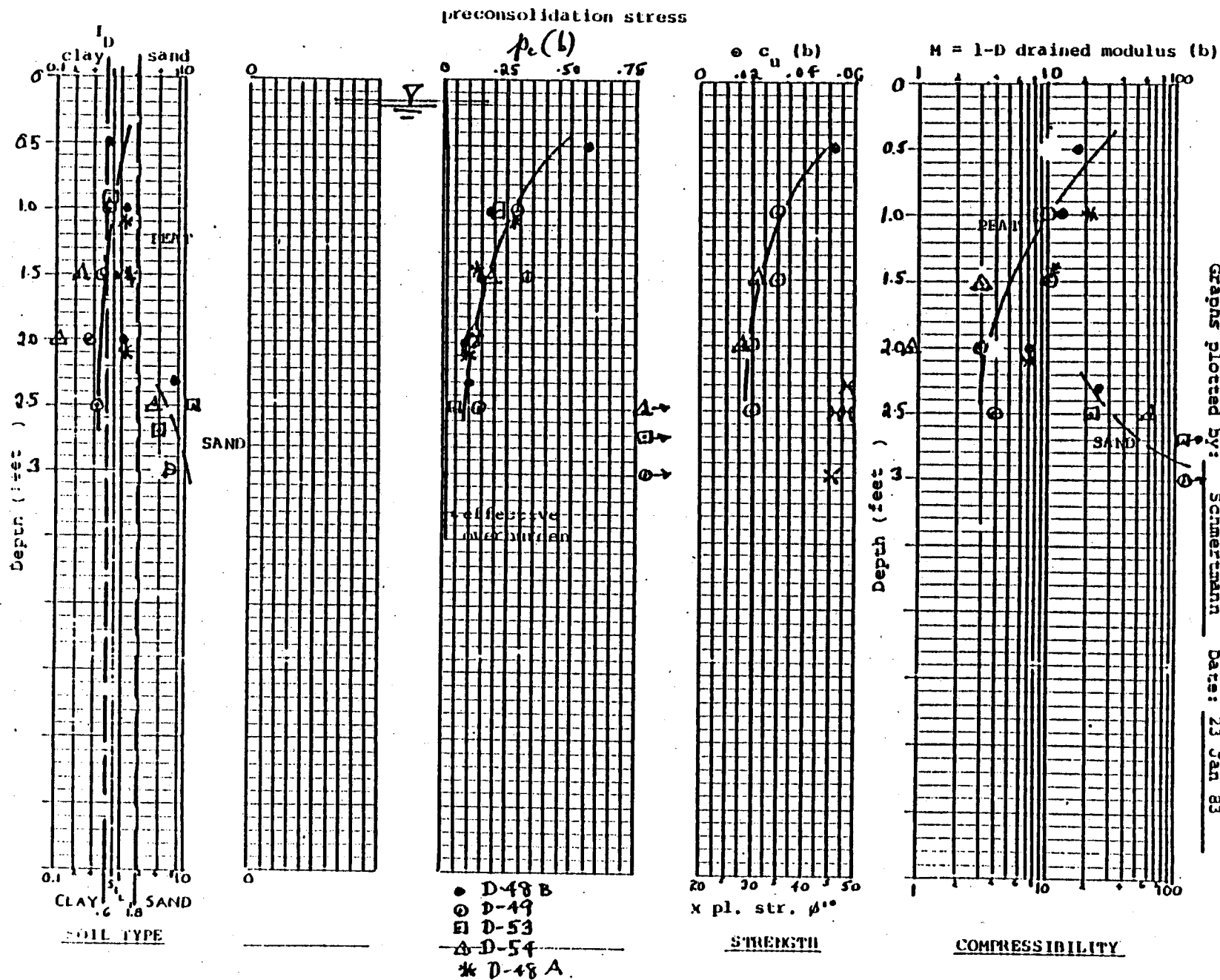
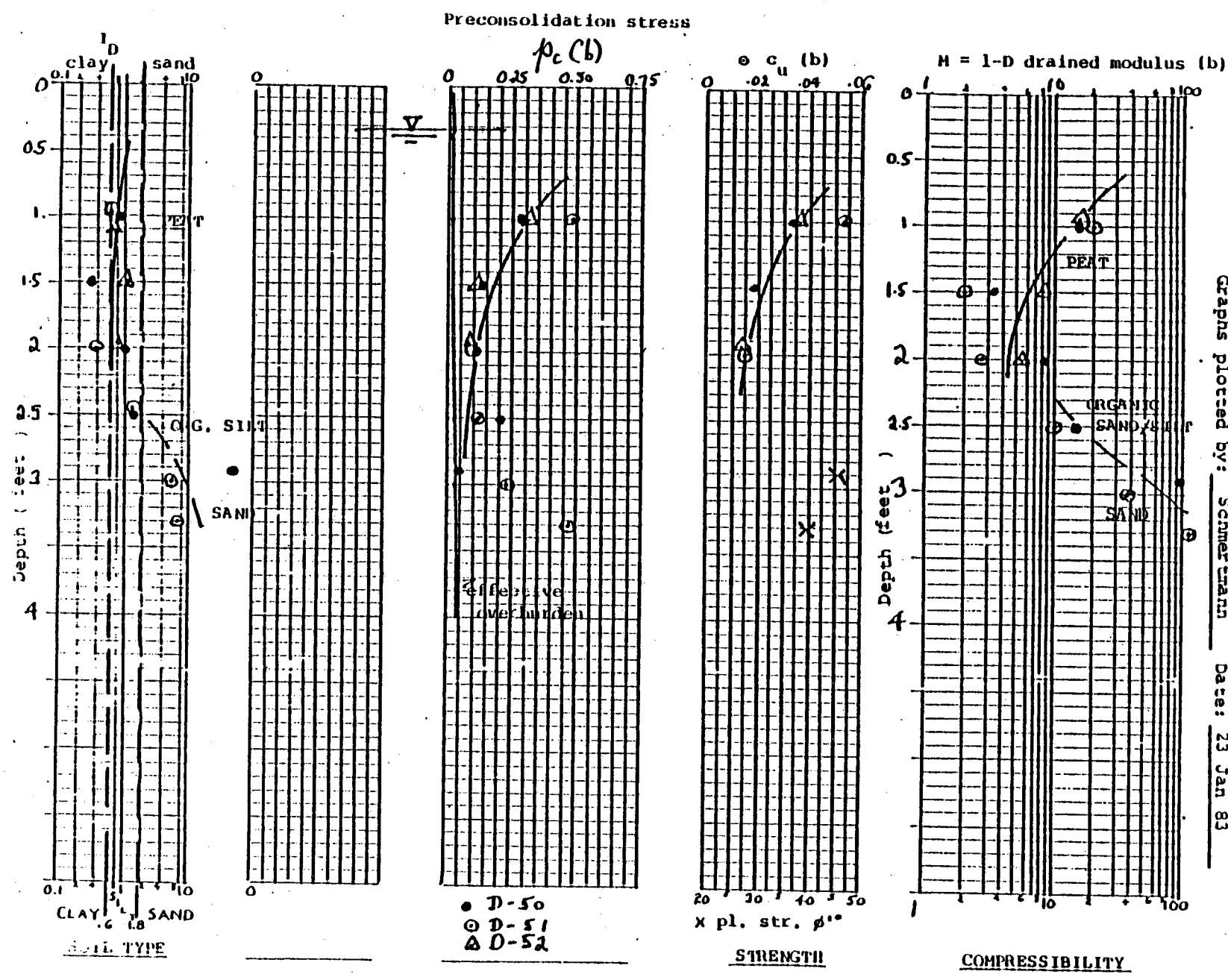


FIGURE 5

GRAPHS OF RESULTS FROM DILATOMETER SOUNDING NO. -50, -51, -52
Sounding location: PROPOSED SLUDGE DISPOSAL SITE, FT. LAUDERDALE
Graphs plotted by: Schmertmann Date: 23 Jan 83



RECORD OF FIELD VANE SHEAR TESTS
COMPOST FACILITY SITE
BROWARD COUNTY, FLORIDA
KBC PROJECT NO. 8202

<u>VANE TEST NO. *</u>	<u>DEPTH, FEET</u>	<u>SHEAR STRENGTH, psf</u>
VT-1	0.7	460
	1.7	460
VT-10	0.8	360
	1.7	430
VT-11	0.5	400
	1.4	430
VT-16	0.7	490
	1.8	430
VT-20	0.7	610
	2.0	610
VT-25	0.7	460
	1.8	430
VT-30	0.4	610
	1.0	670
	1.8	490
VT-70	0.6	610
	1.2	490
VT-65	0.5	820
	1.0	610
	2.2	360
VT-75	0.6	240
	1.2	490
	1.8	460
	2.3	2130
VT-48	0.7	790
	1.3	670
	2.0	610
VT-47	0.8	490
	1.4	760
	2.2	330
VT-46	0.7	730
	2.0	400
VT-45	0.7	610
	1.8	400

*Vane Test No. is the same as Test Location No. shown on Drawing No. 3.

RECORD OF FIELD VANE SHEAR TESTS
COMPOST FACILITY SITE
BROWARD COUNTY, FLORIDA
KBC PROJECT NO. 8202

<u>VANE TEST NO. *</u>	<u>DEPTH, FEET</u>	<u>SHEAR STRENGTH, psf</u>
VT-44	0.8	460
	1.4	460
VT-43	0.5	460
	1.1	520
	1.8	360
VT-42	0.7	610
	1.3	640
	1.8	700
VT-41	0.4	850
	1.1	550
	2.0	490
VT-40	0.8	240
	1.3	550
	1.9	460
VT-58	0.7	400
	1.6	360
VT-57	0.8	460
	1.7	240
VT-56	0.8	430
	1.8	460
VT-55	0.8	460
	1.8	430
VT-54	0.7	300
	1.2	460
	2.0	490
VT-53	0.7	360
	1.9	400
VT-52	0.7	460
	1.3	550
	1.7	610
VT-51	0.7	360
	2.3	460
VT-50	0.8	580
	2.0	300

*Vane Test No. is the same as Test Location No. shown on Drawing No. 3.

RECORD OF FIELD VANE SHEAR TESTS
COMPOST FACILITY SITE
BROWARD COUNTY, FLORIDA
KBC PROJECT NO. 8202

<u>VANE TEST NO. *</u>	<u>DEPTH, FEET</u>	<u>SHEAR STRENGTH, psf</u>
VT-49	0.8	430
	1.8	240
VT-76	0.7	730
	1.8	490
VT-66	0.8	610
	2.1	360
VT-32	0.6	670
	1.1	550
	1.9	400
VT-68	0.8	550
	1.8	490
VT-71	0.7	550
	1.8	430
VT-72	0.6	550
	1.4	460
VT-73	0.8	460
	1.7	460
VT-31	0.8	580
	1.8	300
VT-26	0.7	520
	1.5	360
VT-27	0.5	670
	0.9	460
	1.9	520
VT-28	0.6	610
	1.8	550
VT-29	0.8	460
	1.5	430
VT-21	0.8	360
	1.6	400
VT-22	0.8	550
	1.4	430

*Vane Test No. is the same as Test Location No. shown on Drawing No. 3.

RECORD OF FIELD VANE SHEAR TESTS
COMPOST FACILITY SITE
BROWARD COUNTY, FLORIDA
KBC PROJECT NO. 8202

<u>VANE TEST NO. *</u>	<u>DEPTH, FEET</u>	<u>SHEAR STRENGTH, psf</u>
VT-23	0.8	430
	1.3	460
	2.1	430
VT-24	0.6	330
	1.6	490
VT-17	0.6	850
	1.2	790
	2.2	550
VT-12	0.8	580
	1.9	490
VT-14	0.9	460
	1.8	550
VT-61	0.7	550
	2.0	610
VT-60	0.7	640
	1.2	460
	1.9	430

Average Shear Strength
0.5 ft. to 1.0 ft.-----520 psf

Average Shear Strength
1.0 ft. to 1.5 ft.-----550 psf

Average Shear Strength
1.5 ft. to 2.0 ft.-----460 psf

Average Shear Strength
0.5 ft. to 2.0 ft.-----500 psf

*Vane Test No. is the same as Test Location No. shown on Drawing No. 3.

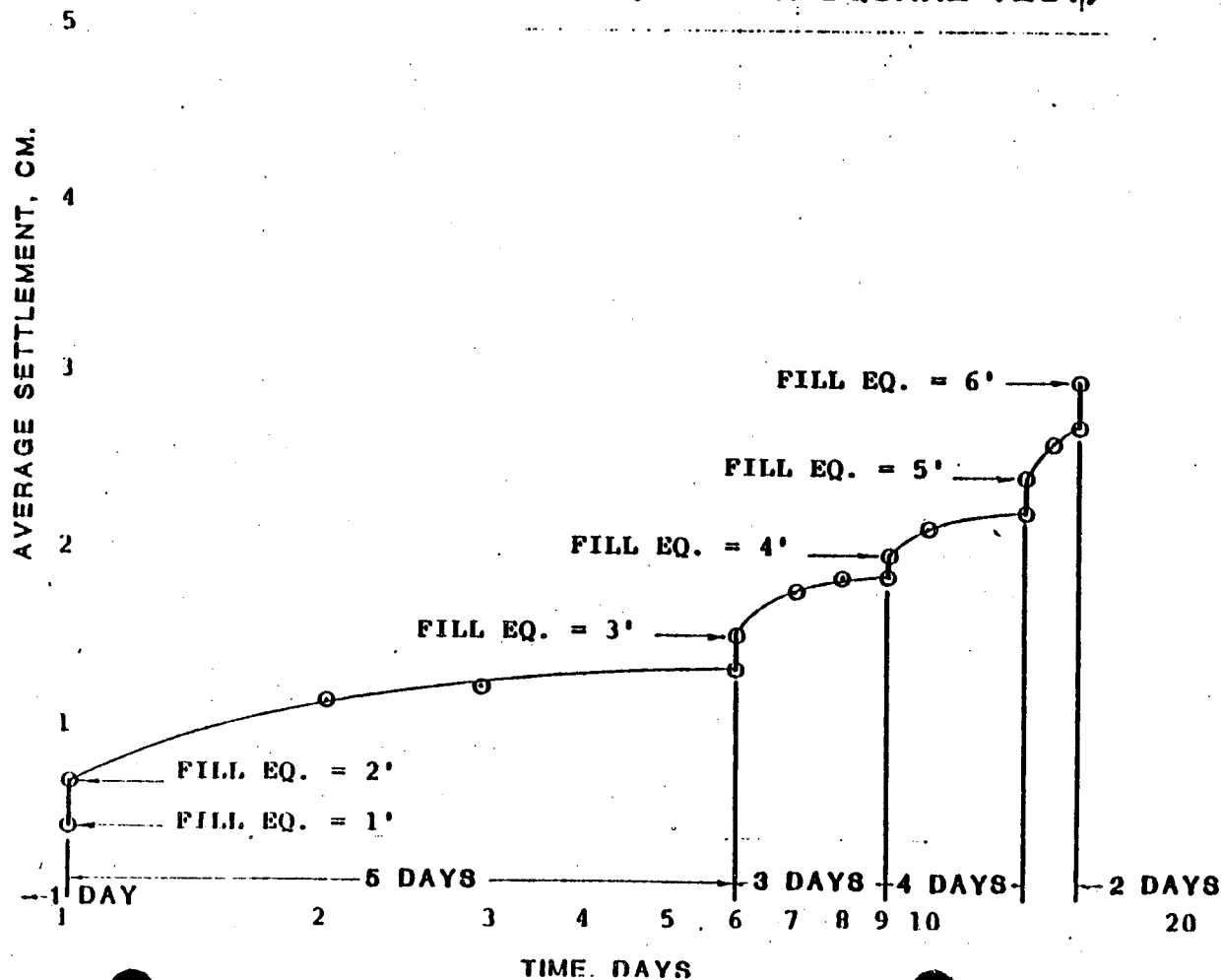
R D O. LABORATORY L. IDENTIFICATION TESTS
COMPOST FACILITY SITE
BROWARD COUNTY, FLORIDA
KBC PROJECT NO. 8202

AUGER BORING NUMBER	DEPTH, FEET	BRIEF DESCRIPTION	WATER CONTENT, %	% ORGANICS	ATTERBERG LIMITS			GRAIN SIZE TEST PERCENT PASSING			USCS SYMBOL
					LL%	PL%	PI	NO. 4	NO. 40	NO. 200	
AB-2	0.5	Peat	320	18.1							
AB-2	1.8	Peat	533	13.4							PT
AB-2	3.3	Sand	28.5					100	88.9	1.5	PT PT SP
AB-2	5.9	Sand	29.0					100	92.4	14.8	SM
AB-4	0.8	Peat	557	13.2							PT
AB-4	1.3	Peat	880	8.8							PT
AB-4	2.3	Sand	31.9					100	91.6	0.9	SP
AB-11	1.3	Peat	1004								PT
AB-13	0.8	Peat	1023								PT
AB-14	1.2	Peat	853	9.5							PT
AB-14	1.6	Peat	1319	6.4							PT
AB-15	0.8	Peat	1106								PT
AB-25	1.8	Silt	30.6					100	84.6	21.2	SM
AB-41	0.3	Peat	232	23.4							PT
AB-41	0.5	Peat	529	13.9							PT
AB-41	1.3	Peat	854	9.6							PT
AB-41	2.0	Peat	990	8.2							PT
AB-41	2.5	Peat	754	8.1							PT
AB-41	4.0	Sand	28.1					100	90.2	1.4	SP
AB-44	3.5	Silt	103.6								ML-OL
AB-45	2.5	Silt	80.1	2.0							ML-OL
AB-52	1.5	Silt	74.6					100	21.5	76.5	ML-OL
AB-54	2.5	Silt			NP	47	NP				ML-OL

RECORD OF LABORATORY SOIL IDENTIFICATION TESTS
COMPOST FACILITY SITE
BROWARD COUNTY, FLORIDA
KBC PROJECT NO. 8202

AUGER BORING NUMBER	DEPTH, FEET	BRIEF DESCRIPTION	WATER CONTENT, %	% ORGANICS	ATTERBERG LIMITS			GRAIN SIZE TEST PERCENT PASSING			USCS SYMBOL
					LL%	PL%	PI	NO. 4	NO. 40	NO. 200	
AB-61	1.0	Peat	209	28.7							PT
AB-61	1.3	Peat	854	9.5							PT
AB-61	2.5	Silt			NP	37	NP				ML-OL
AB-61	3.5	Sand	24.5					100	90.4	1.7	SP
AB-62	1.5	Peat	1014								PT
AB-62	3.0	Sand	26.7					100	92.8	1.2	SP
AB-63	1.3	Peat	822								PT
AB-63	1.7	Silt			NP	39	NP				ML-OL
AB-63	3.0	Sand	24.3					100	92.8	1.7	SP
AB-64	1.0	Peat	704	10.6							PT
AB-64	1.5	Peat	869								PT
AB-64	2.2	Silt	77.1					100	18.0	80.5	ML-OL
AB-65	1.5	Peat	1052								PT
AB-65	2.5	Silt	72.6		NP	62	NP				ML-OL
AB-66	1.0	Peat	991	7.9							PT
AB-66	1.5	Peat	1019	8.1							PT
AB-67	2.0	Peat	1148								PT
AB-68	0.5	Peat	408	23.7							PT
AB-68	1.2	Peat	905	8.6							PT
AB-69	1.0	Peat	644								PT
AB-69	3.5	Sand	26.8					100	82.2	0.8	SP
AB-75	1.0	Peat	806								PT
AB-75	1.5	Silt	87.7		NP	55	NP				ML-OL
AB-76	1.5	Silt	82	2.2							ML-OL

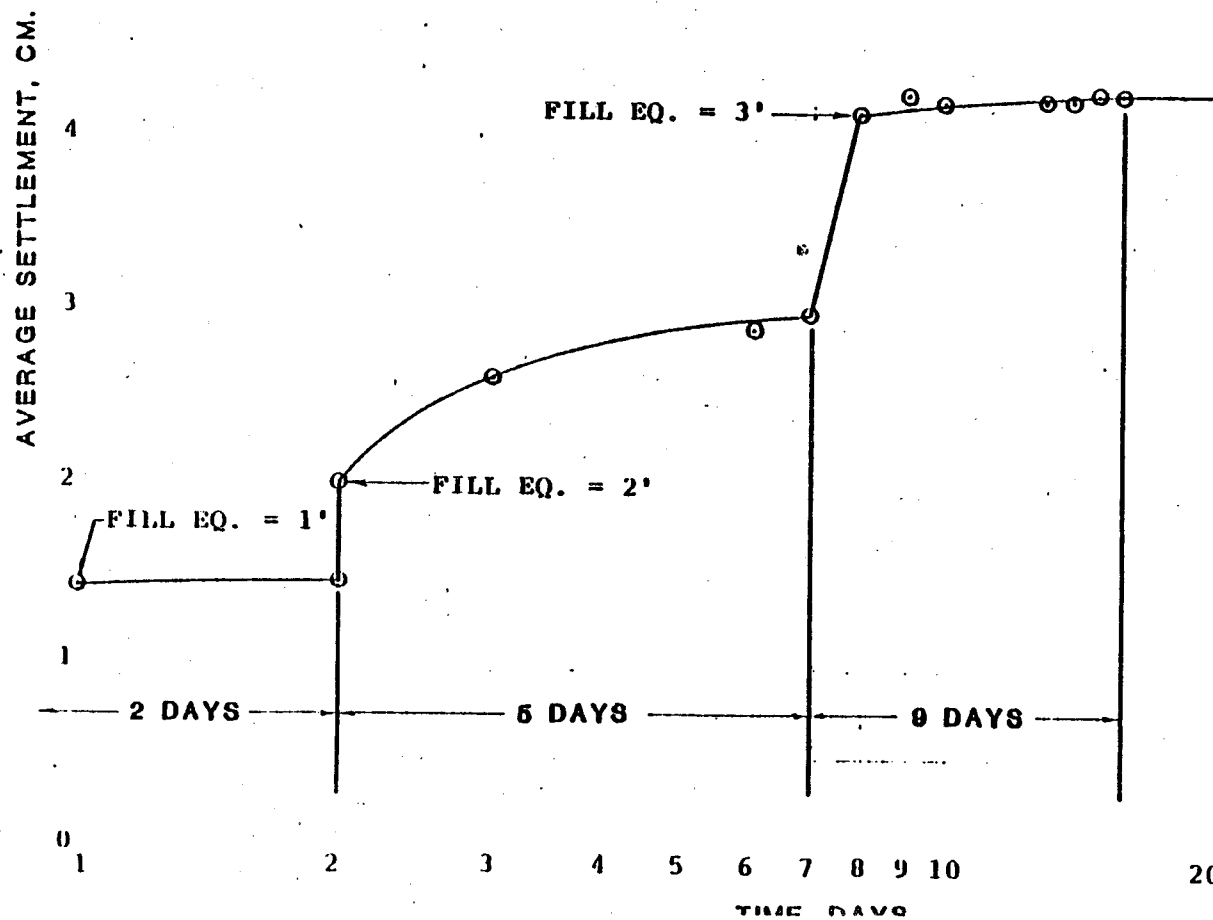
FIELD CONSOLIDATION TEST RESULTS (14-INCH SQUARE TEST)



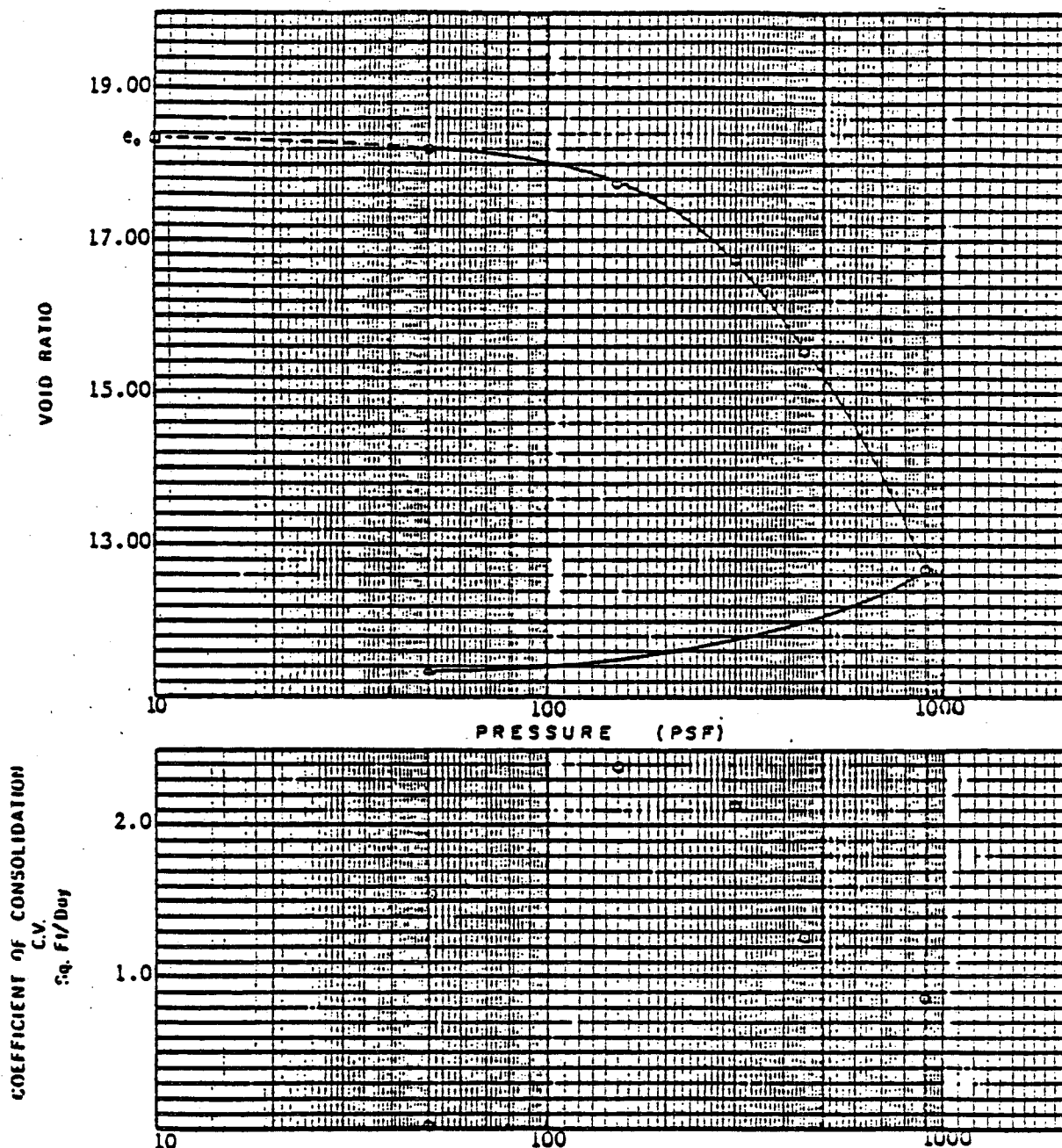
FILL EQ. (Ft.)	TIME AFTER LOAD APPLICATION (Days)	CUMULATIVE SETTLEMENT (cm.)
0	0	0
1	1	0.47
2	0	0.70
	1	1.19
	2	1.26
	5	1.38
3	0	1.55
	1	1.80
	2	1.88
	3	1.88
4	0	2.01
	1	2.16
	4	2.26
5	0	2.43
	1	2.67
	2	2.75
6	0	2.98

A-49

FIELD CONSOLIDATION TEST RESULTS (46-INCH SQUARE TEST)



FILL EQ. (Ft.)	TIME AFTER LOAD APPLICATION (Days)	CUMULATIVE SETTLEMENT (cm.)
0	0	0
1	1	1.47
1	2	1.50
2	0	2.05
2	1	2.63
2	4	2.90
2	5	3.01
3	0	4.13
3	1	4.22
3	2	4.19
3	5	4.20
3	6	4.20
3	7	4.20
3	8	4.25



RECORD OF CONSOLIDATION TEST

CLIENT: Hazen & Sawyer, Engineers

LL: N/A

PI: N/A

PROJECT: Compost Facility
Broward County, Florida

G_s: 1.611

INITIAL s: 98.2

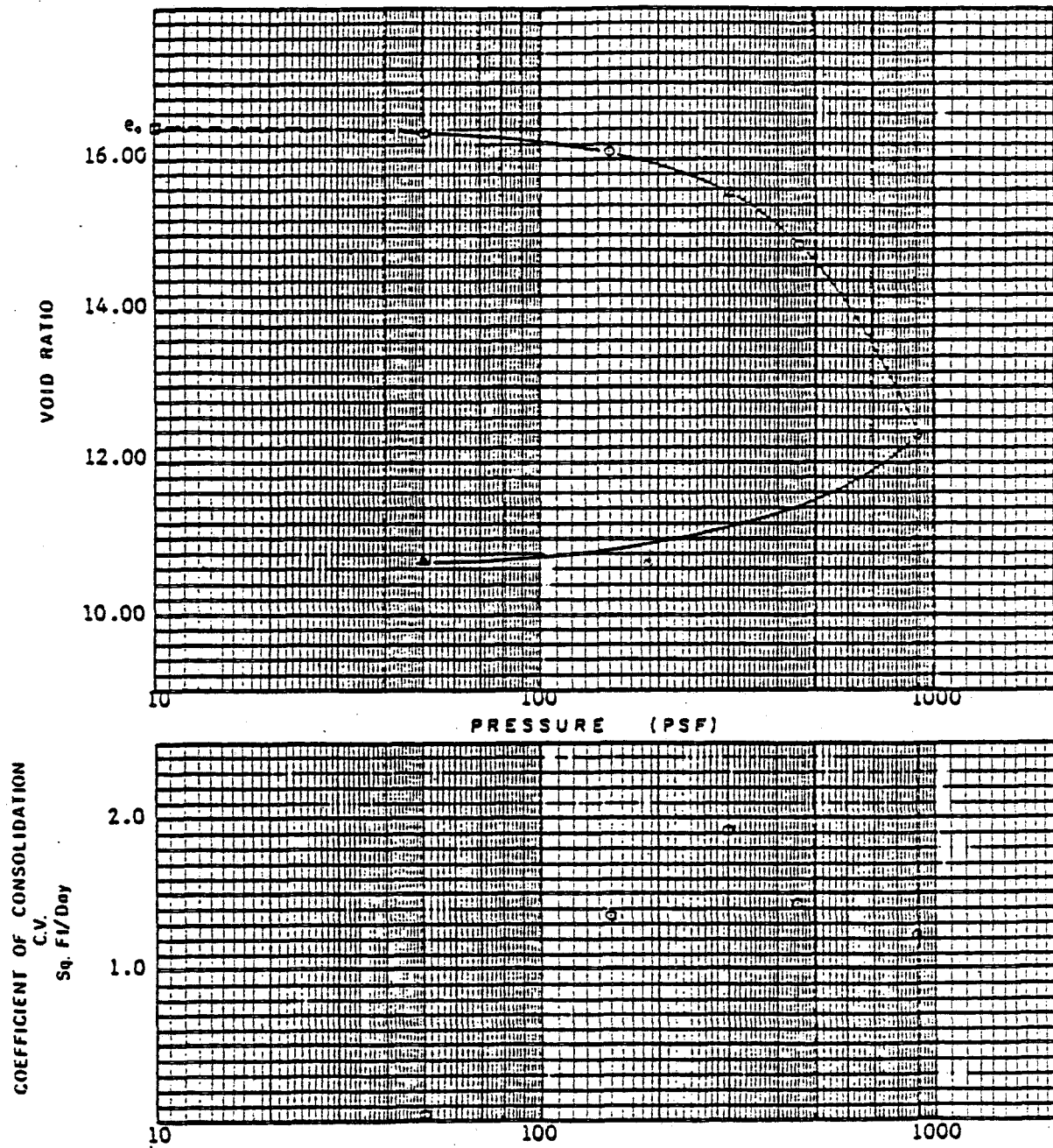
SAMPLE LOCATION: Small block

sd: 5.2

SOIL DESCRIPTION: Peat

FINAL s: 100.0

ss: 8.2



RECORD OF CONSOLIDATION TEST

CLIENT: Hazen & Sawyer, Engineers

LL: N/A

PI: N/A

PROJECT Compost Facility
Broward County, Florida

G_s: 1.628

INITIAL s: 96.3

SAMPLE LOCATION: Boring CB-50
Sample 7

g_d: 5.8

SCIL DESCRIPTION: Peat

FINAL s: 99.5

g_d: 8.7

SUMMARY OF UNDISTURBED BLOCK SAMPLES
KBC Consultants, Inc.
Project No. 8202

<u>Test* Location</u>	<u>Depth Sampled, Inches</u>	<u>Volume, ft³</u>	<u>Water Content, %</u>	<u>Wet Density, pcf</u>	<u>Void Ratio</u>
41	13 - 22	0.42	921	60	13
16	11 - 16	0.09	1164	65	19
56	14 - 23	0.44	767	65	13
1	10 - 22	0.68	1008	67	17
4	9 - 19	0.64	893	68	17
27	15 - 26	0.46	885	64	18
48	12 - 22	0.28	N/A	67	8

*Refer to Drawing No. 3.

APPENDIX

SECTION 2



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

P-7191

LAB. NO. 82921-26

ORDER NO. 82256

REPORT OF: Classification of Soils for Engineering Purposes

CLIENT: City of Fort Lauderdale

PROJECT: No. 7191 (Powell Brothers Tract)

ENGINEER: Hazen & Sawyer, P.C.

SAMPLE DESCRIPTIONS: 1) Brown Fibrous Muck
2) Tan Fibrous Marl
3) Gray F-M Sand w/some Marl
4) Tan-Gray F-M Sand
5) Tan Limestone (6-12')
6) Tan Limestone (12-20')

SAMPLED BY: C. Smith & D. Montgomery on 7-8-82 & 7-9-82

REPORTED TO: 2-Client 1-Hazen & Sawyer

RESULTS OF TESTS

Sample No.	1	2	3	4	5	6
Sieve Size	Percent Passing					
#4	100	100	100	100	49	35
#10	100	100	99	100	39	26
#40	97	99	94	88	28	18
#50	97	98	78	65	24	16
#80	97	94	29	20	19	12
#100	96	89	12	6	14	9
#200	94	84	7.1	1.6	11.2	8.1
Liquid Limit:	N/A	52	20	17	21	21
Plasticity Index:	N/A	3	NP	NP	NP	NP
Moisture Content:	86.0	45.6	16	12	10	9
Organics Content:	28.1	4.5	2.7	0.9	N/A	N/A
Coefficient of Uniformity:	N/A	N/A	N/A	1.9	N/A	N/A
Coefficient of Curvature:	N/A	N/A	N/A	7.7	N/A	N/A
Group Symbol:	PT	MH	SP-SM	SP	GW-GC	GW-GC

STANDARDS FOR METHOD OF TEST ASTM D2487

Sincerely,
Eastcoast Testing & Engineering, Inc.


Francis S. Kleeman, P.E.



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82868 Boring No. B-1
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 18+50 N. & 6+50 E. Date 7-9-82 Driller D. Montgomery
Ground Water 0'6" Date 7-9-82 Ground Elevation UNK Casing NONE Drill No. 01

FEET	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"	BLOWS ON SAMPLER per 6"
0	Brown Fibrous Muck		1/-
1	Gray F-M Sand w/some Marl		1/1
2	Tan-Gray F-M Sand		1/2
3			2/2
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The above test boring was conducted in accordance with A.S.T.M. designation D-1586.

As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

By Francis S. Kleeman
Francis S. Kleeman, P.E.

By Francis S. Kleeman
Francis S. Kleeman, P.E.

Francis S. Kleeman, P.E.

Francis S. Kleeman, P.E.

Francis S. Kleeman, P.E.



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301.

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82873 Boring No. B-1
Project #7191 (Dowell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 16+50 N. & 6+00 E. Date 7-6-82 Driller D. Montoomery
Ground Water 0'6" Date 7-6-82 Ground Elevation UNK Casing None Drill No. -

FEET SAMPLE METERS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"
		0	10	20	30	40	50	60	70	80	90	100	
0	Brown Fibrous Muck												Hand Auger
1	Tan Fine-Medium Sand												
2	Tan Limestone												
3	Bottom of Probe												
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The above test boring was conducted in accordance with A.S.T.M. designation D2488
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By Francis S. Kleeman
Francis S. Kleeman, P.E.



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82874 Boring No. P-2
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 16+50 N. & 7+00 E. Date 7-6-82 Driller D. Montoomery
Ground Water 0'6" Date 7-6-82 Ground Elevation UNK Casing NONE Drill No. -

FEET SAMPLE METERS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 3" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"
		0	10	20	30	40	50	60	70	80	90	100	
0	Brown Fibrous Muck												Hand Auger
1	Tan Fine-Medium Sand												
2	Tan Limestone Bottom of Probe												
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By Francis S. Kleeman
Francis S. Kleeman, P.E.



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430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82675 Boring No. P-3
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 16+50 N. & 9+00 E. Date 7-6-82 Driller D. Montoomery
Ground Water 0'6" Date 7-6-82 Ground Elevation UNK Casing NONE Drill No. -

FEET SAMPLE METERS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"
		0	10	20	30	40	50	60	70	80	90	100	
0	Brown Fibrous Muck												Hand Auger
1	Tan Fine-Medium Sand												
2	Tan Limestone												
3	Bottom of Probe												
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By Francis S. Kleeman
Francis S. Kleeman, P.E.



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430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82876 Boring No. B-4
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 16+50 N. & 9+00 E. Date 7-6-82 Driller D. Montgomery
Ground Water SURFACE Date 7-6-82 Ground Elevation UNK Casing NONE Drill No. -

FEET SAMPLE METERS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"
		0	10	20	30	40	50	60	70	80	90	100	
0	Brown Fibrous Muck												Hand Auger
1	Tan Fine-Medium Sand												
2	Tan Limestone												
3	Bottom of Probe												
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As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

By

Francis S. Kleeman
Francis S. Kleeman, P.E.



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430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82877 Boring No. B-5
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 16+50 N. & 11+00 E. Date 7-6-82 Driller D. Montoomery
Ground Water SURFACE Date 7-6-82 Ground Elevation UNK Casing NONE Drill No. -

CLASSIFICATION		STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"										BLOWS ON SAMPLER per 6"	
FEET SAMPLE METERS		0	10	20	30	40	50	60	70	80	90	100	Hand Auger
0	Brown Fibrous Muck												
1	Tan-Gray-Fine-Medium Sand												
2	Tan Limestone												
3	Bottom of Probe												
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By Francis S. Kleeman
Francis S. Kleeman, P.E.



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430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82578 Boring No. P-6
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 16+50 N. & 13+00 E. Date 7-6-82 Driller D. Montgomery
Ground Water Surface Date 7-6-82 Ground Elevation UNK Casing None Drill No. -

FEET SAMPLE METERS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"
		0	10	20	30	40	50	60	70	80	90	100	
0	Brown Fibrous Muck												Hand Auger
1	Tan-Gray F-M Sand												
2	Tan Limestone												
3	Bottom of Probe												
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By Francis S. Kleeman
Francis S. Kleeman, P.E.



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430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82879 Boring No. P-7
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 16+50 N. & 15+00 E. Date 7-6-82 Driller D. Montgomery
Ground Water 0'6" Date 7-6-82 Ground Elevation UNK Casing None Drill No. -

FEET SAMPLE METERS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"
		0	10	20	30	40	50	60	70	80	90	100	
0	Brown Fibrous Muck												Hand Auger
1	Tan Fibrous Marl												
2	Tan-Gray F-M Sand												
3	Tan Limestone												
4	Bottom of Probe												
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By Francis S. Kleeman
Francis S. Kleeman, P.E.



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82880 Boring No. P-8
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 16+50 N. & 16+00 E. Date 7-6-82 Driller D. Montoomery
Ground Water 0'5" Date 7-6-82 Ground Elevation UNK Casing NONE Drill No. -

FEET SAMPLE METERS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"
		0	10	20	30	40	50	60	70	80	90	100	
0	Brown Fibrous Muck												Hand Auger
1	Tan F-M Sand w/some Marl												?
2	Tan Limestone												
3	Bottom of Probe												
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By Francis S. Kleeman
Francis S. Kleeman, P.E.



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430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82881 Boring No. F-9
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 16+50 N. & 18+00 E. Date 7-6-82 Driller D. Montgomery
Ground Water 0.6" Date 7-6-82 Ground Elevation UNK Casing NONE Drill No. -1

FEET SAMPLE METERS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"
		0	10	20	30	40	50	60	70	80	90	100	
0	Brown Fibrous Muck												Hand
	Tan Fibrous Marl												Auger
1	Tan-Gray F-M Sand												
2	Tan Limestone												
	Bottom of Probe												
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As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

By

Francis Klein



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82882 Boring No. B-10
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 16+50 N. & 20+00 E. Date 7-6-82 Driller D. Montoomery
Ground Water 0'6" Date 7-6-82 Ground Elevation UNK Casing None Drill No. -

FEET	SAMPLE NUMBERS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"
			0	10	20	30	40	50	60	70	80	90	100	
0		Brown Fibrous Muck												Hand
		Tan Fibrous Marl												Auger
1														
2		Tan-Gray F-M Sand												
3		Tan Limestone												
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5		Bottom of Probe												
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The above test boring was conducted in accordance with A.S.T.M. designation D2488
As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

By

Francis S. Kleeman
Francis S. Kleeman, P.E.



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82883 Boring No. P-11
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 16+50 N. & 21+50 E. Date 7-6-82 Driller D. Montoomery
Ground Water SURFACE Date 7-6-82 Ground Elevation UNK Casing NONE Drill No. -

FEET SAMPLE METERS		CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"												BLOWS ON SAMPLER per 6"	
			0	10	20	30	40	50	60	70	80	90	100			
0		Brown Fibrous Muck													Hand	
		Tan Fibrous Marl													Auger	
1		Gray Sand w/some Marl														
		Tan-Gray F-M Sand														
2		Tan Limestone														
		Bottom of Probe														
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By Francis S. Kleeman
Francis S. Kleeman, P.E.



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82884 Boring No. P-12
Project #7191 (Dowell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 19+50 N. & 21+00 E. Date 7-7-82 Driller D. Montoomery
Ground Water Surface Date 7-7-82 Ground Elevation UNK Casing NONE Drill No. -

FEET SAMPLE INTERVALS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"
		0	10	20	30	40	50	60	70	80	90	100	
0	Brown Fibrous Muck												Hand Auger
1	Tan-Gray F-M Sand w/trace Marl												
2	Tan Limestone												
3	Bottom of Probe												
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By Francis S. Kleeman
Francis S. Kleeman, P.E.



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82885 Boring No. B-13
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 21+00 N. & 21+00 E. Date 7-7-82 Driller D. Montgomery
Ground Water Surface Date 7-7-82 Ground Elevation UNK Casing None Drill No. -

SAMPLER DEPTH FEET	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"
		0	10	20	30	40	50	60	70	80	90	100	
0	Brown Fibrous Muck												Hand Auger
1	Tan-Gray F-M Sand												1
2	Tan Limestone												
3	Bottom of Probe												
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By Francis K. Coleman



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82886 Boring No. P-14
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 22+00 N. & 21+00 E. Date 7-7-82 Driller D. Montgomery
Ground Water Surface Date 7-7-82 Ground Elevation UNK Case None Drill No. -

FEET	SAMPLE	NOTES	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"
				0	10	20	30	40	50	60	70	80	90	100	
0			Brown Fibrous Muck												Hand
			Tan-Gray F-M Sand												Auger
1			Tan Limestone												▼
2			Bottom of Probe												
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By Francis S. Kleeman
Francis S. Kleeman, P.E.



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82887 Boring No. D-15
Project #7191 (Dowell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 19+50 N. & 17+50 E. Date 7-7-82 Driller D. Montgomery
Ground Water Surface Date 7-7-82 Ground Elevation UNK Casing None Drill No. -

FEET	SAMPLE	DEPTH	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"
				0	10	20	30	40	50	60	70	80	90	100	
0			Brown Fibrous Muck												Hand
			Tan Fibrous Marl												Auger
1			Tan-Gray F-M Sand												
2			Tan Limestone												
3			Bottom of Probe												
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By

Francis S. Kleeman
Francis S. Kleeman



EAST COAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82888 Boring No. P-16
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Sta. 19+50 N. & 16+00 E. Date 7-7-82 Driller D. Montgomery
Ground Water Surface Date 7-7-82 Ground Elevation UNK Casing NONE Drill No. -

FEET SAMPLE METERS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"
		0	10	20	30	40	50	60	70	80	90	100	
0	Brown Fibrous Muck												Hand
	Tan Fibrous Marl												Auger
1	Tan-Gray F-M Sand												
2	Tan Limestone												
3	Bottom of Probe												
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By Francis S. Kleeman
Francis S. Kleeman, P.E.



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82889 Boring No. P-17
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 19+50 N. & 14+50 E. Date 7-7-82 Driller D. Montgomery
Ground Water SURFACE Date 7-7-82 Ground Elevation UNK Casing None Drill No. -

FEET SAMPLE WEIGHTS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"
		0	10	20	30	40	50	60	70	80	90	100	
0	Brown Fibrous Muck												Hand Auger
1	Tan Fibrous Marl												
2	Tan-Gray Sand w/some Rock												
3	Tan Limestone												
4	Bottom of Probe												
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By Francis E. Kleeman
Francis E. Kleeman E E



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82890 Boring No. F-18
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 21+00 N. & 14+50 E. Date 7-7-82 Driller D. Montgomery
Ground Water Surface Date 7-7-82 Ground Elevation UNK Casing None Drill No. -

FEET SAMPLE METERS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"
		0	10	20	30	40	50	60	70	80	90	100	
0	Brown Fibrous Muck												Hand
	Tan Fibrous Marl												Auger
1	Tan-Gray F-M Sand												
2	Tan Limestone												
3	Bottom of Probe												
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By

Francis S. Kleeman
Francis S. Kleeman, P.E.



EAST COAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82891 Boring No. P-19
Project: #7191 (Powell Brothers Tract) Order No. 82256
Client: City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 22+00 N. & 14+50 E. Date 7-7-82 Driller D. Montgomery
Ground Water Surface Date 7-7-82 Ground Elevation UNK Casing NONE Drill No. -

FEET SAMPLE METERS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"
		0	10	20	30	40	50	60	70	80	90	100	
0	Brown Fibrous Muck												Hand
	Tan Fibrous Marl												Auger
1	Tan-Gray F-M Sand												
2	Tan Sand w/some Marl & trace												
	Rock												
3	Bottom of Probe												
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By

Francis S. Kleeman

Francis S. Kleeman, P.E.



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82692 Boring No. B-20
Project #7191 (Dowell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 19+50 N. & 13+00 E. Date 7-7-82 Driller D. Montgomery
Ground Water Surface Date 7-7-82 Ground Elevation UNK Casing NONE Drill No. -

FEET SAMPLE METERS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"
		0	10	20	30	40	50	60	70	80	90	100	
0	Brown Fibrous Muck												Hand
	Tan Fibrous Marl												Auger
1	Tan-Gray F-M Sand												1
2	Tan Limestone												
3	Bottom of Probe												
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By Francis S. Kleeman
Francis S. Kleeman, P.E.



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82893 Boring No. B-21
Project #7191 (Dowell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 19+50 N. & 12+00 E. Date 7-7-82 Driller D. Montgomery
Ground Water Surface Date 7-7-82 Ground Elevation UNK Casing NONE Drill No. -

FEET SAMPLE METERS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"										BLOWS ON SAMPLER per 6"	
		0	10	20	30	40	50	60	70	80	90	100	
0	Brown Fibrous Muck												Hand
	Tan Fibrous Marl												Auger
1	Tan-Gray F-M Sand												
	Tan Limestone												
	Bottom of Probe												
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By Francis S. Kleeman
Francis S. Kleeman, P.E.



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82894 Boring No. P-22
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 19+50 N. & 10+50 E. Date 7-7-82 Driller D. Montgomery
Ground Water Surface Date 7-7-82 Ground Elevation UNK Casing None Drill No. "

FEET	SAMPLE	METERS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"
				0	10	20	30	40	50	60	70	80	90	100	
0			Brown Fibrous Muck												Hand
			Tan Fibrous Marl												Auger
1			Tan-Gray F-M Sand												
2			Tan Limestone												
3			Bottom of Probe												
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By Francis S. Kleeman
Francis S. Kleeman, P.E.



EAST COAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82895 Boring No. P-23
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 21+00 N. & 10+50 E. Date 7-7-82 Driller D. Montoomery
Ground Water Surface Date 7-7-82 Ground Elevation UNK Casing NONE Drill No. -

FEET SAMPLE METERS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"										BLOWS ON SAMPLER per 6"	
		0	10	20	30	40	50	60	70	80	90	100	
0	Brown Fibrous Muck												Hand
1	Tan-Gray Sand w/some Marl												Auger
2	Tan Limestone												
3	Bottom of Probe												
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The above test boring was conducted in accordance with A.S.T.M. designation D2488

As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

By Francis S. Kleeman
Francis S. Kleeman, P.E.



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82896

Project #7191 (Powell Brothers Tract)

Client City of Fort Lauderdale

Boring Location Station 22+00 N. & 10+50 E.

Ground Water Surface Date 7-7-82 Ground Elevation UNK

Boring No. B-24

Order No. 82256

Crew Chief C. Smith

Driller D. Montgomery

Drill No. -

FEET	SAMPLE	FEET	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"	
				0	10	20	30	40	50	60	70	80	90	100		
0			Brown Fibrous Muck													Hand
1			Tan Fibrous Marl													Auger
2			Tan-Gray F-M Sand													
3			Tan Limestone													
4			Bottom of Probe													
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The above test boring was conducted in accordance with A.S.T.M. designation D2468
As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

By Francis S. Kleeman
Francis S. Kleeman, P.E.



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82897 Boring No. D-25
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 19+50 N. & 9+00 E. Date 7-8-82 Driller D. Montgomery
Ground Water SURFACE Date 7-8-82 Ground Elevation UNK Casing NONE Drill No. -

FEET SAMPLE METERS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"										BLOWS ON SAMPLER per 6"	
		0	10	20	30	40	50	60	70	80	90	100	Hand Auger
0	Brown Fibrous Muck												
1	Tan-Gray F-M Sand												
2	Tan Limestone												
3	Bottom of Probe												
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The above test boring was conducted in accordance with A.S.T.M. designation D2488
As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

By Francis S. Kleeman
Francis S. Kleeman, P.E.



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82898 Boring No. C-26
Project #7191 (Dowell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 19+50 N. & 7+00 E. Date 7-8-82 Driller D. Montgomery
Ground Water Surface Date 7-8-82 Ground Elevation UNK Casing NONE Drill No. -

FEET SAMPLE METERS	CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"										BLOWS ON SAMPLER per 6"	
		0	10	20	30	40	50	60	70	80	90	100	
0	Brown Fibrous Muck												Hand
	Gray Sand w/some Marl												Auger
1													
2	Tan-Gray F-M Sand												
3	Tan Limestone												
4	Bottom of Probe												
5													
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The above test boring was conducted in accordance with A.S.T.M. designation D2488

As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

By Francis S. Kleeman
Francis S. Kleeman, P.E.



EASTCOAST TESTING & ENGINEERING, INC.

430 N.W. FLAGLER DRIVE, FT. LAUDERDALE, FLORIDA 33301

TELEPHONE 305/523-4244

TEST BORING REPORT

Laboratory No. 82899 Boring No. P-27
Project #7191 (Powell Brothers Tract) Order No. 82256
Client City of Fort Lauderdale Crew Chief C. Smith
Boring Location Station 19+50 N. & 5+50 E. Date 7-8-82 Driller D. Montgomery
Ground Water Surface Date 7-8-82 Ground Elevation UNK Casing None Drill No. -

FEET SAMPLE METERS			CLASSIFICATION	STANDARD PENETRATION TEST Blows per foot on 2" O.D. Sampler with 140 lb. hammer falling 30"											BLOWS ON SAMPLER per 6"		
				0	10	20	30	40	50	60	70	80	90	100			
0				Brown Fibrous Muck												Hand Auger	
1				Tan-Gray F-M Sand													
2				Tan Limestone													
3				Bottom of Probe													
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The above test boring was conducted in accordance with A.S.T.M. designation D2488
As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

By Francis S. Kleeman
Francis S. Kleeman, P.E.

APPENDIX

SECTION 3

TEST BORING REPORT

DATE COMPLETED 07/9/78

Florida Testing & Engineering Co.
By W. W. Winterkoller

Florida Testing & Engineering Co.
Engineers' Laboratory
6784 N.W. 17th Avenue
Fort Lauderdale, Florida 33309
TEST BORING REPORT

phone (305) 971-4400

CLIENT Mr. James Griffey

PROJECT see page 1.

LOCATION as staked in field.

DRILLER Krapf & Haire

DRILL No. 4

ORDER No. 7098

REPORT No. 1

HOLE No. 1 (Pg. 2)

DATE STARTED see page 1.

DATE COMPLETED see page 1.

GROUND ELEVATION Not Given.

DESCRIPTION OF MATERIALS

			SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENE- TRATION (FGOT)	HAM- MER BLOW COUNT
				54	16	Hc
				43	17	As
				37	18	
20.0'	5.0'	Gray-tan limerock with silica sand	5	24	19	
				26	20	
				39	21	
				42	22	
				44	23	
25.0'	5.0'	Gray-tan limerock with silica sand	6	43	24	
				41	25	
				29	26	
				31	27	
				36	28	
30.0'	5.0'	Gray-tan limerock with silica sand	7	33	29	
				30	30	↓
		Boring continued on Page 3.....				
	SC					

Water level see page 1..... below surface at date

The above test boring was conducted in accordance with A.S.T.M. designation D-1586.
As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.
By W. W. Wheeler

Florida Testing & Engineering Co.

Engineer's Laboratory

6784 N.W. 17th Avenue

Fort Lauderdale, Florida 33309

TEST BORING REPORT

Phone (305) 971-4400

CLIENT Mr. Griffey

PROJECT see page 1.

LOCATION see page 1.

DRILLER Krapf & Haire

DRILL No 4

ORDER No 7098

REPORT No 1

HOLE No 1 (Pg. 3)

DATE STARTED see page 1.

DATE COMPLETED see page 1.

GROUND ELEVATION Not Given.

DESCRIPTION OF MATERIALS

SAMPLE NUMBER HAMMER BLOWS ON SAMPLER PENETRATION (FOOT) HAMMER BLOWS ON CASING

35.0' 5.0' Gray-tan medium fine silica sand

8

44 31
51 32
58 33
73 34
90 35

Hold
Aug

40.0' 5.0' Gray tan fine to medium silica sand

9

41 36
63 37
82 38
74 39
58 40

43.0' 3.0' Gray-tan fine to medium silica sand

10

29 41
47 42
83 43

45.0' 2.0' Gray fine-medium silica sand w/limerock fragments

11

154 44
120 45

Boring continued on Page 4....

see page 1....

Water level _____' below surface at _____ date _____

SC

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.
W. H. Winterhall

6784 N.W. 17th Avenue
Fort Lauderdale, Florida 33309
TEST BORING REPORT

7098
ORDER No. _____
REPORT No. 1
HOLE No. 1 (Pg. 4)
DATE STARTED _____ see page 1
DATE COMPLETED _____ see page 1

Florida Testing & Engineering Co., Inc.
By J. V. Winterholler
J. V. Winterholler, P.E.

Florida Testing & Engineering Co.

Engineer's Laboratory

6784 N.W. 17th Avenue

Fort Lauderdale, Florida 33309

TEST BORING REPORT

nc. (305) 971-4400

CLIENT Mr. James T. Griffey
 PROJECT Prop. Lake SW 1/4, Sec. 19-50-42, Broward County
 LOCATION as staked in field
 DRILLER Krapf & Haire DRILL No. 4

ORDER No. 7098
 REPORT No. 1
 HOLE No. 2
 DATE STARTED 6/10/76
 DATE COMPLETED 6/10/76

GROUND ELEVATION		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENETRATION (FOOT)	HAMMER BLOWS ON CASING
0.5'	0.5'	Brown muck	1	2	1	Hollow
2.5'	2.0'	Tan medium fine silica sand	2	4	2	Auger
				35	3	
				41	4	
5.0'	2.5'	Tan-gray limeroack with silica sand	3	32	5	
				43	6	
				17	7	
				28	8	
				39	9	
10.0'	5.0'	Gray limeroack with silica sand	4	30	10	
				18	11	
				27	12	
				36	13	
				31	14	
15.0'	5.0'	Gray limeroack with silica sand	5	33	15	

Boring continued on Page 2....

SC

Water level: .5 4:30 pm 6/10/76
 ' below surface at _____ date _____

The above test boring was conducted in accordance with A.S.T.M. designation D-1586.
 As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.
 By J. V. Winterholte
 J. V. Winterholte, P.E.

Florida Testing & Engineering Co.

Engineer's Laboratory

(305) 971-4400

6784 N.W. 17th Avenue
Fort Lauderdale, Florida 33309
TEST BORING REPORT

CLIENT Mr. James Griffey

PROJECT see page 1.

LOCATION as staked in field.

DRILLER Krapf & Haire

DRILL No. 4

ORDER No. 7098

REPORT No. 1

HOLE No. 2 (Pg. 2)

DATE STARTED see page 1.

DATE COMPLETED see page 1.

GROUND ELEVATION		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENETRATION (FGT)	HAMMER BLOWS ON CASING
				26	16	101
				34	17	Aug
				37	18	
				40	19	
20.0'	5.0'	Tan-gray limeock with silica sand	6	45	20	
				23	21	
				28	22	
				31	23	
				44	24	
25.0'	5.0'	Tan-gray limerock with silica sand	7	30	25	
				18	26	
				21	27	
				23	28	
				16	29	
30.0'	5.0'	Tan-gray limerock with silica sand	8	11	30	
		Boring continued on Page 3.....				
	SC					
		see page 1.....				
		Water level: _____ below surface at _____ date _____				

The above test boring was conducted in accordance with A.S.T.M. designation D-1586.
As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.
By [Signature]

Florida Testing & Engineering Co.

Engineer's Laboratory

one (305) 771-1110

6784 N.W. 17th Avenue
Fort Lauderdale, Florida 33309
TEST BORING REPORT

CLIENT Mr. Griffey

PROJECT see page 1.

LOCATION see page 1.

DRILLER Krapf & Haire

DRILL No. 4

ORDER No. 7098

REPORT No. 1

HOLE No. 2 (Pg. 3)

DATE STARTED see page 1.

DATE COMPLETED see page 1.

GROUND ELEVATION		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	FINE-TRATION (FOOT)	HAMMER BLOWS ON CASING
				16	31	Hole
				23	32	Aug
				29	33	
				14	34	
35.0'	5.0'	Gray-tan limerock with silica sand	9	11	35	
				8	36	
				10	37	
				12	38	
				97	39	
40.0'	5.0'	Tan-gray limerock with silica sand	10	83	40	
				13	41	
				21	42	
				27	43	
				38	44	
45.0'	5.0'	Tan-gray medium fine silica sand with limerock	11	35	45	↓
Boring continued on Page 4....						
see page 1....						
SC	Water level: _____' below surface at _____ date _____					

The above test boring was conducted in accordance with A.S.T.M. designation D-1586.
As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.
By W. W. Hatcher

Florida Testing & Engineering Co.
Engineers Laboratory
 6784 N.W. 17th Avenue
 Fort Lauderdale, Florida 33309
TEST BORING REPORT

CLIENT James T. Griffey
 PROJECT see page 1.
 LOCATION see page 1.
 DRILLER see page 1. DRILL No. 4

ORDER No. 7098
 REPORT No. 1
 HOLE No. 2 (Pg. 4)
 DATE STARTED see page 1
 DATE COMPLETED see page 1

GROUND ELEVATION		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PEN-TRATION (FOOT)	HAMMER BLOWS ON CUTTING
				9	46	HOLI
				16	47	Aug
				28	48	✓
				34	49	
50.0'	5.0'	Tan-gray medium fine silica sand with some limerock	12	42	50	

Boring completed.

SC

Water level: see page 1....
 Below surface at _____ date _____

The above test boring was conducted in accordance with A.S.T.M. designation D-1586.
 As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.
 By J. Y. Winterhalter, P.E.
 J. Y. Winterhalter, P.E.

As a further protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authentication

TEST BORING REPORT

(305) 971-4400

CLIENT Mr. James T. Griffey

PROJECT Prop. Lake SW 1/4, Sec. 19-50-42, Broward County

LOCATION as staked in field

DRILLER Krapf & Haire

DRILL No. 4

ORDER No. 7098

REPORT No. 1

HOLE No. 3

DATE STARTED 6/10/76

DATE COMPLETED 6/10/76

GROUND ELEVATION Not Given.

DESCRIPTION OF MATERIALS

			SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENE- TRATION (FOOT)	HAMMER BLOWS ON CASING
2.0'	2.0'	Brown muck	1	1	1	Hell
				3	2	Auger
				3	3	
4.5'	2.5'	Tan-brown medium fine silica sand	2	5	4	
5.0'	0.5'	Tan limerock with silica sand	3	8	5	
				17	6	
				28	7	
				34	8	
10.0'	5.0'	Gray-tan limerock with silica sand	4	43	9	
				58	10	
				43	11	
				28	12	
				31	13	
				39	14	
15.0'	5.0'	Gray-tan limerock with silica sand	5	42	15	
		Boring completed.				

SC

Water level .5 below surface at 10 a.m. date 6/10/76

The above test boring was conducted in accordance with A.S.T.M. designation D-1586.
As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Florida Testing & Engineering Co.
By J. V. Winterholler

J. V. Winterholler, P.E.

As a further protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients and are not to be distributed outside of the client's office.

REPORT OF SUBSOIL INVESTIGATION

FOR

BOARD OF BROWARD COUNTY COMMISSIONERS

RESOURCE RECOVERY OFFICE

By

Florida Testing & Engineering Co.

January, February
1984

INTRODUCTION:

The intent of this report is to present the results of a subsoil investigation conducted at the Broward County Route 441 Resource Recovery Site. The borings were conducted in conjunction with a Hydrogeological study at the site in order to provide data relative to subsoil conditions in the area of the proposed Resource Recovery Building.

SITE DESCRIPTION:

The project site is located East of Route 441 and North of the South Fork of New River in Broward County, Florida. It is legally described as a Portion of Tracts 18, 19 and 20, Sec. 25-40S-41E, Newman's Survey, Plat Book 2, Page 26. No actual topographical information has been provided for purposes of this report, however there appears to be a maximum differential from grade of one (1) foot between boring locations. At the time of the boring program, the site was moderately overgrown by sawgrass and other species indigenous to the area.

FIELD INVESTIGATION:

The field investigation consisted on six (6) "Standard Penetration Borings" conducted to depths varying from thirty (30) feet to forty-eight (48) feet below the existing ground surface. Boring locations were selected and staked in the field by our client's representative. Boring "A" was sampled continuously

to a depth of forty-eight (48) feet by using a combination of two-foot split spoon and five foot solid spoon samplers. Borings "B" thru "F" were conducted in accordance with ASTM Designation D-1586 utilizing a two foot split-spoon sampler. Blow counts on the samplers were recorded for each six inches of penetration on two foot split-spoons and each twelve inches on five foot solid spoons. Representative samples were secured from each boring location and returned to our laboratory for further testing.

LABORATORY TESTING:

The lab tests were limited to twenty-six (26) Sieve analyses and six (6) organic content (Loss on Ignition) tests performed on drill samples as designated by the client's representative. Results of these tests are included with this report.

BORING RESULTS:

Review of the boring logs reveals the following general stratification for Borings "B" thru "F"; the exception, "A", will be characterized separately.

Strata I:

This strata is described as dark gray or dark brown muck and is comprised of organic silts, peat, roots and fine sand. It terminates variously from 2.5' to 4.5' below the surface.

Strata II:

Strata II is a thin lense of gray medium to fine grained silica sand with traces of roots and organic or inorganic silts.

Strata III:

Strata III is a porous limestone formation found to terminal depth of the borings. This material is in a loose to medium dense state, with only an occasional hard lense. Typical of the limestone formation in this area, this strata contains many small sand-filled cavities and occasional sandy marl inclusions. The "trace" of marl indicated on several of the boring logs is presumably the calcareous silty material produced when the leading edge of the sampler crushes portions of the limestone formation, and it is of no real consequence in foundation design considerations.

Boring "A" results indicate a deep solution hole in the limestone formation which is filled with sandy marl to a depth of twenty-two (22) feet. Below this point, and to terminal depth of the boring, the material is comprised of alternating layers of "limerock and sand" and "silica sand with traces of limerock and shell". $\bar{N}$ values recorded in this boring are generally lower than those recorded in the other boring locations.

CONCLUSIONS:

The surface strata of "muck" is highly compressible and incapable of providing foundation support, as is the "sandy marl" deposit shown in Boring "A". The most viable means of dealing with these conditions for purposes of building construction are to bypass them with a piling system, or to

isolate and remove them in their entirety from areas of construction plus an extended perimeter. Proper removal of these soils would allow development of controlled fill building pads supported by the native limestone formation, and if properly constructed, could provide a bearing value of 2500 p.s.f.

Since no construction details are known at this time, it is impossible to provide more definitive recommendations, however we will be happy to be of further assistance when more data is available.

Respectfully Submitted,
FLORIDA TESTING & ENGINEERING CO.



J. V. Winterholler, Jr., P.E.
Registered Engineer No. 6893
State of Florida

Florida Testing & Engineering Co.

Engineer's Laboratory

6784 N.W. 17th Avenue

Fort Lauderdale, Florida 33309

TEST BORING REPORT

Phone (305) 971-4400

CLIENT BOARD OF BROWARD COUNTY COMMISSIONERS, Resource Recovery
 PROJECT Rt. 441 Site, Resource Recovery Program Office
 LOCATION as staked in field by client's representative
 DRILLER Shuman/Brown/May DRILL No. 4

ORDER No. 9181

REPORT No. 1

HOLE No. A

DATE STARTED 1/31/84

DATE COMPLETED 2/1/84

GROUND ELEVATION		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENE-TRATION (FOOT)	HAMMER BLOWS ON CASING
	Not Given.					
4.5'	4.5'	Dark gray muck	1	1/0 1/1 0/1 0/1	1 2 3 4	C A S E
9.0'	4.5'	Gray medium fine silica sand	2	1/2 3/4 3/2 2/4 3/3	5 6 7 8 9	E D
10.0'	1.0'	Gray sandy marl	3	4/3	10	
15.0'	5.0'	Gray sandy marl	4	3/4 4/5 1/2 2/2 1/2	11 12 13 14 15	
20.0'	5.0'	Gray sandy marl	5	2 2 1 3 2	16 17 18 19 20	✓

The above test boring was conducted in accordance with A.S.T.M. designation D-1586.

As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

boring continued on Page 2...

Water level: 0.5' below surface @ -

Date: See Above.

Florida Testing & Engineering Co.
J. V. Winterholler
 By _____

J. V. Winterholler, P.E.

As a further protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.

Florida Testing & Engineering Co.

Engineer's Laboratory

6784 N.W. 17th Avenue

Fort Lauderdale, Florida 33309

TEST BORING REPORT

CLIENT BOARD OF BROWARD COUNTY COMMISSIONERS, Resource Recovery
 PROJECT Rt. 441 Site, Resource Recovery Program Office
 LOCATION as staked in field by client's rep.
 DRILLER See page 1. DRILL NO see pg. 1

ORDER No. 9181
 REPORT No. 1
 HOLE No. A (Pg. 2)
 DATE STARTED see page 1.
 DATE COMPLETED see page 1.

GROUND ELEVATION		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENE-TRATION (FOOT)	HAMMER BLOWS ON CASING
Not Given.						
22.0'	2.0'	Gray sandy marl w/trace of limerock	6	3 4	21 22	C A S E D
				4 5	23 24	
25.0'	3.0'	Tan limerock w/trace silica sand & trace of marl	7	5	25	
				3 6	26 27	
				4 2	28 29	
30.0'	5.0'	Tan limerock w/some silica sand	8	10	30	
				7 4 5 4	31 32 33 34	
35.0'	5.0'	Tan medium fine silica sand w/trace limerock & slight shell	9	4	35	
				13 15	36 37	
37.0'	2.0'	Tan medium fine silica sand w/trace limerock & slight shell	10			
				50 31	38 39	
40.0'	3.0'	Tan limerock w/silica sand	11	8	40	

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. Boring continued on Page 3.
 As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Water level: See Page 1.

Florida Testing & Engineering Co.
 By J. V. Winterholler
 J. V. Winterholler, P.E.

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TEST BORING REPORT

DATE COMPLETED see page 1.

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Florida Testing & Engineering Co.

Engineer's Laboratory

6784 N.W. 17th Avenue

Fort Lauderdale, Florida 33309

TEST BORING REPORT

CLIENT BOARD OF BROWARD COUNTY COMMISSIONERS, Resource Recovery
PROJECT Rt. 441 Site, Resource Recovery Program Office
LOCATION as staked in field by client's representative
DRILLER Shuman/Brown DRILL No. 4

ORDER No. 9181

REPORT No. 1

HOLE No. B

DATE STARTED 2/1/84

DATE COMPLETED 2/1/84

GROUND ELEVATION		Not Given.	DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENE-TRATION (FOOT)	HAMMER BLOWS ON CASING
					1/0	1	
					1/0	2	
3.0'	3.0'		Dark brown fibrous mud	1	1/2	3	
					1/2	4	
5.0'	2.0'		Gray medium fine silica sand w/trace of roots & trace of organics	2	2/2	5	
					4/4	6	
					3/4	7	
					4/5	8	
					3/3	9	
10.0'	5.0'		Tan limerock w/trace silica sand & trace of marl	3	4/4	10	
					4/4	11	
					5/4	12	
						13	
						14	
15.0'	5.0'		Tan limerock w/trace silica sand & trace of marl	4		15	
					14/17	16	
					15/20	17	
						18	
						19	
20.0'	5.0'		Tan limerock w/trace silica sand & trace of marl	5		20	

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. boring continue
As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this on Page 2...

Water level: 0.5' below surface @ -
Date: See Above.

Florida Testing & Engineering Co.
By J. V. Winterholler, P.E.

Engineer's Laboratory

6784 N.W. 17th Avenue

Fort Lauderdale, Florida 33309

TEST BORING REPORT

CLIENT BOARD OF BROWARD COUNTY COMMISSIONERS, Resource Recovery

PROJECT Rt. 441 Site, Resource Recovery Program Office

LOCATION as staked in field by client's rep.

DRILLER See page 1.

DRILL No. See pg. 1

ORDER No. 9181

REPORT No. 1

HOLE No. B (Pg. 2)

DATE STARTED see page 1.

DATE COMPLETED see page 1.

[illegible]

The above test boring was conducted in accordance with A.S.T.M. designation D-1586.

As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Water level: See "Page 1"

Florida Testing & Engineering Co.

By J. V. Winterholler
J. V. Winterholler, P.E.

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REVISED 10/1/88

Florida Testing & Engineering Co.

Engineers Laboratory

6784 N.W. 17th Avenue

Fort Lauderdale, Florida 33309

TEST BORING REPORT

CLIENT BOARD OF BROWARD COUNTY COMMISSIONERS, Resource Recovery

PROJECT Rt. 441 Site, Resource Recovery Program Office

LOCATION as staked in field by client's representative

DRILLER Shuman/Brown

DRILL No. 4

ORDER No. 9181

REPORT No. 1

HOLE No. C

DATE STARTED 2/2/84

DATE COMPLETED 2/2/84

GROUND ELEVATION Not Given.

DESCRIPTION OF MATERIALS

SAMPLE
NUMBER

HAMMER
BLOWS ON
SAMPLER

PENE-
TRATION
(FOOT)

HAMMER
BLOWS ON
CASING

2.5' 2.5' Dark gray muck

3.0' .5' Gray medium fine silica sand w/trace of roots & organics

4.0' 1.0' Tan limerock w/trace silica sand & marl

6.0' 2.0' Tan limerock w/trace silica sand & marl

8.0' 2.0' Tan limerock w/trace silica sand & marl

10.0' 2.0' Tan limerock w/trace silica sand & marl

12.0' 2.0' Tan limerock w/trace silica sand & marl

15.0' 3.0' Tan limerock w/trace silica sand & marl

20.0' 5.0' Tan limerock w/trace silica sand & marl

The above test boring was conducted in accordance with A.S.T.M. designation D-1586.

As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property or designing of structures.

Water level: 0.5' below surface @

Date: See Above.

Florida Testing & Engineering Co.

By

J. V. Winterholler, P.E.

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TEST BORING REPORT

ORDER No. 9181
REPORT No. 1
HOLE No. C (Pg. 2)
DATE STARTED see page 1.
DATE COMPLETED see page 1.

Water level: See Page 1.

Florida Testing & Engineering Co.
By J. V. Winterholler
J. V. Winterholler, P.E.

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Florida Testing & Engineering Co.

Engineer's Laboratory

Phone (305) 971-4400

6784 N.W. 17th Avenue
Fort Lauderdale, Florida 33309

TEST BORING REPORT

CLIENT BOARD OF BROWARD COUNTY COMMISSIONERS, Resource Recovery
 PROJECT Rt. 441 Site, Resource Recovery Program Office
 LOCATION as staked in field by client's representative
 DRILLER Shuman/Brown

ORDER No. 9181
 REPORT No. 1
 HOLE No. D
 DATE STARTED 2/2/84
 DATE COMPLETED 2/2/84

DRILL No. 4

GROUND ELEVATION		Not Given.	DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENE-TRATION (FOOT)	HAMMER BLOWS ON CASING
					1/1	1	CASE
					0/1	2	
3.0'	3.0'	Dark gray muck		1	1/2	3	
4.0'	1.0'	Tan sandy marl w/limerock		2	6/9	4	
					10/14	5	
6.0'	2.0'	Tan limerock w/trace silica sand & trace of marl		3	9/6	6	
					7/5	7	
8.0'	2.0'	Tan limerock w/trace silica sand & trace of marl		4	5/6	8	
					6/5	9	
10.0'	2.0'	Tan limerock w/trace of silica sand & trace of marl		5	3/4	10	
					4/3	11	
12.0'	2.0'	Tan limerock w/trace of silica sand & trace of marl		6	2/2	12	
						13	
						14	
15.0'	3.0'	Tan limerock w/trace of silica sand & trace of marl		7		15	
						16	
					6/8	17	
					8/10	18	
						19	
20.0'	5.0'	Tan limerock w/trace of silica sand & trace of marl		8		20	

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. boring cont
 As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures. on Page 2.

Water level: 0.5' 'below surface @ -

Date: See Above.

Florida Testing & Engineering Co.
J. V. Winterhalter, P.E.

TEST BORING REPORT

DATE COMPLETED see page 1.

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Florida Testing & Engineering Co.

Engineer's Laboratory

6784 N.W. 17th Avenue

Fort Lauderdale, Florida 33309

TEST BORING REPORT

CLIENT: BOARD OF BROWARD COUNTY COMMISSIONERS, Resource Recovery
 PROJECT: Rt. 441 Site, Resource Recovery Program Office
 LOCATION: as staked in field by client's representative
 ORDER No. 9181
 REPORT No. 1
 HOLE No. E
 DATE STARTED 2/1/84
 DATE COMPLETED 2/1/84
 DRILLER: Shuman/Brown
 DRILL No. 4

GROUND ELEVATION	Not Given.	DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENE-TRATION (FOOT)	HAMMER BLOWS ON CASING
4.0'	4.0'	Dark gray muck	1	1/0	1	C A S E D
4.5'	4.5'	Gray medium fine silica sand w/slight roots	2	1/0	2	
				0/1	3	
				1/1	4	
6.0'	1.5'	Tan limerock w/some sandy marl	3	2/3	5	
				3/3	6	
				3/4	7	
				4/6	8	
				2/3	9	
				3/4	10	
11.0'	5.0'	Tan limerock w/trace silica sand & trace of marl	4	4/4	11	V
				4/5	12	
					13	
					14	
15.0'	4.0'	Tan limerock w/trace silica sand & trace of marl	5		15	
				5/6	16	
				8/10	17	
					18	
					19	
20.0'	5.0'	Tan limerock w/trace silica sand & trace of marl	6		20	

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. boring continue on Page 2...
 As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Water level: 0.5' below surface @
 Date: See Above.

Florida Testing & Engineering Co.
 J. V. Winterholler, P.E.

Florida Testing & Engineering Co.

Engineer's Laboratory

6784 N.W. 17th Avenue

Fort Lauderdale, Florida 33309

TEST BORING REPORT

0000-172 (200)

Phone (305) 971-4400

CLIENT BOARD OF BROWARD COUNTY COMMISSIONERS, Resource Recovery
 PROJECT Rt. 441 Site, Resource Recovery Program Office
 LOCATION as staked in field by client's rep.
 DRILLER See page 1. DRILL NO See pg. 1

ORDER No. 9181
 REPORT No. 1
 HOLE No. E (Pg. 2)
 DATE STARTED see page 1.
 DATE COMPLETED see page 1.

GROUND ELEVATION	Not Given.	DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENE- TRATION (FOOT)	HAMMER BLOWS ON CASING
25.0'	5.0'	Tan limeroack w/trace silica sand & trace of marl	7	3/4	21	C
				4/5	22	A
					23	S
					24	E
					25	D
30.0'	5.0'	Tan limeroack w/some silica sand	8	2/3	26	
				3/5	27	
					28	
				4/4	29	
				4/6	30	✓

The above test boring was conducted in accordance with A.S.T.M. designation D-1586.
 As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Water level: See Page 1.

Florida Testing & Engineering Co.
 By J. V. Winterholler
 J. V. Winterholler, P.E.

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Florida Testing & Engineering Co.
Engineer's Laboratory
 6784 N.W. 17th Avenue
 Fort Lauderdale, Florida 33309
TEST BORING REPORT

Phone (305) 971-4400

CLIENT BOARD OF BROWARD COUNTY COMMISSIONERS, Resource Recovery
 PROJECT Rt. 441 Site, Resource Recovery Program Office
 LOCATION as staked in field by client's representative

ORDER No. 9181

REPORT No. 1

HOLE No. F

DATE STARTED 2/2/84

DRILLER Shuman/Brown

DRILL No. 4

DATE COMPLETED 2/2/84

GROUND ELEVATION		DESCRIPTION OF MATERIALS	SAMPLE NUMBER	HAMMER BLOWS ON SAMPLER	PENE-TRATION (FOOT)	HAMMER BLOWS ON CASING
	<u>Not Given.</u>					
2.5'	2.5'	Dark gray muck	1	1/0	1	CASED
				1/1	2	
4.0'	1.5'	Gray medium fine silica sand w/trace roots & marl	2	1/2	3	
				2/2	4	
6.0'	2.0'	Tan limerock w/trace silica sand & trace of marl	3	9/11	5	
				12/8	6	
8.0'	2.0'	Tan limerock w/trace silica sand & trace of marl	4	8/5	7	
				4/3	8	
10.0'	2.0'	Tan limerock w/trace silica sand & trace of marl	5	1/2	9	
				2/4	10	
12.0'	2.0'	Tan limerock w/trace silica sand & trace of marl	6	3/5	11	
				5/7	12	
15.0'	3.0'	Tan limerock w/trace silica sand & trace of marl	7		13	
					14	
20.0'	5.0'	Tan limerock w/trace silica sand & trace of marl	8	10/13	16	
				15/15	17	
					18	
					19	
				6/4	20	

The above test boring was conducted in accordance with A.S.T.M. designation D-1586. boring continued
 As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures. on Page 2..

Water level: 0.5' below surface @
 Date: See Above.

Florida Testing & Engineering Co.
J. V. Winterholler, P.E.

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Florida Testing & Engineering Co.

Engineer's Laboratory

6784 N.W. 17th Avenue

Fort Lauderdale, Florida 33309

0044-177 (208) no. 10

one (305) 971-4400

TEST BORING REPORT

CLIENT BOARD OF BROWARD COUNTY COMMISSIONERS, Resource Recovery

PROJECT Rt. 441 Site, Resource Recovery Program Office

LOCATION as staked in field by client's rep.

DRILLER See page 1.

DRILL No see pg. 1

ORDER No. 9181

REPORT No. 1

HOLE No. F (Pg. 2)

DATE STARTED see page 1.

DATE COMPLETED see page 1.

GROUND ELEVATION Not Given.

DESCRIPTION OF MATERIALS

SAMPLE
NUMBER

HAMMER
BLOWS ON
SAMPLER

PENE-
TRATION
(FOOT)

HAMMER
BLOWS ON
CASING

25.0' 5.0' Tan limerock w/trace silica sand & trace of marl

9

3/4

25

30.0' 5.0' Tan limerock w/trace silica sand & trace of marl

10

3/3

30

The above test boring was conducted in accordance with A.S.T.M. designation D-1586.
As a mutual protection to the owners and ourselves, the engineer in the owner's behalf shall check this report with the samples submitted prior to the purchase of property, or designing of structures.

Water level: See Page 1.

Florida Testing & Engineering Co.
By J. V. Winterholler, P.E.

J. V. Winterholler, P.E.

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Reissued 2/15/84; Correction of Sample 1, Page 1, Sieve #200

REPORT OF: Sieve Analysis

CLIENT: Board of Broward County Commissioners
 Resource Recovery Office

PROJECT: 441 Site, Broward County, Florida

DATE SAMPLED 1/16 thru 2/2/84

TESTED: 2/6 - 2/10/84

REPORTED TO: Client-2
 Malcolm Pirnie, Inc., 100 Eisenhower Drive
 Paramus, N.J. 07652 (Thomas F. Fowler, Project Hydrogeolist)-1

Sample No. 1: Boring 1, Sample 3
 2: Boring 1, Sample 4
 3: Boring 2, Sample 2
 4: Boring 2, Sample 3
 5: Boring 3, Sample 3
 6: Boring 3, Sample 4
 7: Boring 4, Sample 2
 8: Boring 4, Sample 3
 9: Boring 4, Sample 4
 10: Boring 5, Sample 2

Sieve Size	Percent Passing				
	1	2	3	4	5
3/8"	99.4	98.5	96.8	100	100
#4	98.8	98.1	94.7	100	100
#10	98.4	97.6	93.1	100	99.8
#20	97.9	97.4	88.6	99.8	99.3
#40	93.2	90.6	80.8	93.8	87.4
#50	75.1	66.6	69.9	77.8	63.2
#60	61.8	50.3	61.2	64.6	50.6
#100	40.0	16.0	11.6	31.1	7.1
#200	11.1	1.7	5.9	5.6	.9

Sieve Size	Percent Passing				
	6	7	8	9	10
3/8"	91.3	98.7	64.4	67.9	95.5
#4	80.0	98.6	63.1	53.4	94.4
#10	63.2	98.2	55.4	44.8	93.2
#20	48.9	98.0	52.1	37.7	89.3
#40	37.6	92.7	45.9	30.4	81.2
#50	30.3	75.3	31.1	24.4	69.8
#60	26.1	63.6	26.5	21.0	62.9
#100	13.4	10.6	14.4	4.6	19.9
#200	1.8	1.4	1.4	3.0	9.4

continued on Page 2....

REPORT OF: Sieve Analysis
 CLIENT: Board of Broward County Commissioners
 Resource Recovery Office
 PROJECT: 441 Site, Broward County, Florida
 DATE SAMPLED: 1/16 thru 2/2/84
 TESTED: 2/6 - 2/10/84
 REPORTED TO: Client-2
 Malcolm Pirnie, Inc., 100 Eisenhower Drive
 Paramus, N.J. 07652 (Thomas F. Fowler, Project
 Hydrogeologist)-1

Sample No. 11	Boring 5, Sample 3
12	Boring 6, Sample 3
13	Boring 6, Sample 4
14	Boring 7, Sample 2 and 3
15	Boring 8, Sample 2
16	Boring 8, Sample 3
17	Boring 8, Sample 4
18	Boring 9, Sample 2
19	Boring 9, Sample 3
20	Boring 10, Sample 2

Sieve Size	11	12	13	14	15
3/8"	90.5	100	72.0	66.5	100
#4	78.8	100	59.3	62.3	100
#10	62.2	99.8	49.6	58.7	99.7
#20	47.2	99.4	41.9	54.9	99.7
#40	35.7	89.6	35.1	47.7	89.0
#50	28.8	67.6	28.5	37.7	69.5
#60	25.4	55.5	21.6	32.9	54.2
#100	12.7	8.9	12.5	11.2	7.1
#200	8.1	1.2	9.2	9.0	1.9

Sieve Size	16	17	18	19	20
3/8"	100	73.3	89.4	76.1	100
#4	100	63.6	68.4	60.7	95.9
#10	99.6	56.1	47.9	47.0	95.0
#20	97.7	51.2	34.7	38.1	94.1
#40	87.1	45.2	23.6	30.5	81.1
#50	66.4	36.8	16.5	26.6	56.0
#60	54.1	31.5	14.0	21.6	45.0
#100	9.4	15.8	6.0	10.4	12.5
#200	2.3	12.7	3.6	6.6	7.9

continued on Page 3....

REPORT OF: Sieve Analysis
CLIENT: Board of Broward County Commissioners
Resource Recovery Office
PROJECT: 441 Site, Broward County, Florida
DATE SAMPLED: 1/16 thru 2/2/84
TESTED: 2/6 - 2/10/84
REPORTED TO: Client-2
Malcolm Pirnie, Inc., 100 Eisenhower Drive
Paramus, N.Y. 10765 (Thomas F. Fowler, Project Hydrogeologist)

Sample No. 21 Boring 10, Sample 3, 24
22 Boring 11, Sample 2, 27
23 Boring 11, Sample 2, 27
24 Boring 12, Sample 2, 3
25 Boring A, Sample 2, 28
26 Boring A, Sample 3, 28

Sieve Size	21	22	23	24	25	26
3/8"	74.5	100	56.2	86.9	100	100
#4	62.7	100	46.9	71.3	100	100
#10	53.7	99.9	40.8	63.7	100	100
#20	47.1	99.5	36.6	57.1	99.6	99.6
#40	39.6	90.3	31.3	48.3	84.3	90.3
#50	31.0	71.6	24.5	36.2	59.7	70.7
#60	29.3	57.1	21.0	13.7	48.5	59.2
#100	13.6	7.8	7.5	11.7	12.9	9.4
#200	10.3	7.3	5.0	8.9	5.6	1.2

Respectfully Submitted,
FLORIDA TESTING & ENGINEERING CO.

J. V. Winterholler, Jr., P.E.

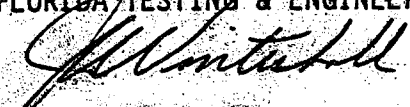
REPORT OF: Organics Content (Loss on Ignition)
CLIENT: Board of Broward County Commissioners
Resource Recovery Office
PROJECT: 441 Site, Broward County, Fla.
DATES
SAMPLED: 1/16 thru 2/2/84
REPORTED TO: Client-2
Malcolm Pirnie, Inc., 100 Eisenhower Drive
Paramus, N.J. 07652 (Thomas F. Fowler,
Project Hydrogeolist)-1

Sample 1; Boring 7, Samples 2 and 3
Sample 2; Boring 8, Sample 2
Sample 3; Boring 8, Sample 3
Sample 4; Boring 10, Sample 2
Sample 5; Boring 12, Samples 2 and 3
Sample 6; Boring 2, Sample 2

RESULTS OF TEST:

SAMPLE NO.	ORGANICS CONTENT, %
1	1.0
2	Less than 1.0
3	Less than 1.0
4	Less than 1.0
5	Less than 1.0
6	2.3

Respectfully Submitted,
FLORIDA TESTING & ENGINEERING CO.


J. V. Winterholler, Jr., P.E.

Broward County,
Florida



SOUTH BROWARD COUNTY RESOURCE RECOVERY PROJECT, INC.

Solid Waste Energy Recovery - Application for Power Plant Site Certification

**MALCOLM
PIRNIE**

Volume III -
Route 441
Appendices

South Broward County Resource Recovery Project, Inc.

Solid Waste Energy Recovery Facility

Application for

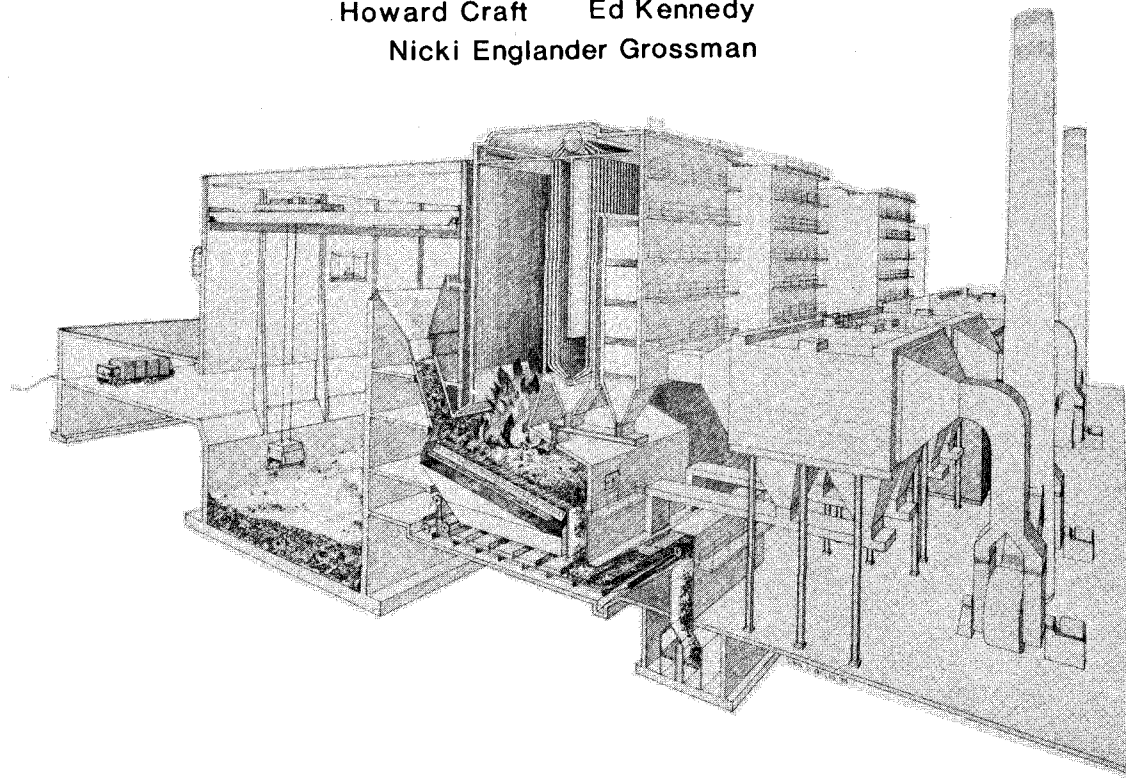
Power Plant Site Certification

Volume III - Route 441 - Appendices

Submitted By
The Broward County
Board of County Commissioners

Scott I. Cowan, Chairman
Gerald Thompson, Vice Chairman

Marcia Beach Howard Forman
Howard Craft Ed Kennedy
Nicki Englander Grossman



Floyd T. Johnson, County Administrator
Thomas M. Henderson, Director, Resource Recovery Office

March 1985

**MALCOLM
PIRNIE**



VOLUME III

LIST OF APPENDICES

- 10.9 SURFACE WATER QUALITY DATA
- 10.10 TECHNICAL NOISE ANALYSIS
- 10.11 PROPOSED PROJECT TECHNICAL AND ENVIRONMENTAL SPECIFICATIONS
- 10.12 SUMMARY UPDATE OF RESEARCH PROJECTS WITH INCINERATOR BOTTOM ASH RESIDUE
- 10.13 DRAINAGE DESIGN CALCULATIONS
- 10.14 SYNTHETIC LANDFILL LINERS
- 10.15 DER OPINION ON ASH RESIDUE
- 10.16 FRED C. HART ASSOCIATES, INC. REPORT TO NEW YORK CITY DEPARTMENT OF SANITATION
- 10.17 GARY SMITH TESTIMONY ON BEHALF OF WILLIAM RUCKELHAUS
- 10.18 ARCHAEOLOGICAL SITES
- 10.19 POWER OF ATTORNEY

SURFACE WATER QUALITY DATA

APPLICATION FILE NUMBER 060781739

FLORIDA DEPARTMENT OF ENVIRONMENTAL
REGULATION

U.S. DEPARTMENT OF THE ARMY

JOINT APPLICATION FOR ACTIVITIES IN
THE WATERS OF THE
STATE OF FLORIDA
RESPONSE TO COMPLETENESS SUMMARY

SOUTHERN RESOURCE RECOVERY FACILITY
APPLICATION FILE NUMBER 060781739

WATER QUALITY SAMPLING PROGRAM
CONDUCTED IN THE
SOUTH FORK OF THE NEW RIVER

BROWARD COUNTY, FLORIDA
MAY 3, 1984

HAZEN AND SAWYER, P.C.
CZR, INCORPORATED
MALCOLM PIRNIE, INC.

TABLE 1

TIDAL FLUCTUATIONS

<u>Time</u>	<u>*Reading</u>	<u>**Tides @ Andrews Avenue for 3/15/84</u>	
0730	762 mm		
1103	890 mm	<u>HIGH</u>	<u>LOW</u>
1216	980 mm		
1511	1200 mm	0703	0138
1708	1050 mm	1921	1334
1846	920 mm		
2010	800 mm	**Information obtained from Fort Lauderdale News 3/14/84	
2235	860 mm		
0219	1750 mm		
0434	1150 mm		

*The reading was taken from the top of the survey stick to the water level. The stick was located on the west bank just north of sample location E.

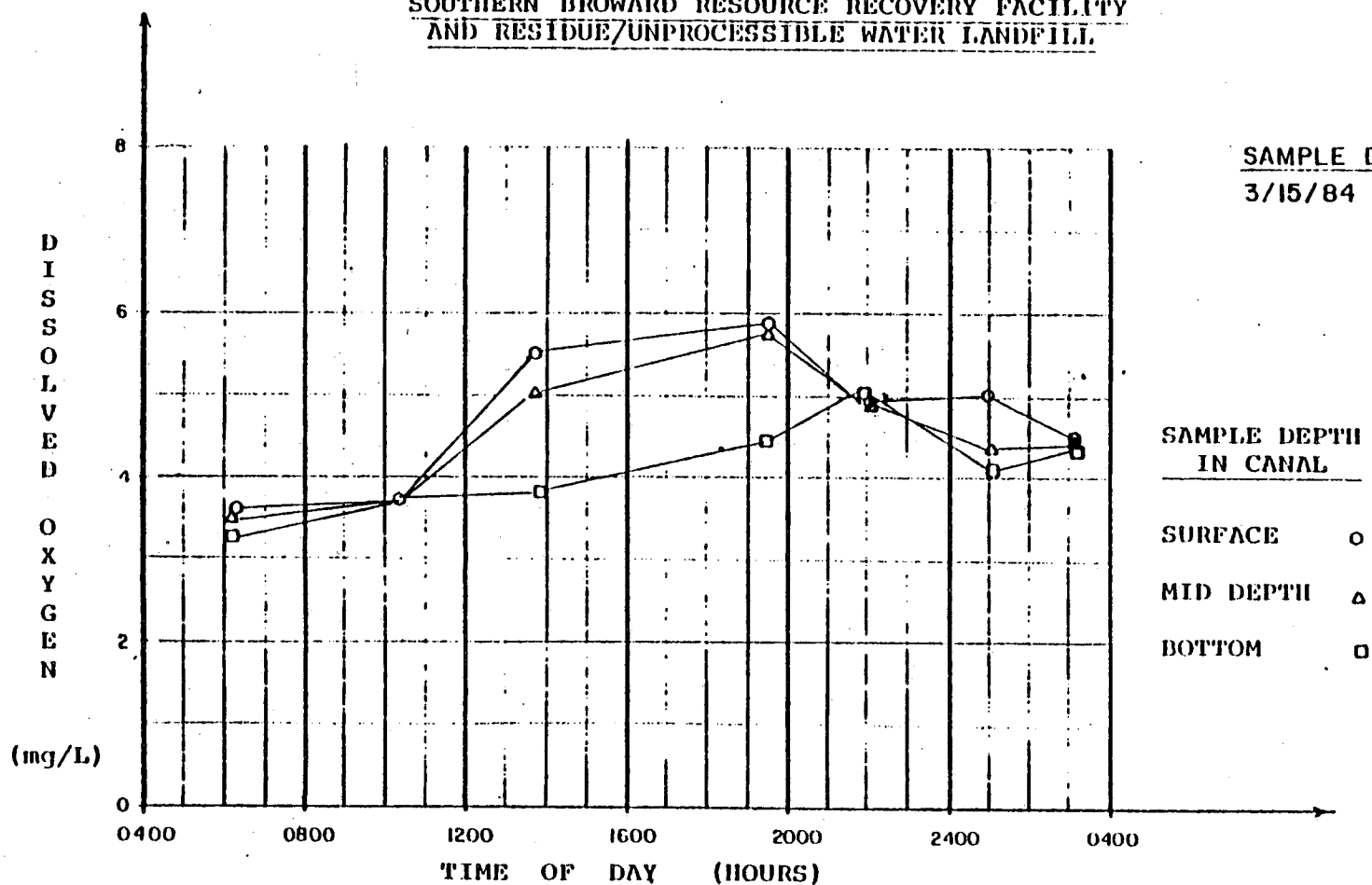
TABLE 2

AMBIENT WEATHER CONDITIONS

<u>Time</u>	<u>Cloud Cover</u>	<u>Wind</u>	<u>Air Temperature</u>
0705	15%	4-7kn from N.E.	21°C
1100	10%	2-4kn from N.E.	23°C
1520	30%	5-7kn from N.E.	26°C
2040	75%	3-5kn from N.E.	23°C
2330	75%	5-10kn from N.E.	21°C
0200	75%	5-10kn from N.E.	20°C
0410	75%	4-7kn from N.E.	18°C

SURFACE WATER SAMPLING SITE A
SOUTHERN BROWARD RESOURCE RECOVERY FACILITY
AND RESIDUE/UNPROCESSIBLE WATER LANDFILL.

SAMPLE DATE
3/15/84

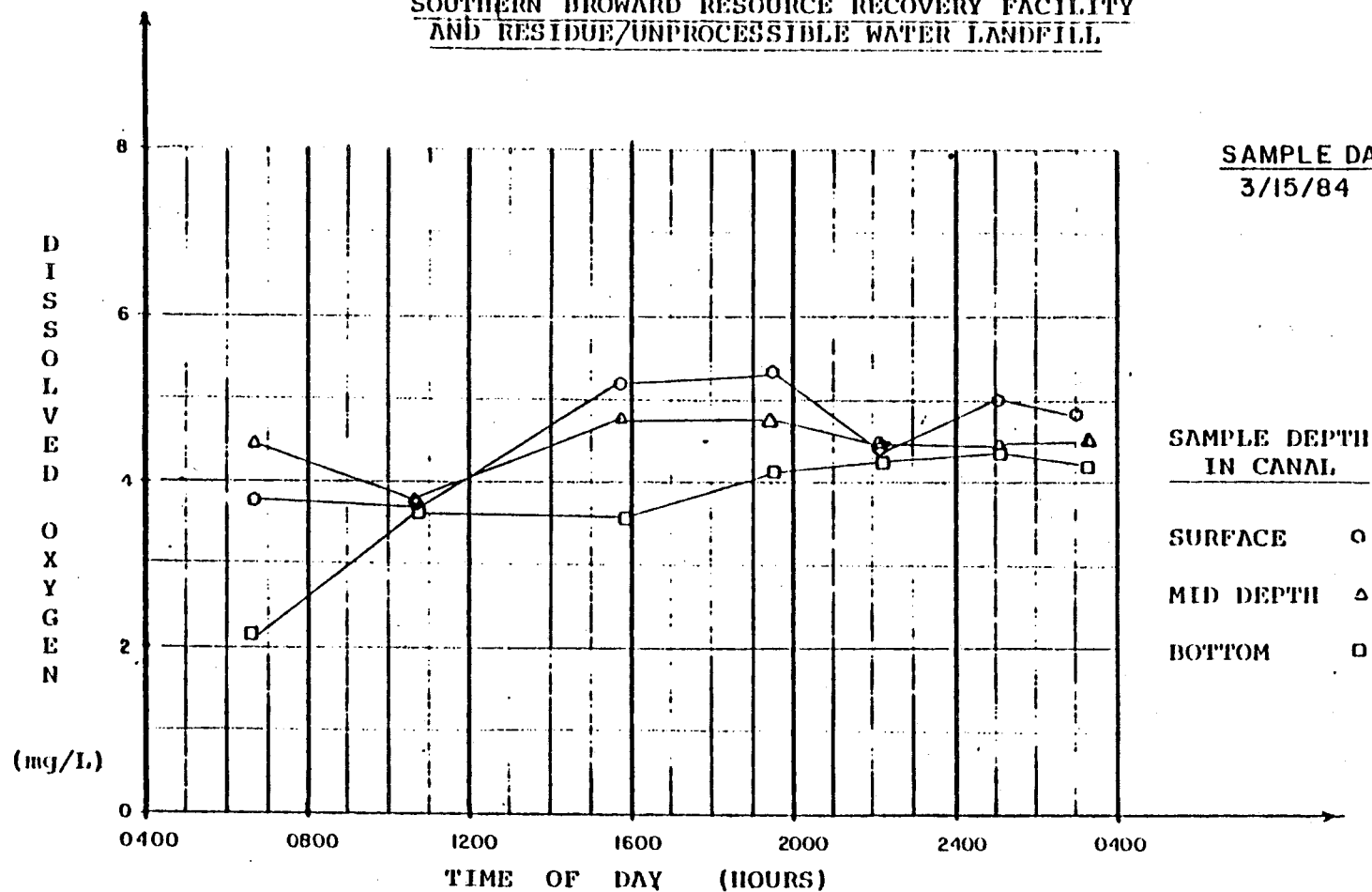


NOTE: Dissolved oxygen measurements were obtained using the Membrane Electrode Method as described in EPA manual "Methods for Chemical Analysis of Water and Wastes", 1979. The membrane was calibrated in the field using the Winkler Titration every 4 hours.

Figure 1

SURFACE WATER SAMPLING SITE B
SOUTHERN BROWARD RESOURCE RECOVERY FACILITY
AND RESIDUE/UNPROCESSIBLE WATER LANDFILL

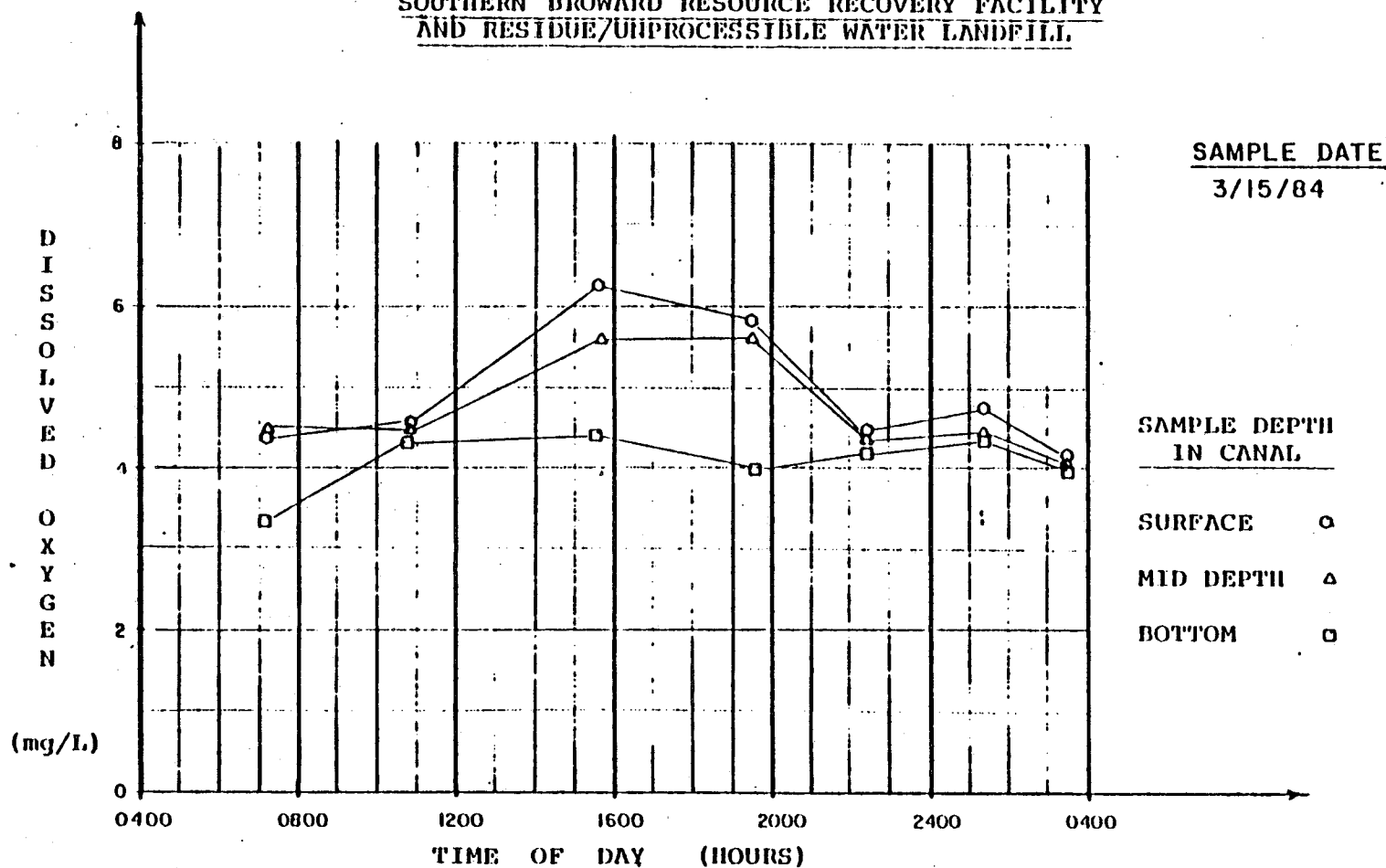
SAMPLE DATE
3/15/84



NOTE: Dissolved oxygen measurements were obtained using the Membrane Electrode Method as described in EPA manual "Methods for Chemical Analysis of Water and Wastes", 1979. The membrane was calibrated in the field using the Winkler Titration every 4 hours.

Figure 2

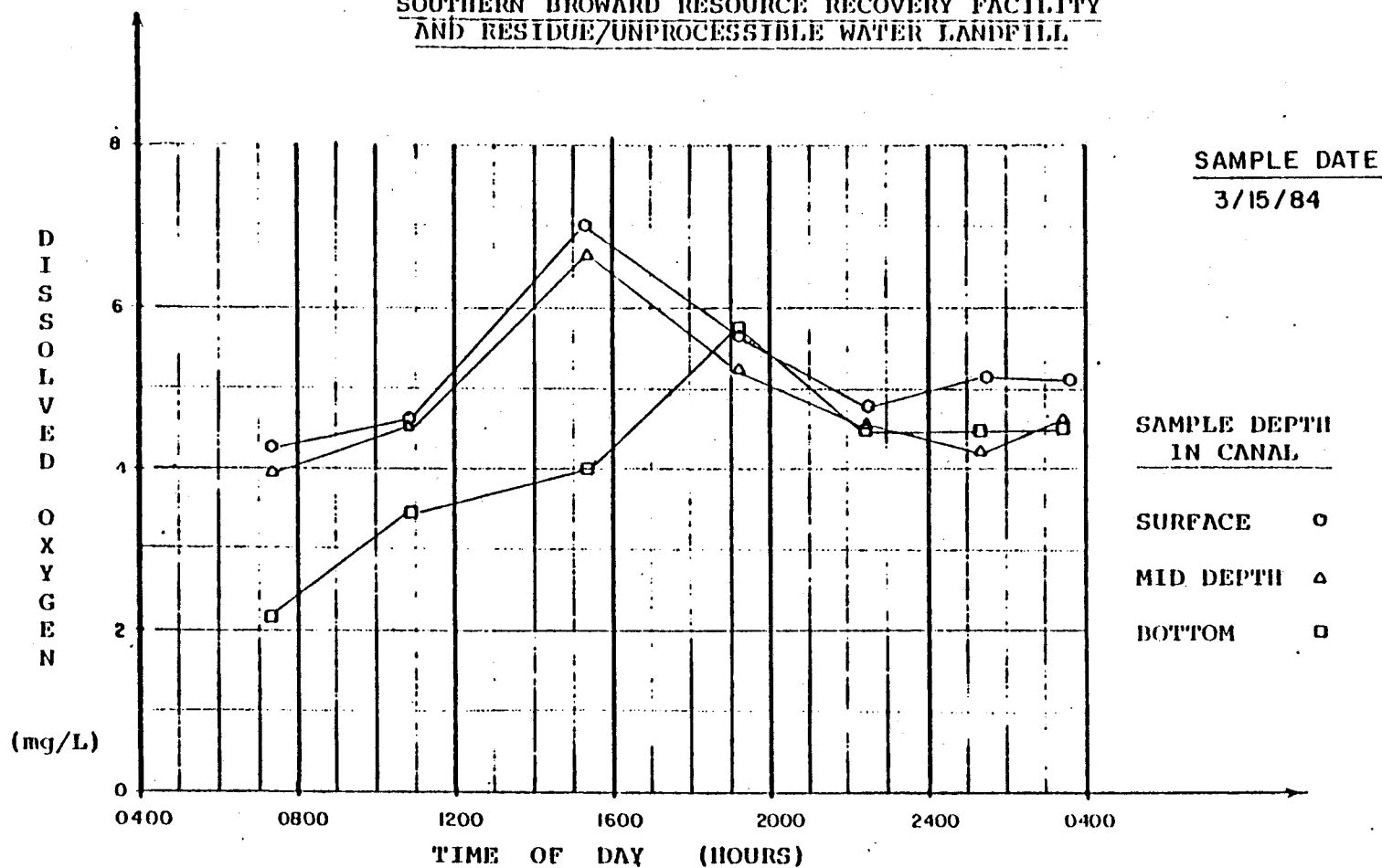
SURFACE WATER SAMPLING SITE C
SOUTHERN BROWARD RESOURCE RECOVERY FACILITY
AND RESIDUE/UNPROCESSIBLE WATER LANDFILL.



NOTE: Dissolved oxygen measurements were obtained using the Membrane Electrode Method as described in EPA manual "Methods for Chemical Analysis of Water and Wastes", 1979. The membrane was calibrated in the field using the Winkler Titration every 4 hours.

Figure 3

SURFACE WATER SAMPLING SITE D
SOUTHERN BROWARD RESOURCE RECOVERY FACILITY
AND RESIDUE/UNPROCESSIBLE WATER LANDFILL

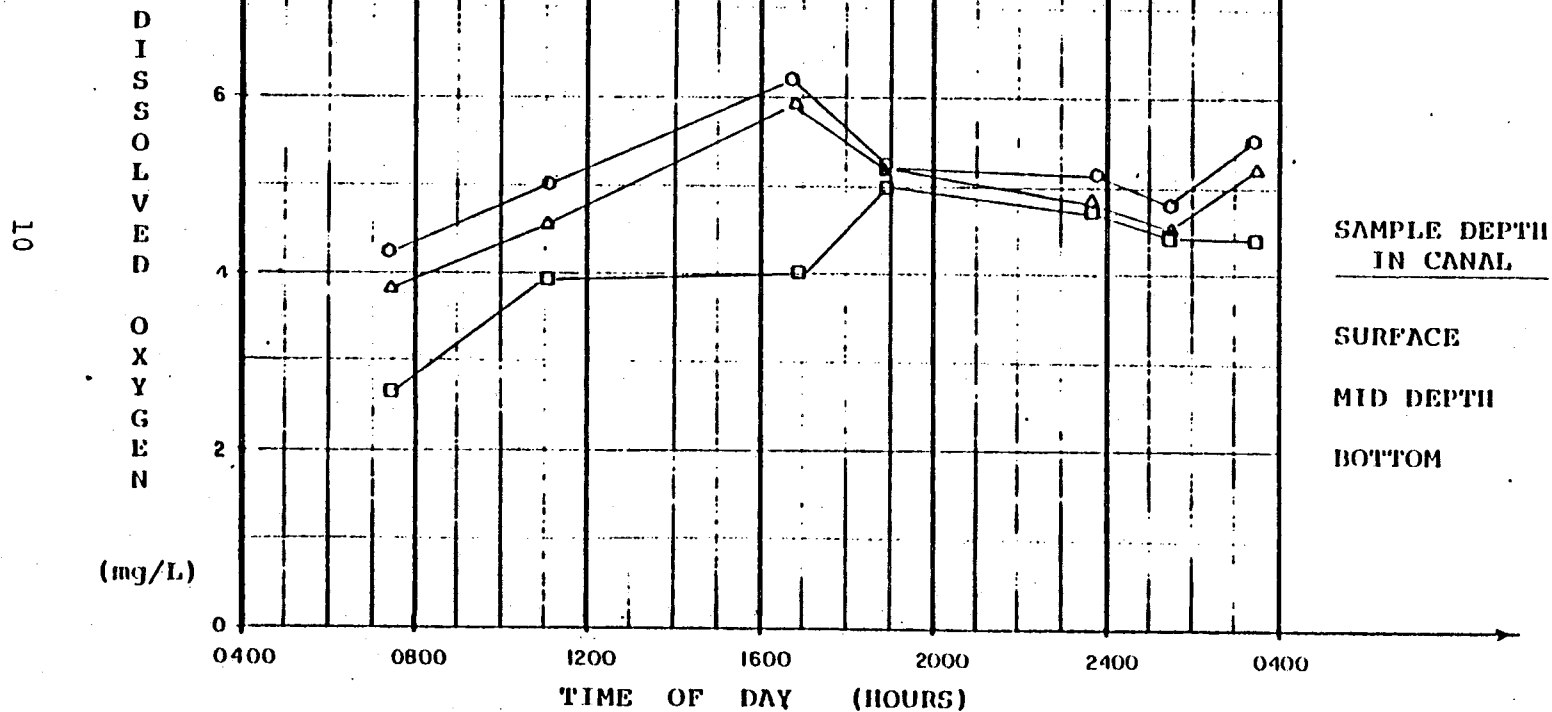


NOTE: Dissolved oxygen measurements were obtained using the Membrane Electrode Method as described in EPA manual "Methods for Chemical Analysis of Water and Wastes", 1979. The membrane was calibrated in the field using the Winkler Titration every 4 hours.

Figure 4

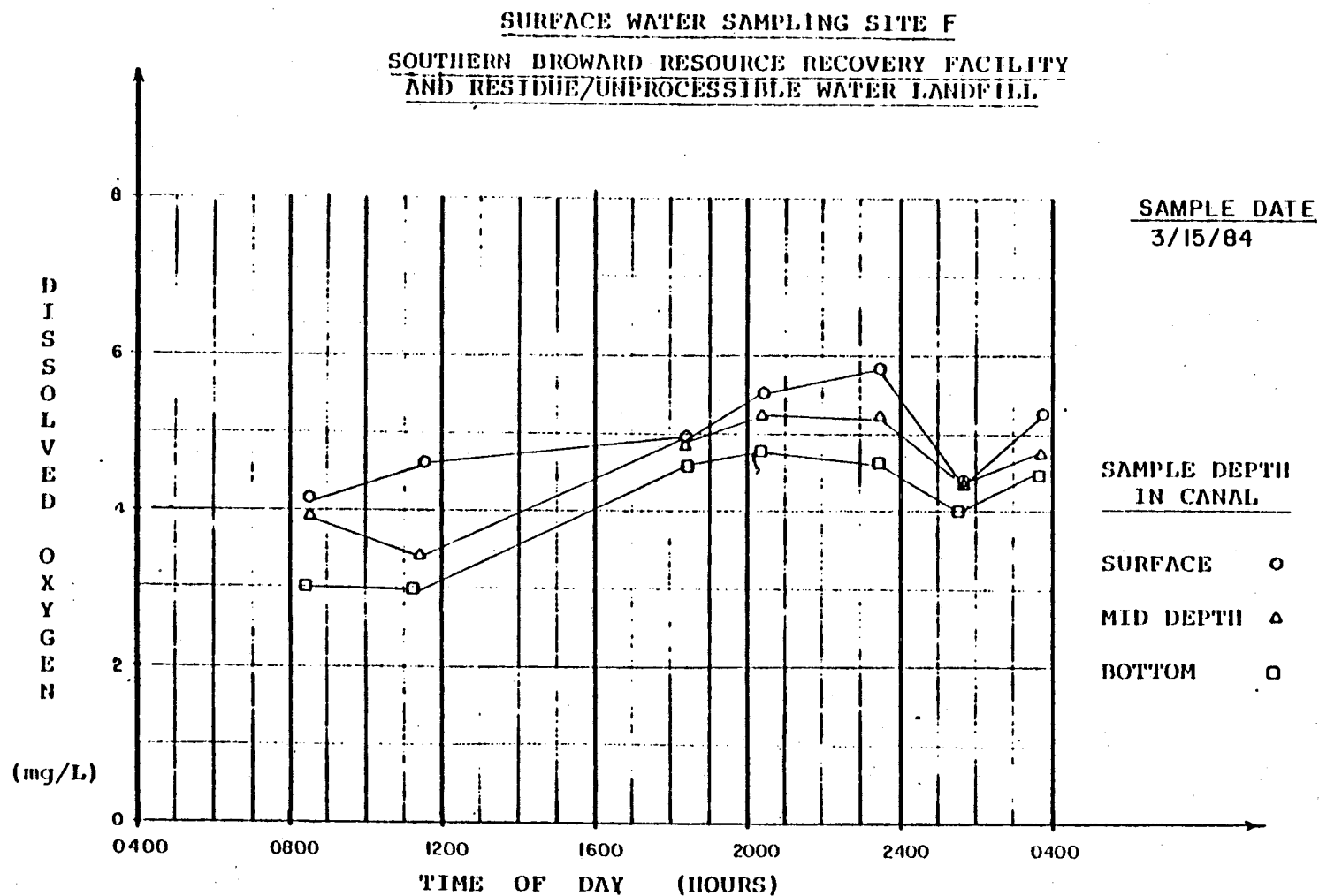
SURFACE WATER SAMPLING SITE E
SOUTHERN BROWARD RESOURCE RECOVERY FACILITY
AND RESIDUE/UNPROCESSIBLE WATER LANDFILL

SAMPLE DATE
3/15/84



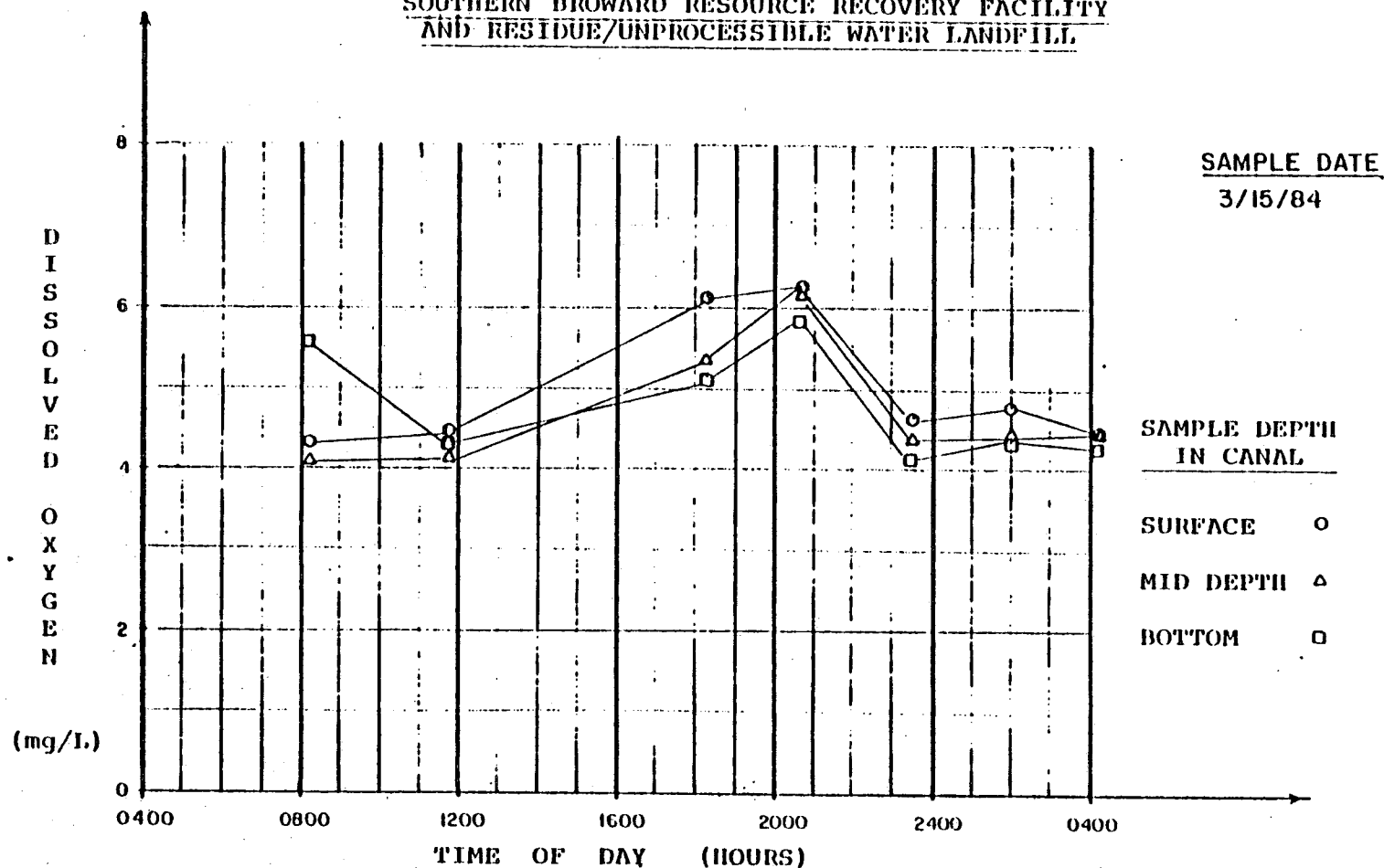
NOTE: Dissolved oxygen measurements were obtained using the Membrane Electrode Method as described in EPA manual "Methods for Chemical Analysis of Water and Wastes", 1979. The membrane was calibrated in the field using the Winkler Titration every 4 hours.

Figure 5



NOTE: Dissolved oxygen measurements were obtained using the Membrane Electrode Method as described in EPA manual "Methods for Chemical Analysis of Water and Wastes", 1979. The membrane was calibrated in the field using the Winkler Titration every 4 hours.

SURFACE WATER SAMPLING SITE 6
SOUTHERN BROWARD RESOURCE RECOVERY FACILITY
AND RESIDUE/UNPROCESSIBLE WATER LANDFILL



NOTE: Dissolved oxygen measurements were obtained using the Membrane Electrode Method as described in EPA manual "Methods for Chemical Analysis of Water and Wastes", 1979. The membrane was calibrated in the field using the Winkler Titration every 4 hours.

Figure 7

TABLE 3

Results of Dissolved Oxygen Monitoring

<u>Sample Point</u>	<u>Date</u>	<u>Time</u>	<u>Depth</u>	<u>Dissolved Oxygen (mg/l)</u>	<u>Salinity (S0/00)</u>	<u>Temp. (°C)</u>
A	3/15/84	0613	Bottom	3.3	0.02	24
		0615	Mid	3.5		
		0617	Surface	3.6		
B	3/15/84	0642	Bottom	2.2	2.0	23.8
		0644	Mid	4.5		
		0646	Surface	3.8		
C	3/15/84	0701	Bottom	3.4	2.0	23
		0703	Mid	4.5		
		0704	Surface	4.4		
D	3/15/84	0712	Bottom	2.2	2.2	24
		0713	Mid	4.0		
		0714	Surface	4.3		
E	3/15/84	0724	Bottom	2.7	1.8	29
		0725	Mid	3.9		
		0726	Surface	4.2		
F	3/15/84	0830	Bottom	2.9	2.0	23
		0831	Mid	3.9		
		0832	Surface	4.1		
G	3/15/84	0805	Bottom	5.6	7.0	24
		0806	Mid	4.1		
		0807	Surface	4.3		
A	3/15/84	1019	Bottom	3.8	2.0	24
		1020	Mid	3.8	1.0	
		1021	Surface	3.8	1.0	
B	3/15/84	1038	Bottom	3.6	5.0	24
		1039	Mid	3.8	0.8	
		1040	Surface	3.7	0.5	
C	3/15/84	1044	Bottom	4.3	5.5	24
		1045	Mid	4.4	1.0	
		1046	Surface	4.6	1.0	
D	3/15/84	1052	Bottom	3.5	5.2	24
		1053	Mid	4.5	1.1	
		1056	Surface	4.6	1.0	
E	3/15/84	1100	Bottom	3.9	4.9	24.5
		1102	Mid	4.5	1.0	
		1101	Surface	5.0	1.0	

<u>Sample Point</u>	<u>Date</u>	<u>Time</u>	<u>Depth</u>	<u>Dissolved Oxygen (mg/l)</u>	<u>Salinity (S0/00)</u>	<u>Temp. (°C)</u>
F	3/15/84	1129	Bottom	2.9	2.5	24
		1130	Mid	3.4	1.5	
		1131	Surface	4.6	1.0	
G	3/15/84	1149	Bottom	4.3	3.0	24
		1151	Mid	4.1	2.9	
		1152	Surface	4.4	2.4	
A	3/15/84	1350	Bottom	3.9	1.2	25.5
		1350	Mid	5.1	0.9	
		1351	Surface	5.6	0.5	
B	3/15/84	1552	Bottom	3.5	6.8	24
		1551	Mid	4.8	0.9	
		1550	Surface	5.2	0.6	
C	3/15/84	1529	Bottom	4.4	5.0	25
		1528	Mid	5.7	1.5	
		1527	Surface	6.3	1.5	
D	3/15/84	1519	Bottom	4.0	4.9	24.5
		1518	Mid	6.7	2.0	
		1517	Surface	7.0	1.5	
E	3/15/84	1658	Bottom	3.9	3.8	24
		1657	Mid	5.9	2.0	
		1656	Surface	6.2	1.9	
F	3/15/84	1833	Bottom	4.6	2.0	24
		1834	Mid	4.9	1.9	
		1834	Surface	4.9	2.0	
G	3/15/84	1817	Bottom	5.2	6.8	24
		1816	Mid	5.4	4.8	
		1815	Surface	6.1	2.8	
A	3/15/84	1939	Bottom	4.5	0.5	23.5
		1939	Mid	5.8	0.5	
		1940	Surface	5.9	0.5	
B	3/15/84	1928	Bottom	4.1	2.1	24
		1928	Mid	4.8	1.0	
		1929	Surface	5.3	1.0	
C	3/15/84	1918	Bottom	4.0	1.5	24
		1919	Mid	5.7	1.4	
		1920	Surface	5.9	1.0	
D	3/15/84	1907	Bottom	5.8	1.5	24
		1908	Mid	5.2	1.9	
		1908	Surface	5.7	1.9	

Table 3 - Results of Dissolved Oxygen Monitoring

Page 3 of 4

<u>Sample Point</u>	<u>Date</u>	<u>Time</u>	<u>Depth</u>	<u>Dissolved Oxygen (mg/l)</u>	<u>Salinity (S0/00)</u>	<u>Temp. (°C)</u>
E	3/15/84	1857	Bottom	4.9	2.0	24
		1857	Mid	5.2	1.9	
		1858	Surface	5.2	1.9	
F	3/15/84	2021	Bottom	4.8	1.5	24
		2021	Mid	5.3	1.5	
		2022	Surface	5.5	1.5	
G	3/15/84	2038	Bottom	5.9	5.0	28
		2038	Mid	6.3	4.0	
		2039	Surface	6.3	3.0	
A	3/15/84	2200	Bottom	5.2	2.0	25
		2201	Mid	5.0	1.0	
		2202	Surface	5.0	0.5	
B	3/15/84	2212	Bottom	4.3	2.0	25
		2212	Mid	4.4	1.0	
		2213	Surface	4.4	0.5	
C	3/15/84	2219	Bottom	4.2	4.0	25
		2220	Mid	4.4	2.5	
		2220	Surface	4.4	1.0	
D	3/15/84	2226	Bottom	4.4	3.0	
		2227	Mid	4.5	2.0	
		2227	Surface	4.8	1.0	
E	3/15/84	2349	Bottom	4.8	3.5	25
		2350	Mid	4.8	2.0	
		2349	Surface	5.2	1.0	
F	3/15/84	2337	Bottom	4.6	1.5	24
		2336	Mid	5.2	1.5	
		2336	Surface	5.8	1.5	
G	3/15/84	2318	Bottom	4.2	6.5	24
		2318	Mid	4.4	3.0	
		2317	Surface	4.7	2.0	
A	3/16/84	0100	Bottom	4.2	0.1	24
		0100	Mid	4.4	0.5	
		0101	Surface	5.0	0.2	
B	3/16/84	0107	Bottom	4.4	2.5	25
		0108	Mid	4.4	0.5	
		0.08	Surface	5.0	0.5	

<u>Sample Point</u>	<u>Date</u>	<u>Time</u>	<u>Depth</u>	<u>Dissolved Oxygen (mg/l)</u>	<u>Salinity (S0/00)</u>	<u>Temp. (°C)</u>
C	3/16/84	0115	Bottom	4.4	2.0	25
		0115	Mid	4.4	1.0	
		0116	Surface	4.8	1.0	
D	3/16/84	0122	Bottom	4.4	2.0	24
		0122	Mid	4.2	1.5	
		0123	Surface	5.2	1.0	
E	3/16/84	0127	Bottom	4.5	4.0	24
		0128	Mid	4.5	2.0	
		0128	Surface	4.8	1.5	
F	3/16/84	0139	Bottom	4.0	2.0	24
		0140	Mid	4.4	1.5	
		0140	Surface	4.4	1.5	
G	3/16/84	0154	Bottom	4.4	5.0	24
		0154	Mid	4.4	2.5	
		0155	Surface	4.8	2.2	
A	3/16/84	0308	Bottom	4.5	0.0	23.5
		0309	Mid	4.5	0.0	
		0309	Surface	4.5	0.0	
B	3/16/84	0316	Bottom	4.2	4.0	24
		0317	Mid	4.5	1.0	
		0317	Surface	4.8	0.5	
C	3/16/84	0324	Bottom	4.0	1.5	23.5
		0324	Mid	4.2	0.3	
		0324	Surface	4.2	0.1	
D	3/16/84	0330	Bottom	4.4	4.0	24
		0331	Mid	4.5	1.5	
		0331	Surface	5.1	0.9	
E	3/16/84	0336	Bottom	4.4	3.0	23
		0336	Mid	5.2	1.2	
		0337	Surface	5.5	1.1	
F	3/16/84	0349	Bottom	4.5	2.0	23.5
		0350	Mid	4.8	1.5	
		0350	Surface	5.3	1.5	
G	3/16/84	0406	Bottom	4.3	5.5	24
		0407	Mid	4.4	3.0	
		0407	Surface	4.4	1.9	

HAZEN & SAWYER PC

CLIENT NAME AND ADDRESS

5950 WASHINGTON ST.

HOLLYWOOD, FL. 33023

3-15-84 1350 INC

DATE/TIME COLLECTED/BY

3-15-84 2200

DATE/TIME RECEIVED

SOUTHERN RRF & LANDFILL

LOCATION

WATER QUALITY SAMPLING

PURPOSE

PARAMETER	STORET #	10154 POINT A TOP	10155 POINT A MID	10156 POINT A BOTTOM	10157 POINT B TOP	10158 POINT B MID	10159 POINT B BOTTOM
BOD(5)	00310	4	4	3	3	2	2
NON FILTER RES	00530	7	5	9	13	24	2
OIL & GREASE	00556	42	<1	<1	<1	<1	<1
pH	00400	6.5	7.0	6.8	7.0	6.9	6.8
KJELDAHL NITROGEN	00625	2.33	2.24	3.22	3.22	2.69	2.15
TOTAL PHOSPHORUS	00665	1.71	8.20	2.30	1.12	1.71	1.71
LEAD	01051	0.004	0.004	0.004	<0.003	0.008	0.017
ZINC	01092	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
MERCURY	71900	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
COPPER	01042	0.006	0.009	0.005	0.004	0.006	0.006
CADMIUM	01027	0.002	0.002	0.002	0.003	0.003	0.007
NITRATES	00630	0.40	0.39	0.40	0.38	0.37	0.36
IRON	01045	0.396	0.396	0.374	0.322	0.311	0.364
NICKEL	01067	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
CHEM. O2 DEMAND	00340	71	88	71	62	71	79

TIME COLLECTED

1350

1350

1351

1552

1551

1550

DATE 4-17-84

BY

ID 86122

All concentrations are in mg/l

HAZEN & SAWYER PC

CLIENT NAME AND ADDRESS

5950 WASHINGTON ST.

HOLLYWOOD, FL. 33023

3-15-84 1350 INC

DATE/TIME COLLECTED/BY

3-15-84 2200

DATE/TIME RECEIVED

SOUTHERN RRF & LANDFILL

LOCATION

WATER QUALITY SAMPLING

PURPOSE

PARAMETER	STORET #	10160 POINT C TOP	10161 POINT C MID	10162 POINT C BOTTOM	10163 POINT D TOP	10164 POINT D MID	10165 POINT D BOTTOM
BOD (5)	00310	3	3	11	2	4	3
NON FILTER RES	00530	7	7	180	4	18	8
OIL & GREASE	00556	4	<1	<1	<1	<1	<1
pH	00400	6.8	6.9	6.8	6.8	7.1	6.7
KJELDAHL NITROGEN	00625	2.51	2.15	1.80	1.98	2.15	2.42
TOTAL PHOSPHORUS	00665	1.42	1.42	4.07	1.71	2.60	2.30
LEAD	01051	0.010	0.021	0.065	0.013	0.010	0.027
ZINC	01092	<0.004	<0.004	0.008	<0.004	<0.004	0.004
MERCURY	71900	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
COPPER	01042	0.006	0.007	0.025	0.005	0.005	0.014
CADMIUM	01027	0.003	0.006	0.010	0.007	0.004	0.009
NITRATES	00630	0.37	0.37	0.19	0.36	0.39	0.34
IRON	01045	0.258	0.269	3.0	0.131	0.163	1.0
NICKEL	01067	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
CHEM. O2 DEMAND	00340	71	79	97	71	79	97
TIME COLLECTED		1530	1535	1540	1635	1645	1655

DATE 4-17-84

BY *B. Smith*

ID 86122

All concentrations are in mg/l

HAZEN & SAWYER PC

CLIENT NAME AND ADDRESS

5950 WASHINGTON ST.

HOLLYWOOD, FL. 33023

3-15-84 1350 INC

DATE/TIME COLLECTED/BY

3-15-84 2200

DATE/TIME RECEIVED

SOUTHERN RRF & LANDFILL

LOCATION

WATER QUALITY SAMPLING

PURPOSE

PARAMETER	STORET #	10166 POINT E TOP	10167 POINT E MID	10168 POINT E BOTTOM	10169 POINT F TOP	10170 POINT F MID	10171 POINT F BOTTOM
BOD (5)	00310	4	4	4	4	2	3
NON FILTER RES	00530	5	5	8	5	2	32
OIL & GREASE	00556	<1	<1	<1	<1	<1	<1
pH	00400	6.8	7.0	6.6	6.7	6.9	6.9
KJELDAHL NITROGEN	00625	2.06	2.33	1.89	2.15	2.95	3.67
TOTAL PHOSPHORUS	00665	1.71	6.73	2.01	4.07	2.30	5.84
LEAD	01051	0.014	0.017	0.015	0.016	0.014	0.012
ZINC	01092	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
MERCURY	71900	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
COPPER	01042	0.004	0.003	0.008	0.004	0.005	0.008
CADMIUM	01027	0.006	0.009	0.007	0.008	0.007	0.007
NITRATES	00630	0.38	0.32	0.37	0.39	0.36	0.38
IRON	01045	0.131	0.110	0.374	0.258	0.163	0.575
NICKEL	01067	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
CHEM. O2 DEMAND	00340	71	62	62	62	53	467
TIME COLLECTED		1710	1715	1720	1740	1745	1750

DATE 4-17-84

BY

Scott

ID 86122

All concentrations are in mg/l

HAZEN & SAWYER PC

CLIENT NAME AND ADDRESS

5950 WASHINGTON ST.

HOLLYWOOD, FL. 33023

3-15-84 1350 INC

DATE/TIME COLLECTED/BY

3-15-84 2200

DATE/TIME RECEIVED

SOUTHERN RRF & LANDFILL

LOCATION

WATER QUALITY SAMPLING

PURPOSE

PARAMETER	STORET #	10172 POINT G TOP	10173 POINT G MID	10174 POINT G BOTTOM
-----------	-------------	----------------------------	----------------------------	-------------------------------

BOD(5)	00310	3	3	11
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NON FILTER RES	00530	6	4	7
----------------	-------	---	---	---

OIL & GREASE	00556	<1	<1	<1
--------------	-------	----	----	----

pH	00400	6.9	7.0	7.1
----	-------	-----	-----	-----

KJELDAHL NITROGEN	00625	2.42	1.98	1.89
-------------------	-------	------	------	------

TOTAL PHOSPHORUS	00665	2.30	2.30	2.01
------------------	-------	------	------	------

LEAD	01051	0.018	0.030	0.062
------	-------	-------	-------	-------

ZINC	01092	<0.004	<0.004	<0.004
------	-------	--------	--------	--------

MERCURY	71900	<0.001	<0.001	<0.001
---------	-------	--------	--------	--------

COPPER	01042	0.005	0.005	0.008
--------	-------	-------	-------	-------

CADMIUM	01027	0.008	0.008	0.015
---------	-------	-------	-------	-------

NITRATES	00630	0.32	0.31	0.21
----------	-------	------	------	------

IRON	01045	0.128	0.150	0.217
------	-------	-------	-------	-------

NICKEL	01067	<0.006	<0.006	<0.006
--------	-------	--------	--------	--------

CHEM.O2 DEMAND	00340	71	79	105
----------------	-------	----	----	-----

TIME COLLECTED		1805	1810	1815
----------------	--	------	------	------

DATE 4-17-84

BY

ID 86122

All concentrations are in mg/l

TOTAL AND FECAL COLIFORM
SAMPLING FOR SOUTH NEW
RIVER CANAL

AMBIENT WEATHER CONDITIONS

Time	Cloud Cover	Wind	Air Temp
0930	60%	2-4 kn from S.E.	78°F
1030	85%	4-6 kn from S.E.	85°F
1100	90%	3-5 kn from S.E.	90°F

TIDAL FLUCTUATIONS

²Tides @ Andrews Ave.

Time	¹ Reading	High	Low
0925	37.69"	0943	0410
1100	35.63"	2213	1613

³TOTAL AND FECAL COLIFORMS

Sample Site	Time	Total	Fecal
A	1043	> 2000	1200
B	1030	1000	270
C	1015	500	70
D	1000	1000	240
E	0945	1200	330
F	0925	> 2000	320
G	0900	> 2000	420

SAMPLING DATE - MAY 1, 1984

NOTE: TOTAL and FECAL counts are in colonies per 100 ml.

¹The reading was taken from the top of the survey stick to the water level. The stick was located on the west bank just north of sample location E.

²Information obtained from the Ft. Lauderdale Sun Sentinel on 5/1/84

³Samples were taken at mid-depth down the centerline of the stream. The samples were stored on ice and transported to Spectrum Laboratories for analysis.

Image Quality

As you review the next group of images, Please note that the original documents were of poor quality.

SOUTH FORK NEW RIVER
B.C.E.Q.C.B. SAMPLING PROGRAM
SAMPLE SITE 19

DATE	SAMPLE TIME	WATER TEMPERATURE °C	TURBIDITY JTU's	PH	SPECIFIC CONDUCTANCE microhm's/cm	FECAL STRIP. colonies/100ml	TOTAL COLIFORM colonies/100 ml	FECAL COLIFORM colonies/100ml
10/10/68	11:00	20.0	4.0	7.1	1600	0	100	0
10/10/68	11:15	20.0	4.0	7.1	1600	0	100	0
10/10/68	11:30	20.0	4.0	7.1	1600	0	100	0
10/10/68	11:45	20.0	4.0	7.1	1600	0	100	0
10/10/68	12:00	20.0	4.0	7.1	1600	0	100	0
10/10/68	12:15	20.0	4.0	7.1	1600	0	100	0
10/10/68	12:30	20.0	4.0	7.1	1600	0	100	0
10/10/68	12:45	20.0	4.0	7.1	1600	0	100	0
10/10/68	13:00	20.0	4.0	7.1	1600	0	100	0
10/10/68	13:15	20.0	4.0	7.1	1600	0	100	0
10/10/68	13:30	20.0	4.0	7.1	1600	0	100	0
10/10/68	13:45	20.0	4.0	7.1	1600	0	100	0
10/10/68	14:00	20.0	4.0	7.1	1600	0	100	0
10/10/68	14:15	20.0	4.0	7.1	1600	0	100	0
10/10/68	14:30	20.0	4.0	7.1	1600	0	100	0
10/10/68	14:45	20.0	4.0	7.1	1600	0	100	0
10/10/68	15:00	20.0	4.0	7.1	1600	0	100	0
10/10/68	15:15	20.0	4.0	7.1	1600	0	100	0
10/10/68	15:30	20.0	4.0	7.1	1600	0	100	0
10/10/68	15:45	20.0	4.0	7.1	1600	0	100	0
10/10/68	16:00	20.0	4.0	7.1	1600	0	100	0
10/10/68	16:15	20.0	4.0	7.1	1600	0	100	0
10/10/68	16:30	20.0	4.0	7.1	1600	0	100	0
10/10/68	16:45	20.0	4.0	7.1	1600	0	100	0
10/10/68	17:00	20.0	4.0	7.1	1600	0	100	0
10/10/68	17:15	20.0	4.0	7.1	1600	0	100	0
10/10/68	17:30	20.0	4.0	7.1	1600	0	100	0
10/10/68	17:45	20.0	4.0	7.1	1600	0	100	0
10/10/68	18:00	20.0	4.0	7.1	1600	0	100	0
10/10/68	18:15	20.0	4.0	7.1	1600	0	100	0
10/10/68	18:30	20.0	4.0	7.1	1600	0	100	0
10/10/68	18:45	20.0	4.0	7.1	1600	0	100	0
10/10/68	19:00	20.0	4.0	7.1	1600	0	100	0
10/10/68	19:15	20.0	4.0	7.1	1600	0	100	0
10/10/68	19:30	20.0	4.0	7.1	1600	0	100	0
10/10/68	19:45	20.0	4.0	7.1	1600	0	100	0
10/10/68	20:00	20.0	4.0	7.1	1600	0	100	0
10/10/68	20:15	20.0	4.0	7.1	1600	0	100	0
10/10/68	20:30	20.0	4.0	7.1	1600	0	100	0
10/10/68	20:45	20.0	4.0	7.1	1600	0	100	0
10/10/68	21:00	20.0	4.0	7.1	1600	0	100	0
10/10/68	21:15	20.0	4.0	7.1	1600	0	100	0
10/10/68	21:30	20.0	4.0	7.1	1600	0	100	0
10/10/68	21:45	20.0	4.0	7.1	1600	0	100	0
10/10/68	22:00							

DATE	SAMPLE TIME	DISSOLVED OXYGEN	7-DAY BOO	TOC	TKN-N	NH ₃ -N	ORGANIC NITROGEN	NO ₂ /NO ₃ -N	TOTAL PHOSPHORUS
		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
11/11/00	11:11	1.73	0.00	0.9	1.44	0.314	1.03	0.522	0.101
11/11/00	11:11	1.66	0.00	0.0	1.49	0.295	1.00	0.476	0.101
11/11/00	11:11	1.66	0.00	0.0	1.43	0.234	1.04	0.282	0.101
11/11/00	11:11	1.66	0.00	0.0	1.40	0.317	1.00	0.541	0.173
11/11/00	11:11	1.74	4.0	0.4	1.29	0.124	1.16	0.140	0.120
11/11/00	11:11	1.66	0.00	0.0	1.47	0.440	1.22	0.436	0.120
11/11/00	11:11	1.66	0.00	0.0	1.44	0.167	1.27	0.459	0.120
11/11/00	11:11	1.66	0.00	0.0	1.40	0.500	0.78	0.601	0.141
11/11/00	11:11	1.66	0.00	0.0	1.43	0.473	1.15	0.512	0.141
11/11/00	11:11	1.66	0.00	0.0	1.40	0.224	1.10	0.173	0.120
11/11/00	11:11	1.66	0.00	0.0	1.45	0.129	1.10	0.220	0.106
11/11/00	11:11	1.66	0.00	0.0	1.45	0.333	1.10	0.410	0.106
11/11/00	11:11	1.66	0.00	0.0	1.45	0.333	1.10	0.410	0.106

NOTE: -999.999 MISSING DATA CODE
MINUS VALUES DENOTES LESS THAN VALUE
B.C.E.Q.C.B. - BROWARD COUNTY ENVIRON-
MENTAL QUALITY CONTROL BOARD

SOUTH FORK NEW RIVER
B.C.E.Q.C.B. SAMPLING PROGRAM
SAMPLE SITE 20

DATE	SAMPLE TIME	WATER TEMPERATURE °C	TURBIDITY JTU's	PH	SPECIFIC CONDUCTANCE microhm's/cm	FECAL STRIP. #colonies/100ml	TOTAL COLIFORM #colonies/100 ml	FECAL COLIFORM #colonies/100ml
11/17/80	1200	22.0	3.7	7.5	-999	200	1200	200
11/18/80	1215	22.0	1.8	7.2	-999	200	1200	200
11/19/80	1215	22.0	1.8	7.2	-999	200	1200	200
11/20/80	1215	22.0	1.8	7.2	-999	200	1200	200
11/21/80	1215	22.0	1.8	7.2	-999	200	1200	200
11/22/80	1215	22.0	1.8	7.2	-999	200	1200	200
11/23/80	1215	22.0	1.8	7.2	-999	200	1200	200
11/24/80	1215	22.0	1.8	7.2	-999	200	1200	200
11/25/80	1215	22.0	1.8	7.2	-999	200	1200	200
11/26/80	1215	22.0	1.8	7.2	-999	200	1200	200
11/27/80	1215	22.0	1.8	7.2	-999	200	1200	200
11/28/80	1215	22.0	1.8	7.2	-999	200	1200	200
11/29/80	1215	22.0	1.8	7.2	-999	200	1200	200
11/30/80	1215	22.0	1.8	7.2	-999	200	1200	200

DATE	SAMPLE TIME	DISSOLVED OXYGEN mg/l	7-DAY BOD mg/l	TOC mg/l	TKN-N mg/l	NH ₃ -N mg/l	ORGANIC NITROGEN mg/l	NO ₂ /NO ₃ -N mg/l	TOTAL PHOSPHORUS mg/l
11/17/80	1200	3.95	3.3	35.2	2.17	0.772	1.40	0.162	0.132
11/18/80	1215	3.45	3.3	26.0	1.53	0.312	1.12	0.432	0.114
11/19/80	1215	3.45	3.3	26.0	1.53	0.312	1.12	0.432	0.114
11/20/80	1215	3.45	3.3	26.0	1.53	0.312	1.12	0.432	0.114
11/21/80	1215	3.45	3.3	26.0	1.53	0.312	1.12	0.432	0.114
11/22/80	1215	3.45	3.3	26.0	1.53	0.312	1.12	0.432	0.114
11/23/80	1215	3.45	3.3	26.0	1.53	0.312	1.12	0.432	0.114
11/24/80	1215	3.45	3.3	26.0	1.53	0.312	1.12	0.432	0.114
11/25/80	1215	3.45	3.3	26.0	1.53	0.312	1.12	0.432	0.114
11/26/80	1215	3.45	3.3	26.0	1.53	0.312	1.12	0.432	0.114
11/27/80	1215	3.45	3.3	26.0	1.53	0.312	1.12	0.432	0.114
11/28/80	1215	3.45	3.3	26.0	1.53	0.312	1.12	0.432	0.114
11/29/80	1215	3.45	3.3	26.0	1.53	0.312	1.12	0.432	0.114
11/30/80	1215	3.45	3.3	26.0	1.53	0.312	1.12	0.432	0.114

NOTE: -999.999 MISSING DATA CODE
MINUS VALUES DENOTES LESS THAN VALUE
B.C.E.Q.C.B. - BROWARD COUNTY ENVIRONMENTAL
QUALITY CONTROL BOARD

SOUTH FORK NEW RIVER
S.C.E.Q.C.B. SAMPLING PROGRAM

SAMPLE SITE 27

DATE	SAMPLE TIME	WATER TEMPERATURE °C	TURBIDITY JTU's	PH	SPECIFIC CONDUCTANCE micromho's/cm	FECAL STRIP. colonies/100ml	TOTAL COLIFORM colonies/100 ml	FECAL COLIFORM colonies/100ml
11/17/80	0800	25.0	2.2	7.4	340	4900	3500	970
12/02/80	1200	25.0	22.0	7.4	310	1000	2000	360
12/17/80	1200	25.0	2.4	7.2	300	340	700	100
01/01/81	1200	27.0	5.1	7.4	850	250	2200	370
01/11/81	1200	27.0	7.5	7.3	300	200	3000	1500
02/05/81	1200	28.0	4.5	7.5	480	220	19000	2300
03/11/81	1200	23.0	3.4	7.3	740	160	4400	1000
03/25/81	1200	28.0	4.6	7.0	820	110	12000	430
04/03/81	1200	27.0	3.1	7.6	730	35	80	40
04/12/81	1200	27.0	1.4	7.4	730	100	50	10
05/06/81	1200	26.0	2.7	7.3	900	100	150	35
05/20/81	1200	29.0	1.7	7.8	750	420	300	61
06/03/81	1200	29.0	3.3	7.5	520	1800	5200	1900
06/24/81	1200	29.0	2.3	7.2	530	300	1300	340
07/08/81	1200	29.0	2.4	7.4	500	200	2000	1200
07/22/81	1200	29.0	2.4	7.4	510	920	1300	460
08/05/81	1200	29.0	2.6	7.4	550	1000	1300	200
08/19/81	1200	29.0	2.0	7.4	500	2300	3800	2400
09/02/81	1200	29.0	1.5	7.5	490	1000	2300	1300
09/16/81	1200	29.0	1.5	7.3	720	200	3800	800
09/30/81	1200	28.0	1.3	7.6	710	4200	730	200
10/14/81	1200	26.0	3.1	7.6	710	940	2000	320
10/28/81	1200	26.0	2.6	7.4	720	240	2000	310
11/11/81	1200	26.0	4.0	7.3	-9999	220	1000	130
11/25/81	1200	24.0	1.4	7.7	790	1000	16000	1600
12/09/81	1200	16.0	1.8	7.4	820	340	1400	170
12/23/81	1200	19.0	1.9	7.5	820	320	6000	3300
01/06/82	1200	25.0	2.0	7.7	-9999	200	2700	1000
01/20/82	1200	24.0	2.0	7.6	300	230	930	360
02/03/82	1200	24.0	2.1	7.3	760	2800	5600	530
02/17/82	1200	24.0	1.8	7.9	820	120	17000	2500
03/03/82	1200	24.0	1.9	7.9	840	140	1200	180
03/17/82	1200	26.0	2.8	7.2	510	1400	3300	1000
03/31/82	1200	26.0	1.0	7.7	730	120	1200	260
04/14/82	1200	27.0	3.0	7.5	490	960	9500	1900
04/28/82	1200	28.0	3.3	7.5	-9999	120	930	690
05/12/82	0800	29.0	3.9	7.4	840	2000	2700	470
05/26/82	1200	23.0	4.2	7.6	810	1900	1100	1200
06/09/82	1000	29.0	3.2	7.3	800	1400	1500	900
06/23/82	0900	28.0	4.0	6.9	300	1600	2200	540
07/07/82	1000	28.0	3.7	7.5	500	3200	7100	1200
07/21/82	1200	27.0	2.8	7.4	620	620	1400	250
08/04/82	1040	24.0	2.5	7.7	-9999	390	2200	280
08/18/82	1200	26.0	4.0	7.1	510	1200	3200	900
09/01/82	1200	26.0	4.6	7.4	650	22000	5300	500
09/15/82	1200	25.0	4.3	7.6	700	1600	5200	380
09/29/82	1200	22.0	1.9	7.5	700	720	1600	150
01/03/83	1245	24.0	1.7	7.1	740	2300	10000	190
01/17/83	1200	20.0	4.3	7.5	-99	32000	22000	7600
02/03/83	1200	22.0	3.9	7.6	640	33000	34000	1000
02/17/83	1100	-99.9	4.0	7.4	500	640	12000	750
03/03/83	1200	25.0	2.4	7.4	620	2600	3400	1100
03/17/83	1200	25.0	5.7	7.4	620	690	7800	300
04/04/83	1210	26.0	1.8	7.6	810	3000	4200	390
04/18/83	1230	24.0	2.8	7.6	720	600	5800	540
05/02/83	1230	26.0	3.0	8.0	690	480	660	160
05/16/83	1200	28.0	1.7	8.0	898	150	340	61
05/30/83	1100	28.0	2.1	7.3	710	900	1300	230
06/13/83	1100	27.0	3.0	7.7	720	2200	1800	500
06/27/83	1100	27.0	2.4	7.5	540	900	2400	450
07/11/83	1200	32.0	4.2	7.8	760	460	930	290
07/25/83	1200	27.0	4.5	7.5	600	2400	4800	1020
08/08/83	1200	28.0	1.6	7.5	800	500	1300	200
08/22/83	1200	30.0	2.6	7.3	610	540	1200	180
09/05/83	1200	30.0	4.4	7.0	500	950	3800	230
09/19/83	1100	28.0	4.1	7.4	510	3100	1100	430
10/03/83	0900	27.0	3.7	7.4	470	2000	2440	710
10/17/83	1200	27.0	2.7	7.4	600	735	1120	560
10/31/83	1200	26.0	2.0	7.0	600	720	2000	380
11/14/83	1100	26.0	2.0	7.7	700	700	1300	340
11/28/83	1200	27.0	1.4	7.4	710	200	1200	500
12/12/83	1200	28.0	2.1	7.7	800	1800	1800	100
01/05/84	0900	20.0	2.3	7.7	650	510	930	220
01/19/84	1245	20.0	7.5	7.5	720	660	1200	220
02/02/84	1100	21.0	1.0	7.6	710	900	1000	210
02/16/84	1100	20.0	1.0	7.7	700	1000	750	200

NOTE: -999.999 MISSING DATA CODE

MINUS VALUES DENOTES LESS THAN VALUE

TEMPERATURE IN DEGREES CELSIUS, TURBIDITY IN JTU'S, PH, CONDUCTANCE IN MICROMHO'S PER CM, BACTERIA COUNTS IN NO. OF COLONIES PER 100 ML SAMPLE

S.C.E.Q.C.B. - BROWARD COUNTY ENVIRONMENTAL QUALITY CONTROL BOARD

25

SAMPLE SITE 27

1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054 2055 2056 2057 2058 2059 2060 2061 2062 2063 2064 2065 2066 2067 2068 2069 2070 2071 2072 2073 2074 2075 2076 2077 2078 2079 2080 2081 2082 2083 2084 2085 2086 2087 2088 2089 2090 2091 2092 2093 2094 2095 2096 2097 2098 2099 2100 2101 2102 2103 2104 2105 2106 2107 2108 2109 2110 2111 2112 2113 2114 2115 2116 2117 2118 2119 2120 2121 2122 2123 2124 2125 2126 2127 2128 2129 2130 2131 2132 2133 2134 2135 2136 2137 2138 2139 2140 2141 2142 2143 2144 2145 2146 2147 2148 2149 2150 2151 2152 2153 2154 2155 2156 2157 2158 2159 2160 2161 2162 2163 2164 2165 2166 2167 2168 2169 2170 2171 2172 2173 2174 2175 2176 2177 2178 2179 2180 2181 2182 2183 2184 2185 2186 2187 2188 2189 2190 2191 2192 2193 2194 2195 2196 2197 2198 2199 2200 2201 2202 2203 2204 2205 2206 2207 2208 2209 2210 2211 2212 2213 2214 2215 2216 2217 2218 2219 2220 2221 2222 2223 2224 2225 2226 2227 2228 2229 2230 2231 2232 2233 2234 2235 2236 2237 2238 2239 2240 2241 2242 2243 2244 2245 2246 2247 2248 2249 2250 2251 2252 2253 2254 2255 2256 2257 2258 2259 2260 2261 2262 2263 2264 2265 2266 2267 2268 2269 2270 2271 2272 2273 2274 2275 2276 2277 2278 2279 2280 2281 2282 2283 2284 2285 2286 2287 2288 2289 2290 2291 2292 2293 2294 2295 2296 2297 2298 2299 2300 2301 2302 2303 2304 2305 2306 2307 2308 2309 2310 2311 2312 2313 2314 2315 2316 2317 2318 2319 2320 2321 2322 2323 2324 2325 2326 2327 2328 2329 2330 2331 2332 2333 2334 2335 2336 2337 2338 2339 2340 2341 2342 2343 2344 2345 2346 2347 2348 2349 2350 2351 2352 2353 2354 2355 2356 2357 2358 2359 2360 2361 2362 2363 2364 2365 2366 2367 2368 2369 2370 2371 2372 2373 2374 2375 2376 2377 2378 2379 2380 2381 2382 2383 2384 2385 2386 2387 2388 2389 2390 2391 2392 2393 2394 2395 2396 2397 2398 2399 2400 2401 2402 2403 2404 2405 2406 2407 2408 2409 2410 2411 2412 2413 2414 2415 2416 2417 2418 2419 2420 2421 2422 2423 2424 2425 2426 2427 2428 2429 2430 2431 2432 2433 2434 2435 2436 2437 2438 2439 2440 2441 2442 2443 2444 2445 2446 2447 2448 2449 2450 2451 2452 2453 2454 2455 2456 2457 2458 2459 2460 2461 2462 2463 2464 2465 2466 2467 2468 2469 2470 2471 2472 2473 2474 2475 2476 2477 2478 2479 2480 2481 2482 2483 2484 2485 2486 2487 2488 2489 2490 2491 2492 2493 2494 2495 2496 2497 2498 2499 2500 2501 2502 2503 2504 2505 2506 2507 2508 2509 2510 2511 2512 2513 2514 2515 2516 2517 2518 2519 2520 2521 2522 2523 2524 2525 2526 2527 2528 2529 2530 2531 2532 2533 2534 2535 2536 2537 2538 2539 2540 2541 2542 2543 2544 2545 2546 2547 2548 2549 2550 2551 2552 2553 2554 2555 2556 2557 2558 2559 2560 2561 2562 2563 2564 2565 2566 2567 2568 2569 2570 2571 2572 2573 2574 2575 2576 2577 2578 2579 2580 2581 2582 2583 2584 2585 2586 2587 2588 2589 2590 2591 2592 2593 2594 2595 2596 2597 2598 2599 2600 2601 2602 2603 2604 2605 2606 2607 2608 2609 2610 2611 2612 2613 2614 2615 2616 2617 2618 2619 2620 2621 2622 2623 2624 2625 2626 2627 2628 2629 2630 2631 2632 2633 2634 2635 2636 2637 2638 2639 2640 2641 2642 2643 2644 2645 2646 2647 2648 2649 2650 2651 2652 2653 2654 2655 2656 2657 2658 2659 2660 2661 2662 2663 2664 2665 2666 2667 2668 2669 2670 2671 2672 2673 2674 2675 2676 2677 2678 2679 2680 2681 2682 2683 2684 2685 2686 2687 2688 2689 2690 2691 2692 2693 2694 2695 2696 2697 2698 2699 2700 2701 2702 2703 2704 2705 2706 2707 2708 2709 2710 2711 2712 2713 2714 2715 2716 2717 2718 2719 2720 2721 2722 2723 2724 2725 2726 2727 2728 2729 2730 2731 2732 2733 2734 2735 2736 2737 2738 2739 2740 2741 2742 2743 2744 2745 2746 2747 2748 2749 2750 2751 2752 2753 2754 2755 2756 2757 2758 2759 2760 2761 2762 2763 2764 2765 2766 2767 2768 2769 2770 2771 2772 2773 2774 2775 2776 2777 2778 2779 2780 2781 2782 2783 2784 2785 2786 2787 2788 2789 2790 2791 2792 2793

ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED

B.C.E.Q.C.B. - BROWARD COUNTY ENVIRONMENTAL QUALITY CONTROL BOARD

TECHNICAL NOISE ANALYSIS

TABLE OF CONTENTS

- 1.0 AMBIENT AND PREDICTED NOISE LEVELS
 - 1.1 Overview
 - 1.2 Ambient Levels
 - 1.3 Noise Generation
 - 1.4 Noise Attenuation
 - 1.5 Predicted Noise Levels at Boundaries
- 2.0 NOISE REGULATIONS
 - 2.1 Overview
 - 2.2 Allowable Noise Levels
- 3.0 REGULATION COMPLIANCE
 - 3.1 Predicted Noise Levels vs. Standards
 - 3.2 Action Requested
- 4.0 SUMMARY

1.0 AMBIENT AND PREDICTED NOISE LEVELS

1.1 Overview

The following methodology was used to best project noise levels which will occur at the property lines of the resource recovery site:

1. Ambient noise levels at property lines were measured and recorded.
2. Based on the type and extent of equipment which is expected to be in operation at the facility and their associated noise levels, noise generated through the operation of the resource recovery facility and residue/unprocessable waste landfill was calculated.
3. The attenuation of noise over distance was factored into calculations of projected noise levels at property lines a given distance from the point of noise generation.
4. Noise levels measured at the property lines of a comparable facility, the Pinellas County Refuse-to-Energy Facility in St. Petersburg, Florida, were compared to these projected levels.

These methods and resulting findings are discussed in further detail in the sections that follow. Section 3 compares projected levels with those mandated in applicable regulations.

1.2 Ambient Levels

A recent inspection of the site indicated that noises present were generated by highway traffic on Routes 441 and 84 and from low-altitude commercial aircraft utilizing the east-west runway of the Fort Lauderdale-Hollywood International Airport. The runway is 10,000 feet east of the eastern side of the central section of the site.

Average ambient noise level readings around the accessible perimeter of the site, as measured on February 23, 1984 both in mid-afternoon and at 9 p.m., using a Simpson 886 Type

2 Sound Level Meter calibrated to OSHA standards at the site, under clear skies and with very little or no wind, ranged from 50 dB(A) to 55 dB(A) (Table 1). The higher readings were taken at the perimeter of the property on the west and north sides, close to the highways (Figure 1).

Noise excursions generated from large trucks on the highways and from aircraft taking off from the Fort Lauderdale-Hollywood International Airport caused dB(A) readings in the high 80's. Both sources, however, are exempt under the Code of Regulations Section 27-7.06 (see Section 2.2).

1.3 Noise Generation

Noise at the southern resource recovery facility and residue/unprocessable waste landfill will be generated in the operation of process equipment, air pollution control equipment, waste transfer trucks, and landfilling equipment. Table 2 is a summary of expected noise level readings from applicable equipment. Details are elaborated upon below.

Operation of the resource recovery facility will result in noises being generated from the following pieces of equipment and machinery inside or around the facility: overhead refuse-handling cranes, a steam turbine, a steam turbine steam exhaust condenser, various pumps, ash and residue conveyors, and the steam condenser water cooling tower fans.

The exact model and specifications (i.e. horsepower, sound rating) of equipment to be used will be finalized by the chosen Contractor for the facility. In any case, the equipment used will not generate unusually high noise levels or higher levels than those associated with equipment used at similar facilities.

The noises generated inside the facility structure(s) will be contained and attenuated by walls and roofing. It is anticipated that all equipment, except the steam condenser

TABLE 1

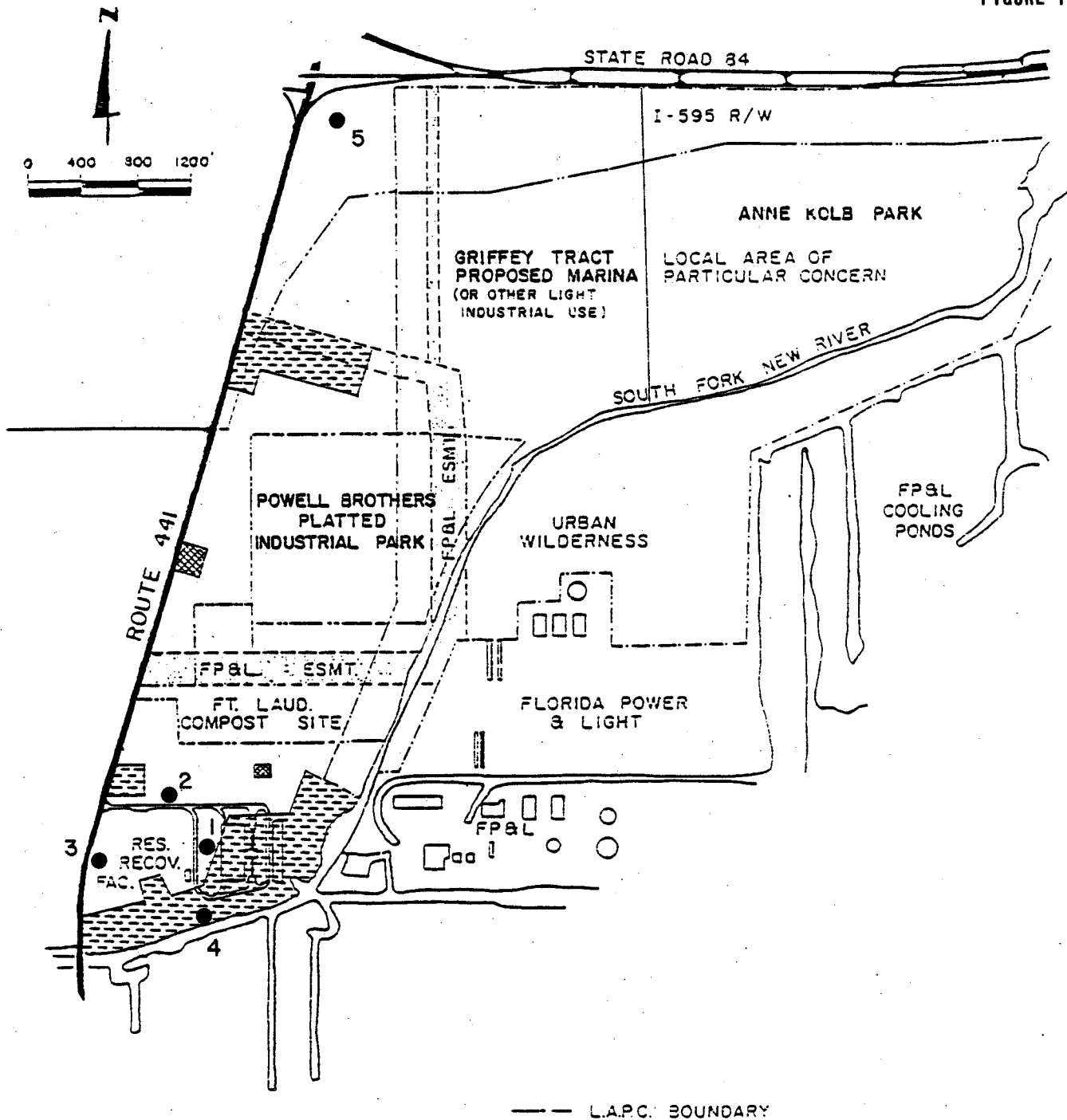
AVERAGE AMBIENT NOISE READINGS
February 23, 1984

<u>Site</u>	<u>Time</u>	<u>Average (dB(A))</u>
1	2:30 PM	55
	9:00 PM	52
2	2:30 PM	55
	9:00 PM	51
3	2:30 PM	55*
	9:00 PM	52.5
4	2:30 PM	51
	9:00 PM	50
5	2:30 PM	55*
	9:00 PM	53

*85 dB(A) with heavy constant vehicular and truck traffic.

Note: In all locations, low flying commercial aircraft gave readings from 70 dB(A) to 85 dB(B).

FIGURE 1



LEGEND

-  BUSINESS
-  UTILITY EASEMENT
-  RESIDENCE

BROWARD COUNTY
 RESOURCE RECOVERY
 AMBIENT NOISE READING
 LOCATIONS

TABLE 2

NOISE GENERATION BY OPERATING EQUIPMENT

<u>Equipment</u>	<u>Location of Equipment</u>	<u>Noise Level @ 50 ft (dB(A))</u>
Overhead refuse-handling crane	inside facility	Note (1)
Steam turbine	inside facility	Note (1)
Steam exhaust condenser	adjacent to facility	Approximately 53 ²
Pumps	inside facility	Note (1)
Ash and Residue Conveyors	inside facility	Note (1)
Water cooling tower fans	adjacent to facility	Approximately 42 ²
Refuse/transfer vehicles	on roads between site entrance and resource recovery facility	80 ³
Residue/unprocessable waste vehicles	on roads between site entrance, resource recovery facility, and landfill	80 ³
Dozers, compactors, graders	at landfill	80 ³

Notes

1. By virtue of containment in buildings, and noise attenuation by building materials, noise generated by this equipment will be essentially undetectable at property lines.
2. Noise level calculated by taking reading from the Pinellas County facility and increasing noise level reading by 6 dB(A) for every halving of distance between noise source and point of measurement (See Section 1.4).
3. Sources:
 1. "Industrial Noise and Vibration Control" by Irwin and Graf. Prentice-Hall, Inc., 1979.
 2. "Handbook of Noise Control," 2nd Edition, Edited by Cyril M. Lewis, PhD., McGraw-Hill Book Co., 1979.

water cooling tower fans, will be located inside the facility building(s).

On-site trucking noise will be generated by refuse-filled collection trucks, by transfer vehicles bringing refuse into the facility, and by these same trucks/vehicles exiting the resource recovery facility. Heavy duty trucks hauling residue/unprocessable wastes from the resource recovery facility to the landfills will also generate on-site noise. In addition, landfilling operations will require use of tractor type dozers, compactors and graders. Much of the noise mentioned will be generated in conjunction with landfill operations. It is important to note that the type of waste to be landfilled (ash residue) and soil of the area itself acts as a buffer to absorb noise generated from such activity.

1.4 Noise Attenuation

Increasing distance from a noise source to the point of measurement is the most practical means of abatement of that noise. Specifically, for each doubling of distance from a single point noise, the noise level drops by 6 dB(A). Thus, if noise level meter readings are taken at 50 feet from the point source, at 100 feet the noise levels drop by 6 dB(A), at 200 feet, by 12 dB(A), and so on. The following table indicates these relationships in terms of various point source noise levels:

Noise Level in dB(A)'s at Various Distances from the Point Source

<u>Noise Source</u>	<u>100'</u>	<u>200'</u>	<u>300'</u>	<u>400'</u>	<u>800'</u>	<u>1600'</u>
dB(A)'s 50' from Point						
65	59	53	50	47	41	-
70	64	58	55	52	46	40
75	69	63	60	57	51	45
80	74	68	65	62	56	50

There are additional attenuation factors which, though difficult to quantify, will undoubtedly reduce noise levels through absorption. These factors include vegetation, the ash residue in the landfill, and the structures on the site. Direction and dispersion of the sound also has an affect on the ambient noise levels. Sounds produced at ground level are generally absorbed at a far greater rate than sounds produced in the air. For the purpose of this permit, these factors are not taken into account. As a result, the projections of noise levels are conservative and true levels can be expected to be somewhat lower than concluded herein.

1.5 Predicted Noise Levels at Boundaries

A review of Figure 2 (Southern Site Zoning) in conjunction with Figure 3 (Conceptual Development and Environmental Enhancement Plan for the Route 441 Site) shows that of the areas surrounding the site, industrial, business, and residential zones to the west and south appear most sensitive to potential noise. On the east and the north sides of the site, there will be extensive open spaces occupied by either the Interstate 595 interchange, the Anne Kolb County Park, or Florida Power & Light facilities. Figure 4 shows the zoning classifications and projected noise levels at sensitive boundaries. Below is a discussion of these projections.

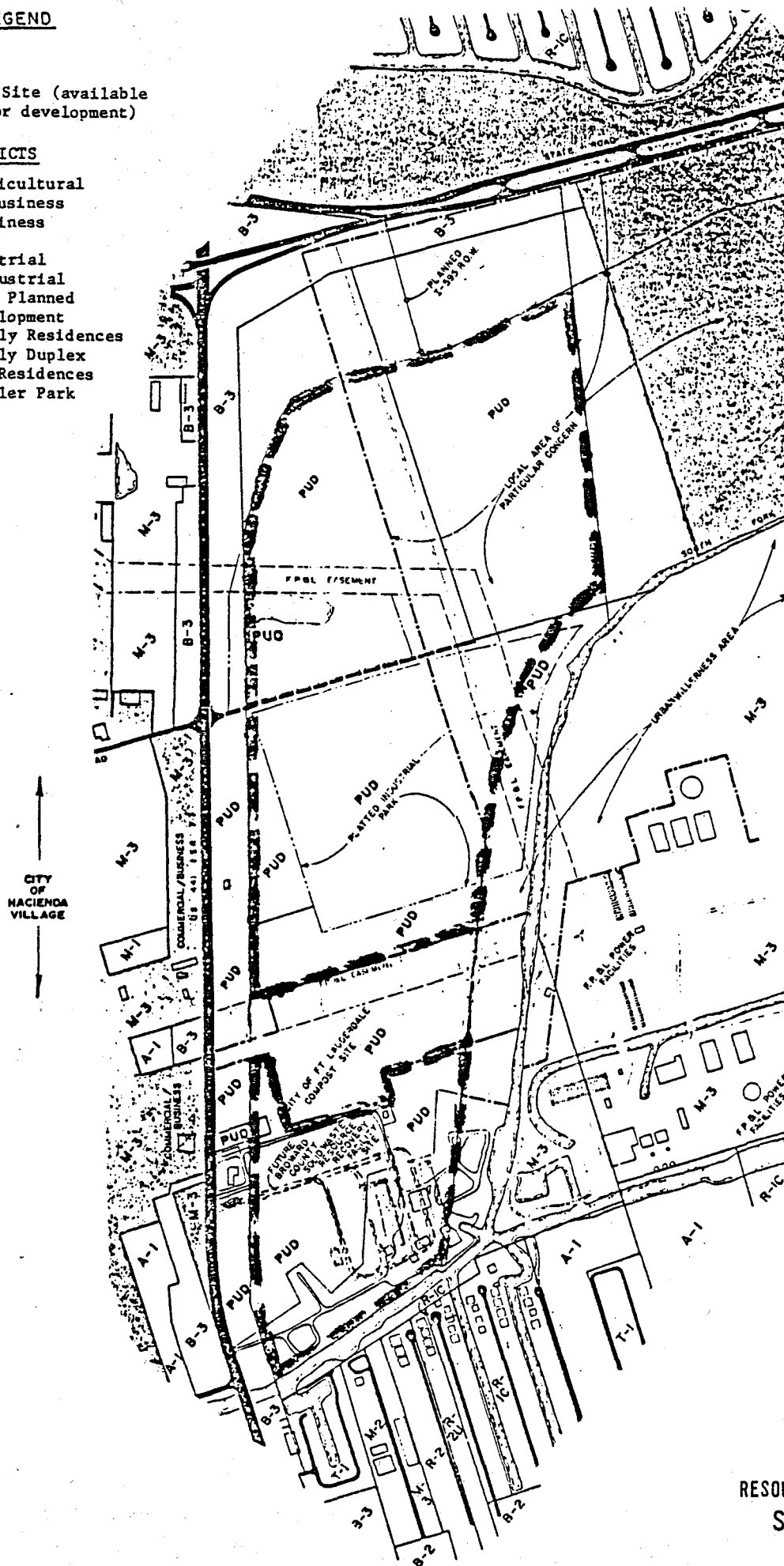
On the west side of the site, there will be a 200 foot setback on the east side of Route 441. The setback will be enriched with extensive landscaping which will include high trees to help buffer noises from facility operations. The Route 441 right-of-way is 100 feet wide. Thus, on the west side of the facility the distance from noises generated on the site to the property lines of noise-receiving lands on the west side of the facility is 300 feet.

LEGEND

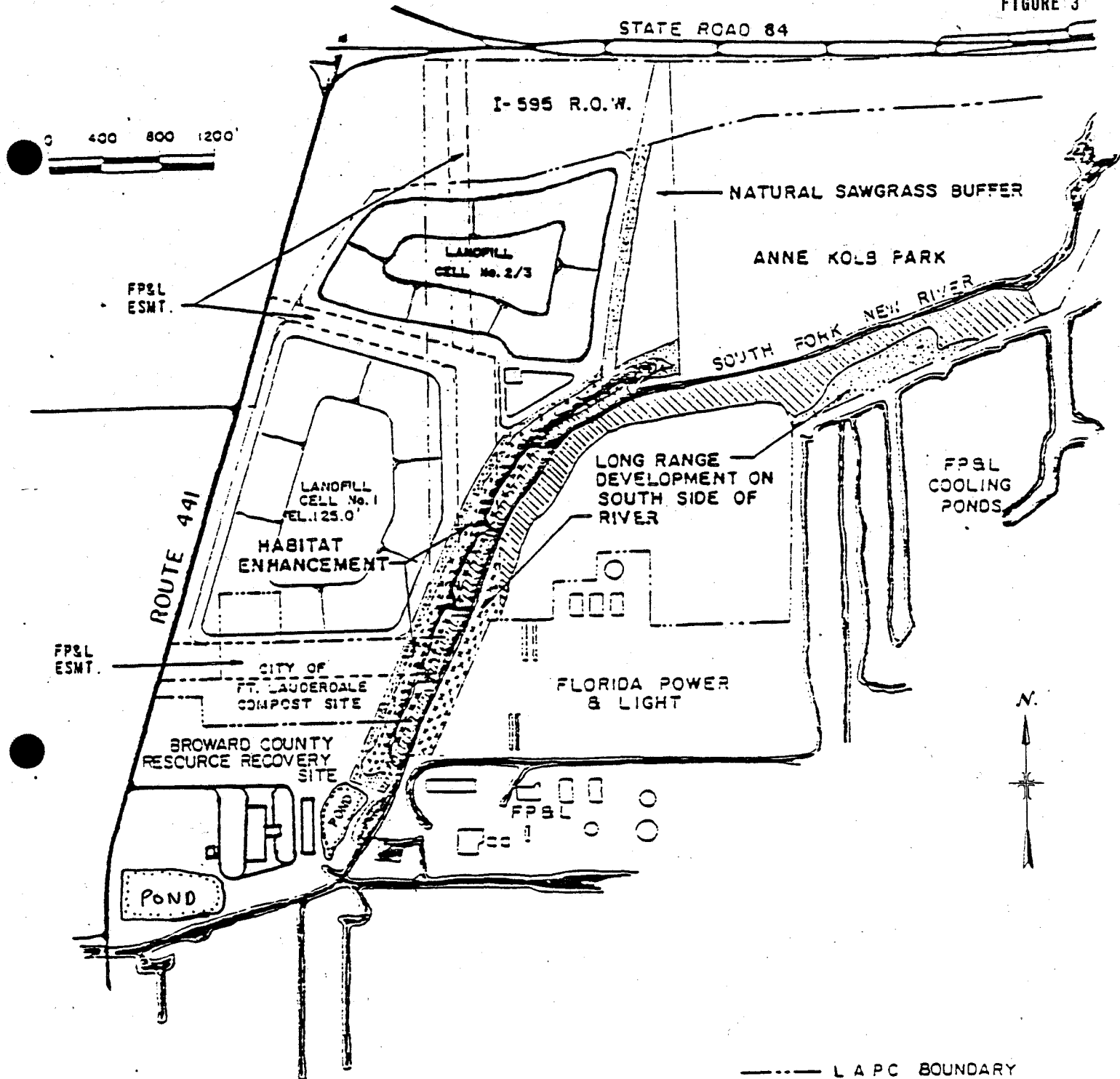
Net Site (available
for development)

ZONING DISTRICTS

- | | |
|------|---|
| A-1 | Limited Agricultural |
| B-2 | Community Business |
| B-3 | General Business |
| C-1 | Commercial |
| M-1 | Light Industrial |
| M-3 | General Industrial |
| PUD | Special Use Planned
Unit Development |
| R-1C | Single Family Residences |
| R-2 | Single Family Duplex |
| R-2U | Two Family Residences |
| T-1 | Travel Trailer Park |



BROWARD COUNTY
RESOURCE RECOVERY PROJECT
SOUTHERN SITE
ZONING
1984

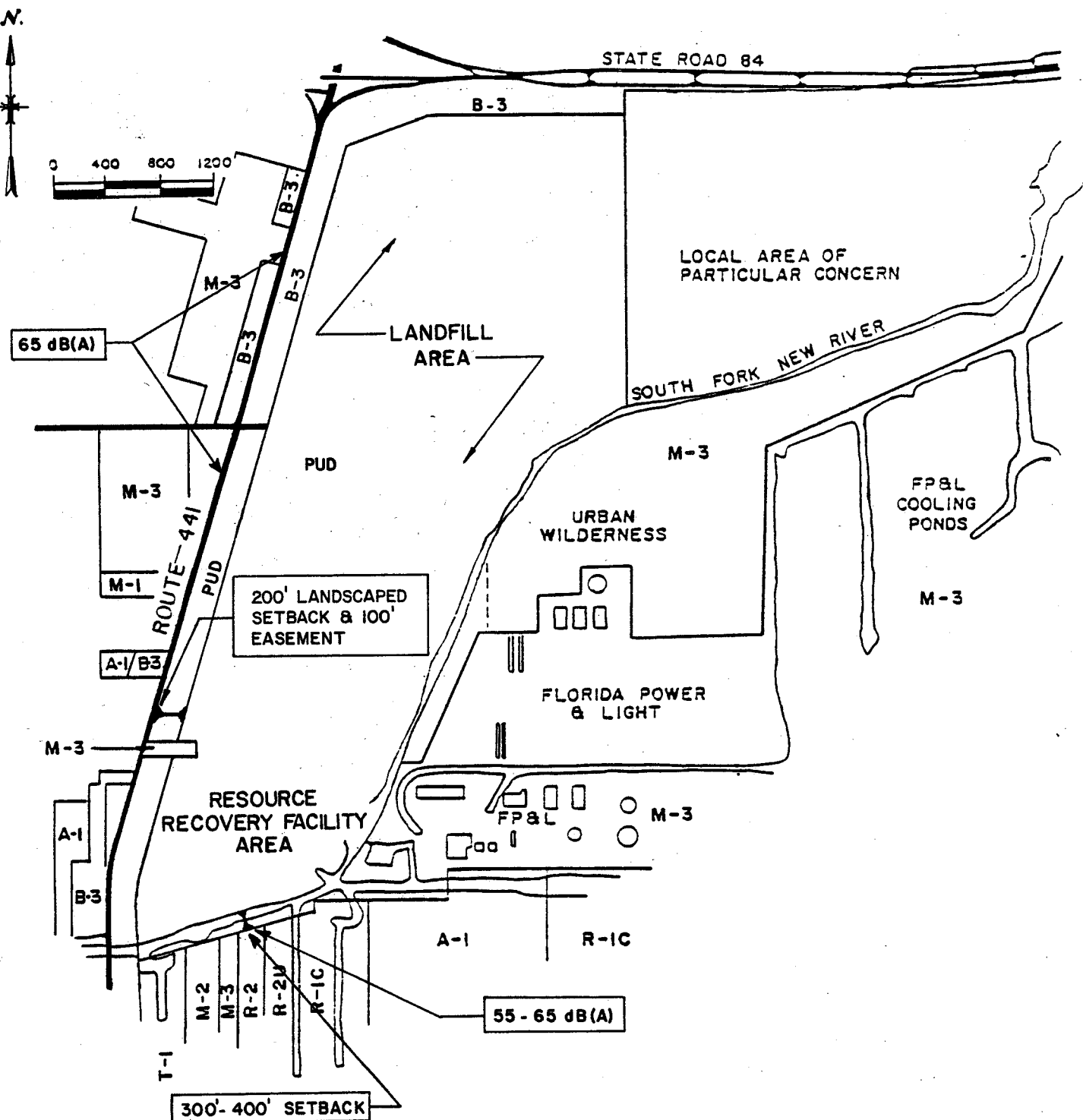


LEGEND

-  MARSH
-  CYPRESS
-  EXISTING VEGETATION

BROWARD COUNTY
RESOURCE RECOVERY PROJECT
CONCEPTUAL DEVELOPMENT AND
ENVIRONMENTAL ENHANCEMENT PLAN
FOR THE ROUTE 441 SITE

FIGURE 4



- A-1 LIMITED AGRICULTURAL DISTRICT
- B-3 GENERAL BUSINESS DISTRICT
- M-1 LIGHT INDUSTRIAL DISTRICT
- M-3 GENERAL INDUSTRIAL DISTRICT
- M-4 LIMITED HEAVY INDUSTRIAL DISTRICT
- R-1C SINGLE FAMILY RESIDENCES
- R-2 SINGLE FAMILY DUPLEX
- R-2U TWO FAMILY RESIDENCES
- T-1 TRAILER PARK DISTRICT
- PUD PLANNED UNIT DEVELOPMENT

BROWARD COUNTY
RESOURCE RECOVERY
SOUTHERN SITE ZONING
AND
PREDICTED NOISE LEVEL MAP

In the landfill (or northern) section of the southern site, as has already been discussed in the preceding section, there is the possibility that trucks, generating noise of 80 dB(A), will operate intermittently on landfill service roads immediately east of the two-hundred foot setback line. Noise from slow-moving trucks would be attenuated by 15 dB(A) to 65 dB(A) simply by virtue of the 300 foot distance.

In the resource recovery (or southern) section of the southern site, on-site noises will be generated by slow-moving refuse and residue trucks and by operation of the facility itself.

Noise from slow-moving trucks, as with landfill operations discussed above, will again be intermittent and will affect the properties west of Route 441 and the properties south of the site and across the New River Canal. On-site, intermittent noises generated by slow-moving trucks reaching the properties zoned for business and for industry on the west side of Route 441 will be similar to those truck-generated noises discussed above in connection with landfill operations.

On-site, intermittent noises generated by slow-moving trucks will also travel an estimated 300 to 400 feet to residential-zoned properties across and south of the New River Canal. At those properties, these truck noises will have been reduced by 15 to 18 dB(A), or from 80 dB(A) to 65 to 62 dB(A), respectively.

On site noise generated from plant processing operations will be either largely contained within the structure or shielded from projection to the residential properties by the location of the sources on the north side of the facility.

The steam condenser water cooling tower, if required, will be surrounded by a noise-attenuating wall/barrier with height taller than the towers themselves. In addition,

attenuation of cooling tower noise will result from its location on the north side of the facility. The facility will thus be between the tower and the residential areas to the south.

For a basis of comparison, noise level readings were taken on February 24, 1984 around the periphery of the Pinellas County Refuse-to-Energy Facility in St. Petersburg. The facility was in operation and has generally comparable process technology and generally similar facility plot plans to those proposed for this Broward County project. Outdoor equipment at the Pinellas facility includes the turbine-generator, the exhaust steam condenser, most of the steam system feedwater pumps, much of the residue handling conveyor system, and large evaporative cooling towers for cooling the exhaust steam condenser water. Noise readings at the described locations at the Pinellas facility were as follows:

- o Exit truck road, 200' south of outside steam turbine/generator and condenser 65 dB(A)
- o Truck road 200' west of enclosed and elevated tipping floor and on the opposite side from the cooling tower 50 dB(A)
- o City street, 500' to east of plant (large 3-cell, evaporative-type water cooling towers between plant and street) 60 dB(A)
- o Near truck weighing station, 500' north of plant (high earth berm between station and plant) 50 dB(A)

Based on noise levels measured during operation of the Pinellas County facility, the noises will be well under the applicable limitations set forth in Section 27-7.04 of the noise code (discussed in Section 2.0) at the property lines of the residential districts.

2.0 NOISE REGULATIONS

2.1 Overview

The Broward County Environmental Quality Control Board (EQCB) requires through the County Code of Regulations, Chapter 27-7, "that any person causing a device, process, or service to be operated or constructed which may be a source of noise pollution, must submit to this office appropriate plans and applications for approval prior to construction, installation, or operation." Appendix A contains applicable excerpts from Chapter 27-7.

This application is for a permit to construct a resource recovery facility and its associated residue/unprocessable waste landfill. Noises generated during normal daily operations at the facility and landfill are described and compared to regulations.

2.2 Allowable Noise Levels

Section 27-7 of the Broward County Code of Regulations govern allowable noise levels and noise permitting in Broward County. Specifically, the regulations set standards for noises which are measured according to regulation at the boundary line of the property of the noise source, as described in Section 27-7.041:

"No person shall operate or cause to be operated any source of sound arising from those activities set forth...in such manner as to create a sound level which exceeds the limits...for the receiving land use district...for more than 50% of any measurement period which shall not be less than 10 minutes, when measured at or within the boundary of a property within the receiving land use district and as a result of a source of sound being located on some other property."

Specifically applicable activities which are regulated, and the hours for which regulation are applicable, are as follows:

<u>Activity</u>	<u>Time Period</u>
Construction and demolition	7 p.m. to 7 a.m.
Engines, generators, pumps, motors, and other machinery	all times

Specifically exempted from noise control provisions are the following activities, among others:

- o Motor vehicles operating on a public right-of-way.
- o Any noise generated by the movement of aircraft in accordance with or pursuant to applicable federal laws or regulations.
- o Any noise generated by the operation of engines, generators, pumps, construction tools, or other equipment for emergency use.

Specific levels are set depending on the zoning designation of the property adjacent to the site from where noise is generated. These "Sound Level Limits", not accounting for "not to exceed" allowments, discussed below, are as follows:

SOUND LEVELS BY RECEIVING LAND USE

<u>Receiving Land Use District</u>	<u>Time</u>	<u>Sound Level Limit (dBA)</u>
*Residential	At all times	55
Recreational or Institutional	7 A.M. - 10 P.M.	60
Recreational or Institutional	10 P.M. - 7 A.M.	55
*Commercial or Business	At all times	65
*Manufacturing, Industrial, or Agricultural	At all times	70

*These zoning designations occur adjacent to the southern resource recovery/landfill site.

The regulations further state that maximum sound levels, as measured according to regulations, shall not exceed the "Sound Level Limit" as listed above by:

1. 10 dBA from 7 a.m. to 10 p.m. for all receiving land use districts except manufacturing, industrial, or agricultural;

2. 5 dBA from 10 p.m. to 7 a.m. for all receiving land use districts except manufacturing, industrial, or agricultural; and,
3. 10 dBA at all times in a manufacturing, industrial or agricultural receiving land use district.

3.0 REGULATORY COMPLIANCE

3.1 Predicted Noise Levels and Standards

Table 3 is a summary of the projected noise levels at property lines as compared to the standards set forth in the Broward County Code of Regulations, Chapter 27-7.

As can be seen from this table, it is projected that all noises generated on-site are attenuated adequately to ensure regulation compliance at all property lines at the perimeter of the site. Noise impacts with respect to various zoning classifications are projected to be in compliance with standards based on these zoning classifications. Figure 4 is a map which illustrates the locations of these areas.

TABLE 3

PROJECTED NOISE IMPACTS (dB(A))

Noise Source	Noise Level 50' from Source	Distance to Closest Property Line	Zoning Classification Impacted	Noise ¹ Attenuation	Noise Level at Property Line ²	Noise ³ Standard
Trucks at Landfill	80	300', west	industrial	15	65	70
Trucks at Facility	80	300-400', south	industrial, agricultural	15	65	70(+10)
Steam Condenser ⁵ at Facility	-	300-400', south	residential	-	approx. 55 dB	55(+10) ⁴

1. Attenuation is by distance (see Section 1.4) for trucks. For steam condenser, attenuation is by distance and a noise attenuating barrier.
2. Noise level at source - noise attenuation.
3. Sound Level Limit (+ allowable increment), from Chapter 27-7 of the Broward County Code of Regulations (see Section 2.2).
4. Standards require that levels measured at residential areas cannot exceed 55 dB(A) for more than 50% of any measurement period. It is predicted that trucks noises above 55 dB(A) will not occur for more than 50% of any measurement period. Further, regulations state that a sound level limit of 65 dB(A) may not be exceeded during the hours of 7 a.m. to 10 p.m.
5. Figures extrapolated from Pinellas County facility data. Noise reading at Pinellas County, 200 feet from the noise source, was 65 dB(A). Attenuation is expected to be achieved by distance and by noise attenuating barriers and surrounding structures.

Attenuation is in most cases achieved by virtue of the distance between the noise source and the point of measurement along the property lines of the site. In the case of the noise generated by the steam condenser water cooling tower, additional attenuation will be achieved through the utilization of noise attenuation walls, as well as of the facility building which will be located between the tower and the property line.

3.2 Action Requested

It can be seen from this permit application that predicted noise generation levels resulting from the operation of the proposed resource recovery facility and associated residue/unprocessable waste landfill in Southern Broward County will be in compliance with applicable regulatory standards. It is therefore requested that the Broward County Environmental Quality Control Board grant approval of this application to Construct a Noise Pollution Source for the referenced facilities.

4.0 SUMMARY

The following points present a summary of this Noise Technical Analysis:

- o Ambient noise levels at the southern site and at an operating resource recovery facility in Pinellas County were measured and recorded. From this data and known generation levels and noise attenuation behavior, predictions of noise levels at property boundaries are calculated.
- o Allowable noise levels, as established by the Broward County Environmental Quality Control Board in Chapter 27-7 of the County Code of Regulations are presented. These regulations include standards which differ according to the nature of the noise source, the time of day, and the zoning classification of the impacted area.
- o Finally, noise standards are compared to projected generation levels. Projected levels comply with all regulations, including those specific to time of day, zoning classification, and the nature of the noise source. The noise generated through the daily operation of the southern resource recovery facility and its associated residue/unprocessable waste landfill is not expected to threaten the public health, welfare, safety or the quality of life of Broward County citizens.

PROPOSED PROJECT TECHNICAL AND ENVIRONMENTAL SPECIFICATIONS

APPENDIX A

TECHNICAL SPECIFICATIONS

APPENDIX A
TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

	<u>Page Number</u>
<u>SECTION 1 - RESOURCE RECOVERY FACILITIES</u>	
1.1 Introduction	A-1
1.2 General Requirements	A-3
1.2.1 Civil Engineering	A-3
1.2.2 Image	A-3
1.2.3 System Availability	A-4
1.2.4 General Facility Process Design Requirements	A-4
1.2.5 Applicable Codes and Standards	A-6
1.2.6 Utilities	A-7
1.2.7 Site Utilities	A-10
1.3 Site Work	A-17
1.3.1 Subsurface Investigation	A-17
1.3.2 Survey	A-17
1.3.3 Clearing, Grubbing and Site Preparation	A-17
1.3.4 Excavation, Filling and Backfilling	A-19
1.3.5 Easements and Setbacks	A-20
1.3.6 Site Maintenance	A-21
1.4 Architectural	A-21
1.4.1 Functional	A-21
1.4.2 Detailed Architectural Requirements	A-28
1.5 Structural	A-31
1.5.1 Structures Supporting Vehicular Traffic	A-31
1.5.2 Structural Steel	A-31
1.5.3 Metal Roof Deck	A-32
1.5.4 Miscellaneous Metals	A-33
1.5.5 Concrete	A-34
1.5.6 Light Poles, Mast Lighting Sign and Signal Supports	A-36
1.5.7 Stacks	A-36
1.6 General Mechanical	A-37
1.6.1 Plumbing/Piping	A-37
1.6.2 Heating, Ventilation and Air Conditioning	A-39

APPENDIX A
TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS
(continued)

	<u>Page Number</u>
<u>SECTION 1 - RESOURCE RECOVERY FACILITIES (cont'd)</u>	
1.7 Electrical	A-39
1.7.1 Scope of Work	A-39
1.7.2 General Electrical Requirements	A-41
1.7.3 Standards	A-42
1.7.4 Temporary and Interim Electrical Work	A-42
1.7.5 Cutting and Patching	A-42
1.7.6 Fire Alarm System	A-42
1.7.7 Fail-Safe Systems	A-42
1.8 Facility Access and MSW Delivery Requirements	A-43
1.8.1 Functional Design	A-43
1.8.2 Traffic Flow	A-43
1.8.3 Traffic Control	A-46
1.8.4 Weighing Station	A-47
1.8.5 Tipping Area	A-49
1.9 Processable Waste Storage and Handling System	A-50
1.9.1 General Description	A-50
1.9.2 Processable Waste Storage	A-50
1.9.3 Crushers/Shears	A-51
1.9.4 Crane and Grapple Systems	A-51
1.9.5 Charging Hoppers and Chutes	A-54
1.10 Combustion Systems	A-55
1.10.1 General Design	A-55
1.10.2 Furnace Design	A-56
1.10.3 Combustion Air System	A-59
1.10.4 Energy Recovery Systems	A-60
1.10.5 Boiler Auxiliary Systems	A-62
1.10.6 Combustion Controls	A-66
1.11 Residue Handling Systems	A-66
1.11.1 General	A-66
1.11.2 Description	A-67
1.11.3 Bottom Ash	A-67
1.11.4 Fly Ash	A-68
1.12 Air Pollution Control Systems	A-68
1.12.1 Electrostatic Precipitators	A-68
1.12.2 Induced Draft Fan Systems	A-71
1.12.3 Stacks	A-73
1.12.4 Opacity Meter	A-73

APPENDIX A
TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS
(continued)

	<u>Page Number</u>
 <u>SECTION 1 - RESOURCE RECOVERY FACILITIES (cont'd)</u>	
1.13 Turbine - Generator Sets	A-73
1.13.1 System Design	A-73
1.13.2 Turbines	A-74
1.13.3 Generators	A-75
1.13.4 Cooling System	A-76
 1.14 Process Control Systems	 A-79
1.14.1 Local Automatic Control Systems	A-79
1.14.2 Remote Automatic Control Systems	A-79
1.14.3 Local Manual Control Systems	A-82
1.14.4 Remote Manual Control Systems	A-82
1.14.5 Control System Priorities	A-83
1.14.6 System Requirements	A-83
1.14.7 Uninterruptible Power Supplies	A-83
1.14.8 Process Alarms	A-84
1.14.9 HVAC	A-84
 1.15 Facility Security and Communications Systems	 A-84
1.15.1 Facility Security	A-84
1.15.2 Communications	A-85
1.15.3 Security Lighting	A-85
 <u>SECTION 2 - LANDFILL TECHNICAL SPECIFICATIONS</u>	
2.1 Introduction	A-86
2.2 General Design and Construction Requirements	A-88
2.3 General Operation Requirements	A-89
2.4 Environmental	A-91
2.4.1 Design and Construction Requirements	A-92
2.4.2 Operations Requirements	A-92
2.4.3 Water Quality Requirements	A-93
2.4.4 Noise Impact Requirements	A-94
2.4.5 Odor/Vector Control Requirements	A-94

APPENDIX A
TECHNICAL SPECIFICATIONS

LIST OF TABLES

<u>Table Number</u>	<u>Title of Table</u>	<u>Page Number</u>
A-1	1982 Average Annual Water Quality Values for the Broward County System 3-A Plant	A-12
A-2	1982 Average Annual Water Quality Values for the City of Fort Lauderdale's Walter E. Peele Plant	A-14
A-3	1982 Average Annual Water Quality Values for the Broward County System 1-A Plant	A-16

APPENDIX A
TECHNICAL SPECIFICATIONS

LIST OF FIGURES

<u>Figure Number</u>	<u>Description</u>	<u>Following Page</u>
A-1	Utility Locations Adjacent to the Route 441 Site	A-10
A-2	Electrical Interconnection Schematic Route 441 Site	A-10
A-3	Utility Locations Adjacent to the Copans Road Site	A-14
A-4	Electric Interconnection Schematic Copans Road Site	A-14

APPENDIX A
TECHNICAL SPECIFICATIONS
SECTION 1 - RESOURCE RECOVERY FACILITIES

1.1 Introduction

The intent of these technical specifications is to set minimum guidelines and functional design requirements to insure comparable proposals of uniform quality and to establish specific standards for the construction and operation of the facilities. In no instance is there any intent to limit the Proposer from adding to these minimum requirements and guidelines, or to unfavorably affect the use of proprietary systems and subsystems developed by manufacturer-suppliers through their own research and development efforts.

If a Proposer desires a change in the functional design requirements described herein, the Proposer shall submit identification of the change by utilizing Form 2.2 contained in the RFP. As discussed in Section 1 of the RFP, these facilities shall include two resource recovery facilities and two final Residue/Unprocessable Waste disposal landfills. In this specification, unless the context otherwise requires, words imparting the singular include the plural and vice versa. Thus, these technical specifications will apply to each facility.

The Contractor shall provide the necessary facilities to dispose fully of all the municipal solid waste (MSW) delivered to the facilities.

The Contractor shall not receive or dispose of pathogenic or hazardous industrial wastes.

Each resource recovery facility shall process all processable waste delivered to the facilities as received and shall obtain the following outputs:

- o Electrical energy
- o Recovered materials (optional)
- o Ash residue

These technical specifications are based on a mass-burn system technology wherein the waste shall be burned continually in furnace-boilers under controlled conditions of air pressure and temperature. Steam, produced in the boilers, shall be passed through a turbine-generator set to generate electricity. The residue and siftings shall be cooled either by spray or quench, and eventually landfilled if no reuse can be found for them. Gas stream particulates and fly ash removed by electrostatic precipitators before the gases are discharged into the atmosphere may be conveyed to a common residue removal system, along with boiler ash or the fly ash and boiler ash may be removed by separate systems from the plant.

The Contractor shall supply, maintain and operate all necessary process equipment and machinery. All equipment shall be arranged in such a way as to insure safety, good housekeeping, accessibility, and ease of replacement and/or maintenance of the equipment. All equipment and machinery shall be new and of the latest proven design. The process design shall include adequate redundancy to meet the required availability and process requirements. In addition, the facilities shall be designed to accommodate future expansions that may be necessitated as a result of increased waste generation.

In accordance with Section 4 of this RFP, a minimum of three distinct and independent process lines shall be provided at the southern resource recovery facilities, and a minimum of two distinct and independent process lines shall be provided at the northern resource recovery facility. Each process line shall, as a minimum, include the following:

- o A refuse-fired mass-burning furnace/boiler (steam generator) with appurtenances
- o Residue conveyors with appurtenances

- o An electrostatic precipitator with appurtenances
- o An induced draft fan and related duct work
- o Instrumentation

Common elements to each resource recovery facility shall include, but not necessarily be limited to:

- o MSW/residue weighing system
- o Enclosed tipping floor
- o Refuse storage pit
- o Refuse charging cranes and grapples
- o Collecting residue conveyors
- o Ferrous removal systems (optional)
- o Condensers
- o Water treatment equipment
- o Steam extraction headers and controls
- o Turbine/generator set or sets
- o Stacks
- o Centralized process control system

1.2 General Requirements

1.2.1 Civil Engineering

The design of each facility shall take into account the existing site conditions with respect to soil conditions, site clearing and drainage. The Proposer shall be responsible for any site preparation including soil stabilization.

Site grading shall meet the requirements for necessary flood protection and be compatible with the general topography of the adjacent properties.

1.2.2 Image

It is important to the County that, because of the anticipated physical size and the activities that take place in and around these facilities, utmost care be paid to minimize any possible adverse impact of the presence of each facility to the public. In this regard, a sensitive and careful urban planning effort is required in the siting and architectural design.

The buildings and grounds of each facility should be designed to project a coherent image of each facility's function and value to the community. Exterior building materials and fenestration shall project an image of quality and functionalism. This architectural image should be contemporary in tone, visually low-key on the exterior, and embody current design for industrial buildings. Each facility should be perceived by the public as a resource and energy recovery industrial building and not as an incinerator or refuse dump.

A GOOD NEIGHBOR RELATIONSHIP IS MANDATORY FOR EACH FACILITY AND THE SURROUNDING COMMUNITY.

The visual quality of each facility's stack design with regard to siting, material, and color options shall be considered.

1.2.3 System Availability

The facilities shall be designed using a modular approach with sufficient equipment redundancy to avoid shutdowns or outages. Each facility shall be designed to accept those quantities delivered by the County and the contract municipalities in accordance with their normal collection and delivery practices. The facilities shall be designed to process 1,095,000 tons of Processable Waste per year, 21,000 tons per week, 3,000 tpd, with allowances made for scheduled and unscheduled downtime.

The system designs shall provide for continuous performance.

Guaranteed availability shall be based on a proposed energy output for each ton of input at varying MSW heating values. The extent to which the guaranteed availability changes with changes in the heating value of the wastes shall also be guaranteed.

1.2.4 General Facility Process Design Requirements

The design of each facility shall incorporate the following requirements:

- o Each facility shall be designed so that all the Processable Waste received will be processed in a highly reliable manner. The Proposer will clearly state and demonstrate the long-term reliability and availability of the systems proposed.
- o Each Processable Waste storage pit shall be large enough to hold a minimum of four times the daily Nampelate Capacity of the facility based on an in-pit density of 500 lbs per cubic yard and without exceeding the elevation of the tipping floor. Minimum volumes for the storage pits shall be 24,000 cubic yards at the northern facility and 32,000 cubic yards at the southern facility.
- o Each vehicle shall be weighed upon entering the site to determine the net payload of the MSW delivered.
- o On-site MSW truck traffic flow shall be designed to minimize conflicts and to allow a maximum on-site time of ten minutes for any vehicle, even during peak traffic periods.
- o Sufficient unloading bays shall be provided to meet the above stated time criteria in regard to the unloading of Processable Waste in a totally enclosed tipping area.
- o Visitor accommodations shall be provided along with the appropriate walkways, galleries, conference rooms, and control room access.
- o The Proposer shall incorporate the following checklist in the design of each facility:
 - Weighing station - automated, with one standby scale
 - No truck queuing on the ramps or public roadways
 - Cranes - minimum of two each at one hundred percent of daily facility capacity, or three each at fifty percent capacity. The crane grapples shall have the capabilities to transfer the Processable Waste quantities at these crane capacities from the storage pit to the charging hoppers.
 - Manual overrides for all systems and equipment with automatic controls
 - Maximum furnace sizes - 750 tons/day
 - Turbine-generator units
 - Air Pollution Control - Electrostatic Precipitators, one per process line

- Stack(s) height - at each facility a maximum of 200 feet above final grade elevation
- Residue removal system - each one hundred percent nominal capacity conveyor systems
- Utility interconnection - as per the requirements of the Florida Power and Light Company (FP&L)
- Fire fighting system

1.2.5 Applicable Codes and Standards

The design and construction of all structures, along with all the equipment, component parts, and ancillaries, shall conform with all governmental and industry codes and standards. Without limiting the foregoing, The South Florida Building Code shall be followed, including requirements for:

- o construction classifications,
- o fire restrictive construction,
- o fire protection systems,
- o elevators.

In addition, the latest issues of the following codes and standards for construction and operation of each facility, shall be incorporated in the design.

- o American Association of State Highway and Transportation Officials (AASHTO)
- o American Institute of Steel Construction (AISC) Specifications
- o American Welding Society Code
- o Applicable codes and standards of the American National Standards Institute (ANSI)
- o American National Standards Building Code Requirements for Minimum Loads in Buildings and Other Structures (ANSI A58.1)
- o Instrument Society of America (ISA)
- o Applicable codes and standards of the American Society for Testing and Materials (ASTM)
- o Air Mixing and Conditioning Association (AMC)
- o ASHRAE Handbook and Standards

- o Tubular Exchange Manufacturers Association (TEMA)
- o American Society of Mechanical Engineers (ASME) - Boiler and Pressure Vessel Code
- o Hydraulic Institute Code (HIC)
- o Heat Exchanger Institute (HEI)
- o American Concrete Institute (ACI)
- o Steel Structures Painting Council (SSPC)
- o All Standards Promulgated by the U.S. Secretary of Labor under Occupational Safety and Health Administration (OSHA)
- o Institute of Electrical and Electronic Engineers (IEEE)
- o National Electrical Code (NEC)
- o National Electrical Manufacturers Association (NEMA)
- o National Fire Protection Association Codes (NFPA)
- o National Board of Fire Underwriting (NBFU)

In the event that any of the above codes or standards conflict with one another, the most stringent requirement shall be applied.

1.2.6 Utilities

General: It is the responsibility of the Proposer to inform the County of the quantities of all utilities required by each proposed facility. The Proposer shall indicate in the proposal if there is an insufficiency in utilities supplying the sites. Off-site costs associated with providing utilities capacity (exclusive of cooling water requirements) in excess of those immediately available shall be treated as "developmental costs" to be included in the Project financing.

The design and installation of all utility connections shall be in accordance with the requirements of the utility suppliers and will be considered as part of the design of each facility.

Water: The requirements of the South Florida Water Management District shall be met, including those for permits.

It is the Proposer's responsibility to include in the proposal, details on the treatment of the water as may be required for plant operations and any pretreatment requirements for industrial wastewater. In addition, the Proposer shall include stormwater drainage plans for the resource recovery facilities and Residue/Unprocessable Waste landfills.

The water quantities and pressures required for plant processing and other purposes, including fire protection, shall be included in the Proposal. If the County cannot provide the quantities and pressures required, auxiliary sources for obtaining same shall be included in the Proposal.

The Proposer shall consider for process water the use of non-potable well water, the recycling of plant wastewater, and the potential use of plant effluent. The Proposal shall include a complete description and estimates for each auxiliary source. Compliance with all applicable codes is mandatory.

Sanitary Sewer: The Proposer shall submit in the Proposal, design data on his projected water discharges, including quantities and qualities of discharge and pretreatment, if required, i.e., characteristics as defined by the rules of the County and/or the host municipality user charge/industrial cost recovery systems. The Proposal shall also include methods to handle discharge if the present systems cannot accept it. Applicable codes and requirements of the State and the County shall be complied with.

Storm Drainage: Storm drainage for the sites shall be developed to conform to all requirements of the South Florida Water Management District (SFWMD). All plans shall be reviewed with the County for conformance with code and other requirements of the SFWMD. The Proposer shall submit calcula-

tions showing the method for determining runoffs. On site retention lakes will be required for storm drainage control. As part of the County's permit application procedure, preliminary storm drainage plans have been developed and submitted to the SFWMD.

Storm drainage plans shall be reviewed with the County for conformance with code and other requirements of the SFWMD.

Electrical Power: Florida Power & Light (FP&L) will bring transmission power to the facility substations. Power requirements and the suggested operating compatibility for the electrical system for each facility during the construction, start-up and operation phases, and for backup, shall be provided in the Proposal. The electrical system includes the plant distribution system, the type of metering, the interconnection systems with FP&L and FP&L protection costs within the interconnection systems. The Proposer shall provide electrical power specifications to the County and shall make all arrangements for electrical service during construction and start-up through FP&L.

For utility interconnection, the design and installation shall be in accordance with the requirements and standards imposed by FP&L and shall be part of each facility. FP&L shall tie-in to electrical substations to be located within each facility site.

The mode of electrical energy distribution shall meet with the following:

- o Each turbo-generator and associated power generation equipment shall have its own bus which is to be at the same voltage level as the generator. Synchronizing and protective relays shall be provided on each generator breaker.
- o Interconnect transformers shall each be sized for the full output of the plant.
- o Complete indoor relay and control switchboards shall be provided for each facility's electric systems.

The distribution systems at each facility shall have 4.16 KV and 400 volt systems with switchgear and related accessories housed in the processing section of each of the facilities.

The electrical output of the turbine-generator sets shall operate within the interconnection system established by FP&L. The turbine-generator sets shall be capable of operating in the full condensing mode, at maximum steam flow, even on the hottest day of the year, and still provide an efficient and adequate quantity of electrical energy.

In addition, payment to FP&L shall be required for interconnection and protection costs associated with the northern and southern facility electrical interconnections, and for the following additional costs:

- o Monthly telephone company charge for FP&L dispatcher communication channel, which has been estimated by FP&L at \$175 per month at each site.
- o Maintenance and operation fee to FP&L for interconnections facilities.
- o Metering costs.
- o Suitable arrangements for termination of FP&L lines. The service points may be adjusted if desirable to provide suitable line terminations.
- o Suitable right-of-ways and easements both on and off the sites for the transmission lines. Thirty-six foot minimum width, accessible easements are required. The right-of-ways must be cleared and finished to adequate grade. Costs of fees and permits, if applicable, shall also be paid.

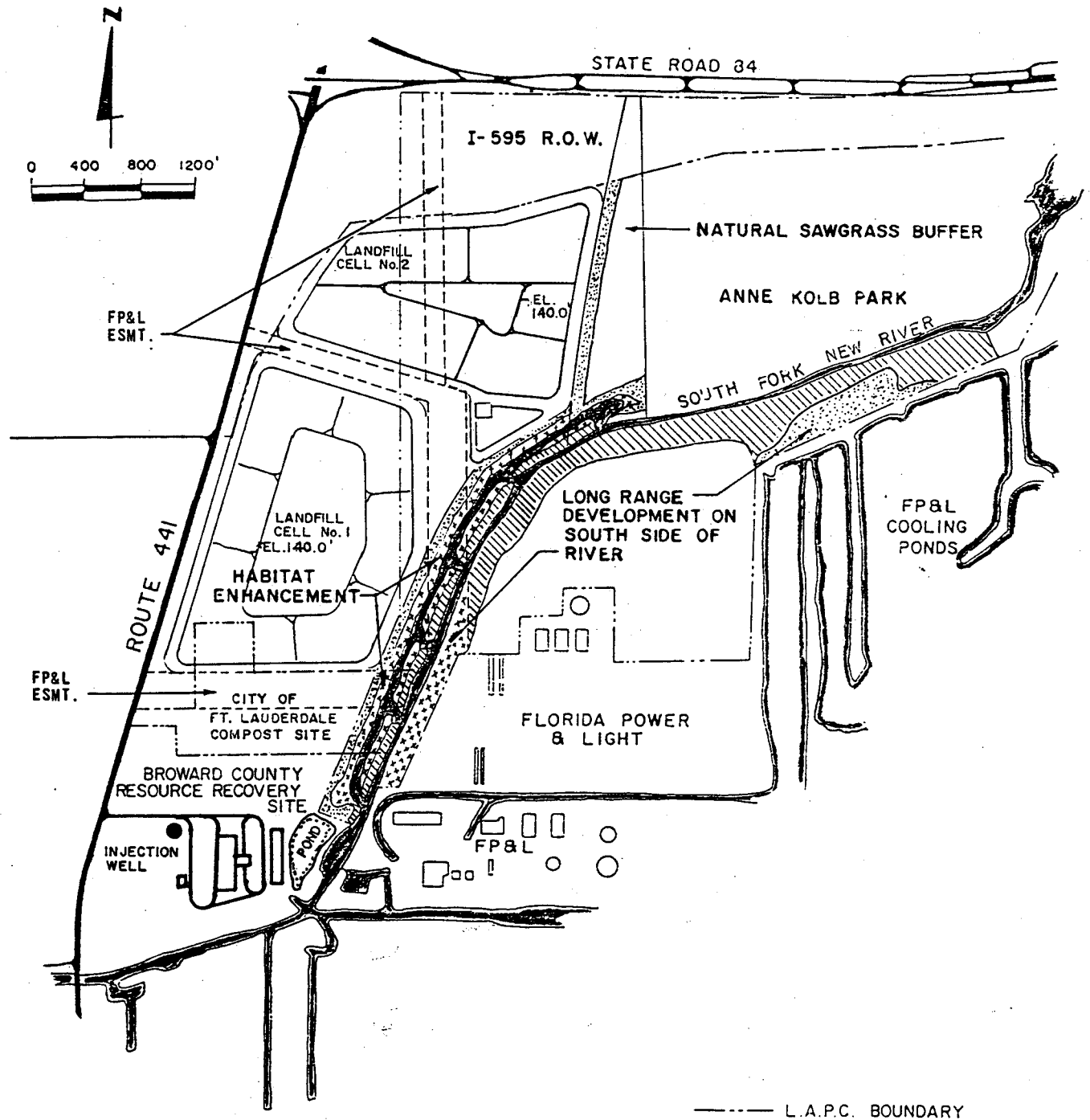
1.2.7 Site Utilities

This subsection provides information on available utility service for the Route 441 and Copans Road Sites. However, it is the responsibility of the Proposer to verify and supplement this information where necessary.

Route 441 Site

Figure 1A illustrates the known utility locations adjacent to the Route 441 site. The electrical interconnection proposed by FP&L is shown in Figure 2A.

figure 1A

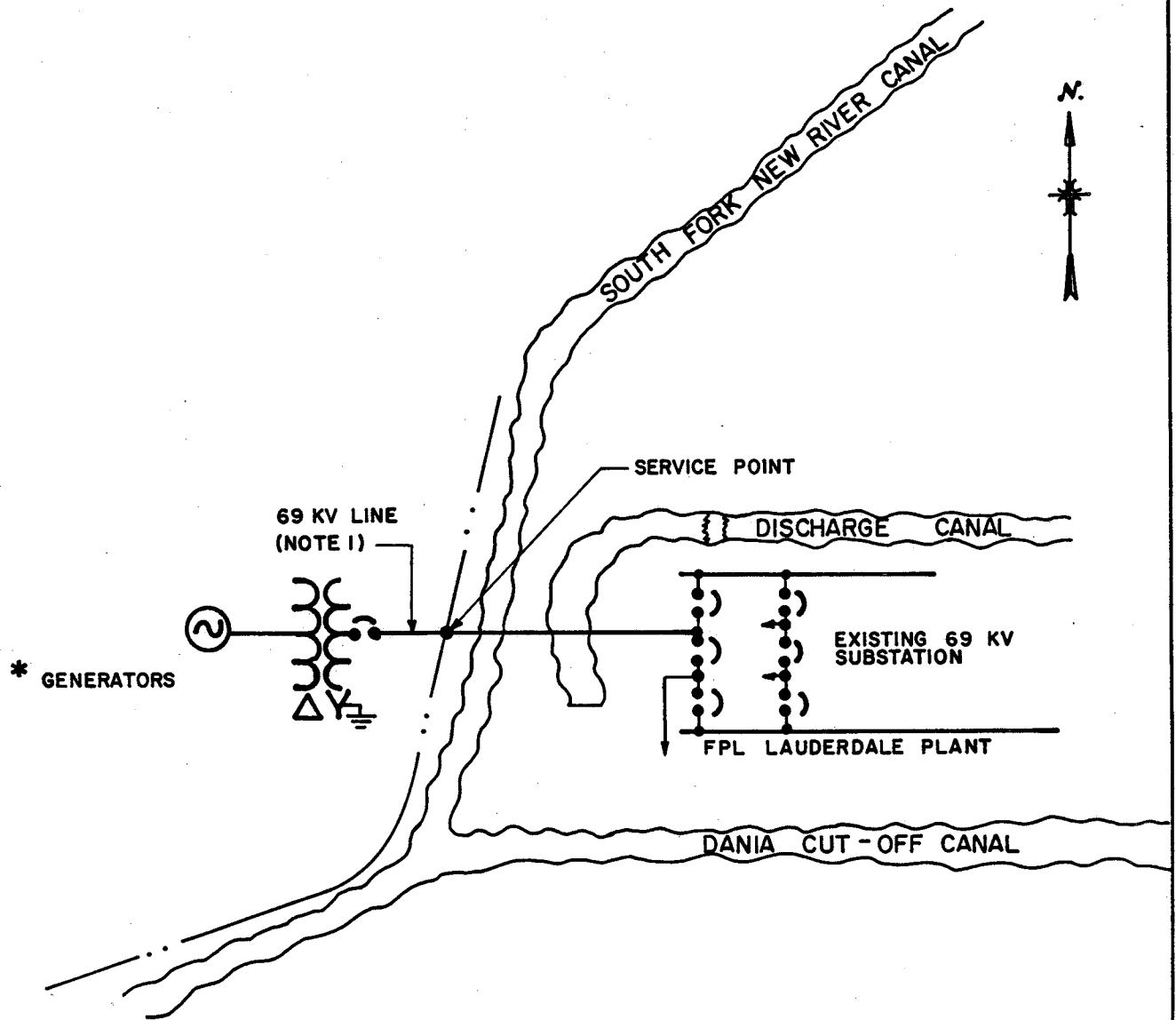


LEGEND

-  MARSH
-  CYPRESS
-  EXISTING VEGETATION

BROWARD COUNTY
 RESOURCE RECOVERY
 CONCEPTUAL DEVELOPMENT AND
 ENVIRONMENTAL ENHANCEMENT PLAN
 FOR THE ROUTE 441 SITE

figure 2A



* GENERATORS

69 KV LINE
(NOTE 1)

SERVICE POINT

DISCHARGE CANAL

EXISTING 69 KV
SUBSTATION

FPL LAUDERDALE PLANT

DANIA CUT - OFF CANAL

* GROSS OUTPUT MAY BE SUPPLIED
BY TWO GENERATORS

NOTE 1
PROVIDE FOR FUTURE CONVERSION
FROM 69 TO 138 KV

Electric Service: For the southern facility, FP&L indicates that a 69 KV transmission line will be extended westwardly across the South Fork New River Canal from FP&L's Lauderdale Power Plant Substation to the southern site's substation. The routing of this line will require coordination in the development of the resource recovery plant. The facilities at the southern sites should be designed to facilitate future conversion of the 69 KV service voltage to 138 KV.

Florida Power and Light has developed an interconnection cost estimate, including modifications to offsite substations and transmission lines, for the southern site. This estimate, based on the above assumptions is \$300,000 which does not include the cost of the transformer, circuit breaker or protective equipment installed at the site.

The above cost, in current dollars, should be regarded as a budget estimate to provide feasibility guidance. Since the Project will pay on the basis of actual cost including appropriate overheads, rather than estimated cost, the estimates must be reviewed when specific designs become available.

Water Service: Water requirements can potentially be provided by Broward County or the City of Fort Lauderdale. Broward County has an existing 12-inch diameter water main, which runs east-west along Griffin Road south of the project site. An 8-inch line extends north from that main to a point adjacent to the resource recovery facility site. Water quality data for the County water plant that would provide service to the southern site is provided in Table A-1. Preliminary information from the County indicates that approximately 100 gpm of water from the County water system may be available to this site.

Service by the City of Fort Lauderdale would require a main extension from the New River Canal, Route 441

TABLE A-1
1982 AVERAGE ANNUAL WATER QUALITY VALUES FOR
THE BROWARD COUNTY SYSTEM 3-A PLANT

<u>Analytical Results</u>	<u>Raw Water</u>	<u>Finished Water</u>
Water pH at the Plant	7.25 units	8.75 units
Water pH at the Field	-	8.50 units
Water Color at the Plant	63 CU	12.0 CU
Water Color at the Field	-	12.8 CU
Water Odor No. Dilutions	3 DIL	-
Water Turbidity	-	0.41 BTU
Water Free Carbon Dioxide	21 mg/l	0 mg/l
Calcium Hardness as CaCO_3	209 mg/l	63 mg/l
Magnesium Hardness as CaCO_3	18 mg/l	14 mg/l
Total Hardness as CaCO_3	227 mg/l	77 mg/l
Total Mo. Alk. as CaCO_3	198 mg/l	26 mg/l
Non Carbonate Hardness as CaCO_3	29 mg/l	51 mg/l
Calcium as Ca^{+2}	83.6 mg/l	25 mg/l
Magnesium as MG^{+2}	4.4 mg/l	3.4 mg/l
Iron as Fe^{+2}	1.67 mg/l	0.03 mg/l
Sodium as Na^{+1}	23.2 mg/l	23.8 mg/l
Bicarbonate as HCO_3^{-1}	242 mg/l	31.7 mg/l
Chloride as Cl^{-1}	35 mg/l	52.4 mg/l
Sulfate as SO_4^{+2}	17.0 mg/l	18.0 mg/l
Fluoride as F^{-1}	0.19 mg/l	0.88 mg/l
Total Dissolved Solids	408 mg/l	173 mg/l
Total Res. Chlorine	-	2.9 mg/l
Total Free Chlorine	-	2.5 mg/l
Total Comb Chlorine	-	0.4 mg/l
Saturation Index	+0.00	+0.14 mg/l

intersection south to the site. This extension will necessitate crossing Route 84 and the proposed I-595 interchange. Preliminary information from the City of Fort Lauderdale indicates that approximately 100 gpm of water may be available from the City's Peele Water Plant. Water quality data for this plant is provided in Table A-2.

Sewer Service: As with water, sewer service can potentially be provided by either Broward County or the City of Fort Lauderdale.

The Broward County system consists of small submersible pump stations discharging through a 6-inch diameter force main located on Griffin Road. The possibility that increased flow through the Broward County system will significantly affect hydraulic conditions must be addressed.

The City of Fort Lauderdale operates pumping station D-54 on S.W. 20th Street to the north of the project site. This is a large station which would probably not be affected by increased flow from the resource recovery facility. However, the piping required to meet the City system must pass across Route 84 and proposed I-595.

Copans Road Site

Figure A-3 illustrates the location of known utilities, adjacent to the Copans Road Site. The electrical tie-in proposed by FP&L is shown in Figure A-4.

Electric Service: For the northern facility, FP&L indicates that a 138 KV overhead transmission line will be brought to the eastern side of the site. This pole line will enter the northern site at approximately the northeast corner and extend southward along the east property line to the northern site's substation.

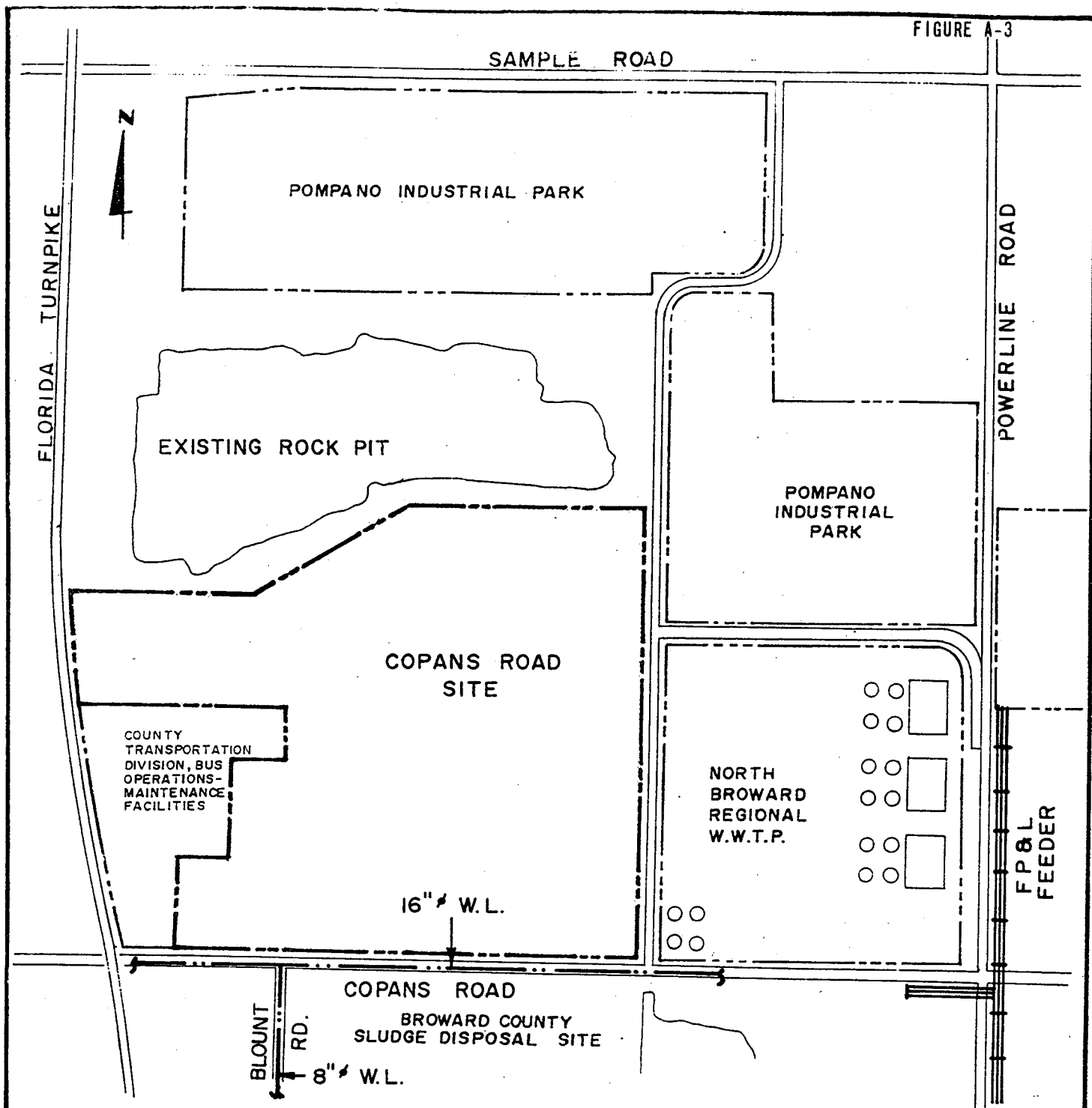
Based on the above assumptions, Florida Power and Light has estimated the interconnection costs for this site, including modifications to offsite substations and transmission lines at \$800,000. This estimate does not include the

TABLE A-2

1982 AVERAGE ANNUAL WATER QUALITY VALUES FOR
THE CITY OF FORT LAUDERDALE'S

WALTER E. PEELE PLANT

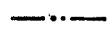
<u>Analytical Results</u>	<u>Raw Water</u>	<u>Finished Water</u>
Water, pH	6.9 units	9.1 units
Water Color	3.65 CU	5.25 CU
Turbidity, NTUO	-	0.36
P Alkalinity	-	8.5 mg/l
M Alkalinity	-	39.7 mg/l
Total Mo. Alkalinity	224 mg/l	-
Calcium hardness as CaCO_3	254 mg/l	81 mg/l
Total Hardness as CaCO_3	165 mg/l	90.5 mg/l
CO_2 Calcium	54 mg/l	-
Iron as FE	1.85 mg/l	0.11 mg/l
Chlorides as Cl^{-1}	42 mg/l	53.7 mg/l
Residual Chlorine	-	2.5/3.4



LEGEND



FP & L POWER LINE



BROWARD COUNTY WATER MAIN

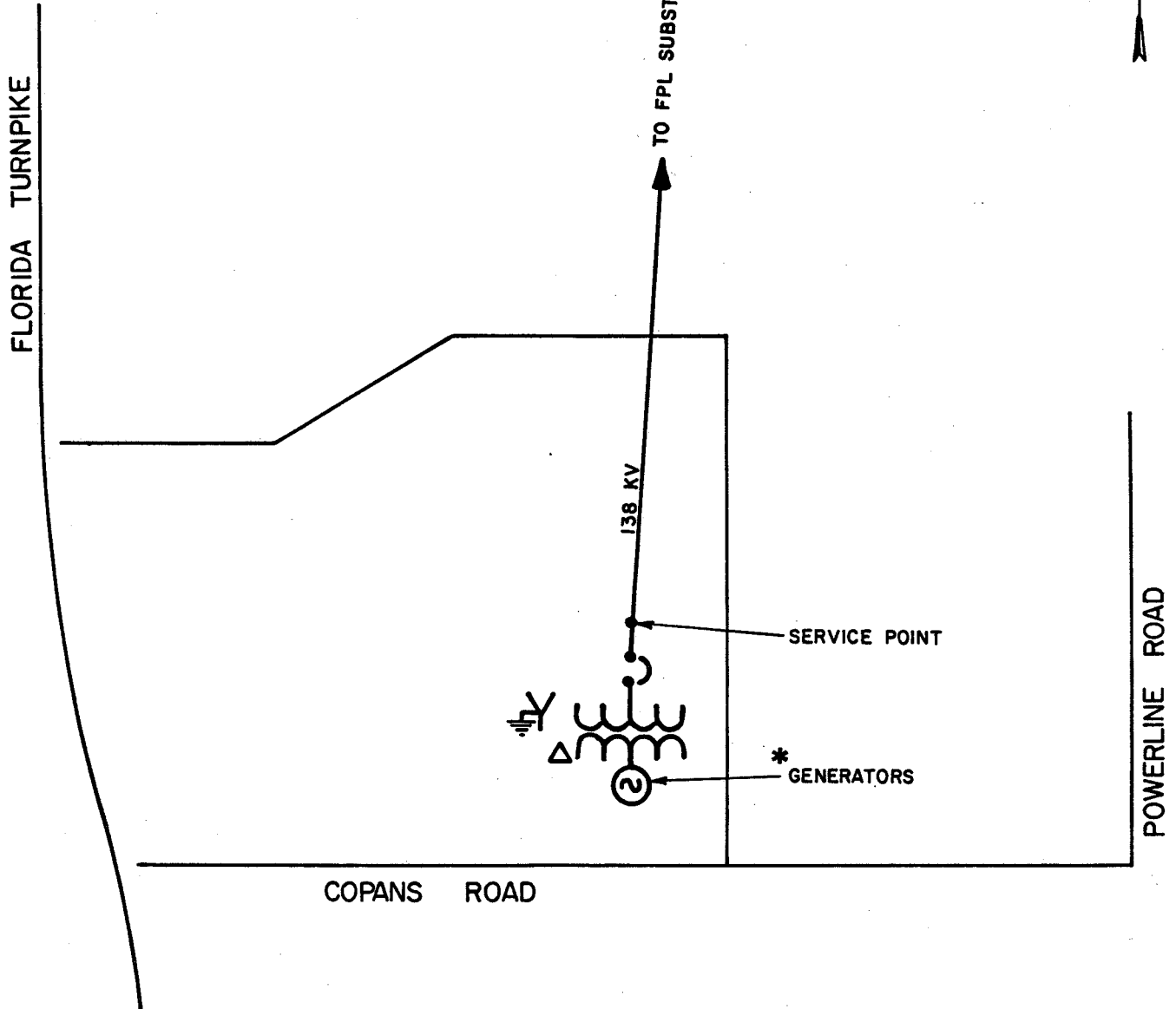


PROJECT BOUNDARY

NOTE: NOT TO SCALE

**BROWARD COUNTY
RESOURCE RECOVERY**

**UTILITY LOCATIONS
ADJACENT TO THE
COPANS ROAD SITE**



* GROSS OUTPUT MAY BE SUPPLIED
BY TWO GENERATORS.

cost of the transformer, circuit breaker, or protective equipment necessary to be installed at the facility.

The Contractor would be responsible for installation and operation of the step down transformers, interfacing circuit breakers and protective equipment.

The preceding cost, in mid 1983 dollars, should be regarded as a budget estimate to provide feasibility guidance. Since the Project will pay on the basis of actual cost including appropriate overheads, rather than estimated cost, the estimates must be reviewed when specific designs become available.

Water Service: Water may be provided from the Broward County water distribution system. Preliminary discussions with the County indicate that approximately 100 gpm of water may be available from the County water system to this site. Water quality data for the County water plant that would provide to the northern site is provided in Table A-3.

Sewer Service: The Copans Road site is located immediately west of the North District Regional Wastewater Treatment Plant which can provide sewer service to the resource recovery facility. Broward County owns and operates this plant.

TABLE A-3
1982 AVERAGE ANNUAL WATER QUALITY VALUES FOR
THE BROWARD COUNTY SYSTEM 1-A PLANT

<u>Analytical Results</u>	<u>Raw Water</u>	<u>Finished Water</u>
Water pH at the Plant	7.2 units	8.9 units
Water pH at the Field	-	8.6 units
Water Color at the Plant	82 CU	10.75 CU
Water Color at the Field	-	11.5 CU
Water Odor No. Dilutions	3.0 DIL	-
Water Turbidity	-	0.40 BTU
Water Free Carbon Dioxide	27 mg/l	0
Calcium Hardness as CaCO_3	235 mg/l	70 mg/l
Magnesium Hardness as CaCO_3	18 mg/l	9 mg/l
Total Hardness as CaCO_3	253 mg/l	79 mg/l
Total Mo. Alkalinity as CaCO_3	227 mg/l	29 mg/l
Non Carbonate Hardness as CaCO_3	26 mg/l	50 mg/l
Calcium as Ca^{+2}	94 mg/l	28 mg/l
Magnesium as MG^{+2}	4.38 mg/l	2.2 mg/l
Iron as Fe^{+2}	1.42 mg/l	0.03 mg/l
Sodium as Na^{+1}	32.6 mg/l	32.8 mg/l
Bicarbonate as HCO_3^{-1}	277 mg/l	35.4 mg/l
Chloride as Cl^{-1}	57 mg/l	82.0 mg/l
Sulfate as SO_4^{+2}	14 mg/l	14.0 mg/l
Fluoride as F^{-1}	0.14 mg/l	0.85 mg/l
Total Dissolved Solids	406 mg/l	275 mg/l
Total Res. Chlorine	-	4.1 mg/l
Total Free Chlorine	-	3.3 mg/l
Total Comb Chlorine	-	0.8 mg/l
Saturation Index	+0.06	+0.37 mg/l

1.3 Site Work

1.3.1 Subsurface Investigation

Data and information pertaining to the subsurface conditions at the southern site are provided in Appendix E of this RFP.

This data will be supplied for informational purposes only. The Contractor must assure itself that subsurface conditions are compatible with its facilities.

1.3.2 Survey

The Contractor shall furnish all labor, materials, tools, equipment, to perform all work and services necessary for or incidental to the performance and completion of survey work necessary for the construction of site work, buildings, new utilities, and other new facilities and establish and maintain bench marks, make measurements to verify location of completed construction, and survey alignment to existing property boundaries.

The following conditions shall be followed in making the above described survey:

- o A survey shall be made to establish the property site lines.
- o Copies of all the County's survey information will be made available at Contractor's expense.
- o The Contractor shall not disturb existing benchmarks or property line monuments. Work necessary to replace stakes and monuments as directed by the County shall be at the Contractor's expense.

1.3.3 Clearing, Grubbing and Site Preparation

Underground Void Areas: Such as tanks, cisterns, tunnels, or the like shall be removed or filled according to all pertinent codes and regulations.

Shoring: All temporary shoring required to support existing work, and adjacent areas and work shall be furnished and installed to prevent settlement or other damage

to surrounding areas and structures and shall be provided with adequate means to compensate for any settlement in the shoring supports.

Debris: All materials removed shall become the property of the Contractor and shall be removed from the premises and disposed of by the Contractor.

Maintenance: All access roadways used by the Contractor shall be maintained in serviceable condition. The Contractor shall keep the surfaces of these roadways free from mounds, depressions and obstructions which might present a hazard or annoyance to traffic.

Signs, Signals and Barricades: All signs, signals and barricades shall be provided by the Contractor and shall meet or exceed all OSHA regulations for accident prevention.

Dust Control: The Contractor shall be responsible for all dust control at the site. The Contractor shall prevent the spread of dust during his operations. Moistening all surfaces with water or applying calcium chloride shall be used to prevent dust from becoming a nuisance to the public and neighbors. Contractor shall furnish all labor and equipment necessary for dust control including but not limited to tank trucks, hoses, calcium chloride spreaders, etc.

Burning: On-site burning shall not be permitted.

Vermin and Rodent Control: During the course of construction and operation, a constant control of vermin and rodents shall be maintained by the Contractor. If necessary, the Contractor shall employ the services of a professional exterminator.

Explosives: The use of explosives shall at all times be in conformance with the conditions set forth in Section 3.5 of the RFP.

Disconnection of Utilities: Before starting site operations, the Contractor shall disconnect or arrange for the disconnection of all utility services required to be removed,

performing all such work in accordance with the requirements of the utility company or agency involved.

Grubbing: The Contractor shall remove all surface rocks and all stumps, roots and other vegetation within the limits of construction.

Dewatering: The Contractor shall be responsible for performing all necessary site dewatering.

Site Drainage: The Contractor shall be responsible to install and maintain adequate drainage and prevent soil erosion at the site during construction.

1.3.4 Excavation, Filling, and Backfilling

The Contractor shall be responsible for furnishing all supervision, labor, tools, materials and equipment and performing all operations in connection with excavation of all materials regardless of character of material, and obtain fill and backfill material approved by a qualified soil engineer to produce final grade lines. All necessary arrangements for obtaining fill material and topsoil from off-site borrow areas shall be the responsibility of the Contractor.

The Contractor shall remove from the site all rubbish and debris found thereon to prepare the site for excavation.

The Contractor shall perform the required excavation of whatever materials encountered, as necessary for the construction of the Project.

Excavation for footings shall be made sufficiently wide for the installation of form work and to the depths required.

The Contractor shall prevent the foundation area from becoming unstabilized by the flow of water into the excavation or by cave-ins.

Deleterious soil not suitable for sustaining design loads must be removed entirely and controlled fill shall be placed in its stead. In areas other than under buildings unsuitable soil shall be removed to the depth required to sustain traffic loads with controlled fill placed in the area.

The Contractor's quality of work including excavation, fill, backfilling, dewatering, subgrade preparation and stabilization, shoring, drainage, for protection shall comply with soils engineer recommendations, the applicable American Society for Testing and Materials (ASTM) standards, and the Florida State Department of Transportation.

All existing utility lines, drains or other structures which are encountered or which are uncovered by excavation shall be carefully supported and protected from injury by the Contractor, and if damaged shall be restored by the Contractor at his expense to the same condition in which they were found.

Surplus excavated material over and above that required for backfilling shall be placed by the Contractor at points on the property consistent with the Contractor's landscaping plan.

Before backfilling, all excavated areas to be backfilled shall be cleared of all building rubbish, wood, lumber and dismantled from work, etc.

Backfill shall consist of suitable clean soil.

Backfill shall not be placed against walls until they have attained sufficient strength to withstand the pressure of the fill material safely.

1.3.5 Easements and Setbacks

Existing easements at the sites, such as those held by FP&L and as indicated on the site drawings in this RFP, must be observed and honored unless specific exceptions are obtained from the easement holder.

A discussion of the required buffer areas for the northern site is provided in Section 4 of the zoning ordinance for the Copans Road Site, while the Zoning and Land Use Section of the "Route 441 Site Environmental Review Form Summary and Report" dated July, 1983 contains information pertaining to setbacks and buffer areas for the southern site.

1.3.6 Site Maintenance

The Contractor shall be responsible for the maintenance of the sites. Maintenance shall include all watering, weeding, clean-up, repair of washouts, repairs to fences and all other necessary work associated with site maintenance.

The Contractor shall clean-up and remove from the site all rubbish and materials as they accumulate and shall not permit them to be scattered about the site. If the Contractor fails to attend to this clean-up promptly and satisfactorily, the County shall have the right to employ others for the work and charge the cost to the Contractor.

1.4 Architectural

1.4.1 Functional

General: The Proposer shall be responsible for developing site layouts which will meet all functional design requirements to provide for efficient operation of each facility.

Plans for each facility shall include an architectural program for all functional areas of the facility, identifying the designated use and capacity of these areas. Concepts for interior design and furnishings shall also be provided. An interior circulation plan shall be designed for efficient movement and functional operation of equipment and control by the crews of each facility. Personnel facilities should be placed in a central location to minimize walking distances.

Each complete facility, including buildings required to house process equipment and administrative functions, public areas, ancillary buildings, infrastructure such as roadways, parking areas and landscaping, shall be designed and constructed to meet all functional requirements of the Project. Each facility shall be designed and constructed of quality materials to ensure that with proper maintenance and repair the facility will remain in good condition both functionally

and visually over the operating period. The selection of exterior materials should be made from the standpoint of durability, weather-resistance and easy maintenance.

The proposal shall include necessary systems for heating, ventilation, air conditioning, plumbing, lighting and power distribution, communication, fire protection, and provision for the handicapped in visitor and administrative office areas to facilitate proper operation of the process equipment and provide essential comfort for the personnel.

Each facility shall include all of the necessary equipment and their enclosures and conform to all applicable Federal, State and local codes.

Each facility shall be designed to facilitate repair and maintenance of process equipment by providing adequate space around and between equipment items.

Main Process Buildings: Each main process building shall house the refuse receiving and handling area, refuse storage area, water and waste handling systems, control room, machine shop and locker rooms. In addition, each main process building shall house an employee area, maintenance and storage areas, laboratory and the first aid center. The turbine-generator sets may be installed outdoors or may be housed within the main process building.

Exterior walls shall be durable, as well as providing noise abatement, and easily maintainable. Natural light shall be utilized throughout the main process buildings to the maximum extent possible.

Material that is easily cleaned, damage resistant against various maintenance activities, and tolerant of adverse conditions created by high humidity and equipment operation (e.g., vibration) shall be selected for the interior walls and partitions. Access stairs, ladders, platforms and elevators shall be provided in accordance with applicable sections of OSHA.

Administrative Office Spaces and Employee Areas: At each facility the administrative offices may be incorporated within the main process building or housed in a separate building. Each facility shall include suitable office space and furnishings to accommodate the facility staff and County representatives.

Conference rooms, a visitor reception area, employee locker room(s) with toilets, an employee lunch room, and toilets for staff and visitors shall also be provided at each facility. These spaces shall be furnished with all customary furniture and equipment.

Visitor Accommodations: Each facility shall provide for occasional visitors, both singly and in groups, and for on-site public educational programs.

In addition, controlled visitor viewing locations, in various process areas of each facility, shall be provided. These viewing spaces shall not be directly exposed to operating equipment to assure the safety of the public. Elevators shall be provided to facilitate visitor access and movement to all levels of each facility.

Maintenance and Storage: Each facility shall include a maintenance and machine shop and adequate storage for spare parts, equipment and rolling stock, sufficient to provide for a regular program of maintenance for all facility buildings and grounds.

The Contractor shall furnish equipment for the machine shop as part of each facility.

Each facility shall have storage spaces for all mobile vehicular equipment necessary to operate the facility and associated landfills. An enclosed vehicular garage/repair shop shall be provided at each facility.

Scale Houses: Each facility shall have a scale house as a separate building. Each shall contain, in addition to the weighing equipment, provisions for an office for the operator with the necessary furnishings and an area with

toilets for truck drivers. Adequate lighting, heating, ventilating and air conditioning shall be provided. A security office shall also be located within each scale house.

Waste Sampling Areas: The enclosed tipping floors at each facility shall have provisions for use of an area on the floors for Processable Waste sampling on a selective or as-needed basis. Vehicular access shall be provided to the sampling areas. Ample space shall be provided to permit waste to be transferred from the receiving areas into a 1-cubic yard box using a small front end loader. These sampling spaces may be routinely used for other purposes and made available for test work on a coordinated basis.

Residue Handling Areas: The residue handling areas shall be enclosed to minimize the aesthetic impact of this operation, control the emission of noise and odor and to conceal the activities from the view of the public.

Laboratory: The facility shall include a fully equipped laboratory to conduct all routine testing of steam and feedwater. The detailed design of the laboratory shall be the responsibility of the Proposer.

First Aid Centers: The Proposer shall provide an area for a fully equipped First Aid Center within each facility.

Access Roads and Ramps: The access roads and/or ramps shall be designed to achieve the greatest efficiency, to minimize the use of space, to minimize the interaction of trucks with staff and visitor vehicles, and to prevent the queuing of trucks on ramps and public roadways.

Road System: The road systems shall include all roadways within the facilities. There shall be at a minimum at each facility a road from:

- (1) The entrance and the exit to:
 - o The weighing station
 - o The main plant building
 - o All auxiliary facilities

- (2) The weighing station to and from:
 - o The tipping area (truck ramp shall be constructed with a slope not to exceed five percent
 - o The ash handling area
 - o The residue/unprocessable waste landfill,
- (3) The main plant building to and from:
 - o All auxiliary facilities

Road Geometric Design: There shall be a MINIMUM of two twelve foot wide paved lanes for each traffic direction, one of which shall be a shoulder for breakdowns and traffic by-pass. The width of each lane shall be as a minimum the size of lane as per construction codes of the American Association of State Highway and Transportation Officials for street width for trucks. The radius or curvature of any roadway shall also be not less than the minimum curvature suggested by the same construction codes.

Road Drainage: Paved roads and surfaces shall be pitched so as to adequately drain all storm waters to drainage ditches or to catch basins connected to a subsurface drainage system.

Site Walkways: All walkways shall conform to applicable State and County requirements and the appropriate codes and standards. In addition, all walkways shall be adequately lighted, maintained and have provisions for the handicapped.

Site Outdoor Lighting: Sufficient outdoor lighting of roads, walkways and parking areas shall be provided to insure the safety and security of the operation of each facility, the safe movement of people and vehicles, and for security purposes.

Facility buildings shall be suitably illuminated to present the facility to the public.

Primary lighting shall be provided for the main roadways from each facility to the street gates; the gate house, if any; the refuse vehicle weighing areas (scale house); employees' parking lot; electrical substation; and pedestrian walkways. Primary lighting shall generally be of higher intensity than secondary lighting and shall utilize fixtures and post equipment of superior aesthetic and structural quality. Exterior light poles and fixtures shall be metal and shall be contemporary in design.

Secondary lighting shall cover areas where activity is more intermittent and, therefore, requires less intense lighting. These activities include storage areas, process water wells, outdoor tanks, service truck parking, residue and ash storage, etc. Special process equipment lighting shall also be provided to assure safe access and work illumination. Stacks shall be obstruction lighted in accordance with Federal Aviation Authority (FAA) regulations. All outdoor signs shall be illuminated.

Signage: Well-designed graphics should be used for directional and identification signing. These signs shall be properly located to achieve their purpose without constituting a hazard to vehicles or pedestrians.

Clear, concise graphic design of all directional and identification signs shall be incorporated into the design of each facility, in accordance with County standards and applicable codes of the County.

Erosion Control/Seeding and Planting: The Contractor shall establish an erosion control plan consistent with the State of Florida and Broward County erosion and sediment control requirements.

The Contractor shall establish grass and plant trees and shrubs in accordance with the Landscaping Plan as approved by the County.

Landscaping: Landscaping of each facility site will be used to control or screen views from adjacent roads.

Trees, shrubs, ground cover, planting, sculpture and use of building and paving materials, shall be integrated into the building arrangement, topography, parking and screening requirements.

Fencing, evergreens, shrubs, or bushes (or combinations), shall be located on the site perimeter to minimize the effect of vehicle headlights, noise, outdoor lighting glare and reflection, movements of people and vehicles, and to shield the site activities from adjacent properties where necessary.

Adequate landscaping shall be required to provide maximum screening for the sites. The landscaping plans shall address the following items:

- o Earth sculpturing to provide topographic relief and to aid in screening such areas as parking lots and blank walls.
- o Appropriate street tree plantings along access roads to the site.
- o Extensive use of plants indigenous to Florida to provide visual screening and local color.
- o Plantings to enhance the main entrance to each facility.
- o Appropriate plantings around employee outdoor sitting areas.
- o Preparation of soil stabilization plans for use during construction which utilizes plants and grass as stabilizers.

The selection of plant species should be based upon those plants which are tolerant of local conditions. Indigenous vegetation should be included in appropriate areas of the site. Planter boxes should be kept to a minimum. Lawn areas should be kept to a minimum with hardy ground covers utilized wherever possible. Top soil shall be provided in all planting areas and all plant pits.

A preliminary landscaping plan for each facility site is a proposal requirement. Special attention in the plan should be given to the entrance and the visitors' area, as well as the view of each facility from the public streets serving it and/or from adjacent highways.

1.4.2 Detailed Architectural Requirements

Masonry: In addition to complying with all pertinent codes and regulations, the Contractor shall comply with the standards of masonry installation described in "Concrete Block Masonry Inspectors Manual" published by the Technical Committee of the California Concrete Masonry Manufacturers Association.

Concrete Curbing: All curbs shall be constructed of concrete with suitable expansion joints. The Contractor's quality of work shall conform to the requirements of the Florida State Department of Transportation, American Concrete Institute and the American Society for Testing Materials (ASTM).

Carpentry and Mill Work: Lumber, herein referred to, shall conform with the American Lumber Standard, Simplified Practice Recommendations, latest edition. Lumber shall conform to and bear the grade and trade mark for the Association under whose rules it is produced.

Wall Panels: Wall construction shall be fabricated and installed to withstand 100 MPH wind.

Wall panels shall satisfy the following requirements:

- ASTM B-117 - Salt Fog Test
- ASTM D-968 - Abrasion Resistance Test
- Kesternich Pollution Resistance Test
- ASTM D-2247 - Humidity Resistance Test
- Color Variance - Not more than 0.5 NBS units

Ceramic Tile: All ceramic tile shall be quality certified by the Tile Council of America Inc. Floor tile shall have abrasive surface. Wall tile shall be glazed surface.

All tile work shall be set in accordance with the "Tile Handbook" superseding the Basic Specifications for Tile Work K-300.

Acoustical Tile Ceilings: Acoustical tile panels shall meet ASTM C523 for light reflectance and Underwriters Laboratories Noncombustible Class 25.

Insulation and Lagging (for Exterior Mechanical Equipment): The Contractor shall furnish and install insulation and lagging for the following equipment: furnaces, boilers, precipitators and inlet ducts and nozzles, precipitators and outlet nozzles, breechings and ducts, I.D. fans and I.D. fan outlet ducts to stack, precipitator hoppers and conveyors.

The exterior lagging shall consist of flat overlapping square panels with cross-brake pattern.

The lagging shall be fastened with non-corrosive studs or clips. Closure strips, flashing and counterflashing of the same thickness as the panels shall be provided as required.

All laps of lagging, flashing and openings which cannot be made waterproof with closure strips shall be filled with high temperatures caulking compound (I-C 405) or equal, so as to render the entire lagging system weathertight.

Any additional stiffeners, corner angles, clips and other fastening and supporting devices shall be supplied as an integral part of the lagging system.

Dissimilar metals shall be insulated from one another by means of dissimilar metals separators or suitable primer and aluminum paint methods in accordance with siding manufacturer's recommendations, subject to approval of the County.

Each precipitator roof shall be adequately insulated. The roof shall be sloped to prevent rain water accumulation and shall be completely weatherproof. The insulation

shall be protected by sheet metal panels, supported on purlins and designed for at least a 50 pounds per square foot live load.

Painting: Painting shall include but not be limited to the following items:

- o Structural steel shapes and members
- o Ferrous metal furnace castings and supports
- o Electrical motors
- o Cranes
- o Charging hoppers, chute extension, refuse chutes and gates
- o Combustion air fans and ductwork
- o Stokers and siftings chutes
- o Furnace access doors and ports; boiler doors and appurtenances
- o Conveyors, flap gates, discharge chutes, drives
- o Boiler structures and supports
- o Precipitator, breechings, ductwork and I.D. fan structures
- o Stack and appurtenances
- o Mechanical Equipment
- o Scale and enclosures
- o Transport equipment
- o All pipework, fittings, valves and supports
- o Tanks, strainers, deaerator, steam piping, valves and pumps
- o Conduit, panel boxes, pull boxes, meter boards and distribution boxes
- o Partitions, doors, frames, stairs, railings, ladders, grilles, registers, air diffusers, and underside of exposed metal decking

- o Wood staining of wood doors, trim, paneling, millwork and wood shelving
- o Stripping of on-site road and parking lots

Galvanizing: Galvanizing shall be done by the hot dip process in accordance with the specifications of the AHDGA.

Fencing and Gates: It is the Contractor's responsibility to provide fencing along the entire perimeter of the project sites and to provide site security. Security fencing and gate controls shall be made attractive.

1.5 Structural

1.5.1 Structures Supporting Vehicular Traffic

The design, loadings, materials, allowable stresses, fabrication and construction of structures subject to vehicular traffic such as roads, ramps, underpasses, tunnels, culverts, elevated roadways and framed slabs shall conform to the current standard specifications of the American Association of State Highway and Transportation Officials (AASHTO), including all interim specifications of AASHTO, and all applicable design requirements of the County and the State.

1.5.2 Structural Steel

General Requirements: The current rules and practices set forth in the "Code of Standard Practice for Steel Buildings and Bridges" and the "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction (AISC) shall apply to the work performed.

Quality Criteria and Inspection Standards shall conform to the AISC publication "Quality Criteria and Inspection Standards" latest edition.

Materials: Structural steel shall conform to ASTM A 36. High strength bolts, with suitable nuts and washers, shall conform to ASTM A 325. Welding electrodes shall conform

to AWS Code D1.1. Stud shear connectors shall conform to AWS Code D.1. The following list indicates the minimum requirements for specific steel items:

Mild Steel Plates: Special Shapes for structural quality - ASTM-A27.

Steel Sheets: Structural quality - ASTM A 245.

Steel Plate: ASTM A 120, fittings for steel pipe shall be standard malleable iron.

Bar Steel: Hot rolled including rounds and squares of all sizes, and flat 6 inches or less in width.

Fabrication: Fabrication shall be in accordance with the applicable provisions of the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings.

Connections: Standard type connections shall comply with the appropriate tables entitled "Framed Beam Connections" of the AISC "Manual of Steel Construction" and shall be used wherever possible to employ such connections.

Bolting: Assembly of structural joints using high strength steel bolts shall be in accordance with the RCRBSJ Specification for "structural joints using ASTM A325 or A490 bolts."

Welding: Welding of structural steel work and stud shear connectors shall be in accordance with AWS Code D1.1.

Shop and field welding shall be performed only by certified welders qualified in accordance with AWS Code D1.1.

Field Erection: All members shall be aligned, leveled, and adjusted accurately prior to final fastening. Tolerances shall conform to the AISC "Code of Standard Practice".

1.5.3 Metal Roof Deck

Materials: Design and fabrication of metal roof deck shall be in accordance with the latest specifications of

the Steel Deck Institute. Steel used in the fabrication of deck units shall conform to the requirements of the AISI "Light Gage Cold-Formed Steel Design Manual".

Field Erection: The complete metal deck, including all shaping, cutting, fitting, drilling, welding, accessories, closures, sump pans, fastenings and all other miscellaneous pieces necessary, shall be properly installed with weathertight construction. Metal deck shall be erected in accordance with the deck manufacturer's instructions.

Welding and Fastening: Welding shall be in accordance with the requirements of the AISI "Specifications for the Design of Cold-Formed Steel Structural Members" and the AWS "Structural Welding Code".

1.5.4 Miscellaneous Metals

Miscellaneous metals shall include such items as:

- o Gratings (aluminum, fiberglass and galvanized steel)
- o Metal Floor Plates
- o Railings
- o Loose Lintels and Miscellaneous Framing
- o Ladders

Galvanizing of miscellaneous metal after fabrication shall be in conformance with ASTM A-123 and A-153. Cadmium plating of miscellaneous metals shall be in accordance with ASTM A-165, Type TS.

Specific requirements for miscellaneous metals include the following:

Grating: Grating shall conform to the following standards:

- o ASTM A-123, zinc (hot-galvanized) coatings on products fabricated from rolled, pressed, and forged steel shapes, plates, bars and strip.
- o ASTM A-385, high quality zinc coatings (hot-dip) on assembled products.

- o ASTM A-569, steel, carbon (0.15 maximum, percent), hot-rolled sheet and strip, commercial quality.
- o NAAMM, Metal Bar Grating Manual and Metal Finishes Manual.
- o Standards of the Reinforced Plastic/Composites Institute.
- o National Bureau of Standards, PS15-69.
- o ASTM B-210, Aluminum-Alloy Drawn Seamless Tubes.
- o ASTM B-221, Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.

Ladders: Vertical ladders and cages shall conform to applicable OSHA regulations.

Railings: All railings (posts, rails and toe plates) shall conform to applicable OSHA regulations.

Metal Floor Plate: All metal floor plate shall conform to the applicable provisions and accommodations of the following:

- o ASTM A-36, Structural Steel.
- o ASTM B-209, Aluminum-Alloy Sheet and Plate.
- o ASTM A-123, zinc (hot-galvanized) coatings on products fabricated from rolled, pressed and forged steel shapes, plates, bars and strip.

1.5.5 Concrete

General Requirements: The requirements of Part III of the American Concrete Institute, "Building Code Requirements for Reinforced Concrete", (ACI 318-77) shall govern the concrete work.

Materials: Portland cement shall conform to ASTM "Standard Specifications for Portland Cement", C 150, Type II.

High-Early-Strength Portland Cement shall conform to ASTM "Standard Specifications for Portland Cement", C150, Type III.

Aggregates for concrete shall conform to ASTM "Standard Specifications for Concrete Aggregates" C33.

Air-entraining admixture shall conform to ASTM C 260, and shall be used in all concrete exposed to the weather. Air entraining admixture shall be added in such quantities as necessary to produce an air content of 4 to 6 percent by volume, as determined by ASTM C 231.

Water-reducing and retarding admixture shall conform to ASTM C 494, Type D and shall be used in all concrete. The admixture shall be added to the proportions recommended by the approved manufacturer.

Water shall be clean and free from injurious amount of oil, acid, alkalies, organic materials, or other deleterious substances.

Metal reinforcement shall be deformed bars and wire mesh conforming to the following requirements:

Deformed bars - ASTM A615, Grade 60.

Wire Mesh - ASTM A 185

Testing and Inspection: Testing and inspection of concrete and materials shall be performed by an independent testing laboratory.

The Contractor shall make test cylinders of the concrete placed at the job in accordance with applicable ASTM standards. Concrete cylinder testing shall conform to the standard Method of Making Compression Test of Concrete, Serial Designation C39.

Test cylinders shall be properly cured and aged before testing. Copies of all test reports shall be retained by the Contractor for record. Cost of all tests shall be borne by the Contractor.

Proportioning and Mixing Cast-in-Place Concrete: All structural concrete shall have a minimum compressive strength of 4000 psi in 28 days. One brand of cement only shall be used to prevent different shading of finished concrete or mortars.

Ready mixed concrete shall be mixed and delivered in accordance with the Standard Specifications of the ASTM C-94 latest edition.

Temperature: Hot weather - All methods and materials used for hot weather concreting shall be in accordance with the requirements of "Recommended Practice for Hot Weather Concreting" (ACI 605).

Lightweight Insulating Roof Fill: All work shall conform with the requirements of the prevailing Building Code in addition to the requirements or qualifications of these specifications.

Lightweight insulating roof fill shall meet all requirements as detailed in:

ASTM C-332-66(71) Group I

ASTM D-312-71

Factory Mutual 69-209.20

1.5.6 Light Poles, Mast Lighting, Sign and Signal Supports

The design, loadings, materials, fabrication and construction of light poles shall conform to standard specifications for structural supports for highway signs, luminaries and traffic signals of the American Association of State Highway and Transportation Officials, and all the design requirements of the County and the State.

1.5.7 Stacks

Stacks shall be designed and erected in accordance with all applicable codes and regulations. Stacks shall include a flue for each combustion line proposed and shall also provide an extra flue for future expansion. The maximum stack height, at each site shall be 200 feet above final grade elevation. The stacks can be of a radial brick, concrete, or steel type with acid resistant high temperature liners. In all cases the stacks shall be of a design providing sufficient draft to exceed by at least twenty percent all losses due to I.D. fan outlet breeching gas velocities, in stack gas velo-

cities and friction and stack outlet velocities. In no case shall the stack designs result in positive pressures at the base of the stacks under normal operating conditions.

The design loading for stacks or chimneys shall conform to the minimum building code requirements of American National Standards Institute (ANSI A58.1). The wind pressure shall be based on a fastest mile speed of 100 miles per hour at 30 feet above ground and Exposure C with consideration given to gusts and vibration response.

The design, materials, fabrications, and construction of concrete chimneys shall conform to the standard specification for design and construction of reinforced concrete chimneys (ACI 505).

The design, materials, fabrication, and construction of steel chimneys shall conform to the specifications of American Institute of Steel Construction and American Iron and Steel Institute with design considerations given to cable deflections.

Masonry chimneys shall be constructed with radial bricks with type "M" mortar conforming to ASTM C-270.

1.6 General Mechanical

1.6.1 Plumbing/Piping

City Water Piping: The Contractor shall furnish and install City water supply piping as required.

Hydrostatic testing for water piping shall conform to AWWA Specification C-600-64 Section 13.0.

All ductile iron pipe and fittings shall be cement lined. Linings shall conform to ANSI Spec. A 21.4. All piping and fittings shall be shop coated with standard bituminous coating on the exterior.

Reinforced Concrete Piping: Reinforced concrete pipe shall be Class IV Reinforced Concrete ASTM C-76 (Steel Area 0.07).

The installation of all pipe shall conform to the applicable requirements of AWWA Standard C600. All accessories for making mechanical joints shall meet the requirements of ANSI Specification A 21.11.

Polyvinyl Chloride Piping (PVC): All piping and fittings shall be Type 1, Grade 1, virgin unplasticized PVC Schedule 80 conforming to ASTM Des. D 1784, D 1785, D 2241, D 2264 and D 2467.

All assembly shall be done strictly in accordance with the manufacturer's specifications.

Miscellaneous Piping Requirements: Bronze gate and globe valves shall conform to ASTM B 62.

All backflow preventers shall conform to local code requirements. Air release valves shall be installed where required. All required accessories, such as gate valves, globe valves and check valves shall be installed as recommended by the air release valve manufacturer.

Wherever dissimilar metals come in contact, dielectric couplings shall be installed in the lines to separate the metals and prevent galvanic action.

The Contractor shall conduct testing of all pipelines leakage. All pipelines shall be tested to not less than one hundred fifty percent of the working pressure. All visible leaks and defects shall be promptly repaired and the line re-tested.

Drain lines on the process piping system shall be tested as per plumbing standards.

Painting: All pipelines shall be painted in conformance with latest ANSI Standards.

Temporary Water: The installation and cost of temporary water shall be provided and borne by the Contractor.

Water Meters: Water meter(s) shall be furnished and installed by Contractor. Water meter(s) shall conform to local code requirements.

1.6.2 Heating, Ventilation and Air Conditioning

Rules and Regulations: The Contractor shall conform to the rules and regulations of the BOCA Basic Building Code having jurisdiction in this State, and to all County and Local laws, ordinances and regulations affecting the erection and completion of the Heating, Ventilation and Air-Conditioning work.

Piping Installation: Piping shall be erected with proper provision for expansion and contraction, as required.

Dampers: In addition to volume control dampers, fire dampers shall be installed as required by insurance underwriters, and local codes.

Thermal Insulation for Ducts and Piping: All components of the insulation for both piping and ductwork, including facings, mastics and adhesives shall have a fire hazard rating not to exceed 25 for flame spread and 50 for fuel contributed and smoke developed. Ratings shall be as determined by Underwriters Laboratories, Incorporated, or other approved testing laboratory.

Belt Guards: Belt guards shall be installed on all equipment equipped with belt drives.

Vibration Isolation: Vibrating equipment such as pumps, fans, etc., shall be isolated from the building structure in a manner such that sound and vibration will not be transmitted through the building.

1.7 Electrical

1.7.1 Scope of Work

The scope of this section is to cover the work consisting of designing, furnishing, and installing all necessary equipment for the following:

- o The interconnection system between each facility and FP&L, which shall include the outdoor switching substation consisting of circuit breakers, metering and power transformers and equipment, and all associated protection and synchronizing equipment, as well as

the transmission feeders and terminating potheads between switching station and the FP&L transmission line.

- o The step-up/step-down power transformers, interfacing circuit breakers and protective equipment at the switching station to meet facility and FP&L requirements. If load tap changers are required, they shall be provided in separate enclosures. Interconnect transformers shall each be sized for the full output of the plant.
- o Three-phase current limiting reactors, one for each generator. The reactor shall limit the three-phase short circuit power on FP&L to FP&L requirements. The exact rating of the reactor shall be calculated by the Contractor and coordinated with the characteristics of the other equipment (i.e., transient reactance of the generators, independence of power transformers, FP&L available short circuit, etc.).
- o 4.16 KV system for auxiliary services consisting of 4.16 KV switchgear, 4.16 KV motors and associated starters, and all other necessary equipment and materials required for the proper operation of the 4.16 KV system.
- o 480 volt system consisting of the 480 volt switchgear, the 4.16/0.48 KV power transformers, all necessary motor control centers, energy saver type electrical motors, all necessary relaying protection with an emphasis on a properly coordinated ground fault protection system and all necessary equipment and materials required for the proper operation of the 480 volt system.
- o Complete indoor relay and control switchboards for all the facility's electric systems.
- o Indoor and outdoor lighting systems comprising all necessary equipment and materials required for the proper illumination of the plant and site, at the required illumination levels for each specific task.
- o 125 volt DC system consisting of 125 volt DC battery, the required charger and the appropriate DC distribution switchboard.
- o Cable and wiring system with all necessary raceways for all power distribution systems, including reinforced, concrete encased, underground duct banks,

and exposed AC and DC conduit system with rigid galvanized steel conduits and approved fittings. This shall include excavating, dewatering and backfilling. All cable and terminations shall be in accordance with the manufacturer's specifications.

- o Control, security and communication systems, Telephone, Fire Alarm, Smoke Detection, Sprinkler, Halon, Lighting, Local Automatic Shutdown, Local Manual Control, Central Automatic Control, Security, and HVAC for all plant and auxiliary operations, all as described elsewhere in these specifications.

1.7.2 General Electrical Requirements

The following items of equipment covered by this specification may be installed either indoors or outdoors in the open atmosphere:

- Turbogenerators and associated power generation equipment.
- 4.16 KV A.C. switchgear and accessories.
- 480 volt A.C. switchgear and accessories.
- 124 volt D.C. battery system.
- Interconnection bus structure, insulators, bus switches, etc.
- Interconnection oil circuit breakers.
- Interconnection power transformers.

The Contractor shall furnish, install and connect any additional components, parts, items and devices not specifically mentioned herein, but necessary for the proper operation of the equipment.

The systems shall be provided in accordance with all local and federal code requirements and shall provide the functional features described. Each system shall be furnished and installed complete with all appurtenances necessary to be fully operational.

1.7.3 Standards

All equipment to be furnished by the Contractor shall be in accordance with the latest applicable standards of NEMA, IEEE, ANSI, AAR, IPCEA, latest OSHA, UL, National Electrical Code, National Electric Safety Code, Florida Electrical Code, and all applicable local codes and/or ordinances with regard to Material, Design, Construction, Testing and Installation except for variations as specified herein.

1.7.4 Temporary and Interim Electric Work

The Contractor shall provide temporary, electrical services required for construction of the Project, including all fees to FP&L for their work associated with such electrical services and connections. FP&L energy use charges shall be paid for by the Contractor.

The installation shall conform to the requirements of FP&L and shall include poles, post, fences, grounding, terminations, meter cabinets, meter and secondary feeder and branch wiring and conduits, circuit breakers, panelboards, lights, wiring devices, wiring, motor connections and supports.

1.7.5 Cutting and Patching

The Contractor shall furnish chases and openings in the floors, walls, and partitions before they are built. The Contractor shall install sleeves or boxes in the forms of floor slabs and/or walls before they are poured.

1.7.6 Fire Alarm System

The Contractor shall equip each facility with a fire alarm system, including all necessary manual stations, bells, control panel and annunciator, wiring and conduit.

1.7.7 Fail-Safe Systems

The Contractor shall install Fail-Safe Systems for all key equipment, including, but not limited to the furnaces, the boilers, turbine-generator set, the electric substation and the electrostatic precipitators. The Fail-Safe Systems of

each key equipment item shall be so designed that if any one piece of equipment fails, other equipment will not be damaged by this failure.

1.8 Facility Access and MSW Delivery Requirements

1.8.1 Functional Design

Each facility site design shall provide adequate ingress and egress roads and maintain continuous control of all traffic movements during facility operating hours. Each facility design shall also include adequate on-site roadways, parking, and maneuvering areas to accommodate, efficiently and safely, anticipated traffic levels during normal and emergency periods, in order to minimize the impact of traffic on noise and air quality levels and to prevent the queuing of disposal vehicles on public roads adjacent to the facilities.

1.8.2 Traffic Flow

The MSW will be delivered to each facility by collection trucks that are either municipally or privately operated.

On-site traffic shall be directed generally using one-way roads either to the weighing stations (MSW trucks), the ash handling areas (residue truck), and/or to the administration areas and process buildings (staffs, visitors and all other vehicles). This one-way flow of traffic shall help ensure congestion-free operations and smooth-functioning facilities.

MSW trucks shall proceed from the entries to the weighing stations, establish the weight of the refuse, proceed to the tipping areas for unloading, stop at the weighing stations again, if necessary, and then exit the facilities.

Trucks hauling Unprocessable Waste shall proceed from the entries of the resource recovery facilities to the weighing stations, establish the weight of the Unprocessable Waste, proceed to the Residue/Unprocessable Waste landfill dumping areas for unloading, stop at the weighing stations again if necessary, and then exit the facilities.

Two-way roads may be planned for on-site roads at the resource recovery facilities to the Residue/Unprocessable Waste landfills.

Maintenance and delivery vehicles shall be directed to the plant office or to service areas within each facility.

Paving and drainage of parking areas shall be in accordance with accepted standards. Staff and visitor vehicles shall be directed to parking adjacent to the administration area immediately upon entering each facility to prevent any traffic conflict with truck flows.

Roadways for trucks shall serve the scale house areas, the tipping floors and other functional areas of the facilities. Roads within each facility shall be designed to allow proper traffic flow to prevent the queuing of waste-handling vehicles, both during normal operation and in the event of mechanical failure of vehicles or at the scale house. Access to the sites from adjacent roads shall be designed to minimize interference with exiting traffic flow and permit vehicles rapid and safe ingress and egress to and from the sites. Sufficient on-site roadways shall be provided to ensure that traffic backups will not extend out to the local streets or highways.

The traffic design for each facility shall be based on the following criteria:

- o A daily quantity of delivered MSW determined by the following formula:

$$DW = \frac{AFT \times AF_1 \times AF_2 \times AF_3}{365}$$

Where:

DW = Quantity of delivered MSW (processable and unprocessable waste) per day in tons

AFT = Annual guaranteed facility throughput in tons of Processable Waste

AF_1 = MSW Delivery Adjustment Factor = 1.17

$$\left(\frac{7 \text{ days per week operation}}{6 \text{ days per week delivery}} = 1.17 \right)$$

AF_2 = Broward County seasonal MSW generation rate Adjustment Factor = 1.11

AF_3 = Broward County Peak Daily MSW Delivery Adjustment Factor = 1.43

- o The estimated number of trucks delivering garbage shall be based upon 55 percent of DW as determined above and an average net load of 9.0 tons per truck.
- o The estimated number of trucks delivering processable trash shall be based upon 23 percent of DW as determined above and an average net load of 5.0 tons per truck.
- o An estimated quantity of residue based upon such residue containing not more than 4 percent combustibles and 0.2 percent putrescibles of the incoming MSW.
- o The estimated number of trucks delivering unprocessable trash shall be based upon 22 percent of DW as determined above and an average net load of 5.0 ton per truck.
- o An estimated volume of 75 employee and visitor cars per day. Visitors arriving by bus shall also be accommodated.
- o Maintenance and delivery vehicles as required.

Proper access shall also be provided for fire fighting apparatus. There shall be a bypass road around each scale house area for fire fighting, passenger and other designated vehicles.

All access roads used by refuse vehicles shall be constructed and paved in accordance with standards for heavy truck usage.

The Contractor shall maintain weighing, receiving, and queuing areas which are capable of:

- o Accepting the refuse in the quantity proposed and assumed transport mix.
- o Completing the functions of the MSW delivery (entering the plant, weighing, unloading, and exiting the plant) within ten (10) minutes of each truck arrival at the site; even during peak arrival periods.
- o Receiving, holding, or processing normal MSW quantities during scheduled downtime.

Adequate parking and maneuvering areas shall be provided for both facility staff and visitors. Provisions for the handicapped shall also be made for parking and sidewalk access.

The design and operation of all vehicular activities and traffic flow patterns associated with the construction and operation of each facility will be subject to the regulations of state and local Traffic and Highway Departments.

1.8.3 Traffic Control

The traffic flow within each facility site shall be controlled by stop signs except at the plant entrances, the weighing stations, and the tipping floor area where traffic lights shall be installed. All routine traffic shall be directed utilizing one-way roads. There shall be a minimum of mixing of truck traffic with staff and visitor traffic. There shall be exclusive truck routes to handle the estimated number of trucks per day including all refuse trucks, residue trucks, unprocessable waste trucks, maintenance and delivery vehicles. Provide a truck turn-around in clear view of the scale operator for diverting unacceptable loads of waste.

The traffic pattern at each facility shall be designed to provide for efficient operation and use of space. The weighing systems and storage facilities may be of whatever design is most applicable to the process needs, while meeting the efficiency and safety specification.

Identification signs at the entrance and appropriate directional signs which are approved by the County shall be

provided. Fences, gates, metal doors with locks, card controlled gates, or other adequate security measures must be provided to control access to each facility.

1.8.4 Weighing Station

General Information: The intake of waste to each facility shall be regulated and controlled by its weighing station's operation. MSW will be transported to the facilities either in municipal collection vehicles or private carter trucks. The facilities will not accept hazardous waste, and private automobiles will not be permitted to dump MSW at the facilities. After weighing, Unprocessable Waste shall be directed to the Residue/Unprocessable Waste landfill. In the event Unprocessable Waste is inadvertently unloaded at the resource recovery facility, the Contractor shall be responsible for cost of transporting such waste to the Residue/Unprocessable Waste landfill.

Deliveries shall be made in accordance with the County's normal collection and delivery practices as now or hereinafter may exist. Safe and adequately-sized areas must be provided for queuing incoming trucks and to prevent traffic back-up from interfering with local street and local highway traffic flows.

Each facility shall have the capacity to unload the Processable Waste from the vehicles, in a totally enclosed tipping area, with a total on-site unloading time of ten (10) minutes for mechanically unloaded vehicles. The unloading time is defined as the time a vehicle first enters the site to the time the vehicle leaves the site.

The Contractor shall maintain an identification system, including scales for weighing and recording deliveries. The scales shall be of a type approved by the State Sealer of Weights and Measures and shall be equipped with automatic printers which shall record the time, date, and scale weight in accordance with the Contractor's identification and accounting procedures.

The number of scales at each weighing station shall be determined using the information for truck flow; queuing space determined by the Proposer, the ten minute time per vehicle as defined above; and the inclusion of one standby scale.

Each weighing station shall be fully automatic with manual override systems. Each weighing station operator shall serve as the equipment operator as well as the traffic flow controller to the tipping area, and also maintain a level of security.

Each weighing station shall consist of as a minimum, but not be limited to, truck scales, scale pit or foundation with understructure and weighbridge, scale house, truck identification system, scale house equipment, approaches, entrance and exit gates and traffic control signal system.

Approach Road: The approach road to the weight station shall be wide enough to "fan" out the incoming flow of traffic as well as serving as a by-pass should any vehicle breakdown.

A deceleration lane shall be provided to ensure that traffic will not back up onto public streets.

The by-pass road for vehicles not having to be weighed (employee, visitor, delivery and maintenance vehicles) shall be controlled by a gate, which shall be manually operated by the weigh scale operator.

Scale Design: The truck scales shall have, as a minimum, a capacity of 70 tons and shall automatically print out vehicular weights on scale tickets. Each scale shall be equipped with an indicating and recording system.

Upon entering each facility, each delivery vehicle shall be weighed. If tare weights have not been established for particular vehicles, these vehicles shall be unloaded and weighed upon leaving the site. Therefore, provisions for scales to be used upon exit shall also be provided.

Scale Houses: The scale houses shall include all equipment which is auxiliary to the scales, such as the digital indicators, card printers with printout of gross, tare and net weights, and an accumulator for daily totals of net weights. These facilities shall include restrooms for truck drivers and employees, as well as visitors' observation spaces.

1.8.5 Tipping Area

General: The Processable Waste tipping process shall take place in totally enclosed tipping areas, which shall have a minimum length equal to the Processable Waste receiving and storage pit, and which shall be kept under negative pressure.

Ventilation systems shall provide for the control of dust, and shall meet all applicable Occupational Safety and Health Administration (OSHA) requirements for ventilation. In addition, sound proofing shall be provided within the tipping floor areas to limit the maximum noise level to 80 decibels (dba).

Truck Tipping Bays: At each facility there shall be an adequate number of tipping bays (to be determined by the Proposer) to handle the peak flow of waste trucks at all times. The number of bays should be based on the maximum vehicle size; peak truck flow; the coordination of queuing space at the weigh station, and the ten minute on-site time from entering the facility at the gate to exiting at a gate.

Safety and Hazard Controls: Safety measures shall be provided to minimize noise, dust, odors and general hazards, such as fire, in the tipping areas. Efforts shall be made in the design of each facility to maximize safety. All applicable requirements of OSHA shall be met with regard to the tipping area.

1.9 Processable Waste Storage and Handling System

1.9.1 General Description

At each facility, Processable Waste shall be stored in a pit large enough to hold, as a minimum, four times the daily Nameplate Capacity of the facility, based on an in-pit density of 500 lbs per cubic yard and without exceeding the elevation of the tipping floor. Minimum volumes shall be 24,000 cubic yards at the north plant and 32,000 cubic yards at the south plant.

At each facility, Processable Waste shall be moved from the storage pit and fed or charged into the furnaces by means of an overhead crane and grapple system. The cranes and grapples will also be used to mix Processable Waste in the pit to produce a homogeneous mass and shall be capable of removing large, bulky items from the storage pit. Provisions shall be made for removal and disposal of such items.

1.9.2 Processable Waste Storage

Construction: The pits shall be constructed of reinforced concrete and take into account soil, groundwater and flood-prone conditions of the sites. The crane parking areas shall be of prestressed concrete with steel reinforced outer perimeters.

The foundations of the pits shall be isolated and the independent of the foundation of the process buildings.

Dust and Odor Control: The pit areas shall be totally enclosed to limit the spread of any odor and dust. The areas shall be kept under negative pressure by drawing combustion air from the pit areas using the combustion air fans.

Ventilation Systems: The ventilation of the tipping areas as well as the pit areas shall be accomplished by the combustion air fans used for all the furnaces. Make-up air louvers, with broad screens shall be provided as required.

Fire Protection: There shall be at least two types of firefighting equipment for control of both chemical and non-chemical fires (water cannon and standpipe system). There shall also be fire alarms provided which shall be tied directly to the local fire departments in the event of any pit fires.

1.9.3 Crushers/Shears (Optional)

At each facility a crusher/shear may be provided for size reduction of oversized combustible bulky waste down to a size which shall minimize bridging or clogging in the furnace charging hoppers and assure complete incineration as fired with processable waste.

1.9.4 Crane and Grapple Systems

Scope: At each facility there shall be two 100 percent or three 50 percent capacity (one spare) heavy duty electric overhead traveling cranes suitable for continuous service handling Processable Waste.

The cranes shall be remote controlled from a stationary pulpit. "Cab-on-Crane" arrangements will not be permitted. Radio controlled cranes will be permitted.

Codes and Specifications: Unless otherwise specified, the cranes at each facility shall be designed and manufactured in accordance with applicable codes, manuals, specifications and requirements for Severe Duty Cycles and Steel Mill Type of Service:

- (a) American Gear Manufacturers Association (AGMA)
- (b) American Institute of Steel Construction (AISC)
- (c) American National Standards Institute (ANSI)
- (d) American Welding Society (AWS)
- (e) Anti-Friction Bearing Manufacturers Association (AFBMA)

- (f) Crane Manufacturers Association of America (CMAA) - Specification No. 70 (Electric overhead traveling cranes, Severe Duty Cycles.)
- (g) Insulated Power Cable Engineers Association (IPCEA)
- (h) National Electrical Manufacturers Association (NEMA)
- (i) National Fire Protection Association (NFPA)
- (j) Occupational Safety and Health Administration (OSHA)
- (k) Steel Structures Painting Council (SSPC)
- (l) American Society for Testing and Materials (ASTM)
- (m) Association of Iron and Steel Engineers (AISE) - Standard No. 6 (May 1969) Specification for electric overhead traveling cranes for Steel Mill Service

In case of conflict between various applicable codes, standards and regulations outlined in this paragraph, the "Specification for Electric Overhead Traveling Cranes for Steel Mill Service" AISE Standard 6 of May, 1969 shall govern.

Rated Capacity: Each crane capacity shall be based on the weight of the grapple including lifting cables, plus material.

Design Stresses: The cranes shall be mechanically and structurally designed and fabricated in accordance with AISE specifications for steel mill service. Unless otherwise specified, the design stress conditions shall be those required under codes and specifications above.

Duty Cycle: Duty cycle computations shall be based on:

Furnace Feeding	43%
Restocking	17.0%
Fatigue	10%
Total Active Time	70.0%

The cranes shall be capable of performing continuously, the feeding and rehandling cycles with full load, with motor temperature rises not exceeding the specified rating of the motors. The following crane/grapple motions may take place simultaneously:

- o Hoisting and bridge travel with grapple at any level.
- o Lowering and bridge travel with grapple at any level.
- o Trolley and bridge travel with grapple in high position.

In addition to the simultaneous motions outlined above, the normal crane operations shall permit the following functions:

- o Grapple open and close at any level.
- o Trolley and/or bridge travel with grapple at any level.

Environment: The cranes shall be designed for an indoor dusty environment.

Crane Parking: The crane runways shall be designed to allow for parking of one crane at each end of the pit when out of service for repairs or for inspections. The roof above the crane runway shall include a penthouse with service platforms for each additional crane over and above the two cranes that can be parked at each end of the runway. The penthouse(s) shall include electric hoists to lift an inactive crane from the runway for parking or maintenance.

Operator's Pulpit: There shall be a minimum of one remote, stationary operating station (operator's pulpit) located above the pit on either the tipping floor or hopper side, which allows full view of the storage pit and of the furnace charging hoppers. The operating station shall contain one operator's control chair for each crane installed.

All station access corridor enclosures, separating station corridors from the refuse storage pit, shall be dust tight. The stations shall be equipped with an independent heating, ventilating and air conditioning system in accordance with the applicable building code requirements.

The pulpit shall be equipped with fire alarm systems, indicating panels and fire fighting control capabilities. There shall be a direct phone line to the local fire department from the operator's pulpit.

The normal crane operation shall provide for automatic location of the trolley and bridge over the selected charging hopper after the grapple has picked its load and achieved its lift to the top elevation.

Each crane shall be operable from either control pulpit on demand except when in use by one of the operators. A traverse switch shall be provided which will enable any one crane to be operated from any operator's station. Interlocks shall be provided to prevent interference and attempts for simultaneous operation.

Grapples: Orange peel or clam shell tine type electrohydraulic grapples shall be provided for each crane with one spare at each facility, in addition to the one on the spare crane.

Electrical Motors: All motors shall be capable of starting and operating under any conditions within the design capacity of the crane and with any voltage within plus or minus ten percent of the rated voltage.

All motors shall be totally enclosed, air over housing fan cooled.

1.9.5 Charging Hoppers and Chutes

Charging Hoppers: Charging hoppers shall be designed to withstand the weight of the refuse as well as the vertical and horizontal impact of the fully loaded crane grapple.

Charging hoppers shall be independently supported by the charging floor structure and shall be arranged so as to minimize spillage onto the charging floor. Spill plates shall be incorporated between the charging hopper and refuse pit wall.

Charging hopper discharge throat (exit) shall be smaller than furnace feed chute entrance to furnace/boiler to prevent clogging (bridging) a furnace/boiler entrance, and shall be adequately sized to accommodate individual furnace/boiler rated throughput capacity.

Chutes and Cut-Off Gates: Chutes connecting charging hoppers and furnace/boiler feed throat shall be either water cooled or refractory lined.

Chutes shall be of the inverse taper type to preclude clogging (bridging) in chute.

Between each charging hopper discharge and chute entrance there shall be a cut-off gate to prevent burnback during furnace/boiler shutdown.

1.10 Combustion Systems

1.10.1 General Design

The combustion systems and all related equipment for each facility shall be supplied by the Contractor. The minimum combined total nameplate rated capacity of the two facilities shall be 3,500 tons of Processable Waste per day. The combustion units proposed shall be of proven design with a minimal successful operating experience of one year. Scaling up of components shall not exceed 25 percent.

The Contractor shall furnish and install a minimum of three combustion units at the southern facility and two combustion units at the northern facility, each with the capability of operating five percent above its rated Nameplate Capacity. The use of multiple units is intended to provide for system redundancy and the capability of selling additional

energy to the utility during peak hours of operation. THE PROPOSER SHALL PROVIDE A FIRING DIAGRAM AND ADDITIONAL INFORMATION INDICATING HOW THE BOILERS WILL BE CAPABLE OF HANDLING FLUCTUATIONS IN BTU AND MOISTURE CONTENT AS WELL AS PROXIMATE AND ULTIMATE ANALYSIS.

The Contractor shall provide the turndown ratio such that the boiler efficiencies do not drop below 85 percent of the boiler design efficiencies.

All furnace equipment and auxiliary equipment shall be manufactured and constructed in accordance with ASME boiler and furnace construction codes except where otherwise stated, and shall be so stamped on the equipment.

The individual units shall each be designed to operate at the minimum excess air level and exhaust the combustion flue gases from the electrostatic precipitator at a minimum of 40°F above dewpoint.

The minimum combustion temperature shall be 1,500°F and temperature shall be controlled to a maximum of 1,800°F.

1.10.2 Furnace Design

General: Furnace design shall be of the mass-burn stoker-fired, or stoker/rotary kiln tandem type, capable of firing as-received Processable Waste (without auxiliary fuel burning) on a continuous feed basis.

Each combustion train shall be equipped with an individual multiple pass waterwall type boiler of a configuration which has been successfully demonstrated in commercial operation.

Refractory Enclosures: The refractory linings of the furnaces, where applicable, shall be of super duty quality, laid in high temperature mortar. The refractory walls (other than rotary kiln) and arches shall be of the sectionally supported type, anchored with high temperature alloy anchors and insulated with an adequate amount of insulation.

The refractory enclosure materials shall conform or be equal to the latest of the following minimum requirements and classification:

- o Super duty fire brick - ASTM C-27
- o Silicon carbide walls - ASTM C-106
- o Insulating brick (where applicable) - ASTM C-15
- o Insulating castable - ASTM C-401, Class Q
- o Expansion joint filler - Fiberfrax, Kaowool or equal
- o Sectionally supported wall and arch mortar--Super-duty Fireclay
- o Insulation - Mineral wool block
- o Tile engaging castings or anchors - ASTM A297-74A

All sectionally supported walls and arches shall be supported on a steel structure independent of stoker supports and assemblies. The exterior surfaces of the wall shall be protected by suitably reinforced steel or aluminum casings.

All structural steel framing shall be designed, fabricated and erected in accordance with the AISC Steel Construction Manual (latest edition), and in accordance with applicable local code requirements, including seismic, impact, lateral, vertical and longitudinal loading.

Grates (Stokers): The grates shall be of manufacturer's design and shall be of a design used in successful operation.

The design of mechanical components and selection of construction materials shall be such as to yield ninety percent availability under normal operating conditions. Routine repairs and adjustments shall not require more than 200 man-hours with major overhauls required at a maximum of every three years (or 20-30,000 hours).

All grate operations (speed, cycle frequency, etc.) shall be arranged for remote operation from a central control room with local manual override. Grate drive shall be by hydraulic motor controlled by a variable volume pump. The degree of burnout on the grate sections shall be established and guaranteed by the Contractor. The combustion efficiency of the stokers shall yield a residue containing not more than 4.0 percent combustibles and 0.2 percent putrescibles.

The stoker surface materials shall conform to the following minimum requirements:

- o Reciprocating stokers shall be of precision ground cast chromium alloy steel grate bars.
- o Feed sections not exposed to burning fuel bed - MEEHANITE HS type cast iron or equal.
- o Circular grates may be cast iron.
- o Parts designed to prevent erosion of side walls (if applicable) extending not more than six inches above stoker surface-MEEHANITE HS type cast iron or equal.
- o Burning section castings exposed completely or in part to burning fuel bed not more than forty five percent of operating cycle time, each cycle not exceeding five minutes - MEEHANITE HS type cast iron or equal.
- o All other surface castings - heat resistant alloy conforming to ASTM A 297-74a Grade HF designation.
- o Alloy (weldable stainless steel) steel grates shall have a minimum of four percent nickel composition.
- o Wear plates shall be "NT" (high density forged steel plate).

Waterwall Enclosures: Waterwall enclosures shall be of gas-tight fully-welded membrane type, backed by mineral wool block insulation. The cold face of the insulation shall be protected by steel or aluminum casing.

Where the waterwalls are expected to be exposed directly to direct flame or alternate reducing and oxidizing

atmosphere, the tubes shall be protected with silicon carbide low oxidizing grade castable refractory, anchored to the tubes with welded studs of high temperature alloy steel.

The tube arrangements shall be of an in-line pattern (staggered tubes are not acceptable). Each boiler shall be equipped with a tube-cleaning system to provide and ensure high operating efficiency.

The walls adjacent to the stoker surfaces shall be of watercooled silicon carbide tile extending a minimum of four feet above the grate surfaces.

1.10.3 Combustion Air System

The combustion air systems shall be designed to control automatically the furnace temperatures within +50 degrees Fahrenheit of the set-point temperature selected by the Proposer while firing Processable Waste with higher heating values (HHV) varying from 3,500 to 6,000 BTU/lb. The Proposers should note the wide range of HHV for the Processable Waste as fired. Sampling conducted on Broward County's Processable Waste indicates that the minimum and maximum extremes of the range may be realized on a sustained seasonal basis (e.g. November through April at upper range and May through October at lower range) as a result of significant variation in moisture content associated with extremes in rainfall.

The distribution of the primary and secondary air, including secondary air jets, shall yield a combustion efficiency resulting in dry gas carbon monoxide (CO) content not exceeding 0.1 percent by volume, measured upstream of boiler convection sections.

Separate fans for primary and secondary air shall be used (minimum two combustion air fans per boiler). Each fan shall be motor driven. All combustion air fans shall be mounted on vibration elimination bases with non-combustible flexible connections at the inlets and outlets of the fans. Either

system shall be automatically controlled by a furnace temperature control system. The control of the primary and secondary air flow shall be automatic with a manual override system in the plant control room.

The combustion air ductwork inlets shall be arranged to use selectively air from the refuse storage area, tipping area, or from outside atmosphere, or any combination of the above. Each primary and secondary air inlet duct shall be fitted with venturi type or similar non-plugging type flow measuring device with remote output readout instruments.

The combustion air ductwork shall be manufactured of sheet metal or steel plate two gauges thicker than required by ASHRAE code for air conditioning and ventilating systems for a similar air capacity and pressure. Section joints shall be flanged and gasketed; access doors or panels shall be provided at each bend; the ductwork system shall be essentially air tight with leakage not exceeding one percent of the maximum design air flow.

The fan drives shall be selected for a minimum of 125 percent of the maximum design brake horsepower (BHP).

1.10.4 Energy Recovery Systems

The steam parameters for the boiler system shall be determined after fully considering their effect on causing high temperature corrosion on superheaters.

Boilers: The boiler design and manufacture shall conform to the ASME boiler code and approved quality assurance program, and, if required by applicable codes, shall bear the ASME stamp.

The boilers shall be designed with in-line tubes and drum(s) perpendicular to the gas flow. Boiler tubes shall be of an adequate tube thickness and diameter with proper spacing provided between the tubes. Adequate air circulation near the convection tubes shall be provided. Gas temperatures coming into contact with the external tubes should not exceed 1,600°F.

Single pass boilers with vertical tubes shall have an arch or stainless steel baffle to redirect the air flow and prevent excessive corrosion of the boiler side tubes. Properly sized valves with welded packing shall be provided.

The tube and drum configuration shall be the option of the Contractor, but shall conform to general requirements specified herein. The drums shall be Class 1 fusion welded construction, tested before shipment. The steam drums shall be fitted with steam separation baffles yielding dry steam with a purity of one parts per million (ppm) solids at maximum continuous steaming conditions, at the design pressure and temperatures, when the boiler water concentrations do not exceed standard ABMA limits. Each drum shall have two manhole openings fitted with hinged steel manhole covers complete with necessary bolts, grabs, and gaskets.

Proper provisions shall be made for thermal expansion of the drums so that abnormal stresses are not produced on either the pressure parts or in the supporting members. The boilers shall be designated with either a soot blowing system or tube rapping system for the cleaning of both the external and internal surfaces. An access door allowing for inspection and maintenance of the tubes and the tube rapping system shall be provided.

Superheaters: Superheaters shall be manufactured out of the alloy best suited to resist thermal corrosion as well as chlorine, fluorine and sulphur corrosion. The Contractor shall specify whether the superheater tubes will be provided with clamp protective metallic shields on the tubes at the vulnerable locations or if the tubes will use plasma-gun coating by metallic or ceramic materials.

The superheaters shall be designed with proper provisions for thermal expansion and with attemperators between the stages of the superheater. The superheater bundle shall be placed away from the primary radiant section.

Economizers: Each boiler unit shall be provided with the proper tubular economizer. The economizers shall be the bare tube type (no finned tubes).

The economizers shall be designed for forced circulation, which is provided by the boiler feed pumps, using at a minimum, a feed water temperature of 250°F. The economizer design pressure shall be at a minimum of 125 percent of the boiler design pressure. The economizers shall conform, as a minimum, in all respects to the ASME boiler codes.

1.10.5 Boiler Auxiliary Systems

Boiler Auxiliaries: The Proposer shall provide all required auxiliary systems to make the boilers complete, operable and maintainable. All boiler appurtenances shall be designed to operate and support each facility at its maximum continuous rating.

Boiler auxiliary systems, including, but not limited to all steam circulation and distribution piping, boiler feed water pumps, treated water pumps, raw water pumps, condensate pumps, tanks and accessories, water treatment and deaeration systems, boiler feedwater heaters, process piping systems, etc., shall be designed and furnished by the Contractor in accordance with:

- o ASME boiler construction codes.
- o Report on the identification of power house piping.
- o U.S. Environmental Protection Agency (USEPA) - noise level of vent, etc.
- o Maximum boiler water concentrations, recommended by American Boiler Manufacturer's Association (ABMA) chemical feed system.
- o ABMA boiler standards.
- o AISC manual on steel construction.
- o ASHRAE standards.

Boiler Trim: Each boiler unit shall be furnished with boiler trim, in accordance with the ASME code requirements as well as conforming to the best standards of power plant practice. Trim shall be designed for a minimum of 125 percent of the nominal operating pressure (PSIG). Each boiler unit shall have manual override systems, which also overrides the boiler auxiliary equipment, located and operated from the plant central control room.

The following list of accessories, at a minimum, are required. The final number and type of accessories shall be determined by the Contractor based on the water circulation and steam distribution designs.

- o Safety valves as per ASME code.
- o Water column, feed water regulator, gauge and glass drain valves.
- o Reliance water column with high and low alarm and water gauges.
- o Low-water cutoff.
- o Water column drain valves and water gauge drain valves, rated for twice the operating pressures.
- o Feedwater regulatory by-pass and drain valves.
- o Feedwater stop and check valves.
- o Drum blow off valves.
- o Boiler air vent valves.
- o Chemical feed valves.
- o Continuous blowdown stop and check valves.
- o Tube rapping - elements, supply and drain valves (if required).
- o Steam and water flow transmitters.
- o Differential level transmitters.
- o Computing relays.

- o Auto-manual set point control station.
- o Air sets.
- o Main steam non-return valves.
- o Feedwater control valves.

Superheater Steam Piping Systems: The high pressure superheated steam piping systems shall be designed in such a way that the pressure drop between the main steam valve of the boilers and the main valves of the turbine, does not exceed ten percent of the nominal boiler pressure and that the drop in temperature does not exceed 10°F. A loop header shall be provided to insure the most flexible mode of operation as well as maintenance.

Reducers and coolers of steam pressure shall be installed so that each facility can bypass the turbines. There shall be no steam released directly into the atmosphere except where silencers are installed to reduce the noise level below 80 decibels (dba). The condensate drainage system of the high pressure superheated piping system shall be designed such that the condensate is recovered.

Feedwater Systems: The feedwater treatment systems shall be capable of handling a minimum of 100 percent of each facility's make-up water requirements. The systems will treat water to meet each facility's boiler water quality requirements.

There shall be ONE HIGH PRESSURE BOILER FEEDWATER PUMP FOR EACH BOILER AND ONE STANDBY (BACKUP) PUMP FOR EVERY TWO BOILERS INSTALLED. High pressure boiler feedwater pumps SHALL BE EQUIPPED WITH DUAL (ELECTRIC AND STEAM) DRIVES. The feedwater system shall be designed in such a manner that achieves the maximum flexibility within the system.

The pumps shall be designed for operation at a maximum water temperature of 350°F, unless the Contractor's designed thermodynamic cycle demands otherwise.

Deaerator Systems: The water deaerator systems shall be designed in accordance with the applicable ASME codes. The deaerator storage tanks shall have a minimum ten minutes of storage of the plant's full load. The working pressure shall be suitable for the designed thermodynamic cycle of the facility. THERE SHALL BE TWO, 100 PERCENT CAPACITY DEAERATORS. The Contractor shall specify and guarantee the oxygen and carbon dioxide (CO₂) removal at any load between five percent and one hundred percent of the rated capacity. The Contractor shall also specify the amount of steam loss while the oxygen and CO₂ is being released through the deaerators. The Contractor may supply and install steam accumulator systems in order to avoid a severely fluctuating steam flow caused by the variation in the Processable Waste Btu/lb content.

Condensate System: Surge tanks for receiving the returnable condensate from the process shall be provided by the Contractor. The size and number of surge tanks depend on the amount of condensate returned and shall be determined by the Contractor. The returnable condensate is that condensate which can be reused without any major form of treatment.

Special Requirements: Boiler auxiliary equipment items shall have as a minimum the same degree of availability and reliability as the facility. Where necessary redundancy of any auxiliary equipment is required, it shall be supplied in the form of spare units.

All auxiliary equipment shall be automatically controlled with manual override systems, all of which shall be controlled from the facility's central control room.

Water Usage, Quality and Treatment: This section pertains to water that is to be used as:

- o Make-up water for steam generating systems.
- o Internal facility consumption (domestic and process uses).

Boiler water for the northern facility may be supplied by water lines from the Broward County water system. Table A-3 in Section 1.2.7 of this appendix, presents the 1982 annual average for water quality values for the County's System 1-A.

Water service by either Broward County or the City of Fort Lauderdale to the southern site may be possible. Tables A-1 and A-2, also in Section 1.2.7 of this appendix, provide annual average water quality values for the System 3-A plant (Broward County) and Walter E. Peele Plant (City of Fort Lauderdale), respectively.

1.10.6 Combustion Controls

At each facility controls shall be provided to monitor water level, furnace combustion temperature, steam flow, and exhaust gas temperature and volume. Combustion air modulation shall also be provided.

Controls shall consist of systems for Remote Automatic, Local Manual, and Remote Manual modes.

1.11 Residue Handling Systems

1.11.1 General

The solid residues from each facility must be managed and disposed of according to Federal and State standards for resource recovery facilities. The Proposer shall indicate the quantity and composition of residue ash expected to be produced at each facility from the furnace/boiler and air pollution control systems. The Contractor shall be responsible for ensuring that this residue ash, will not be considered hazardous based on applicable Federal and State regulations and requirements.

The Contractor will also be responsible for residue removal, transportation and landfilling, and all testing necessary to determine whether the residue is hazardous according to the applicable Federal and State regulations.

1.11.2 Description

The purpose of the residue handling systems is to collect the post-incineration bottom ash and fly ash while separating any recyclable materials in a dust free manner. THE SYSTEMS SHALL HAVE TWO, ONE HUNDRED PERCENT CAPACITY ASH CONVEYORS to transport the ash to the handling areas at each facility.

Provisions for tractor-trailer loading in an enclosed area, with ventilation and dust control shall be incorporated into the design. A clamshell-type bucket for loading ash onto trucks from an ash storage pit may be provided.

The Proposer shall indicate the marketability of ash, if any. THE RESIDUE ASH SHALL CONTAIN LESS THAN 4.0 PERCENT COMBUSTIBLES, AND LESS THAN 0.2 PERCENT PUTRESCIBLES. The residue shall be such that it will not support any type of animal or vermin life and will not sustain combustion.

1.11.3 Bottom Ash

The Contractor shall design the furnace connection of the ash discharge chute to be the full width of the final grate section to prevent blocking of the chute from the burn-out grate section. The distance from the end of the stoker to the furnace rear wall shall be at least equal to the height of the boiler feed throat lintel above the stoker feed section.

The bottom ash or residue shall be water cooled by spray or quenched in tanks or sumps before it is handled by the conveyors. The cooled bottom ash handling systems shall consist of drag or vibrating conveyors designed to handle the total plant load.

The Proposer shall specify water usage for residue quenching. Boiler blowdown may be used for ash quenching.

After removal of the residue ash from the water cooling system by the conveyors, the residue ash may be moved from the furnace/boilers to the ash storage area by either drag, belt, or vibrating conveyors designed for heavy duty service.

The drag conveyors, if included in the proposer's design, shall be extra heavy duty type with double strands (chains), steel flights, and with drives of the hydraulic infinitely variable speed type.

The vibrating conveyors, if included in the proposer's design, SHALL BE NATURAL FREQUENCY, balanced type, not requiring special foundations.

The belt conveyors, if included in the proposer's design, shall be of a trough type.

All conveyors shall be equipped with safety devices and zero speed switches.

1.11.4 Fly Ash

The fly ash may be combined with quenched bottom residue ash removed by the residue ash conveyors. Separate collection of the fly ash may be utilized should the Proposer wish to market the fly ash for re-use.

The fly ash handling systems include, but are not limited to, screw conveyors inside precipitator hoppers, rotary or double flap air lock valves, and dry drag type transfer conveyors.

1.12 Air Pollution Control Systems

Except as may be required under applicable law, the air pollution control systems at each facility shall consist of one electrostatic precipitator and one induced draft fan per combustion line.

1.12.1 Electrostatic Precipitators

Each combustion line shall be equipped with an electrostatic precipitator (ESP) including all appurtenances, structural supports, foundations, external and internal walkways, platforms access stairways, fly ash hoppers with discharge air lock valves, power and control wiring, and other accessories for a complete operation system.

Each ESP shall be a multi-field type with the output of each ESP's flowing into a single flue. The fields shall be sized adequately considering both the volume of gases and amount of excess air. The temperature of flue gases entering the ESP must be below 600°F and at least 40°F above the dew point temperature.

The U.S. Environmental Protection Agency's (USEPA) best available control technology (B.A.C.T.) shall define the minimum efficiency of the ESP's. The Contractor shall guarantee ESP performance. For the purpose of proposal submission, Proposers shall assume that the ESP outlet gases shall not exceed 0.03 grams per cubic foot of air. The actual required removal rate shall be determined during the permit negotiation process with the appropriate regulatory agencies.

Each ESP design submitted shall have been successfully operated in a facility firing Processable Waste for a minimum of three years. The proposed ESP shall not have been scaled up more than 25 percent over previous installation.

Casing and hoppers of each ESP shall be enclosed with weather resistant materials.

ESP structural design shall be based on all applicable codes as to dead, live, wind and seismic loads, using all external structural members, rigid frames, etc. Internal bracing exposed to the gas flow is not allowed. All design, fabrication and installation shall be in accordance with all applicable design codes and standards.

ESP internal walkways shall be provided at the inlet and outlet nozzles and between fields.

All ESP induction motors shall be extra severe duty high efficiency type, with a minimum guaranteed efficiency value which shall be confirmed by NEMA test standard MG-1-12.53a, (IEEE test procedure 112. Method B) using accuracy improvement by segregated loss determination including stray load loss measurement. All motors shall be labeled with the NEMA efficiency.

All ESP steel casing in contact with the flue gas shall be of ASTM A 242 steel; external structural members shall be ASTM A36 steel.

ESP gas distribution shall be accomplished via a low velocity, multiple vane system or a perforated plate system. It should be noted that as part of the contractual requirements of the selected Contractor, model studies of geometrically similar units shall be submitted for evaluation.

ESP collection systems shall consist of formed rolled ASTM A242 sheet of manufacturer's standard design.

ESP collecting surface rapping shall be by shaft-driven rotary hammers. Solenoid impact or vibration rapping is not acceptable.

ESP high voltage systems shall have star shaped, spiked stainless steel electrodes, rigid mast mounted; and high alumina refractory type insulators. Weighted wire systems will not be acceptable.

ESP discharge electrode rapping shall be accomplished by shaft mounted rotary hammers; solenoid impact or vibrating rapping is not acceptable.

ESP electrical systems shall be in accordance with ASA, AIEE, MENA and National Electrical Code requirements, designed by manufacturer. All operational functions controlled remotely from central control room. High voltage field control panel shall include all solid state, full wave bridge, thyristor type regulated D.C. supply with protective reactances. Saturable reactor systems are not acceptable. Key-type safety interlocks with sequential key arrangements shall be included on all precipitator access doors, rectifier enclosure access doors, high tension switching, and control units circuit breakers.

Minimum ESP remote control functions shall include:

- o Transformer overload alarm.

- o Precipitator failure alarm, if field ceases to operate, or if a long-term precipitator under voltage condition exists, while precipitator control is in on position.
- o Isolated contact for precipitator field.
- o Remote on-off switching.
- o Hopper and insulator heaters failure alarm.
- o Rapper start-stop-failure alarms.
- o Flyash conveyor start-stop failure alarms.
- o Flyash discharge air lock valves start-stop failure alarms.

ESP insulation (nozzles, sides, roof and hoppers) shall be mineral wool block or fiberglass blanket, applied directly onto the precipitator casing. Stiffeners and other structural members attached to the casing shall be wrapped with an insulating blanket.

ESP lagging shall be aluminum panels, except for the roof of the precipitator. Roof insulation shall be protected by purlins and metal panels which shall be designed for appropriate loads.

ESP flyash hopper heaters shall be the resistance type extending two thirds of the ash hopper height from the bottom of the hopper (to prevent blockage).

1.12.2 Induced Draft Fan Systems

Each furnace-boiler shall be equipped with an induced draft fan, an induced draft fan drive, an induced fan inlet damper, and appropriate breechings.

Induced Draft Fans: Induced draft fans shall be centrifugal, backward curved inclined blade, treated-radial tip type, designed for continuous operation at 600°F, in a dusty environment.

The fans shall conform to the following minimum requirements:

- o Fan speed not to exceed 750 RPM.
- o Equipped with access doors.
- o Insulation and lagging in accordance with that required for the ESP's.
- o Test block capacity factor: 1.15.
- o If erected on an elevated structure, the I.D. fans shall be mounted on spring-loaded inertia bases.
- o Fan blades shall be lined to withstand corrosion.

Induced Draft Fan Drives: The induced draft fans shall be coupled to electric VARIABLE SPEED DRIVE SYSTEMS consisting of either direct current drive motors with AC/DC converter or AC variable speed motors and operator control stations, as required.

The drive HP shall be a minimum of 115 percent of the fan test block BHP. The control system shall include positive acceleration on demand and deceleration by inertia.

Induced Draft Fan Inlet Dampers: The induced draft (I.D.) fan inlet houses shall be fitted with parallel blade type inlet dampers designed and manufactured for 600°F continuous operation. The dampers shall conform to the following minimum requirements:

- o Blades - ASTM A242 steel plates, air foil type.
- o External blade linkages.
- o End shaft connection with a universal joint (rigid jack shaft coupling not acceptable).
- o Damper operators - Worm gear reducers with beveled gear attachments and AWWA limit stops.

Induced Draft Fan Breechings: All breechings shall be of ASTM A-242 steel plate, reinforced as required. I.D. fan inlet and outlet breechings shall be connected to the I.D. fans via flexible joints and supported independently of the I.D. fans housings.

Shaft extension shall be fitted with a manual handle and a locking arrangement.

All breechings shall be insulated and lagged in accordance with that required for the ESP's.

I.D. fan outlet breechings shall be designed to enter stack(s) at not less than a 45 degree angle.

1.12.3 Stacks

The height of stacks at both sites is to be limited to 200 feet above final grade elevations.

The stacks shall include access ladders, a test platform located at the point required by testing procedures, test ports, access doors at the base of the stack, lightning protection system, and obstruction warning light system. Structural designs shall take into consideration all dead, wind and seismic loads, and shall include natural frequency vibration analysis where applicable.

Heights of the stacks shall be based on draft considerations and residual pollutant dispersion analysis in accordance with latest USEPA regulations along with Federal Aviation Authority (FAA) requirements since the sites are near commercial airports.

The stacks shall have one flue per combustion line and shall include provisions for a possible additional line.

1.12.4 Opacity Meter

The Proposer shall provide continuous read out opacity meter(s) in accordance with USEPA 40 CFR, Part 60.

1.13 Turbine-Generator Sets

1.13.1 System Design

At each facility the turbine-generator set shall consist as a minimum of the following component items:

- o Turbine
- o Generator
- o Cooling Systems
- o Operating Controls

At each facility, the Contractor may provide one multiple stage turbine generator set sized at 100 percent of the maximum generation rate.

Proposers should be aware that the Florida Public Service Commission's proposal rules and regulations, for qualifying alternative energy generation facilities, does contain provisions for minimum on-line generating reliability. Consequently, the Proposer may wish to consider incorporating more than a single turbine generator set at each facility. Should a Proposer wish to consider two turbine generator sets at either, or both, facilities, the Proposer shall be aware that Florida Power and Light may have limitations on the minimum size turbine generator installed.

Design of the turbine-generator sets shall also take into consideration the installed capacity, the available power and the spinning reserve power of the turbines.

The turbine-generator sets shall be designed such that no loss of energy production, either thermal or electrical, occurs throughout the lifetime of each facility. Each facility shall be able to process Processable Waste at full capacity even during scheduled and unscheduled outages of the turbine-generator sets.

The spinning reserve power of the turbines shall be such that variations in the steam mass flow from the boilers can be accepted without overloading the turbines.

1.13.2 Turbines

The turbines shall be radiographically tested, magnetic particle inspected, and sonic tested, as outlined in the currently applicable ASTM specifications.

The turbines, which shall be rated in accordance with the requirements of these specifications, shall be directly connected to the generator and shall drive the generator described herein as an integrated unit.

The turbines shall be designed for continuous operation, even if pressure at the turbine main steam stop valve rises to, but does not exceed, 105 percent of turbines rated pressure.

1.13.3 Generators

The generators shall be alternating current synchronous generators rated in accordance with the requirements of these specifications and shall be directly connected to and driven by the turbines described herein.

The generators shall be of the nonsalient pole revolved field type.

The telephone influence factors of the generators shall be in accordance with the latest ANSI Standards.

The deviation factor of the open circuit terminal voltage wave of the generators shall not exceed ten percent (as defined by ANSI standards).

The generator armatures shall be capable of operating at 130 percent of rated armature current for at least one minute, starting from stabilized temperatures at rated conditions.

The generator field windings shall be capable of operating at a field voltage of 125 percent of rated load field voltage for at least one minute starting from stabilized temperatures at rated conditions.

The generator will be capable of withstanding, without injury, the thermal effects of unbalanced faults at the generator terminals, including the decaying effects of field current (where protection is provided by causing field current reduction, such as with a field breaker or equivalent) and the DC component of the stator current, for times up to 120 sec-

onds, provided the integrated product (It) of generator negative phase sequence current (I) and time (t) does not exceed 30 seconds.

The generator shall be capable of withstanding, without mechanical injury, and type of short circuit at its terminals for times not exceeding the short time thermal capabilities, when operating at rated KVA and power factor and five percent overvoltage, provided the maximum phase current is limited by external means to a value which does not exceed the maximum phase current obtained from the three-phase fault. In the case of stator windings, the criterion for no injury is that the windings will satisfactorily withstand a normal maintenance high-potential test. There will also be no visible abnormal deformation or damage to the winding coils and connections resulting from this test.

The generator shall be suitable, for operation at rated KVA, power factor, and frequency at any voltage not more than five percent above or below rated voltage, but not necessarily in accordance with the standards of performance established for operation at normal rating.

The generator shall be capable of operating continuously at full rated load under usual service conditions. The total temperatures as determined by any of the methods given in ANSI standards shall not exceed 110°C for the stator coils and 125°C for the field when operating at full load or below.

1.13.4 Cooling Systems

General: The following information pertaining to cooling systems is included to provide Proposers with the appropriate systems and project site constraints that may impact upon the actual implementation of a cooling system at the selected sites. The cooling method at each facility may eventually be:

- o Once through cooling (surface condenser).

- o Evaporative cooling (evaporative cooling tower).
- o Air cooling (air cooled condenser).

The final determination of the actual cooling system that will be utilized will be made prior to the approval of the final Contract Agreement.

For the purposes of this proposal submission, however, proposals shall be based upon the utilization of air cooled systems at both the Southern and Northern facilities.

At each facility the steam turbine(s) condenser(s) shall be designed to meet maximum boiler ASHRAE output without any steam being extracted for process, for the hottest day in the year, as per the Florida Weather Bureau, for the Broward County area.

The Proposer shall provide cooling systems sized to condense the exhaust steam for the turbine(s) assuming all boilers are in operation. Reducers and coolers of steam pressure shall be installed so that the facility can also bypass the turbine(s) and condense the total output of all boilers under maximum steam generation. Sustained venting of steam shall be avoided. The condensing system shall be valved and piped to increase operation and maintenance flexibility.

The following sections provide information to acquaint Proposers with the conditions that may impact on the final selection of the cooling systems at each of the selected sites.

Northern Facility (Copans Road Site): Contractors should be aware that the North Broward Regional Wastewater Treatment Plant lies just to the east of site selected for the Northern Resource Recovery Facility. The following information is provided for the period of August, 1982 through May 1983, on effluent from this facility.

	<u>Min.</u>	<u>Max.</u>
Daily Flow (MGD)	-	64.21
Minimum Hourly Flow ⁽¹⁾	10.0	-
Chlorine Residual (ppm)	0.5	2.4
BOD (mg/l)	2.0	13.0
TSS (mg/l)	3.0	22.0
pH	6.7	7.4
Fecal Coliform	<10.0	160.0
Temperature (°F)	78.0	86.0

(1) MGD basis occurred in August, 1982.

The effluent from this facility is currently discharged through an ocean out-fall with a maximum temperature discharge limitation of 97°F.

For eventual consideration of evaporative cooling at this site, the sources of water are limited to County water, as supplied by the County System 1-A plant, ground water, or wastewater treatment plant effluent (provided additional treatment is utilized to enable the acquisition of all necessary permits and approvals. With respect to County water, average annual water quality values are presented in Table A-3 of this Appendix. The Contractor will be responsible for determining makeup water requirements and County water availability to satisfy such requirements. With respect to utilization of groundwater, Appendix B, Environmental Specifications contains data regarding the underlying aquifers in this area.

Southern Facility (Route 441 Site): Steam plumbing is of major concern at this site due to the proximity of Fort Lauderdale International Airport. Consequently, the eventual consideration of evaporative cooling tower(s) at

this site, such towers would be limited to a wet-dry type to eliminate visible plume formation which would occur under certain wet bulb and relative humidity conditions.

City and County water (refer to Tables A-1 and A-3) or ground water may be considered for evaporative cooling use. As in the case for the Northern Facility, the Contractor shall be responsible for determining make-up water requirements and city water availability to satisfy such requirements.

Summary: THE DATA PRESENTED ABOVE REGARDING COOLING SYSTEMS IS PROVIDED FOR INFORMATIONAL PURPOSES AND FOR FUTURE REFERENCE ONLY. ALL PROPOSERS ARE REQUIRED TO BASE THEIR PROPOSALS ON AN AIR COOLED SYSTEMS AT BOTH FACILITIES FOR COMPARISON PURPOSES. THE ACTUAL COOLING SYSTEMS UTILIZED AT THE SELECTED SITES WILL BE DETERMINED DURING CONTRACT NEGOTIATIONS.

1.14 Process Control Systems

1.14.1 Local Automatic Control Systems

At each facility these systems shall provide for automatic shutdown of certain critical operations in the processes. This shall include, but not be limited to:

- o Turbine Generator(s)
- o Electrostatic Precipitators
- o Conveyors
- o Induced Draft Fans
- o Pumps
- o Stokers

These local control systems shall identify their actions to the remote central control systems.

1.14.2 Remote Automatic Control Systems

These on-line, real time systems shall provide automatic operation, control monitoring and data trending and logging of

all plant process from the Central Control Room (CCR) of each facility, by means of a computer based central processing units (CPU).

The CPU's shall continually monitor the parameters of all the plant's process systems. The monitored data shall be used by the CPU's to determine whether the process lines are operating correctly, to identify any alarm conditions to the CCR operator that arise, and to generate operating and management reports.

The CPU's shall automatically control the operations of all process line component systems. Such control shall be in conjunction with any local control systems specified elsewhere in the RFP.

At each facility the systems shall provide to the CCR operators an interactive control station from which the operators shall institute process system startups and shutdowns, and affect modifications to all operating parameter setpoints.

The systems shall automatically optimize the operation of each process line by the proper coordination of the line's component systems, including, but not limited to: furnace grate speed control, under and over fire air feed control, temperature control, and boiler feed water control systems to provide maximum efficiency in steam generation.

The ratio of under and over fire air shall be automatically adjusted to compensate for the Processable Waste's moisture content so that a selected furnace temperature is maintained and complete burnout is obtained. The Processable Waste feed rate, grate speed and combustion air volume shall be adjusted to maintain optimum steam generation and complete burn-out.

The CPU's shall provide data logging and trending of all process parameters, including operator inputs to the system.

The systems shall be computer based and shall have a minimum of two CRT/keyboard operator stations and one printer for logging at each facility.

The mainframe processor (CPU) shall have sufficient memory capacity to contain all software operating systems and shall use, and be furnished with, mass storage devices of the rigid disk type for maintaining event data files, etc. Two magnetic tape drives shall also be furnished with each CPU and used for recording event data for off-line processing. Each CPU shall have a real time clock.

The CPU's shall perform an auto restart after a power failure and restoration of power. Floppy disks may be used for system initialization and restarts requiring software reloads. However, Floppy disks shall not be used for any continuous system function.

At each facility a priority software interrupt system shall be furnished and all high priority alarms shall be individually hand wired into this system, e.g., high steam pressure, malfunction of boiler feed water pump, etc. The CPU's shall instantly respond to all priority interrupts received and indicate appropriate action.

In the event of system malfunctions and/or alarms, the CPU's shall identify the event to the operator in fully description English text and shall also "prompt" the operator with a complete list of the actions to be taken in response to the specific event.

The CPU's shall monitor all process operating parameters and shall maintain and store the same for a minimum period of 30 calendar days.

The CCR operators shall have access to this stored data and be provided with requested hardcopy printouts of a specified parameter over a specified period of time.

1.14.3 Local Manual Control Systems

At each facility these systems shall provide manual on/off and lock-out controls for all moving equipment in the processing systems, i.e., electric motors, hydraulic or steam driven devices, etc. The manual control systems are required specifically for the safe performance of maintenance operations and for equipment testing and startup operations. The remote control systems shall monitor the status of these local manual controls and take appropriate action in response to the status indicated.

1.14.4 Remote Manual Control Systems

At each facility these systems shall provide for the manual operation of the plant's process lines from the plant's central control room. The systems shall be operated from a control and information display board which shall contain start/stop controls for all process operations, instrumentation indication of all critical and necessary parameters associated with the process operations, and alarm and status indication lights for all process operations. The alarm lights shall be provided in addition to an audible indication of a change in their status, to be sounded both in the central control room (CCR) and the plant floor, to cover the event of the CCR being unoccupied. This audible indication to the plant floor areas shall be a unique sound unlike any other audible indications in the facility.

The control/display boards shall be laid-out as a semi-graphic representation of the plant and its process lines. There shall be a fixed graphic display of each plant process line, from chute to stack, and all controls, alarms and instrumentation shall be located and identified such that they are immediately identifiable with their associated process components. A separate section of the control display (C/D) board shall be utilized for the steam and electricity distribution systems.

1.14.5 Control System Priorities

At each facility the local manual "on-off-auto" type controls shall take precedence over all types of controls. The next highest priority shall be that of the local automatic controls. The next priority shall be to the remote manual control board and lastly to the remote automatic computer controls.

1.14.6 System Requirements

All systems shall be comprised of the latest generation of electronic components and the computer software programs shall be written in a high order language.

Maintenance forces for the electronic systems selected shall be available in the Broward County area in sufficient quantity to guarantee 24-hour on-site response to maintenance calls.

1.14.7 Uninterruptible Power Supplies

At each facility an uninterruptible power supply system (UPS) shall be provided to supply power in an emergency to the remote automatic control system and to other facility equipment requiring UPS for its protection in an emergency.

This UPS shall include a converter and a battery storage system. The converter shall have, but not be limited to, a separate isolation step-down transformer, a solid state inverter bypass switch, an automatic transfer switch, input and output circuit breakers, meters, pilot status lights, low alarm, output frequency meter, manual TS control and fault alarm.

The battery storage system shall include lead-calcium batteries, tiered storage racks with interconnecting metal straps, and battery charger. The capacity of the UPS systems shall be twelve hours and shall be rated at not less than 50 KVA for the northern facility and 100 KVA for the southern facility, 120 volt, single phase outlet with one-hour battery reserve power.

1.14.8 Process Alarms

At each facility alarm annunciators shall be provided to alert the control room operators or other operators/attendants to abnormal process conditions of particular importance. These alarm systems will sound until acknowledged by the operators, and the status lights for the alarms will continue to be "on" until the abnormal conditions are attended to.

The various alarms shall be organized on annunciator panels located in the central control room. In addition, duplicate alarms shall be located at local alarm stations, such as the stoker panels, the turbine-generator rooms, the water treatment system rooms and the precipitator control consoles.

1.14.9 HVAC

All central computer system areas and all UPS battery storage areas shall be provided with the special air conditioning required for each area's proper operation.

Each battery storage area shall have a continuous exhaust of air to prevent hydrogen buildup and the area's temperature shall not exceed 85°F to prevent shortening of the batteries' life.

Each computer room shall have a floating floor which shall be utilized for all cable entry to the equipment and for forced air ventilation of the equipment cabinets. The ambient temperature in each room shall be maintained at 70°F, but in no case shall the temperature within any equipment cabinet be allowed to exceed 85°F.

1.15 Facility Security and Communication Systems

1.15.1 Facility Security

The Contractor shall be solely responsible for providing adequate security at each site, both during construction and operation of the facility.

Security during operation of the facility may include personnel, video, lighting, as well as electronic alarms. One, or a combination, of the methods shall be instituted at the Contractor's discretion.

1.15.2 Communications

The communications systems shall include the following services at each facility: telephone, intercom, public address, and two-way radio.

1.15.3 Security Lighting

Security lighting shall be provided on the exteriors of all facility buildings, in the vehicle parking lot(s), and on the entire perimeter fence. The type of light fixtures and the footcandle level of the illumination shall, as a minimum, be high pressure sodium and 2.5 foot candles.

SECTION 2

LANDFILL TECHNICAL SPECIFICATIONS

2.1 Introduction

As with the preceding technical specifications for resource recovery facilities, the purpose of these landfill technical specifications is to set minimum guidelines and functional design requirements to insure comparable proposals of uniform quality.

In addition, the County has initiated the permit application process with the appropriate government agencies, for the Residue/Unprocessable Waste landfills. As part of this activity, the County has and will continue to develop permit submittals containing landfill plans. The Proposals developed by the Proposers must conform to the plans and requirements contained in these permit submittals. As an example, a landfill liner, leachate control system and stormwater drainage system will be required at each of the landfills as part of the permit conditions. As a result, these items must be treated as required in each Proposal.

The Proposer is not limited to these minimum requirements and guidelines, however, should the Proposer desire to change the functional design requirements described herein, the Proposer shall utilize Proposal Form 2.2 of the RFP to describe the change.

The Proposer shall provide for the design, construction and operation of separate Residue/Unprocessable Waste landfills, together with the associated landfill facilities at the northern and southern resource recovery sites. Descriptions of these sites are provided in section 4.7 of the RFP. More specifically, development of these landfills shall include but not be limited to the following at each landfill:

1. Construction and maintenance of access roadways and parking areas.

2. Furnishing, installation and maintenance of a site security system.
3. Furnishing, installation, operation and maintenance of a truck weighing scale.
4. Furnishing, construction and maintenance of a scale building.
5. Furnishing, construction and maintenance of an equipment shed.
6. Furnishing, installation, and maintenance of land-fill liners.
7. Furnishing, construction, operation and maintenance of leachate collection and disposal systems.
8. Construction and maintenance of storm water drainage systems.
9. Clearing and grubbing of trees, brush, shrubs, and stumps within the limits of the site.
10. All excavating, backfilling and disposing of all materials, including unsuitable muck material, encountered at the site as required for the purpose of constructing structures, conduits, pipelines, roads, grading and other facilities required to complete development of the site.
11. Provisions for water, sewage, fire protection, and other utilities.
12. Furnishing, installation, operation and maintenance of a gas control system.
13. Furnishing, installation, and maintenance of ground-water monitoring wells.
14. Placement and compaction of select fill, as required, to increase site elevations to 100 year flood elevations prior to placement of solid waste.

In all cases, the above described work, and any other work required to complete the design, construction and operation of the Residue/Unprocessable Waste landfills, shall be in compliance with all applicable federal, state, county and local rules and regulations.

In addition to the development and construction of the Residue/Unprocessable Waste landfills, the Proposer shall be responsible for the operation, maintenance and final closure of these landfills.

2.2 General Design and Construction Requirements

In addition to the specific design requirements described in the site work section, the Contractor shall meet the following general design requirements:

- o The bottom of the landfills must be at least 5 feet above the groundwater table. To provide a suitable base for constructing the landfills it will be necessary to remove all unsuitable materials and to place clean fill on the site to establish the 5 foot separation of the groundwater table and the landfill bottom. If excavation uncovers an unexpected water table that cannot be lowered the excavated area must be backfilled to a point that will provide the necessary 5 foot separation.
- o Select fill must be placed and compacted wherever necessary to increase grade elevations to 100 year flood elevations. This will insure that solid waste will not be placed in future flood waters.
- o The top slope of completed landfill sections must be maintained at 2 percent or greater for drainage and the slopes at the sides of the fill should not be steeper than 3 horizontal to 1 vertical.
- o All materials and equipment used in the construction of the landfill should be handled, stored and installed in accordance with the manufacturer's recommendations.
- o All concrete structures, including drainage ditches, shall be constructed on a 12-inch layer of clean, fill. Backfill structures shall be backfilled with 12-inch thick layer of clean fill all around and tightly compacted.
- o Erosion control measures such as straw bales, silt fences and temporary seeding must be utilized to keep erosion of soil to a minimum.

- o A sufficient number of ground water monitoring wells shall be provided to determine ground water flow direction, background ground water quality and subsurface geology, as required by the appropriate regulatory agency(ies).
- o A landfill liner system shall be installed and maintained to contain infiltrated rainfall in accordance with the requirements of the Florida Department of Environmental Regulation (DER) and Broward County Environmental Quality Control Board (BCEQCB).
- o A leachate collection system shall be installed, operated and maintained to collect and remove leachate from the landfill in accordance with the requirements of the Florida DER and BCEQCB.
- o A storm water drainage system shall be installed, operated and maintained in accordance with the requirements of the South Florida Water Management District.

Conceptual layouts of the northern and southern landfills are included in the RFP as Figures 2 and 3, respectively.

2.3 General Operational Requirements

As part of the operational requirements, the Contractor shall develop operational procedure and maintenance manuals, which shall include, but not be limited to, the following items:

- o Operation hours;
- o Weighing procedures;
- o Vehicle flow and unloading;
- o Waste handling procedures;
- o Placement of cover;
- o Maintenance procedures;
- o Operating procedures for various weather conditions;

- o Fire prevention procedures; and
- o Salvage and screening policy and procedures.

In addition to the development of operations and maintenance manuals, the general operational requirements for the Residue/Unprocessable Waste landfills include:

- o All of the permanent facilities that will impact on the proposed landfill must be constructed prior to placement of waste in a new area. This includes such items as storm drainage lines and ditches, liner and leachate collection system, monitoring wells, haul roads and gas vents.
- o Temporary measures that must be pursued on a continuous basis include temporary surface water diversion ditches, erosion control measures, and fencing to control blowing paper.
- o The solid waste shall be covered according to the requirements of the applicable regulatory agency(ies). Final cover, however, shall consist of a layer of impervious material having a permeability of 10^{-7} cm/sec or less, topped with sufficient topsoil to support the growth of vegetative cover. Vegetative cover must then be established to prevent erosion.
- o Burning of waste shall not be allowable and hazardous waste shall not be acceptable for disposal at the sites.
- o A minimum 100 foot separation distance shall be maintained between fill areas and property boundaries. (Zoning Ordinances and permit requirements may necessitate larger separation distances).
- o Initially, gas monitoring wells shall be tested once a month. If explosive limits of gas are detected, then a more extensive monitoring program should be developed. This more extensive monitoring program could involve additional monitoring wells as well as mitigating measures to stop the migration of gas.
- o Ground water samples shall be taken in accordance with regulatory requirements and guidelines and shall be tested for those parameters required by the applicable regulatory agencies.
- o After an area of the landfill is completed and final cover is applied, regular checks of the area will be

made to determine if any erosion is taking place. Any eroded areas will be filled and a dense stand of grass established. An active ground water and gas monitoring program meeting the requirements of the Florida Department of Environmental Regulation will be carried out to make sure the landfill does not have an adverse effect on the environment.

2.4 Environmental

The Proposer shall assume and provide that, the design, construction, and operation of the Residue/Unprocessable Waste landfills shall comply with all applicable federal, state, county and local environmental regulations and standards in effect as of the proposal submission due date, unless otherwise advised in writing by the County. These environmental requirements will cover all air quality, water quality, traffic, noise, odor/vector control, residue, and community impacts. In particular, the design, construction and operation of the Residue/Unprocessable Waste landfills shall at all times be in compliance with the rules and regulations of the Florida Department of Environmental Regulation, specifically Chapter 17-7 Resource Recovery and Management; Part I: Solid Waste Facilities. Specific mitigating measures will be necessary at the southern site to minimize the environmental input on the South New River Canal.

The Proposer shall itemize the measures by which all adverse environmental impacts will be mitigated including design features, construction procedures, operating procedures, and control hardware.

Attendance and participation at meetings and hearings will also be required of the Proposer and others retained by the Proposer in connection with the permit approval, and certification process. A listing of the environmental permits and regulations that may be applicable to these landfills is provided in Appendix B.

Information pertaining to the Proposer's Residue/Unprocessable Waste landfills is to be provided in the proposal on Form 2.4 Technical Data; Section 2.4.6 Residue/Unprocessable Waste Landfills. Specifically this section requests information concerning the following:

- o Development plan.
- o Type of security system.
- o Operations plan.
- o Liner system.
- o Leachate system.
- o Closure cover.

The Proposer may provide additional information by attaching supplemental sheets to the proposal.

The following sections are intended to provide an overview of the environmental requirements for the residue/unprocessable waste landfills. These requirements include but are not limited to:

2.4.1. Design and Construction Requirements

During construction of the landfills, the Contractor will be required to:

- o Control or prevent fugitive dust emissions.
- o Prevent the depositing of dirt and construction debris on neighboring streets and properties.
- o Provide for control of soil erosion and sedimentation of existing water courses.
- o Provide appropriate disposal for any water removed through dewatering.

2.4.2. Operations Requirements

During operation of the landfills, the Contractor will be required to:

- o Train special environmental personnel.
- o Prepare operational procedure and maintenance manuals.
- o Develop practices to define the nature and quality of waste input to prevent the processing of obnoxious, undesirable, and hazardous material at the landfills.
- o Prevent dirt and debris from being deposited on neighboring streets.
- o No solid waste shall be disposed of:
 - within 200 feet of any natural or artificial body of water, except canals used to lower site water tables or bodies of water, contained completely within the site, which do not discharge from the site.
 - within 10,000 feet of the closest point of any runway at any airport licensed by the State of Florida, owned or operated by the United State, or subject to regulation by the Federal Aviation Administration which may be used by turbo-jet aircraft; or within 5,000 feet of any runway at any such airport used only by piston engine type aircraft unless it has been determined by the Federal Aviation Administration, or other appropriate federal or state agency charged with preventing airport hazards, that the proposed solid waste facility poses no safety hazard to aircraft in the vicinity.

2.4.3 Water Quality Requirements

No substance shall be discharged into the surface waters, groundwaters, storm or sanitary sewer system without the approval of the applicable agency(ies) regulating that discharge.

Proposers shall provide sufficient information and data on the proposed landfills including any necessary leachate pretreatment process, to show how compliance with these regulations and standards would be achieved.

2.4.4 Noise Impact Requirements

The proposal shall indicate, among other things, the methods to be used to safeguard both people working at the landfills and in neighboring areas from exposure to noise levels, greater than allowable thresholds, during both construction and operation.

The design and selection of equipment and construction materials should be made with consideration to the minimizing of noise generation within the site property lines and the transmission of noise beyond the property lines, and shall incorporate any design or operation measures requested by the County. The prevention of community nuisances due to excessive noise during construction and operation is extremely important to assure that the landfills are "good neighbors".

2.4.5 Odor/Vector Control Requirements

The Proposer shall provide sufficient controls to insure that the landfills will not constitute a hazard to public health, safety, or property both on-site, and in neighboring communities.

The design of the Residue/Unprocessable Waste landfills and associated facilities shall include all necessary provisions as required by Federal, State and local laws and regulations to eliminate any potential problems with odor or vector control.

APPENDIX B

ENVIRONMENTAL SPECIFICATIONS

APPENDIX B
ENVIRONMENTAL SPECIFICATIONS

TABLE OF CONTENTS

	<u>Page Number</u>
<u>SECTION 1 - ENVIRONMENTAL SPECIFICATIONS</u>	
1.1 Applicable Codes	B-1
1.2 Emission of Air Pollutants	B-3
1.3 Discharge of Water Effluent	B-5
1.4 Dredge and Fill Activities	B-10
1.5 Residue (Ash) Generation and Disposal	B-11
1.6 Environmental Testing	B-13
1.7 Environmental Performance Guarantees	B-13

LIST OF TABLES

	<u>Page Number</u>
B-1 Ambient Air Quality Standards	B-7
B-2 Broward County Environmental Quality Control Board 1979-1980 Ambient Air Monitoring Data	B-8
B-3 Broward County Environmental Quality Control Board 1979-1980 Ambient Surface Water Monitoring Data	B-11
B-4 Preliminary Geotechnical Information Subsurface Strata of Broward County	B-12

APPENDIX B
ENVIRONMENTAL SPECIFICATIONS

1.1 Applicable Codes

The Project shall be designed, constructed, and operated in accordance with the latest editions, including all addenda, of the applicable codes, legislation, regulations and standards listed in this section. This list is to be used as a guide and is not necessarily inclusive of all cognizant organizations and their codes and regulations. The Contractor shall meet all applicable codes and regulations, whether or not listed herein. The Project shall be designed, constructed, and operated to insure compliance with environmental laws and regulations of all federal, state, county and local governments having appropriate jurisdiction. Where portions of any such requirements are in conflict, the most stringent shall govern.

The Contractor shall obtain all permits and licenses necessary for the construction and operation of the Project. To expedite the Project, the County has already begun the application process. During contract negotiation, the Proposers will be responsible for monitoring this process and assisting the County. Upon execution of a contract, the Contractor will become responsible for attaining these permits and will adopt the County's prior submissions as its own.

1.1.1 Federal Codes

Prevention of Significant Deterioration (PSD),
(Clean Air Act Amendments of 1977 PL 95-95,
127(a), 91 Stat. 731 Sections 160-169) 40 CFR
Parts 50, 51, 52, 60, 61

Dredge and Fill Permit, (Clean Water Act
Amendments of 1977 and 1981 PL 95-217 and
97-117 86 Stat. 816, 33 USC 466 et seq.) 40 CFR
Part 230

National Environmental Policy Act (NEPA), (PL 91-190)

U.S. Department of Transportation, Federal Aviation Administration (FAA) Regulations (Part 77 - Objects Affecting Navigable Airspace)

National Pollutant Discharge Elimination System (Clean Water Act Amendments of 1977 and 1981 PL 95-217 and 97-117, 33 USC 466 et seq.) 40 CFR Parts 121-125

Resource Conservation and Recovery Act of 1976 as Amended (RCRA) (PL 94-580 and 96-510, 90 Stat. 95, 42 USC 6901 et seq.) 40 CFR Parts 260-265

Standard Performance for New Stationary Sources (USEPA) 40 CFE, Part 60, Proposed Revisions to Subpart D, dated June 19, 1984.

1.1.2 State of Florida Codes

Development of Regional Impact Regulations (Florida Environmental Land and Water Management Act of 1972 ss. 380.012-380.10 FS, Chapters 9B-16.16,, 22F-1, and 22F-2 FAC)

State Air Pollution Control Permit (Florida Air and Water Pollution Control Act ss. 403.011-403.4153 FS, Chapters 17-2 and 17-4 FAC)
Sections 17-2.03, 17-2.04, 17-2.05, 17-4.05,
17-4.21, 17-4.22, 17-4.23

State Solid Waste Facility Permit (Florida Air and Water Pollution Control Act ss. 403-011-403 4153 FS, Chapters 17-4 and 17-7 FAC)
Sections 17-4.05, 17-4.28, 17-4.22, 17-7.01
17-7.11

State Dredge and Fill Permit (Florida Air and Water Pollution Control Act ss. 403.011 - 403.4153 FS, Chapters 17-3 and 17-4 FAC)
Sections 17-4.05, 17-4.28, 17-4.24, 17-4.31

South Florida Water Management District Permit (Florida Water Resources Act of 1972, ss. 373 FS, Chapter 40E FAC)
Sections 40E-1.6, 40E-2, 40E-20, 40E-40

Electrical Power Plant Siting Regulations (The
Florida Electric Power Plant Siting Act ss.
403.501-403.517 FS, Chapter 17-17 FAC)
Section 17-17.04

State Water Pollution Control Permit (Florida
Air and Water Pollution Control Act ss.
403.011-403.4153 FS, Chapters 17-3 and 17-4
Sections 17-3.051, 17-3.061, 17-3.121,
17-4.05, 17-4.21, 17-4.22, 17-4.24,
17-4.244, 17-4.245

State Underground Injection Permit (Florida Air
and Water Pollution Control Act ss.
403.011-403.4153 FS. Chapters 17-3, 17-4, 17-28
FAC)
Sections 17-3.051, 17-3.071, 17-3.151,
17-4.21, 17-4.22, 17-4.24,
17-28 Parts I, II, III

1.1.3 Broward County Codes

Construction/Operation Licenses for Air Pollu-
tion Sources (Broward County Environmental
Quality Control Act, Chapters 27-3 and 27-4
BCC)
Sections 27-3.04, 27-3.05, 27-3.08, 27-3.31,
27-3.32, 27-4.03, 27-4.04

Construction/Operation Licenses for Water Pol-
lution Sources (Broward County Environmental
Quality Control Act, Chapters 27-3 and 27-5
BCC)
Sections 27-3.04, 27-3.05, 27-3.08, 27-3.21,
27-3.25, 27-5.03, 27-5.04, 27-5.06,
27-5.07, 27-5.08

Construction/Operation Licenses for Solid Waste
Pollution Sources (Broward County Environmental
Quality Control Act, Chapters 27-3 and 27-6
BCC)
Sections 27-3.04, 27-3.05, 27-3.08, 27-3.40,
27-3.41, 27-3.42, 27-3.43, 27-3.44,
27-6.03, 27-6.04

Construction/Operation Licenses for Noise
Sources
(Broward County Environmental Quality Control
Act, Chapters 27-3 and 27-7 BCC)
Sections 27-3.04, 27-3.05, 27-3.08, 27-7.04,
27-7.05, 27-7.07

1.2 Emission of Air Pollutants

Contractors proposing a technology that results in the release of pollutants to the atmosphere are herein notified that Federal, State and County laws regulate such emissions. The following information, provided as guidance, outlines certain aspects of regulatory requirements that may be applicable to the Project. The vendors are herein notified that particulate matter emissions shall be controlled to .03 grains per dry standard cubic foot of exhaust gases or 0.1 lbs per million btu heat input, whichever is more restricted.

1.2.1 Air Pollutants Specifically Regulated

Broward County Code 27-4.04, FAC 17-2 and 17-4 and USEPA 40 CFR 50 have established ambient air quality standards for certain classes of air pollutants. The following list includes the classes governed by one or all of these regulations:

- o Particulates
- o Carbon Monoxide
- o Sulfur Oxides
- o Nitrogen Oxides
- o Non-Methane Hydrocarbons
- o Lead
- o Photochemical Oxidants

1.2.2 Unregulated Air Pollutants

With respect to air pollutants not specifically regulated, Proposers are advised that during Broward County Environmental Quality Control Board (BCEQCB) review under Chapter 27-3 and 27-4, Florida Department of Environmental Regulation (DER) review under FAC 17-2 and 17-4 and the USEPA review under 40 CFR 52, the potential for emitting any of the following pollutants, for which no specific regulatory criteria exists, may be critically examined.

- | | |
|----------------------|-----------------------------|
| o Aluminum | o Hydrogen Chloride |
| o Antimony | o Manganese |
| o Arsenic | o Mercury |
| o Asbestos | o Nickel |
| o Bacteria & Viruses | o Polychlorinated Biphenyls |

- o Beryllium
- o Cadmium
- o Chlorinated Dibenzodioxins
- o Chlorinated Dibenzofurans
- o Chromium
- o Copper
- o Fluorides
- o Polynuclear Aromatic Hydrocarbons
- o Sodium
- o Sulfuric Acid
- o Tin
- o Vinyl Chloride
- o Zinc

1.2.3 Regulatory Program Requirements

The discharge of air pollutants from the proposed facilities is subject to BCEQCB, DER and USEPA regulation and approval. USEPA 40 CFR 52 regulates the increment of ambient air quality degradation allowed as a result of the operation of a new source. The final Prevention of Significant Deterioration (PSD) new source review, conducted by USEPA, may require that sophisticated, state-of-the-art modeling be undertaken in order to demonstrate that the Project will be in compliance with all ambient air quality standards, including available PSD increments. Sophisticated modeling may be necessary because of the proximity of other major sources to the site of the Project and possible complex wind flow fields and dispersion patterns. It is, therefore, recommended that the Contractor give serious consideration to a design which would optimize exit flow characteristics and stack height (not to exceed Good Engineering Practice) to maximize atmospheric dilution and dispersion of pollutants emitted.

1.2.4 Baseline or Background Ambient Air Quality

Federal, State and County ambient air quality standards are provided in Table B-1. Results of 1979-1980 ambient air monitoring at Broward County monitoring stations near the Copans Road and Route 441 sites are summarized in Table B-2.

1.3 Discharge of Water Effluent

The Project shall conform to all Federal, State and local requirements for the discharge of wastewater from the site.

The County has filed an application with the South Florida Water Management District in December 1983 for a Surface Water Management Permit at each project site. Agency review of these applications has been suspended until a Contractor is selected.

The County also filed an application for a Water Management Permit for each project site with the Broward County Water Management Division in December 1983. Division review of these applications also has been suspended until a Contractor is selected.

1.3.1 Cooling Water Discharges and Withdrawals

Based on the quality and quantity of available surface and ground waters and potential thermal reduction processes, there appear to be several feasible alternatives for withdrawing and discharging cooling water for the proposed resource recovery facilities:

- o raw water supplied from the Floridan Aquifer for a once-through cooling system with subsequent injection into the Boulder Zone.
- o make-up water supplied from the Biscayne Aquifer for an evaporative cooling tower with blowdown discharge injected into the Floridan Aquifer, the Boulder Zone, or surface waters.
- o make-up water supplied from the South Fork of the New River for an evaporative cooling tower with blowdown discharge injected into the Floridan Aquifer, the Boulder Zone or surface waters.
- o Discharges shall be free of any biologically toxic or hazardous substances which may result in an upset at the receiving sewage treatment plant.
- o Discharges shall be free of any garbage that has not been shredded or otherwise processed.
- o There shall be no discharges of storm water into sanitary sewers.

Criteria for discharges to storm sewers:

- o No sewage, industrial waste, cooling water or other wastewater effluent shall be discharged into any sewer designated to carry storm water.

TABLE B-1

AMBIENT AIR QUALITY STANDARDS

Pollutant ⁽¹⁾	Federal Primary	Federal Secondary	State & County
Suspended Particulates			
Annual Geometric Mean	75	60	60
Maximum 24 hr concentration ⁽²⁾	260	150	150
Sulfur Dioxide			
Annual Arithmetic Mean	80 (0.03 ppm)		60 (0.02 ppm)
Maximum 24 hr concentration ⁽²⁾	365 (0.14 ppm)		260 (0.1 ppm)
Maximum 3 hr concentration		1,300 (0.5 ppm)	1,300 (0.5 ppm)
Carbon Monoxide			
Maximum 8 hr concentration ⁽²⁾	10 (9 ppm)	Same as Federal Primary	Same as Federal Primary
Maximum 1 hr concentration	40 (35 ppm)		
Photo Chemical Oxidants			
Maximum 1 hr concentration ⁽²⁾	240 (0.12 ppm)	160 (0.08 ppm)	Same as Federal Secondary
Nitrogen Dioxide			
Annual Arithmetic Mean	100 (0.05 ppm)	Same as Federal Primary	Same as Federal Primary
Hydrocarbons			
Maximum 3 hr concentration (6-9 a.m.) ^(2,3)	160 (0.24 ppm)		160 (0.24 ppm)
Lead			
Quarterly Arithmetic Mean	1.5	Same as Federal Primary	None Established

(1) All measurements are in $\mu\text{g}/\text{m}^3$ except CO which is mg/m^3 .

(2) Concentration limits not to be exceeded more than once per year.

(3) Used as guide in devising plans to achieve oxidant standards.

TABLE B-2

BROWARD COUNTY ENVIRONMENTAL QUALITY CONTROL BOARD
 1979-1980 AMBIENT AIR MONITORING DATA
 (ug/m³)¹

	<u>Station 2</u> ²	<u>Station 3</u> ³	<u>Station 8</u> ⁴	<u>Station 10</u> ⁵	<u>Station 12</u> ⁶	<u>Station 13</u> ⁷
Nitrogen Dioxide	ND	ND	38.1	ND	24.0	ND
Sulfur Dioxide	ND	ND	BDL	ND	2.6	ND
Carbon Monoxide	ND	ND	ND	ND	2.4	
Total Suspended Particulates	46.0	43.0	40.0	46.1	44.2	ND

Notes:

- 1 All values are annual arithmetic means except for particulates which are annual geometric means; carbon monoxide expressed as parts per million (ppm)
- 2 Station 2 is 3.5 miles west of the Copans Road site.
- 3 Station 3 is 2.5 miles east of the Copans Road site.
- 4 Station 8 is 2.0 miles west of Route 441 site.
- 5 Station 10 is 4.5 miles southeast of Route 441 site.
- 6 Station 12 is 4.5 miles northeast of Route 441 site.
- 7 Station 13 is 1.5 miles north of Route 441 site.

ND - no data

BDL - below detectable limits

1.3.2 Discharge to Sanitary and Storm Sewers

The following criteria apply to any and all discharges from the proposed Project to the sanitary sewer system.

- o Discharges shall be free of any benzene, gasoline, fuel oil or any other flammable or combustible materials.
- o Discharges shall be free of any solids that may restrict or obstruct flow through the sanitary sewer system.
- o The temperature of any discharge shall at no time exceed 150 degrees fahrenheit.
- o Discharges shall at all times be free of any highly corrosive materials.
- o At no time shall a discharge have a pH below 5.5 or above 9.5 units.

1.3.3 Regulatory Program Requirements

The discharge of cooling water effluent to surface or ground waters is regulated by the BCEQCB and DER, and effluent limitations determined by BCEQCB and DER must be met. To obtain a surface water discharge permit for cooling water, the potential impact of the thermal discharge on the receiving water temperature standard must be evaluated. The effects of any other discharge constituents on receiving waters must also be evaluated. For a ground water discharge by injection, an underground injection well permit must be obtained from DER. It must be demonstrated that the hydrogeologic environment is suitable for waste injection and will not endanger underground drinking water sources or modify ambient water quality in other overlying aquifers. Regional impacts may also have to be considered. A suitable confining zone, confirmed by testing, must exist above the injection zone. DER has also developed construction and operation requirements for injection wells in Chapter 17-28 FAC.

In addition to these permits, the South Florida Water Management District (SFWMD) regulates water withdrawal and

artificial recharge of ground water in Broward County and the surrounding area. Industrial Water Use permits are granted contingent upon the demonstration that the withdrawal will not influence the inland movement of the salt water interface, affect potable water supplies or existing legal uses, or cause other impacts identified in SFWMD regulations and guidelines. For permitting purposes, ground-water recharge, through underground injection, is evaluated on a case-by-case basis, with the SFWMD and DER permitting reviews coordinated as one process.

1.3.4 Baseline or Background Ambient Water Quality

Water quality data for the South Fork of the New River, adjacent to the Route 441 site, over the period 1979 to 1980 is provided in Table B-3. There are no surface water monitoring stations in the vicinity of the Copans Road site. The Route 441 site lies in the western edge of the extensive coastal area subject to salt water intrusion. The Copans Road site is approximately three miles west of the affected coastal area. Ground water information for geologic formations underlying Broward County is summarized in Table B-4.

1.4 Dredge and Fill Activities

The filling in of regulated wetlands and dredging or filling projects in surface waters are regulated by Federal, State and County agencies through their permitting programs.

1.4.1 Regulatory Permit Requirements

Route 441 Project Site

The U.S. Army Corps of Engineers (COE) and DER have determined that a portion of the Route 441 site is regulated wetlands. A permit is, therefore, required for facility construction in or affecting this area from both regulatory agencies.

The County filed a joint application for a dredge and fill permit with both the COE and DER for this site in

TABLE B-3

BROWARD COUNTY ENVIRONMENTAL QUALITY CONTROL BOARD
 1979-1980 AMBIENT SURFACE WATER MONITORING DATA*
 S. Fork of New River near Route 441

	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>
BOD, mg/l	1.6	2.0	1.0	1.1	2.0	2.0	2.3	2.0	2.0	1.6	2.4
Dissolved Oxygen, mg/l	2.4	3.4	2.6	1.8	6.0	5.5	5.5	3.9	2.5	2.6	2.10
Nitrogen, mg/l	1.9	2.2	2.1	1.6	1.8	2.1	2.0	1.9	1.9	1.9	2.2
pH	7.6	7.6	7.4	7.5	7.7	7.9	7.6	7.6	7.7	7.6	7.6
Temperature, °F	81	77	66	72	68	79	77	82	86	86	86

*Average Monthly Values

November 1983. The County received a Letter of Intent to Permit from the COE in August 1984. COE permit issuance is conditioned upon the County obtaining a dredge and fill permit from DER. The COE is not requiring an Environmental Impact Analysis nor a public hearing for this permit application.

The County is anticipating a Letter of Intent to Permit from DER in September 1984. At a minimum, DER will require a public hearing.

Copans Road Project Site

The COE has determined that a dredge and fill permit is not required for the Copans Road Project Site (Appendix J). However, DER has determined that a portion of this site is regulated wetlands. The County, therefore, filed an application for a dredge and fill permit with DER in November 1983. The DER issued a Letter of Intent to Permit in June 1984. (Administrative Hearing comments).

TABLE B-4

PRELIMINARY GEOTECHNICAL INFORMATION SUBSURFACE STRATA OF BROWARD COUNTY

<u>Generalized Formation Category</u>	<u>Base of Formation (Feet)</u>	<u>Permeability (Feet/Day)</u>	<u>Transmissivity (gpd/ft)</u>	<u>Temperature (Deg. F)</u>	<u>Salinity (mg/l)</u>	<u>Total Hardness as CaCO₃ (mg/l)</u>	<u>TDS (mg/l)</u>	<u>Porosity (%)</u>	<u>Geological Description</u>
Biscayne Aquifer	160			66-68					Fossiliferous limestone
Hawthorn Formation	890			67					Marl & limestone with chert lenses.
Floridan Aquifer	1,860		88,000 to 250,000	67-68	6,060 - 19,150	3,350 - 10,600	6,834 - 24,036	Varies extensively	Crystalline limestone to biocritic limestone
Confining Bed	2,000			67-68				30-40	Biomicritic limestone with layers of silty marly material.
Saline Water Bearing Zone	2,100			67-68					Dolomite interbedded with limestone with cavities
Confining Bed	2,570	0.0218		67-63				28	Soft, silty, marly bio- micritic limestone
Saline Water Bearing Zone	2,690			63-49	36,100	6,200	43,400		Limestone and dolomite with producing zones
Leaky Confining Bed	2,930	0.0821 to 0.439						31-38	Limestone with small amounts of dolomite
Boulder Zone			22,000,000 45,000,000 ⁽¹⁾	51 63 ⁽¹⁾	36,850	6,400	45,000		Dense, hard dolomite. Massive rock with numerous vugs, fract- ures and cavities

*Information derived from Ft. Lauderdale Test Injection Well except where noted.

(1) West Palm Beach Wells

1.5 Residue (Ash) Generation and Disposal

The quality and quantity of residue (solid waste) to be disposed of in a sanitary landfill may be reviewed in accordance with 40 CFR 241 and may be further regulated by 40 CFR 260-265. Landfill disposal of residue is also subject to BCEQCB and DER regulatory approval. This residue shall contain less than 4.0 percent combustibles and shall contain less than 0.2 percent (dry weight basis) of putrescible matter.

1.5.1 Residue Quality and Regulatory Program Requirements

Fly ash from air pollution control equipment and boiler bottom ash may both contain heavy metals. Previous studies have indicated that boiler bottom ash metal concentrations can be expected to be less than RCRA defined hazardous waste levels; however, fly ash analyses have indicated that metal levels may exceed RCRA defined hazardous waste levels.

The Contractor may be required to characterize the ash residue as hazardous or non-hazardous based on RCRA criteria in 40 CFR Part 261. The most critical criterion will be the toxicity of the residue, as determined by an EP toxicity test. If the residue is found to be non-hazardous, State sanitary landfill criteria and County regulations will apply to the disposal of the residue. Procedures provided in 40 CFR 241, Guidelines for Land Disposal of Solid Wastes, should also be considered. If the residue is determined to be hazardous, provisions found in Chapter 17-7 FAC and in RCRA regulations will apply to the generation, transport and disposal of the hazardous residue. The Contractor is encouraged to consider process alternatives, such as mechanical mixing of boiler bottom and air pollution control device ash as an integral part of the process, which may result in the formation of non-hazardous residuals.

1.6 Environmental Testing

During trial operation of the constructed Project, the Contractor will be required to conduct tests to verify compliance with existing regulatory requirements and permit conditions.

1.7 Environmental Performance Guarantees

The Contractor shall guarantee that during construction, start-up, testing, and operation that all Federal, State, County, or local environmental laws and regulations in effect as of June 30, 1983, or later if adjusted in accordance with the Contract Agreement (including conditions pursuant to permits received specific to the Project) will be met and adhered to. Such guarantee is subject to demonstration through Acceptance Testing, as set forth in Section 3 of Appendix A, prior to the Actual Acceptance Date being reached.

TABLE B-5

SANITARY LANDFILL DESIGN AND OPERATION GUIDELINES

<u>Item Description</u>	<u>Regulation</u>	<u>Comments</u>
1. Surface and Groundwater Contamination	Leachate control is required where water table is less than 5 feet below ground surface or within 500 feet of a water supply well. Surface runoff collection, control and treatment shall be provided for. Landfills shall not be located in areas of frequent and periodic flooding. Landfills shall not be within 200 feet of any water body except canals used to lower site water tables or on-site water bodies which do not discharge from the site.	The USEPA has designated the Biscayne Aquifer as a sole source water supply and no degradation is allowable. Permanent leachate control should be provided, i.e., impermeable soil layer or membrane liner with leachate recycle or treatment. Berms, dikes or ditch should be provided at toe of landfill cells. A minimum of 200 feet must be maintained between the landfill and adjacent connected water bodies.
2. Hazardous Waste Disposal	Method of disposal must be approved; determined on a case by case basis.	Wastes which cannot be rendered non-hazardous and which present a harmful condition to human health or air or water quality should not be landfilled.
3. Infectious Waste	Prohibited - must be incinerated.	Prohibited
4. Burning	No open burning of solid waste is permitted.	Prohibited

TABLE B-5
(Continued)

SANITARY LANDFILL DESIGN AND OPERATION GUIDELINES

<u>Item Description</u>	<u>Regulation</u>	<u>Comments</u>
5. Monitor Wells	At least 3 monitoring wells shall be constructed and sampled in accordance with EPA/530/SW-611. One well shall be upgradient of the site, one well at the downstream boundary of the site and one at the downstream boundary of the first cell filled. Background water quality data shall be recorded.	Three wells is a minimum for a Class I landfill. Additional wells may be required by the DER dependent on actual design, operation and hydrogeologic conditions.
6. Initial Cover	Site shall receive an initial cover (6 inches of compacted soil) at the end of working day.	All solid waste on the site should be covered daily with 6 inches of compacted soil.
7. Solid Waste	Scales or volume estimates are required with quantitative records available to DER upon request.	Scales should be provided at high volume landfills (greater than 50 TPD).
8. Working Face	The working face shall be kept as narrow as is consistent with proper operation of equipment and to minimize exposed areas.	Provisions should be made signs to limit the areas where waste is discharged, spread and compacted to 100 feet or less.
9. Attendant	An attendant shall be on site during landfill hours of operation.	Supervisory personnel and a trained equipment operator should be in attendance during hours of operation.
10. Fire Protection	Adequate fire protection facilities shall be provided.	Earth stockpiles and adequate water supplies should be available on site.

TABLE B-5
(Continued)

SANITARY LANDFILL DESIGN AND OPERATION GUIDELINES

<u>Item Description</u>	<u>Regulation</u>	<u>Comments</u>
11. Access Road	An all weather access road shall be provided.	A minimum 24 foot wide, permanent paved road from the public thoroughfare to and around the work area should be provided.
12. Potable water supply, employee shelter, hand-wash and toilet facilities, electric service, equipment washout facilities	Encouraged but not required.	All recommended.
13. Communication Facilities	Required.	Telephone service should be provided.
14. Equipment and reserve equipment	Required.	Required.
15. Dust Control	Provisions for dust control shall be provided such as approved chemicals, oils, or water sprays.	Dust control material should be readily available.
16. Litter Control	Portable fences shall be provided.	Portable fences should be provided at the working face.
17. Scavenging	Must be controlled by local facility authority.	No unsupervised scavenging should be permitted.
18. Pesticides	Vector control shall be provided pursuant to Chapter 5E-2 FAC of the Florida Department of Agriculture and Consumer Services.	A schedule of insect and rodent control should be provided by a contracted exterminator.

TABLE B-5
(Continued)

SANITARY LANDFILL DESIGN AND OPERATION GUIDELINES

<u>Item Description</u>	<u>Regulation</u>	<u>Comments</u>
19. Aesthetics	Screening must be provided where practical for a landfill in view of a major public thoroughfare.	A vegetation buffer zone of 100 feet (or grass covered berm) should be provided on the site perimeter.
20. Special Waste Handling	Waste sludges shall be accepted only where alternate disposal methods are not available and when such disposal does not violate the regulations.	Municipal sludges should only be accepted on an emergency/ interim basis.
	Abandoned vehicles may only be stored temporarily.	Arrangements must be made for frequent removal to an automobile recycler.
	Milled solid waste without daily soil cover may be acceptable, contingent on conditions.	Requires milling facility and all leachate control and operation conditions listed above.
21. Landfill Liner	Permeability of Class I landfill liner must be 1×10^{-7} cm/sec or less.	A natural clay or synthetic liner with a permeability of 1×10^{-7} cm/sec must be provided.
22. Proximity to Airports	Landfill should not be located within 10,000 feet of closest point of any runway at a State licensed airport used for turbo-jet aircraft or within 5,000 feet of a runway used for piston engine type aircraft unless FAA or DER approve.	Minimum required distances must be maintained.

**SUMMARY UPDATE OF RESEARCH PROJECTS WITH INCINERATOR
BOTTOM ASH RESIDUE**



**Summary Update
of
Research Projects
with
Incinerator Bottom Ash Residue**

**COMMONWEALTH OF MASSACHUSETTS
Executive Office of Environmental Affairs
Department of Environmental Management
Bureau of Solid Waste Disposal
Boston, Massachusetts 02202**

FEBRUARY 1982

Governor Michael S. Dukakis

Secretary of Environmental Affairs James S. Hoyte

NUMBER 3

SUMMARY UPDATE OF RESEARCH PROJECTS WITH RESCO INCINERATOR RESIDUE

1977-1981

The INTERIM REPORT, already in the possession of the Department of Environmental Quality Engineering carries the work through July 1979. Since then work with RESCO incinerator residue has taken the following several directions:

- A. Continuing evaluation of potential ash/wetland interaction, including:
 - 1) heavy metal monitoring of ground water
 - 2) heavy metal monitoring of soils beneath and downstream of residue piles
 - 3) investigation of residue impact on wetland soil algal populations
 - 4) investigation (bi-yearly) of residue impact on higher plant populations
- B. Leaching studies have been continued and expanded to include soil/residue mixtures in addition to preliminary residue leachate studies.
 - 1) event monitoring of rainfall
 - a) amount
 - b) pH
 - c) chemical analysis (heavy metals)
 - 2) event monitoring of leachate from residue and residue/soil columns
 - a) pH
 - b) soluble salts
 - c) chemical analysis (heavy metals)

RESULTS

Briefly, the results of these various studies to date are as follows (by number category)

- A. 1) No additional contamination of ground water from residue heavy metals has been observed to date.
- 2) No significant increase in heavy metal concentrations has been found in soil beneath the residue piles. A significant increase in soil Pb has been observed in the wetland soils immediately adjacent to the residue pile.

There has been no significant increase in the concentration of any other trace heavy metals measured. (Cd, Zn, Ni, Cu, Cr.)

- 3) No deleterious impact on the soil algae has been observed (See paper by Mika).
- 4) No deleterious impact on wetland higher plants has been observed as of summer '79. (See abstract)

B. 1) event monitoring of rainfall

- a) the amount of rainfall passing through the leaching columns of pure ash residue has been 360,000 ml to date. (Represents about 60 inches of rainfall).
 - b) the mean pH value of rainfall to date is 4.0
 - c) chemical analysis of the rainfall events to date indicate that only Pb is present in appreciable amounts in the wet precipitation falling on the Waltham collection station.
- 2) event monitoring of the leachate from residue and residue/soil columns
- a) pH of pure residue leachate to date continues to range between 7.6 - 8.2. Mean is 7.9.
 - b) pH of residue/soil or soil/residue leachates range between 5.7 - 7.7 and 7.5 - 8.2 respectively. pH of soil leachate ranges between 5.8 - 7.1.
 - c) soluble salts are all below 100.
 - d) Mean heavy metal content in leachates are as follows:
(all concentrations are in PPM)

	<u>Pb</u>	<u>Ni</u>	<u>Cd</u>	<u>Cu</u>	<u>Cr</u>	<u>Zn</u>
Residue	0.18	0.07	0.006	0.027	0.037	0.07
Soil	0.19	0.03	0.006	0.03	0.035	0.05
Residue/soil	0.32	0.04	0.006	0.025	0.035	0.075
Soil/residue	0.375	0.07	0.008	0.025	0.035	0.105
Rain	0.173	0.038	0.013	0.023	0.03	0.05

CONCLUSIONS

The data indicate that the incinerator bottom/fly ash mix (residue) is highly buffered; that the buffering capacity is massive and persistent; that heavy metals are chemically bound in the residue matrix, and that the residue can raise the pH of leaching acid rainwater from 4.0 - 7.8 without a concomitant release of heavy metals into the leachate. The data to date suggest that incinerator residue (bottom/fly ash) might be used as a landfill and may improve landfill management by buffering acid rain percolating through the landfill, thereby reducing the leaching of heavy metals from the residue as well as from other metal-containing materials which might be present in the landfill. Growth of a grass cover crop on the residue surface presents no problems in the greenhouse or in the field.

Respectfully submitted:

William A. Feder

William A. Feder
Professor

Date 2/18/82

Jane S. Mika

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The Commonwealth of Massachusetts
Department of Environmental Quality Engineering

Water Supply Analysis (mg. per liter)

Waltham

Source A Bottom Ash Area - Location #8A

Collector: Grozan & McKay

Source B #83

Source C #8C

Source D #9A

Source E #9B

Source F #9C

	A	B	C	D	E	F
Sample No.	543480	481	482	483	484	485
Date of Collection	8/9/77					
Date of Receipt	3/31/77					
TURBIDITY	0.7	2.4	2.2	0.9	0.6	4.6
SEDIMENT	0	1	---	0	0	heavy
COLOR	0	20	100	0	10	20
ODOR	0	0	---	0	0	35
pH	7.8	7.9	7.9	7.8	7.7	7.1
ALKALINITY-Total(CaCO ₃)	31	31	38	32	36	36
HARDNESS(CaCO ₃)	70.	70.	39.	67.	74.	35.
CALCIUM(Ca)	20.	19.	10.	20.	10.	10.
MAGNESIUM(Mg)	4.8	6.0	3.3	4.0	6.5	2.5
SODIUM(Na)	7.2	7.5	7.0	8.0	7.0	8.0
POTASSIUM(K)	1.7	2.5	1.5	1.7	1.5	2.0
IRON(Fe)	.03	.45	1.5	.05	.05	.70
MANGANESE(Mn)	.18	.10	.01	.35	.05	.02
SILICA(SiO ₂)	12.	13.	27.	14.	16.	26.
SULFATE(SO ₄)	27	36	1	27	36	2
CHLORIDE(Cl)	21.	18.	19.	21.	19.	14.
SPEC.COND.(micromhos/cm)	184	184	---	172	185	116
NITROGEN(AMMONIA)	.01	.01	.11	.07	.02	.16
NITROGEN(NITRATE)	1.6	0.0	0.1	1.4	0.8	0.0
NITROGEN(NITRITE)	.002	.000	.021	.003	.003	.000
COPPER(Cu)	.00	.00	.00	.00	.00	.00

A SUMMARY OF RESEARCH CONDUCTED AT THE SUBURBAN EXPERIMENT STATION OF THE UNIVERSITY OF MASSACHUSETTS IN COOPERATION WITH THE BUREAU OF SOLID WASTE MANAGEMENT, THE DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING, THE DEPARTMENT OF PUBLIC WORKS, AND THE RESCO INCINERATION FACILITY, TO EVALUATE THE ENVIRONMENTAL IMPACT AND UTILIZATION OF INCINERATOR RESIDUE

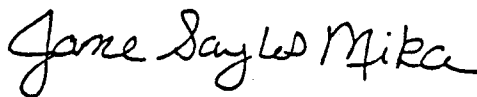
Progress Report 1977-1981

Submitted to the Bureau of Solid Waste Management

Suburban Experiment Station
University of Massachusetts



William A. Feder
Professor



Jane Sayles Mika
Research Associate

RESEARCH OVERVIEW

The research conducted over the past several years through the cooperative efforts of the University of Massachusetts and the following state agencies: BSWM, DEQE, & DPW, has been unique in scope and nature. The characterization and potential utilization of incinerator residues is becoming increasingly necessary with the realization that: 1) land available for waste disposal is decreasing, 2) regulations implemented to govern waste disposal are stringent and complex, and 3) the need for alternative energy sources is imperative. Incineration of municipal refuse addresses points 1 and 3 above, however the by-products of this technology, including both fly ash and bottom ash, may impede progress due mainly to lack of information, and questionable regulation. The purpose of the studies being conducted at the Suburban Experiment Station is to supply the information needed to properly regulate incineration by-products so that refuse incineration may not be wrongly sequestered.

The several studies described in this report were designed to assess the direct and indirect interaction of incinerator residues with the natural environment. Direct effects include acute effects on indigenous and introduced plant species, metal uptake, and groundwater pollution. Indirect effects may include chronic effects on plant growth and reproduction, disturbance of plant community stability, and soil erosion. Quantifying impacts in the natural environment necessitates collection of data over time. The length of time necessary to measure these impacts is presently unknown. The data collected from the long-term projects at Waltham and North Andover will be invaluable for providing components with which models may be designed to predict heavy metal movement through ecosystem compartments. Since the initial expenditures have been made, these projects should continue to be supported by the state, at a reasonable cost, for at least 5 more years, so that the time and effort to date will not have been wasted.

Incineration of solid waste is gaining popularity and support. Massachusetts is currently closing many existing landfill disposal sites and disposal alternatives must be properly assessed and implemented. Incineration of municipal refuse not only drastically reduces refuse volume, but can also provide resources for land reclamation (reducing our reliance on valuable top soil), road construction (creating a possible market for aggregate substitute) and energy alternatives. Other states are now looking to Massachusetts for support and information with which they may justify or expand refuse incineration. Any support must be based on sound information regarding both the practicality and safety of residue utilization. Massachusetts is currently the forerunner in this type of research. This unique position should not be lost.

TABLE OF CONTENTS

	Page
INTRODUCTION AND PURPOSE	1
EXECUTIVE SUMMARY	2
WETLAND STUDIES	6
Groundwater	9
Soil	15
Higher Plants	26
Soil Algae	32
Discussion	39
LEACHING STUDIES	40
HORTICULTURAL STUDIES	47
Greenhouse Raised Benches	47
Turf Plots	47
Pot Studies	54
SUMMARY AND RECOMMENDATIONS	57

INTRODUCTION AND PURPOSE

The recovery of useful energy from solid wastes can be achieved through incineration of these wastes using a variety of technologies developed in Europe. The vanRoll and the Martin Moving Grate systems are two that are being adapted for use in the U.S. Another type of technology, not considered in this report, produces a solid or liquid fuel from the waste and this fuel is then distributed to the final consumer.

The system considered in this report, converts solid wastes to heat which in turn converts water to steam. The steam is piped to a nearby consumer, and the waste steam and excess heat is recycled to maintain the system temperature. Waste gases and particulates are scrubbed from the stacks and, in the system under discussion, these fly ash components are combined with the heavier bottom ash residues to produce an ash residue which constitutes the unburnable portion of the waste feed stock. The mixed ash residue is cooled by quenching in lime water and then graded to recover ferrous metals and other materials of possible commercial value. The final product is a heterogeneous mixture of carbonaceous and siliceous matter, metal oxides, plus a certain percentage of fine particulates which represent the fly ash component of the burning process.

In Massachusetts, incinerator residue is currently regulated as a solid waste. These regulations prohibit marketing and place restrictions on disposal of the residue. This limits the economic potential of a waste disposal technology that may 1) limit biological contamination from municipal landfills by a reduction in percent organic matter; 2) reduce the amount of land needed for waste disposal, and 3) increase regional energy supplies by utilizing waste steam for cogeneration. Variances to reclassify the residue will not be issued by state regulatory agencies until it has been determined that the residue is nonpolluting.

The paucity of suitable landfill sites coupled with the economic benefits accruing from possible commercial uses of the ash have prompted these studies which attempt to describe and quantify the effects of this metalliferous residue on the integrity of the environment. The metals of concern are among those elements considered as potential toxins in water supplies, and either primary or secondary standards have been established for all but nickel. Though heavy metals are also present in untreated refuse, it is the relatively greater concentration of metals in residue landfilling that increases the pollutant potential of the residue.

If it can be shown that land application of the residue exerts a minimal impact on the environment, and that residue metals will not contaminate the groundwater, then it would be possible to reclassify the residues to allow for commercial marketing, and enhance the resource recovery process by transforming nearly 100% of the initial raw waste into useful products or available energy. The background, methods and results of the several integrated research projects undertaken to demonstrate and quantify the environmental impact and market potential of RESCO incinerator ash residue are described in the body of this report.

EXECUTIVE SUMMARY

The following summary outlines the scope of research undertaken at the Suburban Experiment Station, University of Massachusetts, on municipal incinerator residue from the RESCO incinerator, Saugus, Mass. The outline and following report describe several field and laboratory studies conducted during the period 1977 to 1981.

- A. Evaluation of potential residue/wetland interaction, including:
 - 1) heavy metal monitoring of groundwater
 - 2) heavy metal monitoring of soils
 - 3) investigation of residue impact on higher plant populations
 - 4) investigation of residue impact on soil algal populations
- B. Leaching studies involving acid rain deposition on residue and soil-residue mixtures
 - 1) event monitoring of rainfall, including:
 - a) amount
 - b) pH
 - c) chemical analysis (heavy metals)
 - 2) event monitoring of leachate from residue and soil/residue columns, including:
 - a) pH
 - b) soluble salts
 - c) chemical analysis (heavy metals)
- C. Evaluation of residue as a horticultural medium
 - 1) greenhouse studies on raised benches, including:
 - a) grasses
 - b) flowering plants and vegetables
 - c) "roadside" simulation
 - 2) turf plots
 - 3) pot studies to identify horticultural potential by examining:
 - a) growth, vigor and flower production
 - b) metal uptake

RESULTS

Briefly, the results of these various studies to date are as follows:
(by letter, number category)

- A. 1) No additional heavy metal contamination of groundwater from residue landfill has been observed to date.
- 2) Of the six heavy metals monitored (Pb, Cd, Zn, Ni, Cr and Cu), only lead (Pb) was found to have increased significantly in soil adjacent to the residue landfill one year following residue deposition.
- 3) No deleterious impact has been observed on the wetland higher plant community.
- 4) No deleterious impact was observed in the soil algal community.
- B. 1) event monitoring of rainfall
- a) The amount of rainfall passing through leaching columns of pure residue has been 360,000 ml to date (represents about 60 inches of rainfall).
- b) The mean pH of rainfall to date is 4.0.
- c) Chemical analysis of the rainfall events to date indicate that Pb may be the only metal present in appreciable amounts in the wet precipitation falling on the Waltham collecting station.
- 2) event monitoring of leachates
- a) The pH of pure residue leachate to date continues to range between 7.6 and 8.2. Mean pH is 7.9.
- b) The pH of residue/soil or soil/residue leachates range between 5.7 to 7.7 and 7.5 to 8.2 respectively. Soil leachate pH ranges between 5.8 and 7.1.
- c) Leachate soluble salts are all below 100.
- d) Mean heavy metal content in leachates are as follows:

	<u>Pb</u>	<u>Ni</u>	<u>Cd</u>	<u>Cu</u>	<u>Cr</u>	<u>Zn</u>
Residue	0.18 ^{1/}	0.07	0.006	0.027	0.037	0.07
Soil	0.19	0.03	0.006	0.03	0.035	0.05
Residue/soil	0.32	0.04	0.006	0.025	0.035	0.075
Soil/residue	0.375	0.07	0.008	0.025	0.035	0.105
Rain	0.173	0.038	0.013	0.023	0.03	0.05

^{1/} all concentrations in p.p.m. (parts per million)

C. 1) Greenhouse studies

- a) Flooding the raised beds with tap water reduced the pH to 7.2 and soluble salts to below 100. Both annual and perennial rye grasses grew well directly on the bare residue.
- b) Residue supported the growth of lettuce, corn, tobacco, geraniums, marigolds, zinnias, petunias, chrysanthemums, narcissus, and daffodils. All plants grew normally on the residue, produced normal flowers, fruit and seed where applicable.
- c) Grass grew equally well on the residue hillside, and the soil below. Analysis showed that minimal heavy metal leaching occurred vertically through the residue, but heavy metals were not detected in the runoff.

2) RESCO residue proved suitable as a subsoil layer for turf construction.

3) Pot studies

- a) All plant species grown produced a commercially acceptable crop utilizing an incinerator residue medium.
- b) Heavy metal uptake indicated that an insignificant portion of the heavy metal load in RESCO residue is "available".

CONCLUSIONS

A. Wetland/Incinerator Residue Interactions

Following 15 months of wetland/incinerator residue interaction, the accumulated chemical and biological data indicate that heavy metals have not leached (with the possible exception of lead), and/or are not available in quantities sufficient to disturb the structure of the wetland plant communities. The pollutant/ecosystem interaction represents one in which the soils (or biota) are acting as unaffected sinks (Class I), due to the possible accumulation of lead. There is not sufficient evidence at this time to predict future impacts. The indication of lead mobility, however, warrants the continued monitoring of all ecosystem compartments.

B. Leaching Studies

Extensive leaching studies with natural rain have revealed no significant losses of heavy metals from the residue in spite of a mean rainfall pH of 4.0. The residue has a high buffering capacity which has persisted undiminished for over 3 years, during which time about 360,000 ml (60 inches) of rain has passed through the residue.

C. Horticultural Studies

RESCO residue is an excellent medium for growth of turf and horticulturally valuable plant materials such as bedding and pot plants like chrysanthemums, poinsettias, geraniums, bulb plants etc. Mixtures containing RESCO residue, peat, and soil perform as well as commercial soil mixes and several soilless potting media.

RESCO residue will also perform well as a subsoil for building golf courses and as fill for grading highway slopes and median strips. After two years' contact with soil and cropping with a variety of plants, the RESCO residue takes on the character of a loose, granular soil-like material which drains well, is easy to work, and is quite resistant to erosion from wind or water.

RECOMMENDATIONS

The data indicate that incinerator bottom/fly ash mix (residue) is highly buffered; that the buffering capacity is massive and persistent; that heavy metals are chemically bound in the residue matrix, and that the residue can raise the pH of leaching acid rainwater from 4.0 - 7.8 without a concomitant release of heavy metals into the leachate. The data to date suggest that incinerator residue (bottom/fly ash) might be used as a landfill and may improve landfill management by buffering acid rain percolating through the landfill, thereby reducing the leaching of heavy metals from the residue as well as from other metal-containing materials which might be present in the landfill. Growth of a grass cover crop on the residue surface presents no problems in the greenhouse or in the field.

WETLAND STUDIES

Introduction

The mobility and availability of residue heavy metals in the terrestrial environment are the problems addressed in the following research. Mobility is the movement of materials both from the source and through ecosystem compartments. Availability is the efficiency with which the materials enter biological systems. Both parameters should be integral components in the classification of potentially hazardous wastes. Current federal regulations designed to test for leachate toxicity are limited in their scope to criteria established for drinking water supplies. Criteria for terrestrial ecosystems have yet to be addressed by regulatory agencies. Incinerator residues and sewage sludges (both potential sources of toxic metals) are often land applied. Heavy metals, if released through leaching, may be effectively filtered out by soils, which are the primary sink for metallic cations. Because soils are also the primary sink for excess acidity, (exacerbated through acid precipitation), heavy metals, being more mobile in acid environments, may be initially bound by soil organics and later released due to increasing soil acidity.

In order to assess the impact of residue landfilling, a long term field study was initiated in the spring of 1978 with the disposal of incinerator residue adjacent to a freshwater wetland. In addition to monitoring heavy metal mobility in soil and groundwater, metal availability and toxicity were assessed through repeated sampling of the plant communities over time and distance from residue deposition.

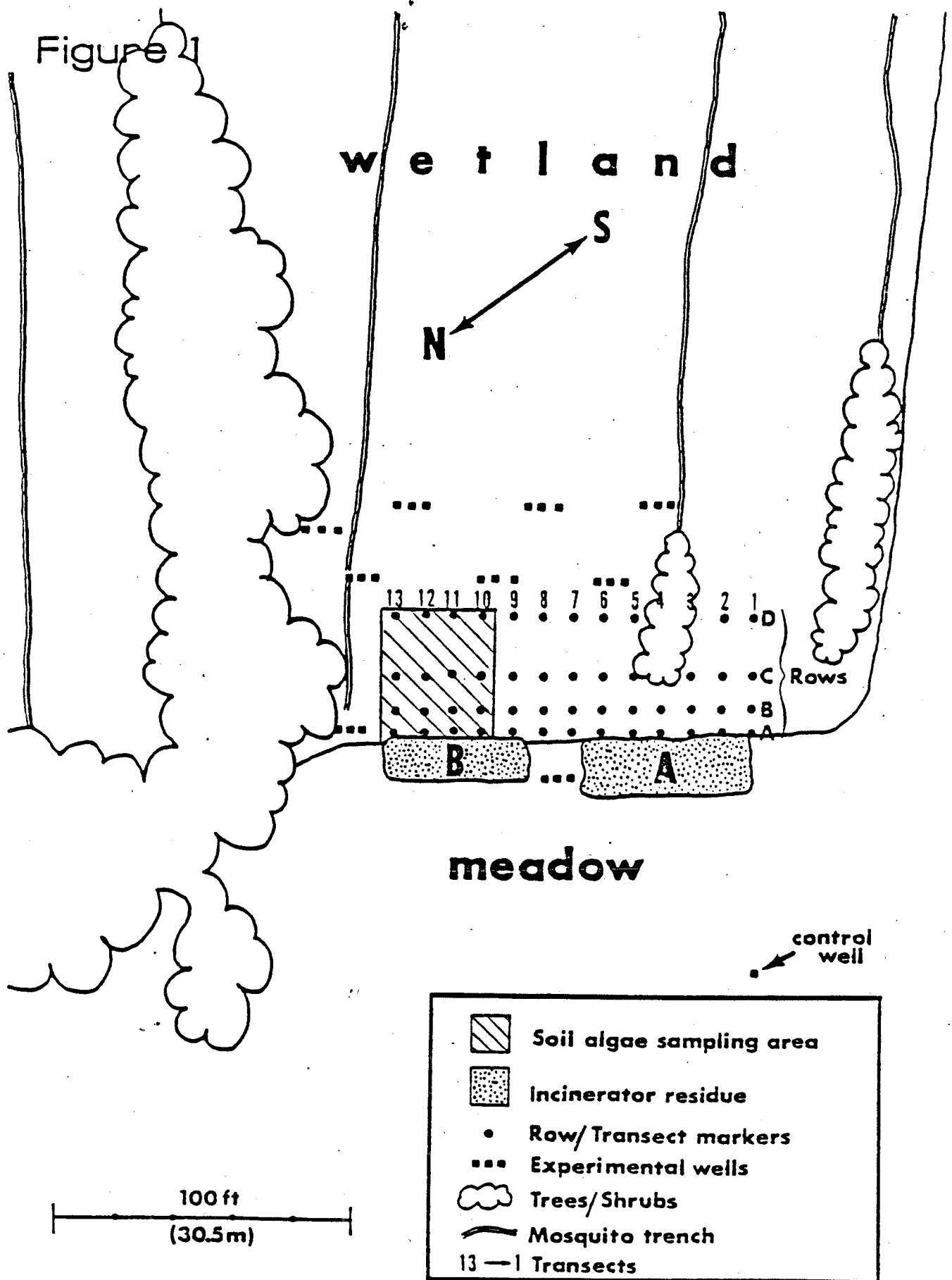
Description of Study Site

The experimental site encompasses approximately 484m^2 (5200ft^2) along the border of a wetland located on the property of the University of Massachusetts Agricultural Experiment Station, Waltham, Mass. (Figure 1.) The site is transversed by 13 line transects, at 3.05 (10 Ft) intervals, which extend approximately 12.2 m (40 ft) into the wetland. These permanent transects were established in 1977 and continue to serve as sampling locations for soils, herbaceous plants, and algal communities. The predominant wetland soil types are peat and muck, intermixed and underlain with sand and gravel. A layer of till or bedrock is encountered approximately 7.6m (25 ft) below the surface. Flooding normally occurs only in the spring and winter, though standing water may persist through the summer months in semi-permanent pools and mosquito trenches. Twenty seven wells are located at various depths and distances into the wetland for groundwater monitoring. A "control" well is located upland from the wetland.

In June, 1978, two 30m^3 volumes of incinerator residue were deposited in the meadow, along the northeast border of the wetland, adjacent to the experimental site. At one location the residue was laid over the existing groundcover. At the second location, the residue was deposited to a depth of 0.6 m (2 ft) and brought up to grade

Figure 1. Map of wetland and experimental site. Row/transect markers designate soil and vegetation sampling locations. Incinerator residue at site "A" was deposited over existing groundcover; residue at site "B" was deposited to a depth of 0.6m (2 ft), and brought up to grade. Higher plants were sampled along the 13 transects at rows A, B, C & D. Soil and soil algae were sampled within the hatched area (transects 10-13). Groundwater was sampled at 3 depth in each of the well locations.

Figure 1



Groundwater

Groundwater samples were collected and analyzed by cooperating state agencies. The well locations are included in Figure 1. Samples were analyzed for various chemical constituents including Pb, Cd, Cr, Ni, Zn, and Cu. Samples from the 27 experimental wells were not significantly different in metal concentrations and, therefore, data were averaged for the present analyses. Over a two year period, ten groundwater collections were made: two prior to the residue deposition (10/77 and 4/78); three following residue deposition in 1978 (5/78, 7/78, and 12/78); and five in 1979 (5/79, 6/79, 7/79, and 9/79, and 11/79). For analysis, these collections were grouped into three collection periods: "Pre-ash"; "1978 Post-ash"; and "1979". The grouping facilitated statistical analysis and should have reduced the standard error of analysis over time.

Kruskal-Wallis one-way ANOVA was used to test for differences in metal concentrations over space (wells # 2 through # 10) and over time (pre-and-post ash collection periods). Metal concentrations from the experimental wells (#2-#10) were also compared to those from the control well (# 1) to factor in normal fluctuations in groundwater.

The results of k-sample testing (Kruskal-Wallis one-way ANOVA) of metal concentrations in groundwater over space (wells # 2 through # 10) and over time ("pre-ash", "1978 post-ash", and "1979") are presented in Table 1. With the exception of cadmium, the probability of such levels occurring over space exceeded 70 percent, and, therefore, the variations were not significant. (The range of probability for cadmium was between 20 and 30 percent, also insignificant.) Thus, the spacial distribution of wells, relative to the residue landfill, was not a factor in heavy metal distribution in groundwater during the two year collection period (10/1977 through 11/1979).

The concentrations of Pb, Cd, Cr, and Ni from the experimental wells did, however, differ significantly over time. The heavy metal concentrations in the "control site" (well # 1, located upland from the residue) were equal to, and often exceeded those from the experimental wells (Figures 2 and 3). These significant changes in the levels of Pb, Cd, Cr, and Ni may have been the result of normal yearly fluctuations, or the standard error of analysis.

Primary drinking water standards were either equalled or exceeded for lead, chromium and cadmium in both experimental and control wells (Figure 2). The current secondary standards for zinc and copper are 5 ppm and 1 ppm respectively; there is currently no standard for nickel.

The heavy metal concentrations in groundwater varied significantly only over time (as did soil metals) and, therefore, these variations may have been partially a result of the standard error of analysis. Significant differences, in groundwater drawn from "experimental" wells, were found for lead, cadmium, chromium and nickel. These metal concentrations, however, were paralleled and often exceeded by the metal concentrations from the "control" well. These data indicate that significant differences in groundwater metals were not the result of residue leaching. Because lead and cadmium concentrations in the groundwater exceeded primary drinking water standards prior to residue disposal, care should be taken to avoid additional stress on the underlying aquifer.

Table 1. Kruskal-Wallis one-way ANOVA of metal concentrations in groundwater over distance (wells # 2 through # 10) and over time ("Pre-ash", "1978 Post-ash", and "1979"). Chi-square (X^2) values and associated probabilities are presented. Significant differences are indicated by one or more asterisks over the X^2 value.

DISTANCE ANALYSES (WELLS # 2 through # 10)

	Pb	Cd	Cr	Cu	Ni	Zn
X^2	3.76	10.04	4.02	4.97	5.18	1.37
Prob.	.8<p<.9	.2<p<.3	.8<p<.9	.7<p<.8	.7<p<.8	p>.99
df=8						

TIME ANALYSES (PRE-ASH, 1978 POST-ASH, and 1979)

	Pb	Cd	Cr	Cu	Ni	Zn
X^2	11.12***	8.41**	16.13***	0.77	10.65***	5.24
Prob.	.001<p<.01	.01<p<.02	p<.001	.95<p<.98	.001<p<.01	.05<p<.10
df=2						

** = significant difference at .02
 *** = significant difference at .01

Figure 2. Lead (Pb), chromium (Cr), and cadmium (Cd) concentrations in groundwater over time. Metal concentrations for the "control well" (#1) are averaged over the 3 collection periods. Metal concentrations for the "experimental wells" (#2 through # 10) are averaged over space and time. (See text for explanation of grouping procedures.) Dashed lines indicate present drinking water standards.

Figure 2

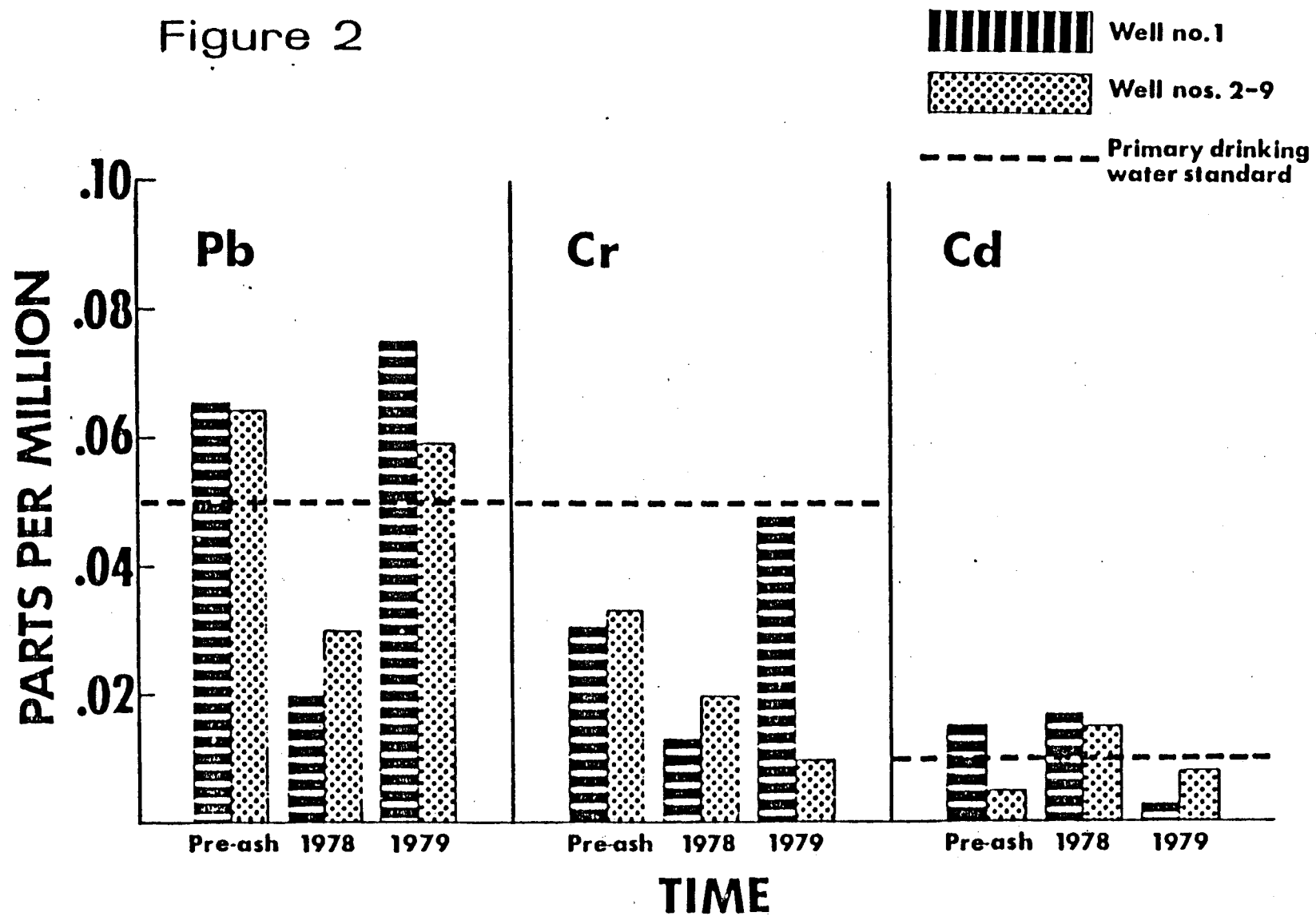
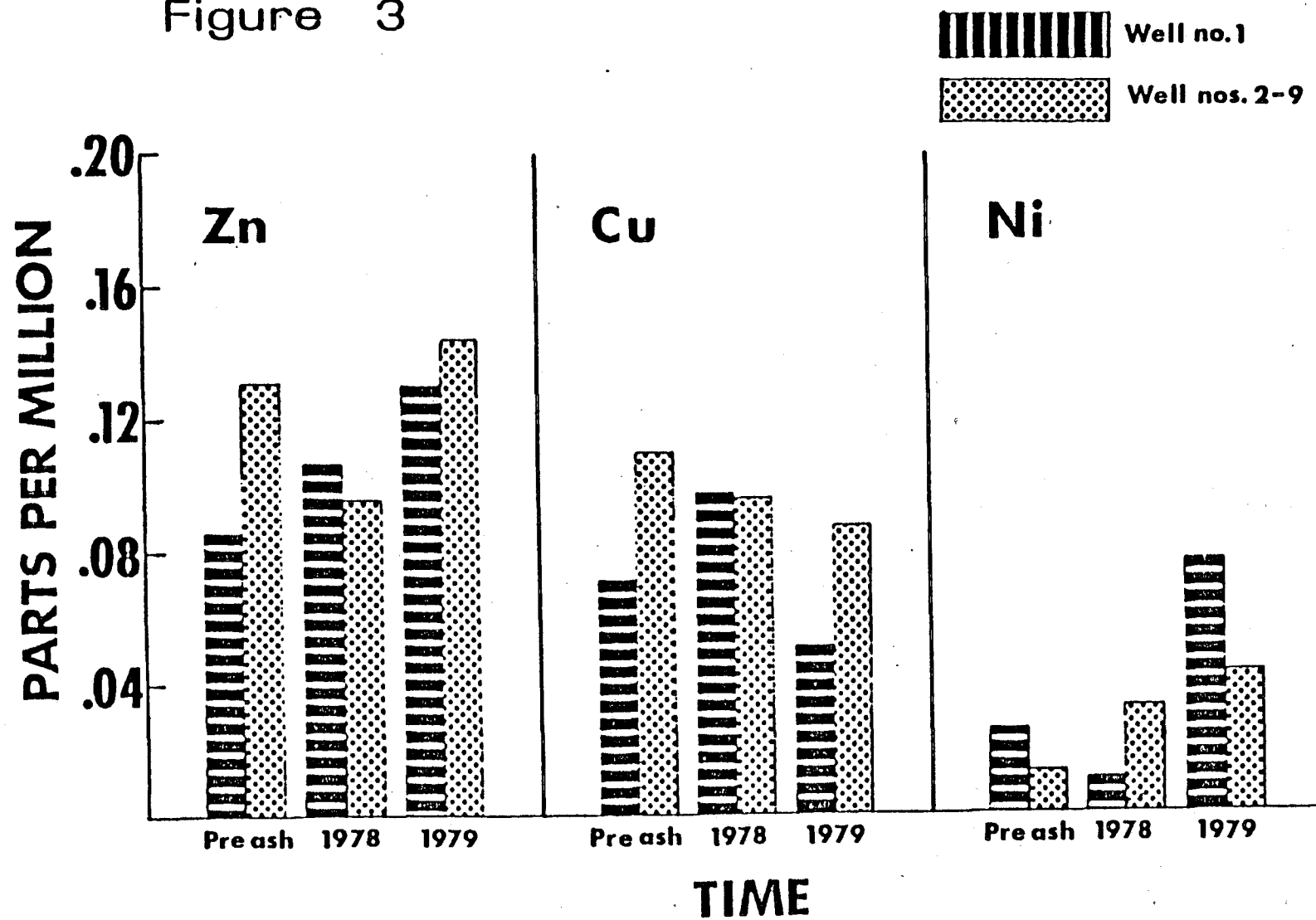


Figure 3. Zinc (Zn), copper (Cu), and nickel (Ni) concentrations in groundwater over time. Metal concentrations for the "control well" (#1) are averaged over time. Metal concentrations for the "experimental wells" (#2 through #10) are averaged over space and time.

Figure 3



Soil

Wetland soils were sampled one month (Series I, July 1978), three months (Series II, Sept. 1978), thirteen months (Series III, July 1979), and fifteen months (Series IV, Sept. 1979) following residue deposition. In addition to chemical analyses, the soils were used for the biological studies described in the following section. The procedures outlined below apply to all series.

The soil samples were taken at distances of 0m (Row A), 2.4m (Row B), 6.1m (Row C), and 12.2m (Row D) from the submerged residue (pile B) along transects numbered 10 through 13 (see Figure 1). Soil was collected to a depth of 13-18cm (after removal of the top 2-3 centimeters) at each of the 16 locations. The samples were dried at approximately 90°F for three weeks. The dry soils were thoroughly mixed and graded to uniform particle size.

Ten g of soil (1mm in diameter) from each sampling location (10A through 13D) in each experimental series (Series I through Series IV) were analyzed at the Massachusetts Department of Public Works Laboratory in Wellesley Hills, MA for the following heavy metals: lead (Pb), cadmium (Cd), chromium (Cr), copper (Cu), nickel (Ni) and zinc (Zn). Samples were analyzed using a Perkin Elmer atomic absorption spectrophotometer, model # 403. Significant differences in heavy metal concentration were tested using the Kruskal-Wallis one-way ANOVA over distance and time.

The results of soil heavy metal analyses are presented in Figures 4 through 7, for Pb, Cd, Cr, Cu, Ni and Zn respectively. Each figure presents the mean concentration (ppm) of the metal as it varied through distance and time from residue deposition. There were no significant inter-row differences in soil metals through time. All test results are summarized in Table 2.

1) Lead (Figure 4). Lead was the only metal for which there was a significant increase through time in Rows A and B only (zero to 2.4m from residue landfill). This increase, nearest the wetland/residue border, resulted in similar lead levels in all rows by Series IV.

2) Cadmium (Figure 5). Cadmium concentration throughout the wetland changed significantly through time. The statistical significance of these changes increased with distance from .05 to .01. Significant differences over time were due in part to the relatively low soil Cd concentrations detected in Series III. If these unusually low concentrations (relative to Series I, II and IV) were the result of analytical error, and consequently removed from analysis, the Cd concentrations in Row A would no longer vary significantly, and the significance of inter-series differences in Rows B, C and D would be reduced to .05, .02, and .02 respectively. The soils in all rows, with the exception of Row A, decreased in Cd concentration over time. Therefore, as with lead, the change in cadmium concentration appeared to be a function of distance from the residue (or distance into the wetland).

3) Chromium (Figure 6). Chromium concentration changed significantly over time only in Rows B and D (2.4m and 12.2m from residue deposition). The direction of change was paralleled in all rows, and levels tended to decrease over time. Due to the extreme similarity in soil concentrations over time, it is probable that the significant differences between 1978 and 1979 were partially the result of a precision error in the analyses.

4) Copper, nickel and zinc (Figure 7). There were no significant changes in the soil concentrations of these metals over time.

Table 2. Kruskal-Wallis one-way ANOVA of soil metal concentrations over distance and time. Significant differences are indicated by one or more asterisks over the chi-square (χ^2) value.

DISTANCE ANALYSES (ROWS A through D)

Series	Pb	Cd	Cr	Cu	Ni	Zn
I	4.17	3.76	1.25	3.36	1.45	4.45
II	3.06	1.64	1.84	1.80	1.31	2.47
III	3.40	4.87	1.40	7.74	5.07	0.64
IV	2.46	7.45	1.44	6.39	0.53	2.43

TIME ANALYSES (SERIES I through IV)

Row	Pb	Cd	Cr	Cu	Ni	Zn
A	12.41***	9.42*	7.65	2.37	3.95	7.10
B	12.51***	11.18**	9.99**	3.49	6.01	6.72
C	2.83	13.35***	7.57	3.57	4.33	3.46
D	1.73	13.62***	12.36***	6.06	4.09	0.59

* = significant difference at .05; df=3

** = significant difference at .02; df=3

*** = significant difference at .01; df=3

Figure 4. Lead (Pb) concentrations in soil presented as a function of time (Series I-IV) in each Row (A, B, C and D). Lead concentrations represent the mean of 4 locations/row.

Figure 4

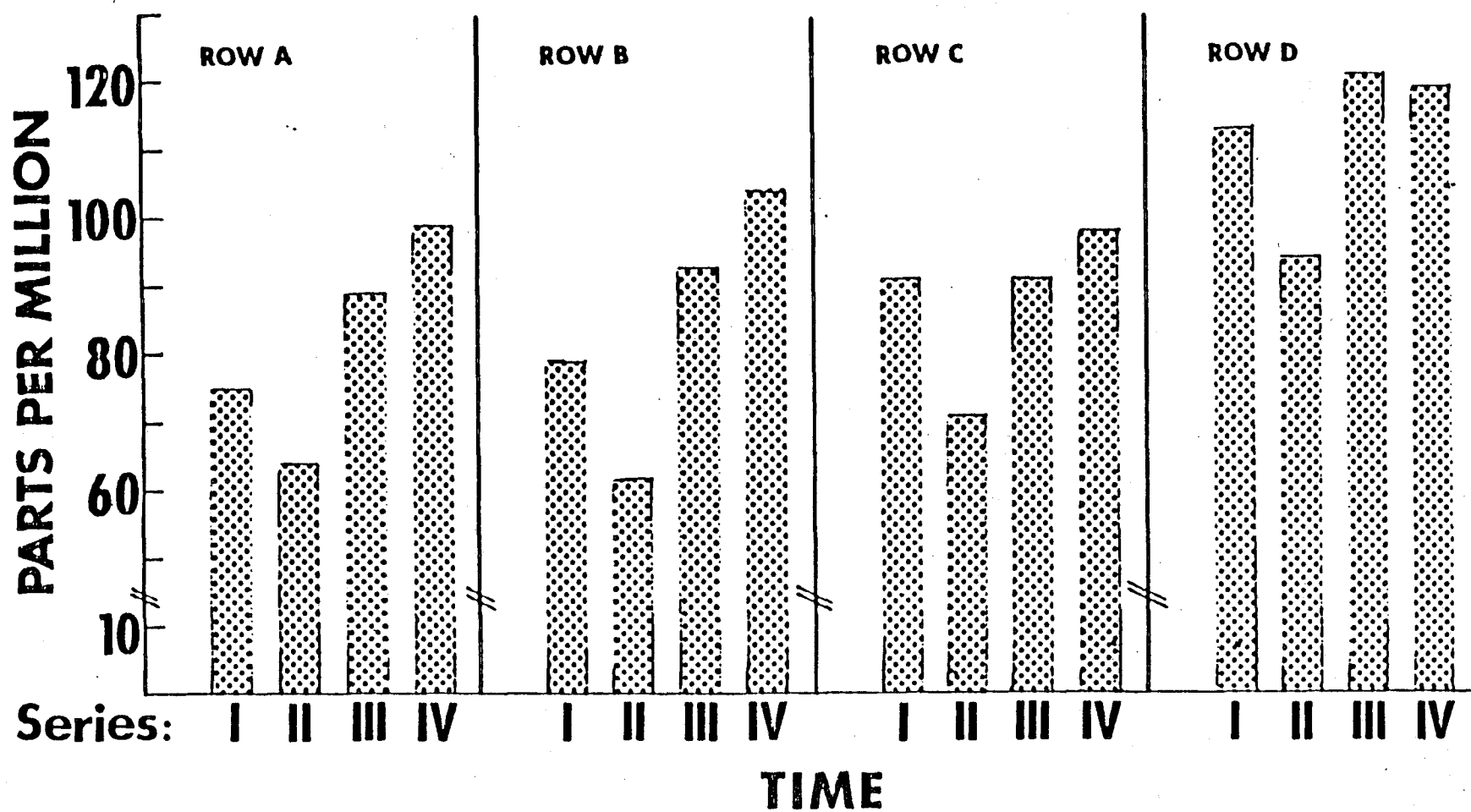


Figure 5. Cadmium (Cd) concentrations in soil presented as a function of time (Series I-IV) in each Row (A, B, C and D). Cd concentrations represent the mean of 4 locations/row.

Figure 5

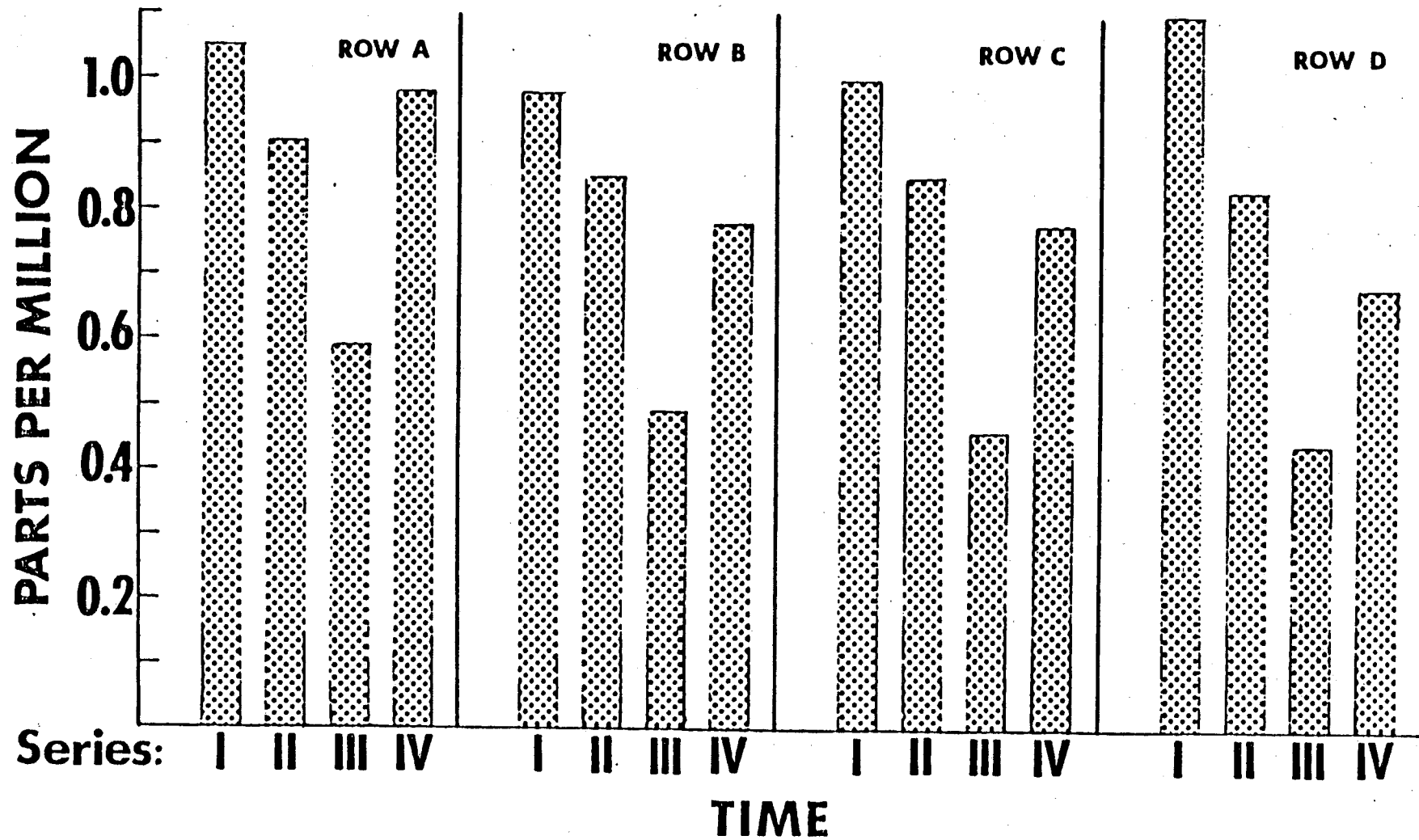


Figure 6. Chromium (Cr) concentration in soil presented as a function of time (Series I-IV) in each Row (A, B, C and D). Metal concentrations represent the mean of 4 locations/row.

Figure 6

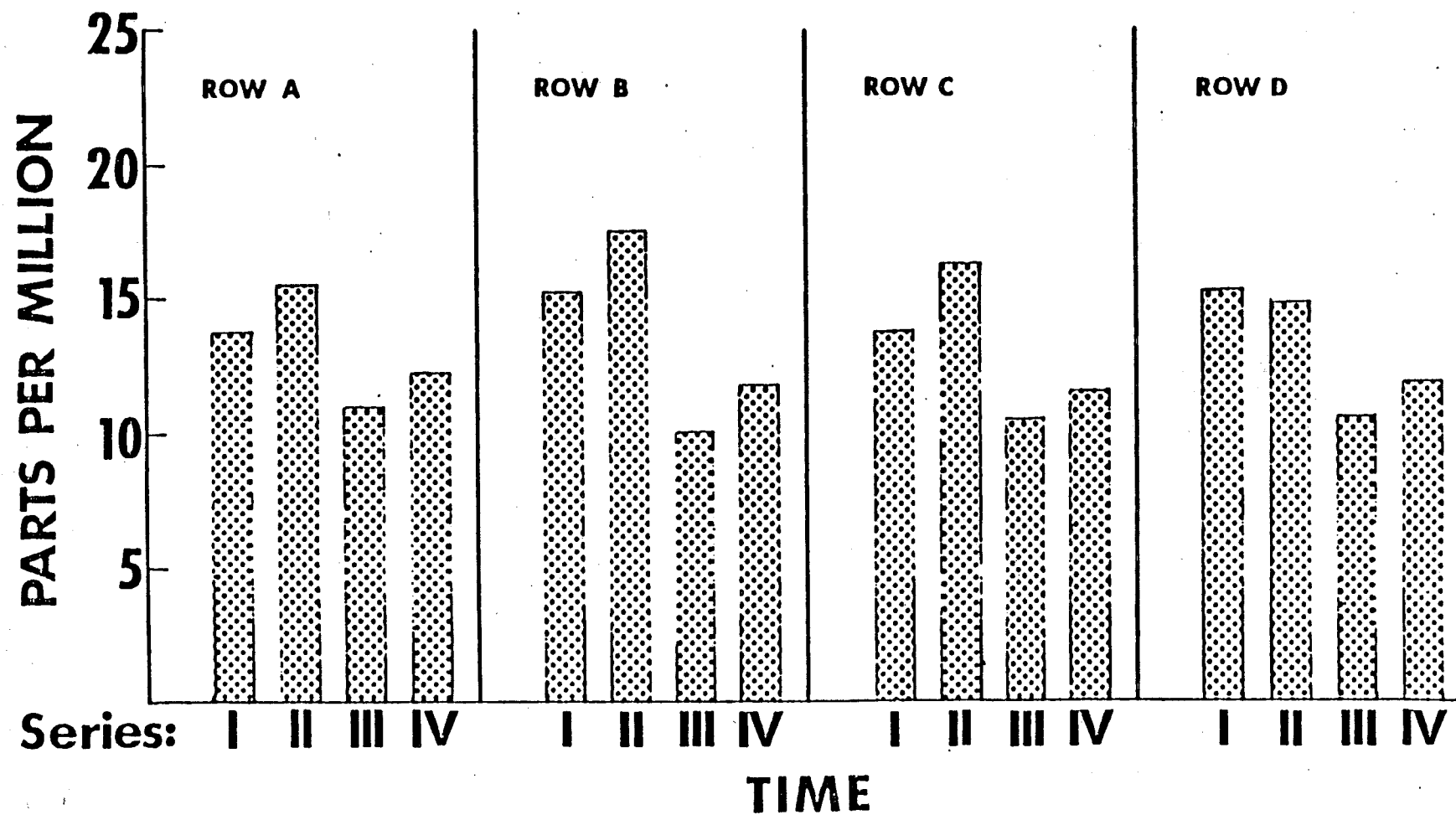
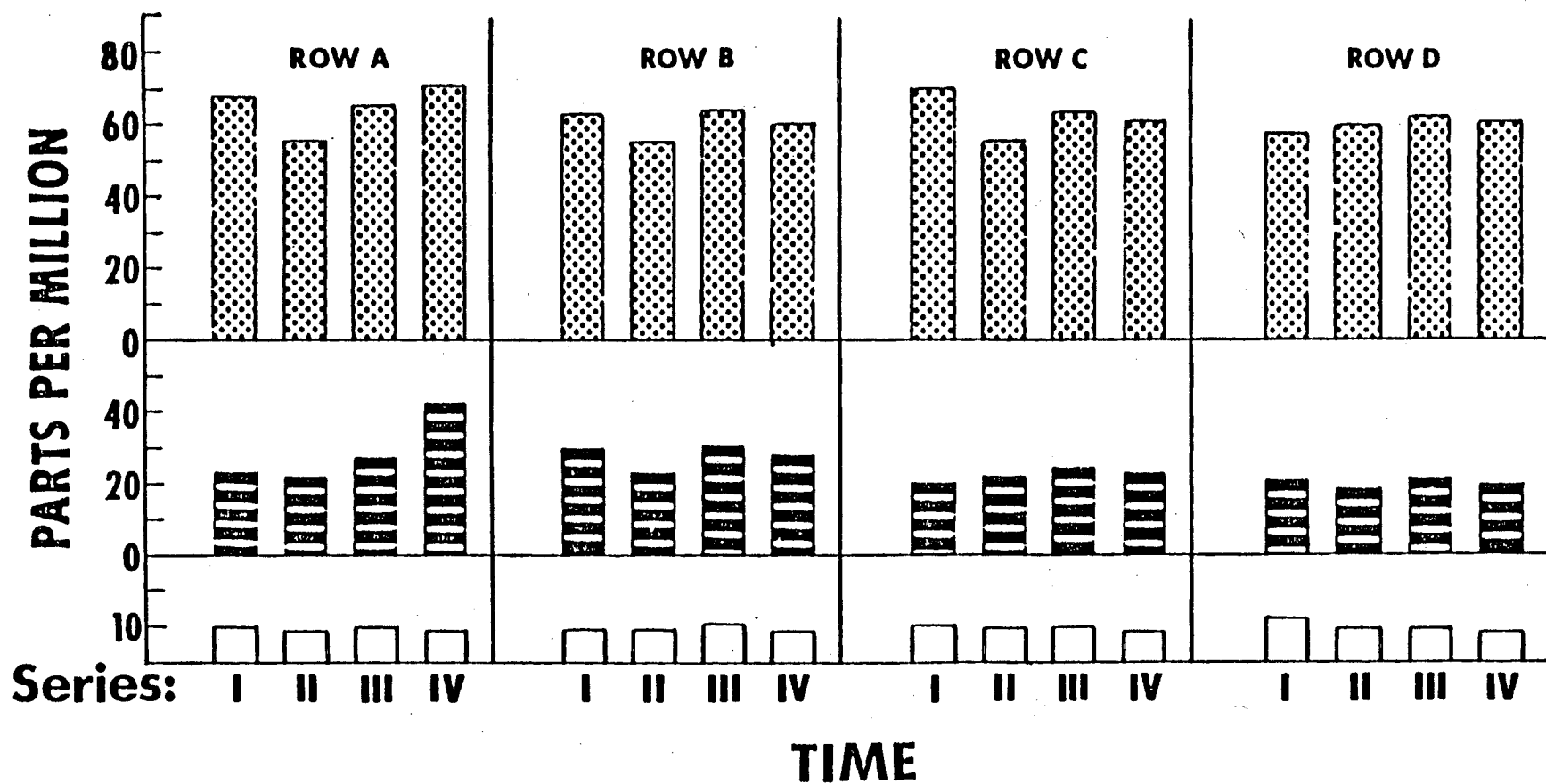


Figure 7. Zinc (Zn), copper (Cu), and nickel (Ni) concentrations in soil presented as a function of time (Series I-IV) in each Row (A, B, C and D). Metal concentrations represent the mean of 4 locations/row.

Figure 7



In summary, significant differences in soil metal concentrations were detected only when the samples were compared over time. Due to varying analytical precision (Olds [analytical chemist], pers. comm.), the significant differences observed in metal concentrations over time must be weighted with inter-row variance to detect those differences which may have been the result of a precision error. The temporal changes in lead and cadmium concentrations varied over distance; these changes may have been the result of residue/soil interactions.

Heavy metal concentration in the wetland soil, measured over time and distance from residue deposition indicated: 1) the availability of the metal in the ash residue; and 2) the relative mobility of the metal through the soil matrix. The soil samples from the wetland did not differ significantly in heavy metal concentrations over distance from the residue, but did differ significantly in lead, cadmium, and chromium over time. The fluctuations in metal concentration followed identical trends in all rows, and may have been partially the result of varying analytical precision. Of these three metals listed above, only lead increased significantly ($p < .01$) in soil near the residue landfill, and remained unchanged ($p > .70$) in soil farthest from the residue. Lead, therefore, may have leached from the residue landfill and accumulated in the organic soils near the wetland/residue interface. These results are not contradictory to expectations, in that, of the six metals tested, lead has been shown to be relatively more reactive to changes in pH and the presence of organic substrates. In conclusion, lead may have limited mobility in the residue, given an acid environment; however, mobility and availability may be restricted in organic soils.

Wetland Higher Plants

During the summer of 1977, the higher plants occupying the area proximal to the site of residue deposition were identified and quantified. The experimental area was sampled using quadrat analysis. A 4' X 4' frame was placed at rows A,B,C and D along each transect to obtain frequency and percent cover of the herbaceous species (see Figure 1). A total of 52 sites were sampled. Seventeen herbaceous species and several grasses were mapped (Table 3).

The residue was deposited at the wetland edge in June, 1978. The wetland plants bordering the residue showed no adverse effects, and soil pH remained slightly acid (5.0 to 5.5). Initial invasion of plants on to the ash piles was noted during the first growing season. Colonizing species appeared to come from the meadow, rather than from the wetland.

The higher plants were quantified again in the summer of 1979. The results indicated that the residue had not had any acute toxic impact on the wetland plant community. In general, the various species significantly increased in percent cover and density (Figure 8), without a concomitant change in diversity (Table 4).

Invasion of plants on to the residue piles was monitored throughout the growing season. Plant growth and community structure differed between the two residue piles. Pile "A" (residue deposited directly over existing groundcover) supported a generally more diverse plant community with greater biomass. Plant growth on pile "B" (residue deposited to a depth of 2 feet) was low and scrubby; the community was considerably less diverse.

In order to determine if heavy metal availability differed in the two residue piles, leaves were collected from three plant species common to both, and analyzed for metal content (Table 5). Only the zinc concentration was consistently higher in plant tissue collected from pile "B". Preliminary investigation of the residue plant communities during spring, 1981, indicate that initial differences in growth and structure still persist. Additional tissue samples will be collected in the next few months (summer, 1981) to determine what, if any, role metal availability has in determining the diversity and biomass of invading plant communities.

Table 3. Wetland higher plant species.

Common Name	Family	Scientific Name
Common Milkweed	Asclepiadaceae	<u>Asclepias Syriaca</u>
Creeping Thistle	Compositae	<u>Cirsium arvense</u>
Rock Goldenrod	Compositae	<u>Solidago canadensis</u>
Purple Loosestrife	Lythraceae	<u>Lythrum Salicaria</u>
Joe-Pye Weed	Compositae	<u>Eupatorium purpureum</u>
Cow Vetch	Fabaceae	<u>Vicia Cracca</u>
Jewel-Weed	Balsaminaceae	<u>Impatiens biflora</u>
Arrow-leaved Tear-thumb	Polygonaceae	<u>Tracaulon sagittatum</u>
Elderberry	Caprifoliaceae	<u>Sambucus canadensis</u>
Dodder	Cuscutaceae	<u>Cuscuta</u> sp.
Sensitive Fern	Polypodiaceae	<u>Onoclea sensibilis</u>
Marsh Shield-Fern	Polypodiaceae	<u>Dryopteris Thelypteris</u>
Corn Grass	Gramineae	<u>Panicum clandestinum</u>
Timothy	Gramineae	<u>Phleum pratense</u>
Meadow Foxtail	Gramineae	<u>Alopecurus pratensis</u>
Carex	Cyperaceae	<u>Carex</u> sp.
Fox Sedge	Cyperaceae	<u>Carex vulpinoidea</u>
Steeple-bush	Rosaceae	<u>Spiraea tomentosa</u>
Cinquefoil	Rosaceae	<u>Potentilla</u> sp.
Wood-sorrel	Oxalidaceae	<u>Xanthoxalis Brittoniae</u>
Aster	Compositae	<u>Aster dumosus</u>
Goldenrod	Compositae	<u>Solidago rugosa</u>

Figure 8. Pre- and post incinerator residue percent cover for wetland higher plants. Transects represent area occupied by individual species at designated distances from the residue landfill, before and following residue deposition.

Figure 8

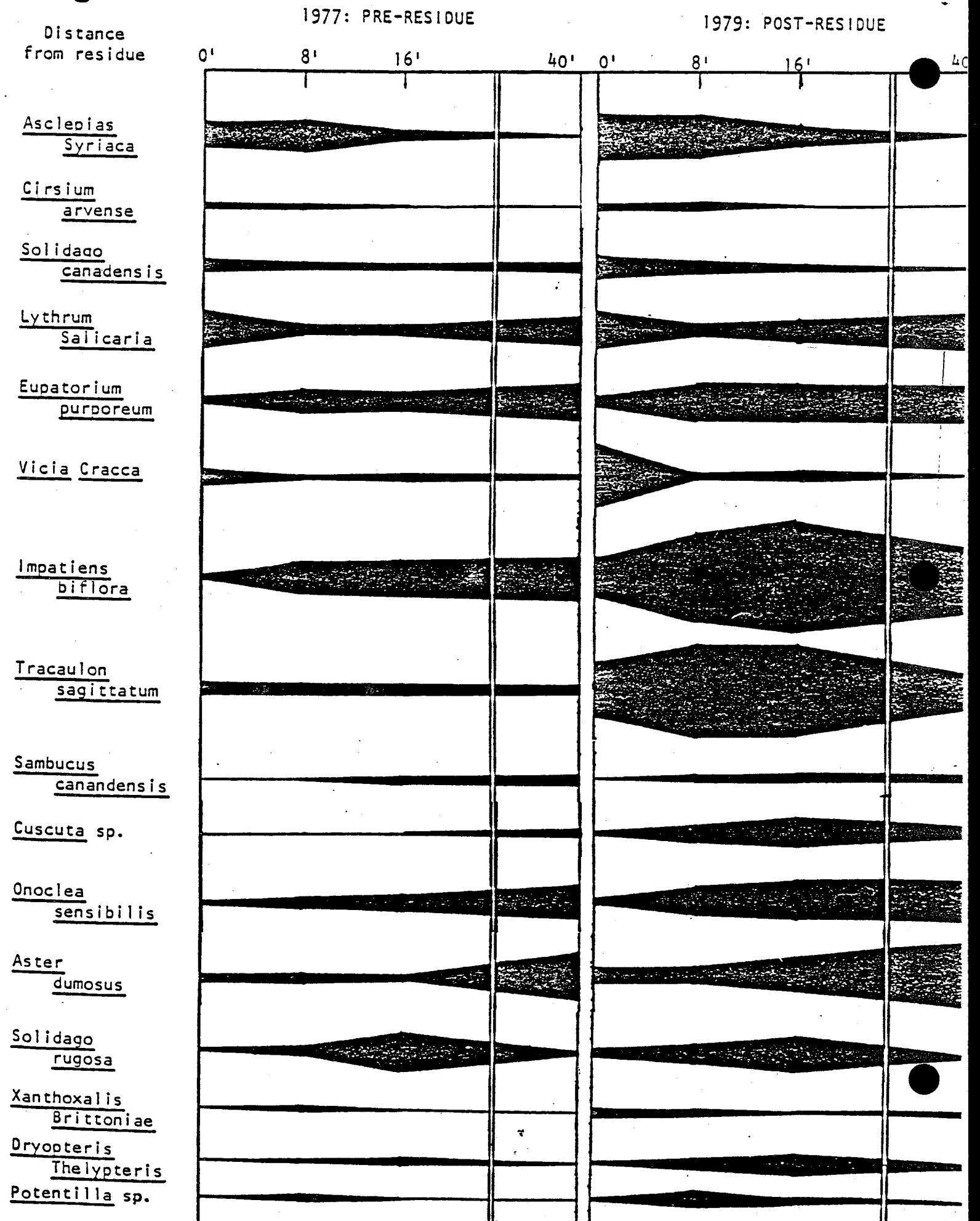


Table 4. Wetland higher plant community parameters: pre-(1977) and post-(1979) residue landfill.

ROW	DISTANCE FROM RESIDUE	COMMUNITY ^{1/} PERCENT COVER		SPECIES DENSITY ^{2/}		DIVERSITY ^{3/}	
		1977	1979	1977	1979	1977	1979
A	0m (0ft)	116.4	288.4***	4.2	6.4***	2.16	2.38
B	2.4m (8ft)	157.8	373.1***	5.0	7.3***	2.49	2.45
C	4.9m (16ft)	173.6	407.0***	5.3	7.5***	2.38	2.37
D	12.2m (40ft)	201.9	274.5*	4.4	5.6*	2.16	2.16 ^v

^{1/} Percent Cover = $\frac{\sum_{i=1}^S (\text{cover}_i / \text{cover}_T)}{S}$, where: i=species, 1,2,...,S; cover =area occupied by species "i";
cover_T = total area

^{2/} Species Density = $\frac{\sum_{j=1}^Q (\# \text{ species/quadrat}_j)}{Q}$, where: j=quadrat 1,2,...,Q

^{3/} Diversity = $H' = - \sum_{i=1}^S P_i \ln P_i$, where: i=species 1,2,...,S; P_i=percent cover for species "i";
ln=natural log function

* significant Increase at .05

*** significant Increase at .01

Table 5. Metal uptake of three plant genera growing on residue piles during summer, 1979. Pile "A" was deposited directly over existing groundcover; pile "B" was deposited in a 2 foot deep trench and brought up to grade. Data represent metal concentration in leaves, measured in parts per million (ppm).

	Pb	Cd	Zn	Ni	Cu	Cr	
<u>Lythrum Salicaria</u> collected 8/23/79	14	4.5	355	1.8	7.6	0.5	PILE "A"
"	10	3.0	525	1.9	4.3	0.3	PILE "B"
<u>Radicula sp.</u> collected 7/26/79	32	12	410	3.2	5.0	1.1	PILE "A"
"	41	22	850	4.6	6.0	1.0	PILE "B"
<u>Persecarla sp.</u> collected 7/26/79	18	0.90	115	1.8	6.0	0.8	PILE "A"
	23	0.28	310	2.9	5.0	0.7	PILE "B"

Soil Algae Studies

Sampling and Culture Techniques

Wetland soil algae were sampled one month (Series I), three months (Series II), 13 months (Series III) and 15 months (Series IV) following residue deposition. Soil samples were taken at distances of 0m (Row A), 2.4m (8 ft, Row B), 6.1m (20 ft, Row C) and 12.2m (40 ft, Row D) from the submerged residue along transects # 10, 11, 12 and 13 (see Figure 1). The soils were dried and graded according to particle size. Fifteen g of medium grade (1 mm) soil, covered by 10 g of fine grade (0.25 mm) soil from each wetland sampling location, were weighed into each of three petri plates. Soils were saturated with 20 ml sterilized, distilled water. Six # 1, 18 mm glass coverslips were randomly placed on the soil surfaces as algal collectors. The soil samples received continuous light at 21°C for a four week period.

At weekly intervals one coverslip was removed from each replicate for microscopic analysis. Determinations were made as to the percent cover (proportion of area occupied [an estimate of abundance]) and richness (number of algal types) of the algal communities. Identification was made to family, this being the lowest practical OTU (operational taxonomic unit) which could be identified without sub-culturing.

Data Analysis

Algal community data were grouped by distance and time from residue deposition. These groups contained data from Rows A, B, C, and D, (increasing distance from the residue), and Series I, II, III and IV, (increasing time from residue deposition).

Abundance of soil algae was estimated by determining the percent cover of algal communities during the third culture week. The systematic sampling procedure, described previously, necessitated the use of nonparametric statistics. The abundance data were tested for significant differences over distance and time using two nonparametric tests: 1) Kruskal-Wallis one-way ANOVA for samples and 2) Mann-Whitney U test for two samples. Significance was set at 0.05.

Richness of the algal communities was determined by totaling the cumulative number of algal families sampled during the four week culture period (Series) at each distance (Row) from the residue. Significant differences in richness were assessed as with abundance.

Results and Conclusions

The soil algae were classified into three divisions (Cyanophyta or "blue-green algae" [classified here as algae despite bacterial affinities], Chlorophyta or "green algae" and Chrysophyta or "golden-brown algae" [including only the Bacillariophyceae or "diatoms"]), ten orders and 14 families.

Abundance. The abundance of soil algae (as percent cover) over time and distance from residue deposition is presented in Figure 9. Chi square (χ^2) values and associated probabilities signifying the significance of differences in abundance over distance and time are presented in Table 6. There were no significant differences in soil algal abundance over time, and only one significant difference ($0.02 < p < 0.05$) over distance which occurred in Series II (3 months following residue deposition). It is evident from Figure 3 that this difference resulted from the rela-

tively high abundance in Row A (the residue/wetland interface). In general, as distance into the wetland increased, algal abundance varied less over time and tended to decrease. As time from residue deposition increased (Series I to Series IV), algal abundance varied less over distance. Therefore, with increasing time and distance from residue deposition, the variation in algal abundance decreased.

Richness. Richness of the soil algal communities over distance and time from residue deposition is presented in Figure 10. Chi square values and associated probabilities that signify the significance of differences in community richness are presented in Table 7. Over distance, the richness of algal communities differed significantly only during the first month following residue deposition. Over time, significant changes in richness occurred only midway (Row C) into the experimental area of the wetland. The data presented in Figure 10 indicate that these differences in community richness were attributable to a significant increase in algal types cultured from Row C (6.1m [20 ft] from residue) during Series III and IV. As with algal abundance, there appeared to be a trend toward increasing inter-row similarity with time.

A summary of the significant differences resulting from 2-sample testing (Mann-Whitney U test) of all row and series combinations is presented in Table 8. These results indicate the individual row and/or series data which contributed to the previously noted trends in abundance and richness. Significant differences in both abundance and richness among the rows (distance factor) occurred only during the first few months following residue deposition, and were the result of relatively high abundance and richness at the residue/wetland interface (Row A). Significant changes in algal parameters over time were due predominantly to an increase in algal types in Row C, and a decrease in algal abundance in Row A. There were no significant inter-row differences in year 2 (Series III and IV), and no significant inter-series differences in Rows B and D.

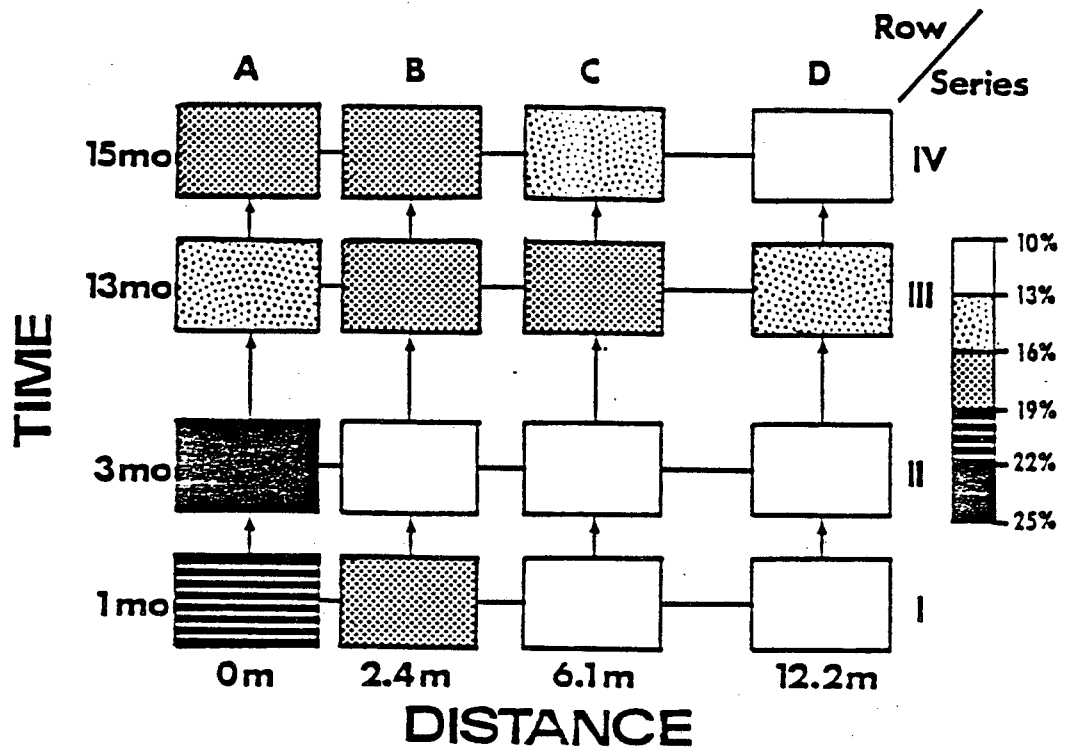
Soil lead levels proximate to the disposal site increased by approximately 25 ppm. If this influx of residue lead were available to the wetland soil algae, such quantities might be sufficient to disrupt this community of micro-algae whose metal tolerances are often measured at levels below 1 ppm. The hypotheses of declining algal abundance and/or community richness were not supported by the data collected from these high lead soils. Soil lead levels in both Rows A and B increased significantly over time, whereas algal abundance declined only in Row A. The change in algal abundance at the wetland border (Row A) was due to an initial increase in ephemeral algae (colonizing organisms) which would be expected following a nutritive salt influx from the residue and/or reduced competition following soil crust disturbance as a result of residue deposition. Therefore, the limited leaching of residue lead, and the lack of sufficient evidence of an adverse response in the soil algal community indicated that residue heavy metals had not leached in quantities sufficient to disturb soil algal community structure.

Heavy metal mobility and availability are both source-specific and site-specific. Though the heavy metal concentrations in incinerator residue are high, when land-applied, heavy metal impact depends less upon concentration than on chemical speciation and the physical and chemical nature of the soil. Testing procedures should therefore be designed so as not to overlook pollutant interactions in the soil.

Figure 9. Soil algal abundance as percent cover over time and distance from incinerator residue deposition.

Figure 10. Soil algal community richness over time and distance from incinerator residue deposition.

9



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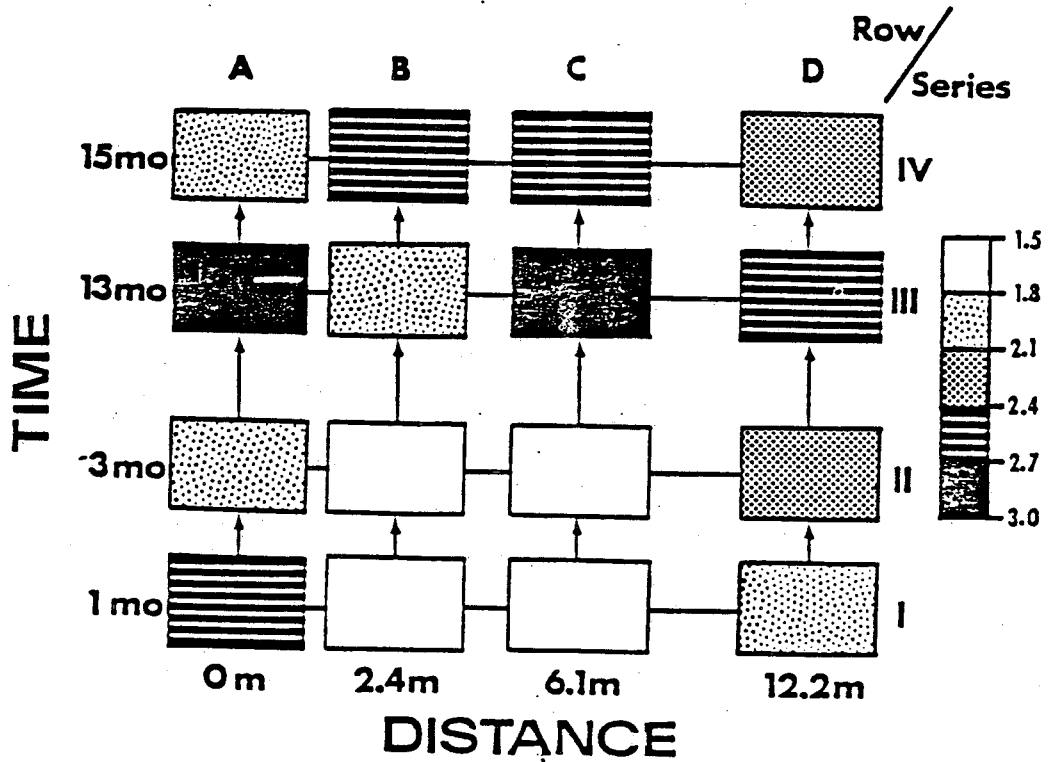


Table 6. Kruska-Wallis one-way ANOVA of algal abundance (percent cover) over distance and time. Significant differences are indicated by one or more asterisks over the chi-square value (χ^2). Associated probabilities are included in parentheses.

DISTANCE ANALYSES (Rows A to D)

Series I	$\chi^2 = 5.41$	(0.10 < p < 0.20)
Series II	$\chi^2 = 8.04^*$	(0.02 < p < 0.05)
Series III	$\chi^2 = 1.47$	(0.50 < p < 0.70)
Series IV	$\chi^2 = 3.56$	(0.30 < p < 0.50)

TIME ANALYSES (Series I to IV)

Row A	$\chi^2 = 5.27$	(0.10 < p < 0.20)
Row B	$\chi^2 = 3.70$	(0.20 < p < 0.30)
Row C	$\chi^2 = 3.21$	(0.30 < p < 0.50)
Row D	$\chi^2 = 2.85$	(0.30 < p < 0.50)

*: significant difference at 0.05; df=3

Table 7. Kruskal-Wallis one-way ANOVA of community richness (# of families) over distance and time. Significant differences are indicated by one or more asterisks over the chi-square value (χ^2). Associated probabilities are included in parentheses.

DISTANCE ANALYSES (Rows A to D)

Series I	$\chi^2 = 9.27^*$	(0.02 < p < 0.05)
Series II	$\chi^2 = 5.06$	(0.10 < p < 0.20)
Series III	$\chi^2 = 4.00$	(0.20 < p < 0.30)
Series IV	$\chi^2 = 2.05$	(0.50 < p < 0.70)

TIME ANALYSES (Series I to IV)

Row A	$\chi^2 = 6.26$	(p = 0.10)
Row B	$\chi^2 = 2.41$	(0.30 < p < 0.50)
Row C	$\chi^2 = 12.18^{***}$	(0.001 < p < 0.01)
Row D	$\chi^2 = 2.21$	(0.50 < p < 0.70)

*: significant difference at 0.05; df=3

***: significant difference at 0.01; df=3

Table 8. Summary of significant results from "2-sample" testing^{a/} of algal community abundance and richness over time and distance from residue deposition.

SERIES (time from residue deposition)		ABUNDANCE ^{b/}	RICHNESS ^{c/}
I	(1 mo)	Row A: Row C*	Row A: Row B* Row A: Row C**
II	(3 mo)	Row A: Row B* Row A: Row C* Row A: Row D**	NSD
III	(13 mo)	NSD	NSD
IV	(15 mo)	NSD	NSD
<u>ROW (distance from residue)</u>			
A	(0 m)	Ser. II: Ser. III*	NSD
B	(2.4m)	NSD	NSD
C	(6.1m)	NSD	Ser. III: Ser. IV** Ser. I: Ser. IV* Ser. II: Ser. III** Ser. II: Ser. IV*
D	(12.2m)	NSD	NSD

a/: Mann/Whitney U test

b/: measured as percent cover

c/: number of algal families

NSD: no significant differences

*: significant difference at 0.05

** : significant difference at 0.02

Heavy metal toxicity is species-specific. The impact of potentially hazardous waste leachates on biota should be assessed on indigenous organisms. Soil algae provide a practical approach for investigating the potential and actual impact of waste leachates on terrestrial ecosystems.

Wetland/Residue Studies: Discussion

This research was designed to assess the impact of low-level, long-term heavy metal pollution on a wetland ecosystem. Environmental research on pollutant stress generally involves two types of effects: acute and chronic. Acute responses usually follow short-term exposure to lethal pollutant concentrations. The effects are easy to identify and quantify, either at the population or community level. To date, no acute effects of metal toxicity have been observed in the wetland.

According to the classification system devised by Smith, pollutant/ecosystem interactions may be designated as one of three types:

- 1) Class I includes interactions where soil and/or biota are unaffected sinks for pollutants;
- 2) Class II includes sublethal, adverse effects on organisms and/or processes; and
- 3) Class III includes lethal effects (acute) on organisms and the likely disruption of ecosystem processes.

In order to classify such interactions, the experiment must disclose the relative abundance, mobility, availability and toxicity of the pollutant. By examining both chemical and biological parameters, these studies were designed to assess the abundance, mobility, availability and toxicity of incinerator residue heavy metals, and the resultant pollutant/ecosystem interaction.

The site selected for the field experiment approximated "worst case" conditions for heavy metal leaching. Acid conditions tend to increase the mobility and availability of heavy metals. The residue was exposed not only to an acid soil/water substrate (pH range 4.8 - 5.2), but was also leached by acid precipitation (avg. pH 4.0). Recent evidence on the effects of "acid rain" has indicated that soils are the primary sink for excess acidity. Acid precipitation may, therefore, have a pronounced effect on heavy metal interactions in terrestrial ecosystems.

The combined data from soil and groundwater monitoring indicate that, 15 months following residue deposition, measurable quantities of metals had not leached from the residue, with the possible exception of lead. Given this information, the ecosystem/pollution interaction cannot be classified beyond Class I where the soil may be acting as an unaffected sink for lead.

Because there was not measurable heavy metal leaching from the residue (with the possible exception of lead), the biological availability of these metals and the levels necessary to disturb plant communities are still unknown. This lack of positive results in both the chemical and biological data, however, does indicate that in 15 months time, the incinerator residue has had no adverse effects on the wetland ecosystem. If the significant increase in soil lead at the wetland border (Row A) is the result of residue leaching, the lack of an adverse reaction in the biological community questions the availability or toxicity of incinerator residue lead in organic soils.

LEACHING STUDIES

Since all manner of solid wastes are burned in the incinerator, the residue contains a spectrum of heavy metals including Pb, Cd, Zn, Cu, Ni, Cr, Fe, Mg, and Mn. Contamination of the soil, aquatic ecosystems, or the ground water by heavy metals leaching from the incinerator ash residue or products made with the residue would mean that the residue could not be marketed and also could not be used as a landfill except in those few situations where it could be totally isolated from the surrounding environment. The problem appears to be further exacerbated by the fact that rain falling on the northeastern United States is highly acid in character. Acid precipitation could actually increase the rate of release of heavy metals from the residue since it is well documented that some heavy metals are more easily mobilized under increasingly acid conditions.

It is clear that unless the environmental impact of this material can be assessed and understood, no cogent, practical method of disposal and/or use of this residue can be made, and further, if the residue cannot be safely disposed of, no large-scale development of solid waste to energy planning or implementation can be carried out.

These studies were undertaken to learn how the residue acid precipitation interaction would affect the leaching of heavy metals from the incinerator ash residue both in the presence and the absence of natural field soil.

Experimental Methods

Incinerator ash residue was obtained from the RESCO incinerator and brought to the Suburban Experiment Station of the University of Massachusetts in Waltham, Massachusetts. Lysimeters were constructed from 111 liter plastic trash cans by cutting a hole in the side 2 cm above the bottom of the can and inserting a piece of tygon tubing which, in turn, led into the shoulder of a 1.9 liter plastic (polypropylene) bottle with a cap. The bottom of the can was filled with 5 cm of styrofoam balls to provide unimpeded drainage through the drain spout. Duplicate lysimeters were filled with about 95 liters of pure RESCO incinerator ash residue. At a later date, an added series of lysimeters, constructed in the same manner, were filled with i) duplicate lots of unamended, unsterilized field soil, and ii) mixtures of this field soil and incinerator ash residue. The complete experiment contained a pair of lysimeters with only incinerator ash residue, a second pair with only field soil, a third pair with field soil superimposed over ash, (S/A) and a fourth pair with ash superimposed above field soil. (A/S). In the mixed cans the bottom layer of soil or residue was 28 cm deep and the top layer was 43 cm deep. The filled cans were placed on cinder block platforms in the open air on a site which was not obstructed by trees or buildings. They were, therefore, exposed to each rainfall or snowfall event which occurred during the period of the study. In addition, a rain gauge was installed on the same site so that rainfall could be measured and collected for chemical analysis. No water was added to any of the columns other than that which occurred as a natural rainfall or snowfall event. Any water leaching through the lysimeter columns was collected immediately after each rainfall event and tested for pH and soluble salts. Leachate from the paired lysimeters was combined and a sample was preserved by freezing until it could be analyzed chemically for a series of heavy metals, including Cd, Pb, Cr, Cu, Zn, & Ni. Some samples were also analyzed for Fe and Mn.

pH was measured with a PhotoVolt pH meter equipped with a combination electrode. The meter was calibrated before each series of measurements. Soluble salts were measured with a Lectro HO Meter distributed by LABLine. Measurements were recorded as umhos/cm. Heavy metal analyses of the water samples were made using a Perkin Elmer Atomic Absorption Spectrometer # 403 and all analyses were carried out by the Microanalysis Laboratory of the University of Massachusetts in Amherst, Massachusetts. (Signal/noise ratio for that instrument is about 2). Rainfall amounts were recorded in mm for each rainfall event. Ash residue analysis was carried out by digesting 5 grams of a thoroughly mixed larger sample dried at 90° C/72 hr and sieved through # 60 soil sieve. The material was covered with aqua regia and heated to near dryness. It was then cooled and weighed and enough 25% HNO₃ was added to bring the total weight gain to 25 grams. This mix was left standing over night after which it was stirred and filtered. The filtrate is a 5 times dilution of the original metal concentration. Analyses were made using an Atomic Absorption Spectrophotometer, Perkin Elmer # 403. These analyses were carried out by the Research Laboratory of the Commonwealth of Massachusetts Department of Public Works. Pure residue leaching columns were set up in Oct. 1978, the mixed S/A & A/S columns were set up in Nov. 1979 and sampling data continues to be collected to the present.

Results and Discussion

Acid soluble metal ion concentrations of the incinerator ash residue used in these studies are given in Table 9. The parent material is quite heterogeneous which gives rise to some of the differences in concentration between samples. Quantity and pH of the rainfall events are shown in Table 10. The average pH for rain and snow events recorded from 1978 to the present was 4.0. Normal rainfall pH is considered to be about 5.3 - 5.6, which means that rainfall recorded in this study should be characterized as acid precipitation. In 4 weeks soluble salt levels in the pure ash lysimeter leachate dropped from 2500 umhos to below 20 umhos. Total rainfall passing through the pure ash columns totaled 360,000 ml as of June, 1981. Rainfall passing through the mixed columns totaled 36,000 ml as of the same date. pH of the pure ash leachate ranged from 7.6 - 8.2 and averaged about 7.9. pH of the soil leachate ranged from 5.8 - 7.1 and averaged 6.4; while that of the soil over ash mix ranged from 7.5 - 8.2 and averaged 7.9; and ash over soil ranged from 5.7 - 7.7 and averaged 6.7. These figures represent a total rainfall of 60 inches for the period in question.

Table 11 shows the mean concentration of heavy metals in leachate collected from all the columns during separate rainfall events extending over a period of 33 months. Table 12 shows the results of sampling a single rainfall event in September 1980. Here leachate from all the possible combinations was analyzed along with rainfall taken during the same event.

Rainfall events during the entire experimental period consistently produced rain with a pH of about 4.0. Leachate from the "Ash only" columns has continued to have a mean pH value of about 7.9, indicating the high exchange capacity of the incinerator ash residue. The mechanisms responsible for this effect are not yet understood but the effect is remarkable for its persistence over time. Soluble salts like Na, K, etc are apparently leached out very rapidly as indicated by the measured change in electrical conductivity over time. The high "heavy metal" content of the remaining ash residue does not reveal itself in the leachate during the 33 months experimental period. Heavy metal content of the ash residue leachate is about the same as that found in the ambient rainfall during the 33 month observation period. This could be due to the basic physical/chemical composition of the residue resulting from the previous high temperature treatment. The heavy metals were simply tied up

Table 9. Acid soluble metal ion concentrations in incinerator ash residue samples

Metal ions ppm	<u>Sample 1</u>	<u>Sample 2</u>	<u>Sample 3</u>	<u>Sample 4</u>	<u>Sample 5</u>
Cd	32.2	32.0	29.7	28.0	34.3
Pb	3503	3635	3499	3015	4321
Cr	98.7	128	115	116	137
Ni	113	148	134	172	147
Al	1.98%	2.45%	2.50%	2.00%	2.15%
Cu	1610	899	633	3490	773
Mn	.388%	3.89%	.405%	.419%	.394%
Zn	2.25%	2.21%	2.01%	3.55%	2.47%
Fe	6.52%	6.47%	6.41%	7.63%	6.31%
Ca	1.96%	1.90%	2.12%	2.10%	1.82%
Na	2.81%	2.67%	2.86%	2.59%	2.34%
Mg	.297%	.290%	.311%	.359%	.308%
K	.356%	.396%	.418%	.404%	.369%

Table 10. Total amount of rainfall passing through leaching columns over 33 months and mean pH of that rainfall before and after passing through leaching columns made up of ash residue, soil, and mixtures of ash residue and soil.

Type of Leaching Column	Total Amount of Rainfall Passing through Leaching Columns	pH of Rainfall (Mean)	pH Leachate Water (Mean)
Ash	360,000 ml*	4.0	7.9
Soil	36,000 ml	4.0	6.4
Soil over Ash	36,000 ml	4.0	7.9
Ash over Soil	36,000 ml	4.0	6.7

* Total Rainfall for 33 months = 60 inches

Table 11. Mean heavy metal content in all leachates over 33 months.
(all values are ppm)

	<u>Pb</u>	<u>Ni</u>	<u>Cd</u>	<u>Cu</u>	<u>Cr</u>	<u>Zn</u>
Residue	0.18	0.07	0.006	0.027	0.037	0.07
Soil	0.19	0.03	0.006	0.03	0.035	0.05
Residue/Soil	0.32	0.04	0.006	0.025	0.035	0.075
Soil/Residue	0.375	0.07	0.008	0.025	0.035	0.105
Rain	0.173	0.038	0.013	0.023	0.03	0.05

Table 12. Heavy metal content of leachate from all columns taken during a single rainfall event in September 1980

Column Identification	Metal ions in ug/ml					
	Pb	Cd	Ni	Cr	Cu	Zn
Ash only	0.14	< 0.005	0.04	< 0.04	< 0.01	0.02
Soil only	0.21	< 0.005	0.04	< 0.04	0.03	0.05
Soil over Ash	0.53	0.010	0.12	< 0.04	0.02	0.11
Ash over Soil	0.42	< 0.005	0.06	< 0.04	0.02	0.06
Rain only	< 0.14	< 0.005	< 0.04	< 0.04	< 0.01	0.02

Rain only pH = 4.0

in non-active forms by the heat treatment and are therefore not reactive even when leached with water carrying a pH of 4. It is also possible that the ability of the ash to raise the pH of the incident rainfall which leaches through it, makes it less vulnerable to a loss of heavy metals which might normally be released if leached with water carrying a pH of 4. At this point it is not possible to say which of these mechanisms is more important or if both may be operative.

Based on this simplest case it would seem reasonable to describe the incinerator bottom ash residue as a relatively benign material which would not release its heavy metal load into the environment when leached with acid precipitation. The demonstrated ability of the ash to attract and hold hydrogen ions also suggests that the material might be used to cover older dump sites and landfills in order to raise the pH of the rainfall leaching through these sites thus possibly reducing the rate of heavy metal leaching from the metal sources buried in the sites. However, such a prospect must be viewed with great caution because soil in the presence of ash in the leaching columns may foster a different kind or rate of chemical behavior than that found in the pure ash.

HORTICULTURAL STUDIES

Horticultural applications of RESCO ash residue could provide an attractive market for this material. To this end, several different demonstration projects were initiated and carried out at the Suburban Experiment Station of the University of Massachusetts in Waltham, MA (SES).

Greenhouse Raised Benches

RESCO residue was used to fill several raised concrete benches in an experimental greenhouse range at SES in 1976. Over the years since then these benches have been used to grow a variety of different plant species. The initial pH and soluble salts in these residue beds was 8.9 and over 2,000 respectively. Flooding of the beds with tap water (pH 8.2) once a week for 3 weeks reduced the pH of the residue to between 7.2 - 7.5 and the soluble salts to below 100. The beds were then sown with annual and perennial rye grasses and watered on a weekly basis. No fertilizer was added for 3 months and the result was a good, green grass cover as shown in Fig. 11. The demonstration showed that the bare residue with no soil cover could support good plant growth and that there was some amount of available plant nutrient in the residue which leached out or was used up within a few months, after which time it was necessary to routinely fertilize the plots.

In subsequent studies these beds have supported such diverse crops as lettuce, corn, tobacco, geraniums, marigolds, zinnias, petunias, chrysanthemums, narcissus, and daffodils. All plants grew normally on the residue, produced normal flowers, fruit, and seed where applicable. (Figures 12, 13, and 14).

Another study utilized one of the beds to demonstrate the feasibility of using RESCO residue as cover for a roadside slope along a highway. Fig. 15. The bed was set up to provide a "hill" of residue which sloped down to a lower level soil surface. The hill and soil were seeded with rye grasses and fertilized and watered on a routine basis. It was found that grass grew equally well on the residue hillside and on the soil below. Further, soil analysis showed that any heavy metals leaching out of the residue did not flow down the slope into the soil below, but leached vertically directly down through the ash hill and accumulated at the bottom of the ash hill but not in the adjacent soil. Heavy metal leaching was minimal and well within RCRA standards. These results are further evidence of the utility of the RESCO residue as a useful horticultural tool.

Turf Plot

A series of turf demonstration plots are routinely maintained on the grounds of SES. These were seeded in 1975 to demonstrate the performance of cool season grasses suited to eastern Massachusetts. There were 12 plots which measure 20 X 50 feet and are bisected by sun and shade. Grass varieties were selected for their availability in local garden centers. Maintenance consists of a weekly mowing at a height of 2-1 inches and normal fertilizing and liming schedule. In 1976 a 13th plot was added which was prepared with RESCO ash residue as the subsoil layer. A ten inch deep bed was dug adjacent to the other turf plots. The bottom 6 inches were filled with RESCO ash residue and this sub-layer was covered with 4 inches of native topsoil from the SES grounds. The plot was graded, seeded, fertilized, compacted and watered. From then on it was treated exactly the same as the other 12 adjacent plots. Growth

Figure 11. Annual and perennial turf grasses growing on
RESCO incinerator ash residue.

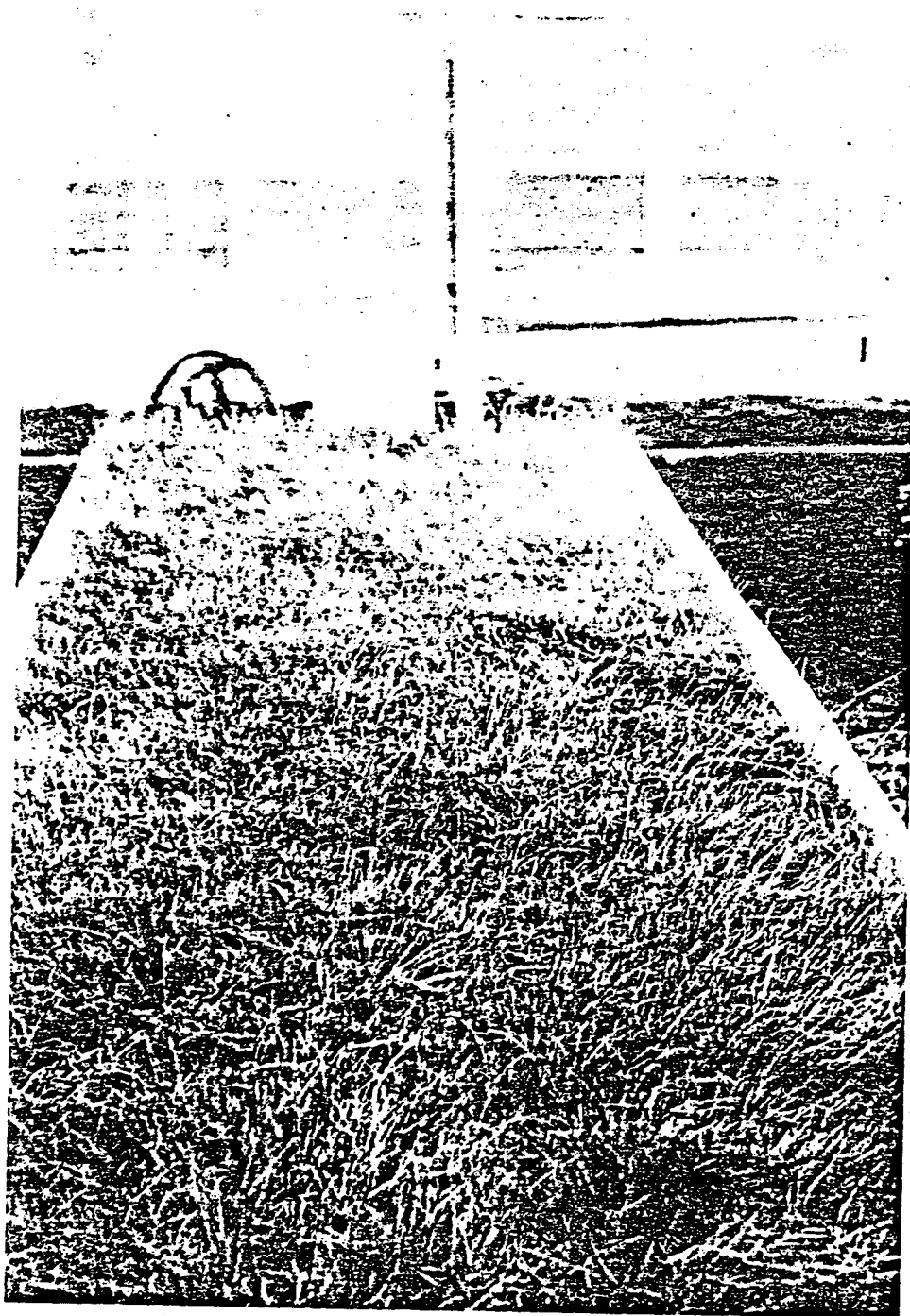


Figure 12. Begonia, Coleus, Chrysanthemum and flowering bulb cultivars growing in RESCO incinerator ash residue.

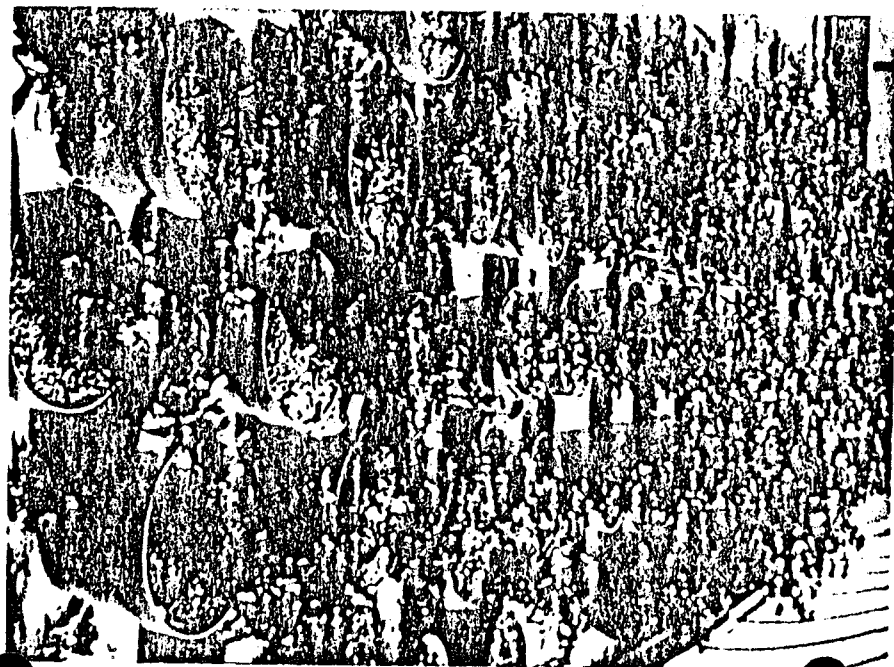
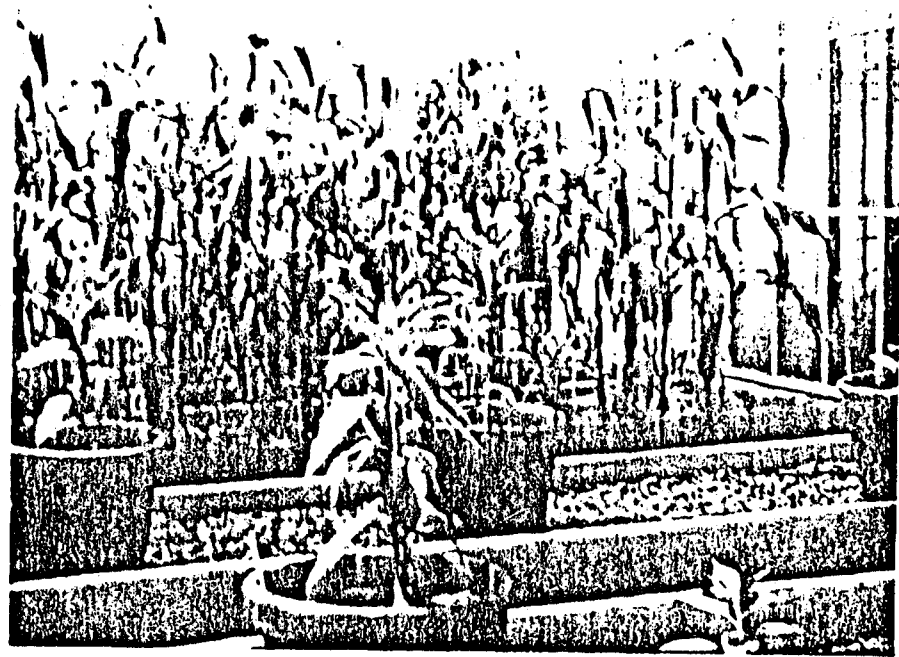
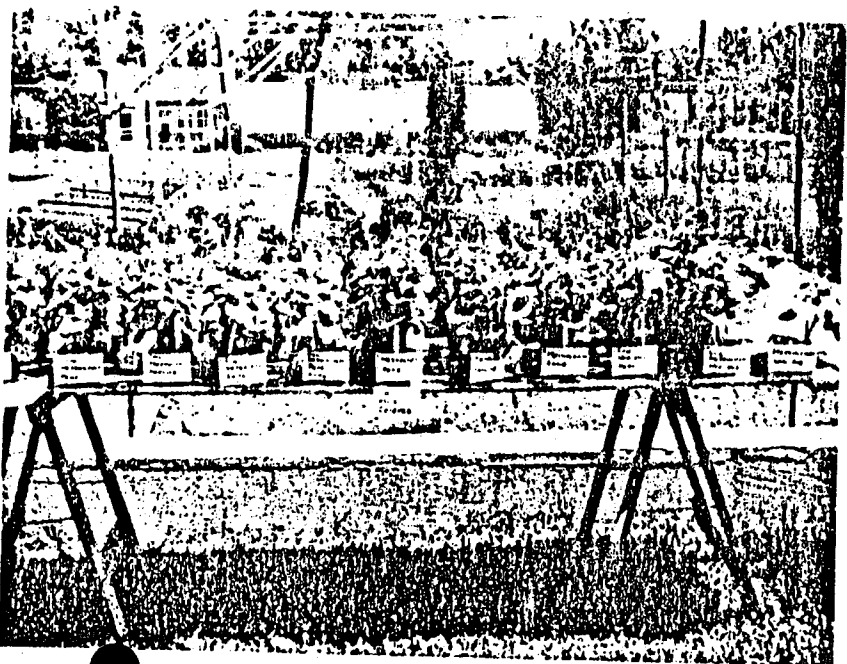
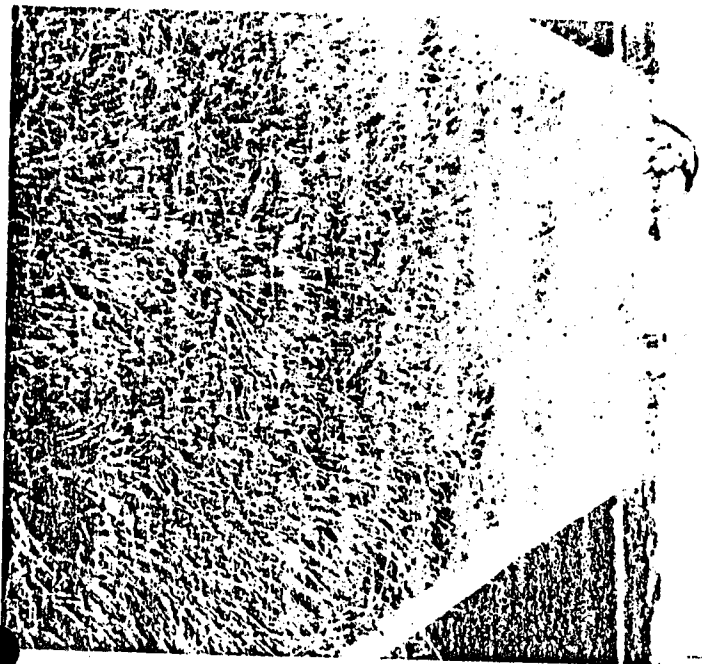


Figure 13. Field corn growing in RESCO incinerator residue.

Figure 14. Geraniums growing in RESCO incinerator residue.

Figure 15. Grass growing in RESCO incinerator residue in
"Roadside" simulation study.



and development of grass on this plot has been normal and the turf surface seems to be able to withstand wear and compaction quite well. Subsoil drainage under the plot is excellent and fertilizer response has been normal. The results indicate that the RESCO residue might prove useful as a subsoil material for the landscaping industry and for the construction of golf course greens and fairways.

Pot Studies

Another possible horticultural use of the RESCO residue is as a potting mix for plants like Poinsettia, Begonia, Chrysanthemum, Geranium etc. Several demonstration studies were carried out with these different commercially important plant species in order to evaluate the RESCO residue as a soil medium in pot culture. Since these plant types are all non-edible and are only used decoratively, there is little concern for the heavy metal content of the residue except for the possible effect it may have on plant growth and development. The basic format was the same for all the pot studies. Residue, residue and mixtures of peat or Perlite plus soil in various mixture ratios, and soil alone were the media used throughout. Commercially rooted cuttings of Poinsettia, Chrysanthemum, Begonia, and Geranium were used in all cases. Growing conditions and cultural practices were kept as close to commercial practice as possible. All tests were run in a greenhouse during the winter heating season; i.e.: November through March. All plants were grown to maturity and data was collected periodically in order to record possible changes or differences in plant growth vigor, flower production, time to maturity etc. In addition, some data measuring heavy metal uptake in plant materials was also recorded. The results of these studies may be seen in Table 13, 14.

In summary, these results indicate that the RESCO residue can be used as a medium for raising pot plants. The residue drains very well but is quite heavy. This makes the pot and its contents quite heavy; a factor which would be considered disadvantageous from a labor point of view. Planting, cultivation, water and pest control are all equally as good in residue as in a good commercial soil mix. Plant response to residue differs among species and may differ among individual cultivars (varieties) of the same plant species. Chrysanthemums and Geraniums grow as well in residue as in soil; Poinsettias and Begonias do less well as the proportion of residue to soil is increased. However, all of these plant species will produce a commercially acceptable crop in the RESCO residue. Figs. 14, 15. Uptake of heavy metals by several of the studies plant species as is shown in Table 13 indicate that very little of the heavy metal load in the RESCO residue is in an "available" form; a further indication of the relatively benign nature of the RESCO residue.

Table 13. Pot plant studies using various mixtures of RESCO Ash Residue and soil and/or peat.

Growing Medium	<u>Poinsettia</u>			<u>Begonia</u>			<u>Chrysanthemum</u>			<u>Geranium</u>		
	Growth Rate	Vigor	Commercial Rating	Growth Rate	Vigor	Commercial Rating	Growth Rate	Vigor	Commercial Rating	Growth Rate	Vigor	Commercial Rating
RESCO RESIDUE	G	F	F	F	F	F	G	G	G	G	G	G
RESCO RESI- DUE + Soil												
1/1	G	G	F	F	F	F	G	G	G	G	G	G
2/1	G	G	F	F	F	F	G	G	G	G	G	G
1/2	G	G	G	G	G	F	G	G	G	G	G	G
RESCO RESI- DUE + Peat												
1/1	G	G	G	F	F	F	G	G	G	G	G	G
2/1	G	G	G	F	F	F	G	G	G	G	G	G
1/2	G	G	G	G	G	G	G	G	G	G	G	G
Standard Soil Mix (Control)	G	G	G	G	G	G	G	G	G	G	G	G

Ratings:

Growth Rate: Good(g); Fair(f); Poor(p)
 Vigor: Good(g); Fair(f); Poor(p)
 Commercial Rating: Good(g); Fair(f); Poor(p)

Table 14. Uptake of heavy metals in selected plant species growing on RESCO ash residue.

	<u>Pb</u>	<u>Cd</u>	<u>Zn</u>	<u>Cr</u>	<u>Cu</u>	<u>Mn</u>
Grass Leaves	33	0.95	127	1.1	35	8.3
Poinsettia						
Leaves	50	1.3	108	--*	--	--
Bracts	14	0.6	45	--	--	--
Geranium						
Tops						
(stems & leaves)	46	0.9	154	3.1	26	6.1
Chrysanthemum	26	4.4	248	2.6	16.3	4.8
Ash residue	3595	31	2620	119	1481	143

*Not analyzed

SUMMARY AND RECOMMENDATIONS

Studies carried on at the Suburban Experiment Station over the past 4 years with RESCO ash residue have indicated that land application of this heterogeneous material has had no discernable impact upon the quality of groundwater, the growth and diversity of the soil algal community, or the growth and diversity of the terrestrial higher plant community. Further, with the possible exception of Pb, there has been no significant increase in heavy metal content of soils adjacent to large deposits of residue under our field conditions. Extensive leaching studies with natural rain have revealed no significant losses of heavy metals from the residue in spite of a mean rainfall pH of 4.0. The residue has a high buffering capacity which has persisted undiminished for over 3 years; during which time about 360,000 ml (60 inches) of pH 4.0 rainfall has passed through the residue. Under field conditions, the bare residue is readily colonized by native plant species, without the addition of any nutritional amendments. Three years after land application of the residue, the majority of the higher plants growing on the residue appear vigorous and normal. Some heavy metal uptake occurs in plants growing on the residue, but except for perennial plants, the amounts are not phytotoxic. Food chain contamination remains an area for study, but would be of no consequence to human consumption, since only non-food plants would ever be recommended for growth on the residue. The RESCO residue is an excellent medium for growth of turf and horticulturally valuable plant materials such as bedding and pot plants like chrysanthemums, poinsettias, geraniums, bulb plants etc. Mixtures containing RESCO residue, peat, and soil perform as well as commercial soil mixes and several soilless potting media. RESCO residue will also perform well as a subsoil for building golf courses and as fill for grading highway slopes and median strips. After two years' contact with soil and cropping with a variety of plants, the RESCO residue takes on the character of a loose, granular soil-like material which drains well, is easy to work, and is quite resistant to erosion from wind or water.

All the data to date indicate that the RESCO residue is a relatively benign material which over the short-term will not release its heavy metal load into the environment when exposed to leaching with naturally occurring acid rains carrying a pH of 4.0. The demonstrated ability of the ash residue to attract and hold hydrogen ions also suggests that the material might be used to cover old dump sites and landfills in order to raise the pH of the rainfall passing through these sites thus possibly reducing the rate of heavy metal leaching from metal sources buried in the sites.

It must be born in mind that in terms of environmental change, 3-4 years is a very short period. Long-term (10-25-100) years of weathering of this ash residue may indeed begin to release significant amounts of heavy metals into the environment.

In order to best avoid further contamination of the environment (i.e. groundwater or biota), it is essential that the wetland studies at Waltham and Harold Parker State Forest, and the leaching studies described herein, be continued for at least 5 more years. The status of these projects will be updated on a yearly basis for that 5 year period.

A SUMMARY OF WORK COMPLETED AND
OBSERVATIONS TO DATE

INCINERATOR RESIDUE - A COMPONENT OF BITUMINOUS
PAVEMENTS

During the Summer of 1980, the Massachusetts Department of Public Works in cooperation with the Massachusetts Department of Environmental Management (Bureau of Solid Waste) and Refuse Energy Systems Company (RESCO) of Saugus placed a test pavement on Route 129 in Lynn, Massachusetts in which aggregate components of the bituminous pavement consisted, in part, of incinerator residue.

The incinerator residue used was the residue resulting from the incineration of municipal waste at the RESCO plant in Saugus.

Prior to the placement of the test pavement, preliminary laboratory evaluation and testing of the incinerator residue was performed. Based on the laboratory data obtained, various mix designs of asphaltic concrete incorporating incinerator residue as an aggregate component were developed and trial batches of mix were made and subject to standard test procedures.

As the resulting laboratory data indicated that the potential for using incinerator residue as an aggregate in bituminous concrete was promising, it was decided to place a test pavement in order to study all placement characteristics and service performance under actual field conditions.

The site selected for the test pavement was a section of Route 129 in Lynn. This highway met all of the criteria required in the work plan for this project.

The project as advertised included the placement of a bituminous concrete pavement consisting of four experimental sections that incorporated incinerator residue as aggregate in the bituminous paving mix and one control section of standard bituminous paving mix.

The contract was awarded to the Essex Bituminous Concrete Corporation. Work on placement of the first experimental section started August 16, 1980. This section was placed in two courses; 1-1/2 inch binder course and 1-1/2 inch top course. Each course was to consist of 100% incinerator residue plus asphalt. The binder course to consist of incinerator residue with maximum particle size of 1 inch and the top course with maximum particle size of 1/2 inch.

Only one lane 13 feet wide and approximately 1100 feet long was placed when production was halted because of plant break down. The plant operators, unfamiliar with incinerator residue were attempting to maintain their normal production rate. However, when only 120 tons of mix had been produced the breakdown occurred. To quote the plant owner "The air pollution equipment (baghouse collector) could not handle the combination of a large percentage of super fine dust/ash and the high moisture content of the materials. The moist dust/ash caked up on the screw conveyor causing it to jam and burn out the drive motor".

After cleaning out the baghouse and replacing, the motor production resumed but after only another fifty tons were produced the same breakdown occurred again. At that point all work was cancelled for the day.

When work was resumed the following week, it was decided to discontinue any further attempts to place mix containing 100% incinerator residue as the aggregate. The remainder of this experimental section was paved with standard mix.

By reducing their production rate the plant operators were able to complete the remaining three experimental sections as stipulated in the work plan.

The paving mix containing the incinerator residue was prepared, placed and compacted with conventional equipment and standard methods. All pavements were open to traffic within the same time frame as with standard pavements.

With the exception of Section 4 all other experimental sections received a wearing course of standard top mix. The wearing course of Section 4 was a combination of 50% incinerator residue and 50% 3/8 inch natural aggregate. After exposure to traffic for a few days, particles of glass, pottery, metal and other reflective materials would sparkle and glitter under the sunlight or headlights at night. Other than this there were no other visually apparent differences between this section of pavement and the standard pavement.

Several weeks after all pavement sections had been placed and opened to traffic skid resistance tests were run on all experimental and control sections. Skid test results obtained on the section that contained incinerator residue in the wearing surface were comparable to the results obtained from the sections that had standard pavement for a wearing surface. A year later skid resistance tests were repeated and the results between experimental sections and control sections were still comparable. There was a small reduction in skid numbers but it was approximately the same between all sections of pavement.

To date this experimental project has been subject to the climatic extremes of two New England winters and at this point in time there does not appear to be any apparent difference in rideability, skid resistance or serviceability between the experimental sections and the control sections. However, it is too soon to draw any conclusive judgements regarding the suitability of incinerator residue and a substitute for natural aggregate.

Gene Bastanza
Research and Materials Section
State Department of Public Works
Commonwealth of Massachusetts

February 1982

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS
RESEARCH AND MATERIALS SECTION
WELLESLEY HILLS, MASSACHUSETTS 02181

PROPOSAL
RESEARCH PROJECT R-37-0
BOTTOM ASH RESIDUE - A COMPONENT OF BITUMINOUS PAVEMENTS

Work Plan for Calendar Years 1979 - 1984

In cooperation with the Bureau of Solid Waste
Disposal, Massachusetts Department of Environ-
mental Management; Federal Highway Administration,
U.S. Department of Transportation; and Resco,
Inc. Saugus, Massachusetts

Submitted by *Gino J. Bastanza*
Gino J. Bastanza
Project Supervisor

WORK PLAN

R-37-0 Bottom Ash Residue - A component of Bituminous Pavements

The construction, restoration, and maintenance of highways consume vast quantities of natural resources, the supply of which, in many instances is rapidly diminishing. For example, the demand for aggregates is increasing at a time when sources near urban and other high-use areas are being depleted, and the quality of available aggregates is either at a low level or unavailable because of environmental restrictions and appreciating land values. Real and artificial shortages are therefore occurring.

Rising construction costs in an era of strong inflationary pressures, intense competition for available public funds, and increasing public demands to reduce the taxes which provide these funds, compel transportation agencies to develop and apply technologies aimed at curtailing the use of scarce or expensive materials and promote the use of less costly, more plentiful items. Reducing costs can be accomplished by the substitution of less expensive materials for those that are more costly. Today, municipal waste is being viewed as the largest source of material that may prove to be a cheap and abundant highways construction material.

Conservation of energy is a matter of growing national concern and importance. The substantial energy consumption in constructing highways provides an opportunity for energy conservation. The production of pavement aggregate requires energy for removal from their source,

crushing, sizing, and transporting. Hauling aggregate can consume large quantities of energy to match distribution and quality of supply with project location. The result is that aggregate that is normally inexpensive can become costly from an energy viewpoint.

The objectives, as detailed above, can be identified as: (1) conservation of construction materials; (2) reduction of construction costs; and (3) energy conservation.

Limited research to date has indicated that one of the most promising and potentially valuable means of serving these needs lies in the use of incinerator residue (bottom ash) as an aggregate in bituminous pavement. The proposed state-wide network of seven regional resources recovery facilities in Massachusetts for the processing of municipal wastes will produce vast quantities of incinerator residue. An experimental construction project to examine the suitability of this residue as a substitute for asphalt concrete aggregate is therefore intended. This project will be financed with Federal and construction funds. Preconstruction engineering, monitoring and evaluation activities will be conducted as an HPR-II research study. A successful conclusion of this effort will also reduce land fill requirements for the disposal of waste material and demonstrate a beneficial environmental affect of the highway program

Research Objective:

To evaluate the feasibility, both technically and economically, of using incinerator bottom ash residue as a substitute for natural aggregates in plant mixed bituminous concrete paving mixtures.

Scope and Approach:

A. Select a highway that is currently under consideration for resurfacing and meets the following criteria:

1. There are no foundation or drainage problems
2. The profile and cross section are reasonably the same as original design, requiring only a minimum of leveling.
3. The ADT is a minimum of 15,000 including a reasonable amount of truck traffic.
4. Project length is approximately 1.5 miles

B. Prepare a contract for pavement resurfacing including all Department standard design and construction procedures plus the following:

1. Divide the project length into five equal sections:

Section 1 will be the control section resurfaced with 1-1/2" of standard I-1 binder and 1" of standard I-1 top.

Section 2 will be resurfaced with 1-1/2" of binder mix (consisting of a blend of 3/4" natural aggregate and bottom ash) plus 1" of standard I-1 top.

Section 3 will be resurfaced with 2-1/2" of binder mix consisting of a blend of 3/4" natural aggregate and bottom ash. It will be sealed with rubberized asphalt and chip-stone.



ANTHONY D. CORTESE, Sc.D.
Commissioner
727-5194

The Commonwealth of Massachusetts
Department of Environmental Quality Engineering
Metropolitan Boston - Northeast Region
323 New Boston Street, Woburn, MA 01801

STATUS REPORT
RESCO ASH RESIDUE
ENVIRONMENTAL EVALUATION
DECEMBER, 1982

PREPARED FOR:

William J. St. Hilaire, P.E.
Regional Environmental Engineer
Metropolitan Boston/Northeast Region

William F. Cass, Director
Division of Hazardous Waste

WJSH

WFC

PREPARED BY:

John J. Fitzgerald
Senior Sanitary Engineer
Metropolitan Boston/Northeast
Region

Section 4 will be resurfaced with 1-1/2" of binder mix consisting of a blend of 3/4" natural aggregate and bottom ash plus 1" of top mix consisting of a blend of 3/8" natural aggregate and bottom ash.

Section 5 will be resurfaced with 1-1/2" of binder mix consisting of 100% bottom ash plus 1" of top mix consisting of 100% bottom ash. Depending on compaction results and surface texture, the Engineer will reserve the right to seal this section with rubberized asphalt and chipstone if he deems it necessary.

All work outlined above will be executed in accordance with Department standards and any contract special provisions.

C. As the contract progresses, monitor and document each of the following phases of the work:

1. Design and batching of bottom ash pavement mixes:
 - a. Mix design criteria
 - b. Problems, if any, of processing material through batching plant
 - c. Any special treatment or handling of bottom ash residues
2. Placing and compacting the mix:
 - a. Workability and placing characteristics of the mix.
 - b. Irregularities, if any, in mix after passing through paving machine.
 - c. Rolling characteristics of mix during compaction.
 - d. Types of rollers and number of passes (Vibratory rollers will not be permitted)

3. Pavement Density:
 - a. In-place density of the finished pavement courses (both top and binder) will be determined by nuclear density gage.
4. Finished pavement characteristics:
 - a. Skid resistance
 - b. Rideability
 - c. Overall appearance and surface texture
5. Comparative service performance of finished pavement sections over a five year period:
 - a. Semi-annual change in skid resistance properties
 - b. Semi-annual change in rideability characteristics
 - c. Semi-annual change in pavement durability - cracking, ravelling, rutting, shoving. etc.

Staffing

Francis W. Holden, Research and Materials Engineer
Gino J. Bastanza, Chief-of-Laboratory-Project Supervisor
Joseph M. Hegarty, Pavement Maintenance Engineer-Project
Technical Advisor
John L. Griffith, Principal Sanitary Engineer (BSWD) -
Project Coordinator

The environmental impacts associated with the handling, disposal, and/or re-use of the RESCO ash residue has been of continuing interest to the Department since operations began in 1975. Due to the lack of a comparable precedent and the nature and magnitude of the RESCO project, a series of laboratory and in-situ ash residue testing and analyses programs were instituted by facility operators and various agencies and institutions of the Commonwealth, including the Department of Environmental Quality Engineering, the Department of Environmental Management, and the University of Massachusetts.

In the intervening years, a considerable amount of analytical test data has been generated concerning the occurrence and leachability of metals and other inorganics in the ash residue. In recent months, however, concern in this area has increased dramatically, owing to an increased regional and national interest in resource recovery technology and the recent promulgation of state and federal solid/hazardous waste laws and regulations.

Ash Residue from the RESCO facility, approximately 200 tons per day, is currently being stockpiled on-site on the northwest perimeter of an abandoned 200 acre landfill according to an approved engineering plan. A proposal by facility operators to utilize the ash residue as a final cover material (to support vegetation) on this abandoned landfill is currently being evaluated by the Department.

Testing programs instituted in the past seven years have attempted to assess leaching properties of the residue, and have included laboratory lysimeter and elutriate studies utilizing tap water, distilled water, acidic solutions and ambient acid precipitation (eastern Massachusetts). In-situ testing programs at the RESCO site and controlled residue deposition areas in Waltham and North Andover, Massachusetts, are also under review.

While stressing the on-going status of many of the residue studies, the following is a compendium of information, conclusions, and speculations on this material, as currently understood by the Department:

- (1) GENERAL CHARACTERISTICS - The generic term "ash residue" has been taken to mean those end products of high temperature refuse combustion consisting of a heterogeneous mixture of "bottom" ash (riddlings, clinkers) and "fly" ash (furnace fly ash, electrostatic precipitator fly ash). At the RESCO facility in Saugus, the bottom and fly ash waste streams are combined, directed to a quench channel drag conveyor, and ultimately removed from the plant as a combined ash residue mixture.

In the context of the end-of-process mixture defined above, the RESCO residue is a combination of inert ash, unburned organic and inorganic material, some ferrous metal, and glass slag. The residue is angular, free draining, alkaline, and purported to be biologically sterile. The total volatile solids content of the residue has been reported to be in the area of 2.4% by weight or less, indicative of a relatively complete refuse incineration process.

- (2) **CHEMICAL COMPOSITION** - Significant differences in contaminant concentrations have been reported by various researchers, undoubtedly due to the residue's intrinsic variability, different sampling methodologies, analytical procedures and perhaps significantly, bottom/fly ash ratios.

In general terms, the RESCO residue contains elevated levels of mineral salts and alkalinity, and high concentrations of some heavy metals including lead, cadmium, copper, and zinc.

- (3) **RESIDUE LEACHABILITY** - High concentrations of mineral salts and heavy metals in the RESCO residue is not in itself a cause for concern. Rather, the real and potential leaching properties of the residue material will ultimately determine its environmental compatibility and scope of utilization.

Inorganic leaching is a complex phenomenon, dependent upon such factors as the types and distribution of compounds, the pH and ionic strength of the solute, the types and concentrations of complexing ligands, and the redox environment of the leaching system. Interfacing laboratory and "real world" conditions is difficult, especially when trying to evaluate long-term potentials. Nevertheless, the leaching of soluble salts and certain heavy metals from the RESCO residue has appeared with some frequency, yielding a preliminary indication of overall leachate patterns.

Clearly, substantial leaching of readily soluble salts from "fresh" ash residue has been well documented, at least in terms of specific conductance measurements, which can average 2500 μ mhos/cm² or more upon initial leachate generation. Ions leached from these salts include sodium, iron, calcium, potassium, magnesium, phosphorous, chlorides, nitrates, and sulfates. The leaching of heavy metals from the ash residue, though proportionately minute, are of key environmental concern.

Ash testing programs to date have not disclosed massive leaching of heavy metals from the mixed residue, even when subjected to prolonged exposure to ambient "acid precipitation" (pH=4.0) conditions. Data from several testing programs and methodologies, however, appear to implicate lead and cadmium as heavy metals with significant short and long term leaching potential. In some instances, lead and cadmium concentrations have exceeded allowable limits in the EPA EP Toxicity procedure, although this test is probably more of a regulatory classification procedure than an absolute measurement of leachability.

Lead is a ubiquitous contaminant emanating from a variety of common waste sources. High levels of lead contained within the RESCO residue, however, may be attributable to lead-base inks utilized for newsprint. (It is interesting to note that paper and cardboard products comprise 40 to 50% of "typical" municipal refuse; newspapers and magazines alone comprise an estimated 15%.)

It is speculated that the high concentrations of cadmium contained in the RESCO residue is due to the presence of plastic products in municipal solid wastes, as cadmium is utilized as a stabilizer and pigment in common consumer thermoplastics, including polyolefins, polyvinyl chloride, and polystyrene. The percentage of thermoplastics in municipal refuse is expected to increase substantially in the future from a present value around 5%, to 13 to 20% by the year 2000.

- (4) BUFFERING ABILITY OF RESIDUE - Field and laboratory studies on RESCO ash residue undertaken at the University of Massachusetts Waltham Experiment Station since 1977 have identified a persistent ash buffering capacity in that residue samples exposed to ambient acid precipitation events (mean pH=4.0) will produce a leachate with a mean pH value of 7.9. This alkaline buffering characteristic has important implications to residue leachability, since, in general, trace metal species are least soluble under alkaline conditions. However, although this neutralization mechanism is not totally understood, it is presumably of a finite nature, which creates speculation as to the long-term stability of the residue and the potential for a future breakdown of the material due to physical, chemical, and/or biological processes.

- (5) BOTTOM/FLY-ASH COMPOSITION - As previously mentioned, the end-of-process waste product exiting the RESCO plant is a mixture of "bottom" ash and "fly" ash, with the bottom ash component comprising the bulk of the mixture. Newer facilities of this type, however, often segregate these two component wastestreams.

Recent test data has disclosed that bottom and fly ash components may have substantially different properties; future testing programs will attempt to further define these discrepancies.

- (6) RESCO PLANT PROCESSES - The physical and chemical characteristics of incinerator ash residue are a direct function of (1) the nature of the raw refuse, (2) incinerator design, and (3) incinerator operational parameters. Thus significant differences in residue properties can exist between individual incineration facilities. (this is especially true in consideration of the substantial differences between European and American refuse).

The major effect of high temperature refuse incineration is the almost total exchange of inorganic salts for organic compounds, the partial oxidation of metals, and the physical concentration and intermingling of metallic compounds and inorganic salts.

Operational parameters at the RESCO plant in Saugus, to the extent they may impact on residue generation and chemical properties, have recently been analyzed in great detail by the facility operators, the results of which are currently under review by the Department.

- (7) CONTINUING RESEARCH PROGRAMS - The analyses of a material as heterogeneous as the RESCO residue is necessarily data-intensive. Existing and future research programs will attempt to further define short and long term chemical characteristics and will address such topics as bottom/fly ash differentiation, residue structure and chemical speciation, dissolution characteristics and kinetics, buffering mechanism (quantification), soluble salt leaching, and EP Toxicity testing.

In conclusion, while some of the residue's physical properties have been evaluated, many questions still remain relative to the nature and stability of this material. In addition to being a severe impediment to product sampling and laboratory analyses, the heterogeneous nature of the ash residue makes data analysis difficult and complicates environmental assessment.

The Department is presently compiling and analyzing existing data on the RESCO residue. The technical data will be utilized to identify environmentally appropriate ash disposition options, and the Department will formulate a regulatory position on the handling, use and disposal of the RESCO residue consistent with applicable laws and regulations.

Additional research or data may be necessary for the Department to make such a determination. The next step in this process will be a Departmental review of the existing data to identify information gaps. If the current data is insufficient, the Department will collaborate with parties conducting research on the RESCO residue during the generation of the requisite information.

The Department of Environmental Quality Engineering is a proponent of resource recovery facilities such as RESCO. Given the sometimes unsanitary and polluting nature of conventional "sanitary" landfills, energy and metal recovery facilities are viewed as an environmentally attractive method of solid waste management, if for no other reason than to physically reduce waste volumes requiring land disposal. Of course, facility ash residues must be managed properly.

Nationally, RESCO has been at the forefront of resource recovery technology and implementation, and as such has encountered and dealt with many situations unique to the field. The evaluation and characterization of the facility's residue is yet another area lacking precedent that will require original research and study. Once sufficient information has been derived, proper residue management and disposal procedures can be engineered.

The Department of Environmental Quality Engineering is the state's environmental regulatory agency responsible for developing, administering, and enforcing programs which regulate air, surface water and groundwater, water supplies, wetlands, and solid and hazardous waste.

DRAINAGE DESIGN CALCULATIONS

APPENDIX 10.13

DESIGN CALCULATIONS FOR THE RESIDUE/UNPROCESSABLE WASTE LANDFILL

Introduction

The following design calculations consider the surface water management plan for the project during its final phase. During this phase Cells 1 and 2 will be completely filled and stormwater storage will be provided in a stormwater pond and the diked FPL easement.

Peak design elevations will be highest during this project development phase and thus the 10-year - 24 hour, 25 year - 72 hour and 100 year - 72 hour design storms have been applied to this phase.

During the initial phase of development (i.e., landfilling of Cell 1) the area set aside for Landfill Cell 2 will also be utilized for stormwater storage. Design calculations for this phase for the 25 year - 72 hour design storm are included in this Appendix.

I. Final Phase - Cells 1 and 2 capped.

A. Water Quality Design Criteria

SFWMD water quality guidelines for retention storage require a retention volume equal to 50% of the runoff from the 3 yr. - 1 hr. storm (precipitation = 2.8 inches).

Impervious Drainage Area = 131.2 acres
Swale Area = 18.6 acres

Determine weighted runoff coefficient

Runoff coefficient (impervious areas) = 0.9
Runoff coefficient (pervious areas) = 0.2

$$\text{Weighted runoff coefficient} = \frac{(0.9) \times (131.2) + 0.2 \times (18.6)}{149.8} = 0.81$$

Retention storage required

$$\begin{aligned} &= 0.5 \times (0.81) \times (2.8 \text{ inches}) \times (1 \text{ ft}/12 \text{ inches}) \times (149.8 \text{ acres}) \\ &= 14.2 \text{ ac/ft} \end{aligned}$$

For a control elevation of +2.0 feet NGVD, determine minimum discharge elevation to retain 14.2 ac-ft of stormwater in the stormwater pond and FPL easement.

TABLE 1

TOTAL STORAGE - SWALE, FPL EASEMENT AND POND

<u>El (ft)</u>	<u>Swale (Ac-ft)</u>	<u>FPL Eas (Ac-ft)</u>	<u>Pond (Ac-ft)</u>	<u>Total (Ac-ft)</u>
2	0	0	0	0
3	0	6.7	1.5	8.2
4	0	14.1	3.0	17.1
5	0	22.1	4.5	26.6
6	10.7	32.0	6.0	48.7
7	23.2	42.3	7.5	73.0
8	37.4	52.9	9.0	99.3
9	53.3	63.8	10.5	127.6
10	71.2	75.0	12.0	158.2

Interpolating between total storage achieved for elevations of 3 and 4 feet, the outfall weir must be set at El. +3.7' NGVD for 14.2 Ac-ft retention in stormwater pond and FP&L easement.

B. Peak Discharge Criteria

A stormwater runoff model (DRAINCALC) which is based on SCS TR-55¹ (24 hour type II storm event) was utilized to

1. Calculations based on methodology presented in "Urban Hydrology for Small Watersheds: Technical Release No. 55; Soil Conservation Service January, 1975.

determine the pre-development discharge hydrograph. Conservatively, the first two days of rainfall were ignored. The following information was input into the model:

Drainage Area = 149.8 acres
Precipitation = 11.0 inches, (34d day of design storm)
*Time of Concentration = 95 minutes
**Curve Number = 78

*Based on Soil Conservation Services (SCS) velocity method of determining the time of concentration. Flow length - 2400 ft. with an average overland flow velocity of 0.42 ft/sec.

**Natural ground elevations are 0 to 2.0± ft. with soil condition D. Reported curve number assumes a meadow in good condition (see U.S. Department of Agriculture, SCS Technical Release No. 55, "Urban Hydrology for Small Watersheds" - 1975).

The predevelopment peak design discharge as calculated in the model is 434.3 cfs. Using SCS TR-55 tables and assuming 25% ponding throughout the watershed the peak runoff adjustment factor for a 25 year storm = 0.57.

Assuming a watershed slope of 0.1%, the slope adjustment factor for the site = 0.32.

Thus, the adjusted peak discharge for the site is:

$$(0.57) \times (0.32) \times (434.3) = 104 \text{ cfs}$$

Results: Limit post development peak design discharges below 104 cfs.

Utilizing the same methodology, i.e. the DRAINCALC model hydrographs and SCS TR-55 tables, the post-development peak runoff rate is 2551 cfs.

Using SCS TR-55 the following can be attained:

Given:

Limiting Discharge: $Q_o = 104 \text{ cfs}$

Runoff Peak Rate: $Q_i = 2551 \text{ cfs}$

Runoff Volume (conservatively): $V_r = 15 \text{ in.}$

Result

The storage volume required to attenuate post-development runoff discharges to 104 cfs is 125.5 acre feet.

With this storage volume, calculate the storage elevation with weir set at elevation +4.0 NGVD:

From Table 1:

<u>El. (ft)</u>	<u>Total Retention Vol. (Ac-ft)</u>
8	99.3
8.9*	125.5
9	127.6

*Interpolation between 8 and 9 feet of available storage volume.

Summary

High water elevation in the capped configuration is approximately +8.9 feet NGVD with discharge weir set at elevation +4.0 feet and +8.6 feet NGVD with weir set at elevation +3.7 feet. Say retention pond high water level will be at elevation +8.6 feet NGVD since weir at elevation +3.7 feet is adequate for water quality retention and discharge control with tailwater elevation assumed at +3.0 feet NGVD in C-11 Canal.

II. Initial Development Phase - Cell 1 Operational

In this case Cell 2 will be utilized for stormwater retention purposes during the landfilling of Cell 1. This will be achieved by hydraulically connecting Cell 2 to the stormwater retention basin.

As stated earlier, for the 25 year - 72 hour design storm the limiting discharge is 104 cfs and the runoff peak rate is 2551 cfs.

From SCS TR-55 tables, the required storage volume to limit post-development stormwater discharges to predevelopment levels is 125.5 Ac-ft.

With the outfall weir set at elevation +4.0 feet NGVD calculate the storage/elevation assuming no swale storage in Cell 2, control elevation in Cell 2 is +2.0 feet NGVD, and FP&L easement will not be used during initial Cell 1 development (only retention pond utilized).

Utilizing DRAINCALC model the following was computed:

<u>Elevation (ft)</u>	<u>Vol. Cell 2 (acre-feet)</u>	<u>Vol. Retention Pond (acre-feet)</u>	<u>Total Storage (acre-feet)</u>
2	0	0	0
3	50.5	1.5	52.0
4	101.0	3.0	104.0
4.4*			125.5
5	151.5	4.5	156.0

*Interpolation between elevation 4 and 5 feet of available storage.

Calculate preliminary length of outfall weir:

- o With weir set at elevation +4.0 feet NGVD, and a discharge flow rate of 104 cfs for the design storm. With 0.4 feet of surcharge head on the weir (4.4'-4.0'), the approximate length of weir, (sharp crested) required is 128'.
- o With weir set at elevation +3.7 feet NGVD, the approximate length of weir required is 55'.
- o If the water elevation is allowed to pond to elevation +5.9' NGVD weir length required is approximately 10 feet.

Therefore set the outfall weir at elevation +3.7 NGVD, provide approximately 10 feet of weir length and allow water to pond in Cell 2 and retention pond to elevation +5.9 feet NGVD.

DESIGN CALCULATIONS FOR THE
RESOURCE RECOVERY FACILITY

I. Design Criteria

- a) Water Quality: Retain 50% of 3 year - 1 hour storm (precipitation = 2.8 inches)
- b) Peak Discharge: Limit discharge to 24 year - 72 hour storm (precipitation = 15.0")
- c) Utilize two retention ponds with areas equal to 3.4 acres and 4.3 acres for total of 7.7 acres.
- d) Control elevation equals +2.0 feet NGVD.
- e) High water elevation is approximately +5.3 feet NGVD for 25 year storm with outfall weir elevation of +3.0 feet NGVD.
- f) Peak discharge of 90.7 cfs to C-11 Canal.

II. Site Land Use

Total Drainage area = 38 acres

Where:

	<u>Acres</u>	<u>% of Total</u>
Impervious (buildings, roads, parking)	8	21.1
Pervious	30	78.9
Landscaped	(22.3)	
Retention/Detention	<u>(7.7)</u>	<u> </u>
	38	100.0

III. Provide Water Quality Criteria

- A. Retain 50% of 3 year - 1 hour storm (2.8")

Note: Calculations based on methodology presented in Urban Hydrogology for Small Watersheds: Technical Release No. 55; Soil Conservation Service, January 1975, which uses of 24 hour, Type II storm distribution.

1. Develop Runoff Curve Number for developed site:

<u>Use</u>	<u>Curve No.</u>	<u>Area (ACS)</u>	<u>Composite</u>
a. Bldgs, roads, parking lots, etc.	98	x 8	= 784
b. Landscaped, ponds, etc.	80	x 30	= 2,400
		38	3,184

(Note: CN = 74, based on open space with good grass cover placed on relatively permeable structural fills, i.e., crushed limestone, etc.; high groundwater.

$$\text{Weighted runoff curve number} = \frac{3,184}{38} = 84$$

2. From Table 2-1 (interpolated for CN-84 and 2.8 in.) Runoff depth from 2.8 inches = 1.36 inches.

B. Vol. retained in basins at 50% of 3 year - 1 hour storm

$$0.50 \times 38 \text{ acres} \times 1.36 \text{ in.} \times \frac{1'}{12"} = 2.15 \text{ acre-feet}$$

C. Depth of storage in ponds at discharge of 3 year - 1 hour storm.

$$D = \frac{2.15 \text{ acre ft}}{7.7 \text{ acres}} = 0.279' = 3.3" \text{ for 50\% retention}$$

Set control elevation of weir to discharge 3 year storm at 3.3" surcharge above lowest selected control elevation.

IV. Peak Discharge

A. 25 year - 72 hour storm (15"); 38 acres
(Note calculations based on TR-55)

1. Runoff curve number prior to development:

CN = 89 (Table 2-2, Pasture, poor condition poorly drained)

2. Runoff prior to development:

From EQS 2-5, 2-7 (TR-55)

Runoff depth from 15 inches = $Q = 13.61$ inches
(unadjusted)

Peak discharge from Figure D-2 (flat slope) (TR-55) for 38 acres, CN-89, peak discharge = 26 cfs/in. of runoff. Since site is very flat with little grade, peak flows must be adjusted. Adjustment for flat slopes of <1% is taken from Table E-1 (TR-55). For slope of 0.1% (characteristic of site), adjustment factor = 0.45 (for slope). Furthermore, swampy and ponding areas will attenuate peak flows further. Therefore, an additional correction is applied from Table E-3 (TR-55). Assuming that approximately 25% of site area is swampy, for 25 year storm the frequency adjustment factor = 0.57 (for ponding).

Therefore peak discharge from predevelopment site = $13.61 \text{ in.} \times 26 \text{ cfs/in.} \times (0.45) \times (0.57) = 90.7 \text{ cfs}$ for 25 year - 72 hour storm.

Limit peak discharge to 90.7 cfs after development.

Detention Basins

Compute developed site discharge for 25 year storm runoff depth from 15 inches: CN = 84: $Q = 12.94$ inches

From Figure D-2 (flat slopes) for CN = 84, DA = 38 acres peak discharge = 23 cfs/in. of runoff. Adjust for ponding = 0.57. Therefore, peak discharge for developed site:

$12.94 \text{ in.} \times 23 \text{ cfs/in} \times (0.57) = 169.6 \text{ cfs}$ for 25 year - 72 hour storm

Determine required storage to attenuate discharge to 90.7 cfs.

$$Q_o \text{ (desired outflow)} = 90.7 \text{ cfs}$$

$$Q_i \text{ (future condition inflow)} = 169.6 \text{ cfs}$$

$$\frac{Q_o}{Q_i} = \frac{90.7}{169.6} = 0.534$$

Determine V_s (storage volume) from Figure 7-2 (TR-55)

For:

$$\frac{Q_o}{Q_i} = 0.534 \quad \frac{V_s}{V_r} = 0.262$$

For:

$$V_r = 12.94 \text{ in.} \quad V_s = (0.262) \times 12.94 \text{ in.} = 3.39 \text{ in.}$$

$$\text{Storage} = \frac{(3.39 \text{ in}) \times (38 \text{ acres})}{12 \text{ in/ft.}} = 10.74 \text{ ac-ft.}$$

With 7.7 acres for basins, then the minimum surcharge height at discharge:

$$\frac{10.74 \text{ ac-ft}}{7.7 \text{ acres}} = 1.39'$$

Say 1.4' for outflow structure with 90.7 cfs capacity.

Preliminary Basin Design

The site control elevation is +2.0 NGVD. Weir elevation to be set at elevation +2.3' to provide sufficient storage for 50% of the 3 year - 1 hour storm for quality control. To attenuate peak flows from the 25 year - 72 hour storm so as not to exceed predevelopment discharge a minimum of 10.74 acre-feet of storage is required. Assume that this storage will be provided above elevation 2.3' (weir crest). Also discharge from the basins must not exceed 90.7 cfs. Basins should be provided with a minimum freeboard of 0.5 feet in addition to depth above crest. Outflow control structure would contain a weir to control discharge to C-11 Canal. Table 2 below presents preliminary analysis of 7.7 acre basin and outlet control structure to meet design criteria.

TABLE 2

PRELIMINARY ANALYSIS - BASIN/OUTFLOW STRUCTURAL

<u>Storage Provided</u>	<u>Storage Requires</u>	<u>Depth Above Crest Elevation</u>	<u>Surcharge Elevation at Discharge</u>	<u>Length of Weir for Limiting Discharge</u>
10.47 acre-feet	10.47 acre-feet	1.4 ft.	+3.7 ft. NGVD	17'
19.25 acre-feet	10.47 acre-feet	2.5 ft.	+4.8 ft. NGVD	7'
23.10 acre-feet	10.47 acre-feet	3.0 ft.	+5.3 ft. NGVD	5'

Summary: Pond storage elevation of 5.3 feet NGVD is maximum estimated elevation for site, and the estimated length of the weir to limit discharge is five feet.

SYNTHETIC LANDFILL LINERS

BROWARD COUNTY, FLORIDA
SYNTHETIC LANDFILL LINERS

Introduction

This report describes the results of a study on the state-of-the-art application of flexible membrane liners used for the containment of landfilled materials including municipal solid waste, ash residue from power generation units (coal) and industrial waste. The objectives of the study were to assemble information concerning the chemical and physical properties and field performance of various synthetic liner materials. Specifically, the categories of investigation are as follows:

- o The effect of MSW leachate and industrial waste sludges on the physical and chemical properties of various synthetic liner materials. This category includes testing in accordance with ASTM standards of liner materials after exposure during laboratory and field conditions.
- o Design standards which minimize the adverse effect of differential settlement on synthetic liner materials.
- o The effect of a landfill fire on synthetic liner materials.

Information was sought concerning the following commercially available flexible membrane liners and fabric-reinforced flexible membrane liners as they occur in the following four types of polymers:

1. Vulcanized Elastomers:

Butyl rubber
Chlorinated polyethylene (CPE)
Chlorosulfonated polyethylene (CSPE, Hypalon)
Ethylene propylene rubber (EPDM)

2. Thermoplastic Elastomers (TPE):

Chlorinated polyethylene (CPE)
Chlorosulfonated polyethylene (CSPE, Hypalon)

3. Thermoplastics:

Plasticized polyvinyl chloride (PVC)
PVC with selected elastomers

4. Crystalline polymers (thermoplastic):

High Density Polyethylene

Information used in this report was obtained from literature searches, manufacturers, fabricators, suppliers, and installers of liners; and interviews and discussions with various consultants, industry personnel, and testing laboratories.

Summary of General Liner Properties (from USEPA Publication, "Lining of Waste Impoundment and Disposal Facilities").

a. Polyvinyl Chloride

PVC liners are produced in roll form in various widths and thicknesses. Most liners are used as unsupported sheeting, but fabric reinforcement has been used. PVC compounds contain 25% to 35% of one or more plasticizers to make the sheeting flexible and rubber-like. They also contain 1% to 5% of a chemical stabilizer and various amounts of other additives. The PVC compound should not contain any water soluble ingredients. A wide choice of plasticizers can be used in PVC sheeting, depending upon the application and service conditions under which the PVC compound is to be used. Plasticizer loss during service is a source of PVC liner deterioration. There are three basic mechanisms for plasticizer loss: volatilization, extraction, and microbiological attack. The use of the proper plasticizers and an effective biocide can virtually eliminate microbiological attack and minimize volatility and extraction. The PVC polymer, itself, is not affected by these conditions. It is affected, however, by ultraviolet exposure.

The principal reason for loss of plasticizer is by volatilization in the heat of the sun rather than solution in the waste fluid. Carbon black prevents ultraviolet attack but does cause the

absorption of solar energy raising the temperature to a high level to cause vaporization of the plasticizer. A soil or other suitable cover material used to bury the liner protects it from ultraviolet exposure and reduces the rate of plasticizer loss. PVC sheeting is not recommended for exposure to weathering and ultraviolet light conditions during its service life. In some burial tests and in some liner applications, PVC sheetings have become stiff, presumably due to loss of plasticizers. Some plasticizers can be degraded by microorganisms, while others can be extracted, to a limited extent, by water.

Plasticized PVC sheeting has good tensile, elongation, puncture and abrasion resistance properties. It is readily seamed by solvent welding, adhesives, and heat and dielectric methods.

PVC membranes are the most widely used of all polymeric membranes for waste impoundments. They show good chemical resistance to many inorganic chemicals; however, they are attacked by many organic chemicals, particularly hydrocarbons, solvents, and oils which extract the plasticizer. Special compounds of PVC are available, designated as Oil-Resistant PVC (PVC-OR), that possess high resistance to oil attack. These "oil-resistant" grades of sheeting must be made with "specialty" plasticizers; the PVC polymer is inherently resistant to the effects of oils.

b. Chlorosulfonated Polyethylene (CSPE, Hypalon)

Hypalon, produced by Dupont, is characterized by ozone resistance, light stability, heat resistance, good weatherability, and resistance to deterioration by corrosive chemicals, e.g. acid and alkalies. It has good resistance to growth of mold, mildew, fungus, and bacteria. Membranes of this material are available in both vulcanized and thermoplastic forms, but primarily in the latter. Usually, they are reinforced with a polyester or nylon scrim and generally contain at least 45% of CSPE polymer. The fabric reinforcement provides the necessary tear strength for use on slopes, and reduces the distortion resulting from shrinkage when

placed on the base and when exposed to the heat of the sun. The latter is more suitable for lining industrial and hazardous waste impoundments.

CSPE can be seamed by heat sealing, dielectric heat sealing, solvent welding, or by using "bodied" solvent adhesive. Membranes of this polymer do not crack or fail at extreme temperatures or from weathering. Disadvantages of unreinforced CSPE membranes are low tensile strength and a tendency to shrink on exposure to sunlight due to the heat absorbed. Also, thermoplastic CSPE tends to harden on aging, due to crosslinking by moisture, ultraviolet radiation, and heat and has relatively poor resistance to oils. The hardening can cause problems in repairing damaged sheetings due to crosslinking of CSPE, which can make it insoluble and difficult to heat seal.

c. Polyethylene

One type of polyethylene, high density polyethylene (HDPE), has been used as a landfill liner material since the mid-1970's. It is available in sheetings of 20-120 mils in thickness, is an unreinforced product, and is free of additives such as plasticizers and fillers. HDPE is characterized by its high resistance to oils, solvents, permeation by water vapor and gases, and weathering; as well as, its high tensile strength, puncture resistance, and excellent elastic properties. Seaming of HDPE liner material is performed in the factory and in the field by an extrusion welding process which if properly performed yields a seam which is stronger than the parent material. Because HDPE is stiffer than most liner materials and because fusion seaming is more involved than solvent seaming, HDPE liners take somewhat longer to install.

Physical and Chemical Compatibility of Liner Materials

The information contained herein was obtained from the USEPA publication entitled "Lining of Waste Impoundment and Disposal Facilities", and from manufacturers and suppliers of synthetic liner materials.

Because of the potential impact that pollutants from waste disposal sites might have on the groundwater quality, EPA initiated research work in this area to determine the state-of-the-art with respect to liners and to assess the various liners available under conditions which simulated as closely as possible actual service conditions. EPA felt that the test results from this type of evaluation would give the greatest credibility to the use of lining materials for land waste disposal facilities.

a. Laboratory Results of Exposure to MSW Leachate

The primary liners were recovered from landfill simulators after 12 and 56 months of exposure.

The results of the analyses and physical testing of the specimens before and after exposure are presented in Table 1. These test results are divided into analyses, physical properties, and seam strength and are arranged by liner material and exposure time. The following is a summary of Table 1:

- o CSPE, CPE and EPDM materials absorbed the most leachate.
- o EPDM and PVC lost about 10% of its plasticizer.
- o In general tensile strength increased (Figure 1).
- o Puncture strength did not change appreciably.
- o There was a significant drop in several cases in seam strength; however, this loss in adhesion did not result in any seepage.

Overall, the changes in the physical properties of the membranes resulting from 56 months exposure to MSW leachate was relatively minor. None of the liners showed any seepage. The absence of seepage confirms the very low permeability of the membrane lining materials and the adequacy of the seams that were placed in the liners.

b. Exposure of Membrane Liners to Hazardous Waste

The EPA study was concerned with the laboratory evaluation of various commercial lining materials upon exposure to a variety of hazardous wastes under conditions which simulate real service.

The wastes included two strong acid wastes, a strong alkali waste, an oil refinery tank bottom waste, a lead waste from gasoline, saturated and unsaturated hydrocarbon wastes, and a pesticide waste. Results show the variation in the volatiles and extractables both with respect to the polymer type and the waste. There are indications that, in some cases, the plasticizer which was in the original compound was removed during the exposure period. In other cases, the extractables were higher, indicating the absorption of nonvolatile constituents in the waste.)

The effects of 3.5 years of exposure to the waste varies considerably with the liner material and the waste. Only one material, a polyester elastomer, completely lost its elongation and that was in exposure to a strongly acidic waste. The CSPE, and EPDM liners lost significant elongation in the caustic, lead, and nitric acid wastes, respectively. The CSPE and PVC liners stiffened during exposure to the wastes and the neoprene liner softened. The CSPE crosslinked during exposure and the PVC probably lost plasticizer.

Table 2 provides a summary of the compatibilities of various liner materials with various industrial hazardous wastes.

c. Test Results

Test results provided by liner manufacturers and supplier's regarding the compatibility of synthetic liner materials with a large number of chemicals is provided in the following tables:

- Table 3 - Oil Resistant CPE
- Table 4 - Polyvinyl Chloride
- Table 5 - Hypalon
- Table 6 - HDPE

In selecting polymer and rubber compounds for service in a liquid medium, a designer generally selects materials which have low or negligible swell. Swelling of a compound can have adverse effects which will make the product unserviceable. Some of the major effects of swelling generally are:

- Softening
- Loss or tensile and mechanical strength
- Loss of elongation
- Increased permeability
- Increased potential of creep
- Greater susceptibility to polymer degradation

All of these effects are adverse with respect to liner performance. Swelling, therefore, is a valuable indicator of the compatibility of a liner to a waste.

Shrinkage can also be a measure of compatibility for liner compositions that are highly plasticized. For example, in the case of highly plasticized PVC compounds, the plasticizer can leach and diffuse out of the polymer leaving the compound stiff and brittle.

Therefore, in Tables 3, 4, and 5 one should look for a small weight change in order to determine liner chemical compatibility. Table 6 provides outright chemical compatibility of various types of liner materials.

In sum, more often than not, for a given chemical environment, there are several types of synthetic membrane liner materials which exhibit chemical compatibility. It should be noted that the leachate from a MSW or ash residue landfills would generally be less aggressive than many of the hazardous and industrial waste listed in the above tables; therefore, liner performance with respect to chemical compatibility can be expected to be good.

Settlement Capability

There are several potential modes of liner failure due to physical processes, one of which is differential settlement. Differential settlement can damage all liners. This problem is best mitigated with a thorough geologic analysis prior to site selection and careful subgrade design and construction. Differential settlement is a localized stress phenomenon and the greater the thickness and elasticity of the liner, the greater the tolerance range for differential settlement. Therefore, the inherent elasticity of some synthetic liners, serves to mitigate settlement effects by conforming to the subgrade if movement occurs.

Upon review of the literature and information provided by manufacturers and suppliers, the most acceptable liner material for the mitigation of differential settlement on the market today is HDPE. Its attributes include:

(For HDPE between 60 and 100 mils in thickness)

- a. Elongation
 - 15% at yield
 - 800% at break
- b. Tensile strength
 - 2,500 psi at yield
 - 3,500 psi at break
- c. 100% weld strength (fusion weld)
- d. highly puncture resistant
- e. highly chemical resistant

Its drawbacks include:

- a. somewhat greater difficulty in installation - HDPE is stiffer than most liner materials, and fusion seaming is more time and quality control intensive than solvent seaming.

Further mitigation of a differential settlement problem can be achieved by installing a double liner using a material such as PVC which has a fairly high elasticity (300% at

break). The purpose of utilizing two liners, separated by several feet of sand, is to distribute the stresses induced by localized settlement by distributing the load over a wider area. Likewise, the use of geotextiles in lieu of or with sand fill will function to strengthen the liner system and distribute stress.

HDPE liner material has successfully been utilized to mitigate differential settlement. A municipal sanitary landfill located in southeastern Pennsylvania was built over a depository of discarded cars. The design incorporated two layers of HDPE material 30 and 40 mils in thickness. The combination of sheets and 100% integrity seam welding provided the flexibility and security required to compensate for the possibilities of upward movement and downward settlement. Hazardous waste disposal sites in New York State using HDPE liner have been designed to accommodate expected settlement.

Proper foundation design can help reduce the amount of differential settlement. The installation of a drainage system under the liner can prevent hydrostatic pressures from building up. These pressures change the stresses on the foundation soil (sand) and may make it more susceptible to differential settlement by causing a shift in the soil.

The Effect of Landfill Fires on Synthetic Liners

The result of discussions with personnel from liner manufacturers and suppliers as well as engineering consultants involved with synthetic liners, is that landfill fires should have a negligible effect on synthetic liner materials. This conclusion is based on the following factors:

- a. The liner will be covered with one to two feet of sand. This sand cover will act as an effective insulator by virtue of its low thermal conductivity. There is a large percentage of voids in a medium grained sand; therefore, the entrapped dead air and water (if saturated) will act as an insulator.

- b. The "flash point" or ignition temperature where many liner materials will burn if in contact with flame is in the neighborhood of 350°F for PVC and 675° for HDPE. The effect on these liners when they reach these temperatures is to melt and disintegrate. The important point here is that flame must come in contact with the liner material; if one utilizes a soil cover this cannot happen.
- c. The highly chlorinated liner materials such as PVC and Hypalon will burn if in contact with flame but will not support flame by virtue of the high chlorine content of the material. Chlorine gas smothers the flame.
- d. After discussions with many industry personnel only one sanitary landfill, lined with a synthetic liner, was reported to have had a fire. The liner was 4 to 5 feet below the fire and was unaffected.

Existing Lined Landfills

Table 7 identifies landfills that have successfully utilized synthetic liner materials to protect underlying groundwater. Tables 8 and 9 provide supplemental lists of landfill liner installations as provided by installation companies.

Conclusions

Based on the information gathered during the course of this study, the following conclusions have been formulated:

- a. Available literature contains sufficient engineering and laboratory performance data on which to base an engineering analysis of synthetically lined land impoundment sites for various forms of municipal and industrial wastes.
- b. The method of utilizing flexible membrane liners to prevent groundwater contamination by leachate from waste impoundment facilities is a highly developed technology. With proper design considerations, these liners will be physically and chemically compatible with a given landfill environment. Proper quality control during construction and facility operation are the most important variables in successful liner performance.

TABLE 7

LANDFILLS UTILIZING SYNTHETIC LINER MATERIALS

<u>Landfill Location</u>	<u>Year in Operation</u>	<u>Type of Waste</u>	<u>Material Utilized</u>	<u>Comments</u>
Cathcart LF in Snohomish, WA	1981	MSW	35 and Hypalon 36 mil PVC	Staff Inc. installation
Crawford County, OH demonstration LF (EPA Study)	1971	MSW	30 mil PVC	Liner tested after 6 yrs. of exposure; buried material should little change in overall properties incl. seam strength
Boone County, KY, LF and EPA Field Site	1972	MSW	CSPE, CPE, LDPE	LF was operated by EPA Solid and Hazardous Waste Research Division. All materials showed little overall change in physical properties.
EPA Field Site	Operational for 6.5 yrs.	Industrial Sludge	15 mil PVC	Conclusions drawn: PVC should be covered and should be thicker than 15 mils.
Experimental LFs at Georgia Institute of Technology (EPA Study)		MSW	CSPE (unreinforced)	After 4 years in operation, only minor changes in physical properties of the material was encountered.
Brookhaven Landfill in N.Y.		MSW	PVC	Facility was expanded by adding 2nd layer of PVC.
New Jersey L.F.	1980	MSW	Hypalon	All physicals after 18 months burial were normal with tensile modulus increasing. See Table 10 for specific test data.
New Hampshire Superfund Project		Hazardous Waste	40 mil HDPE	Gundle installation.
Southeastern Pennsylvania		MSW	Double liner 30 and 40 mil HDPE	1st landfill installed under the Pennsylvania Title 25 regulations. Differential settlement expected.

TABLE 7

LANDFILLS UTILIZING SYNTHETIC LINER MATERIALS
(continued)

<u>Landfill Location</u>	<u>Year in Operation</u>	<u>Type of Waste</u>	<u>Material Utilized</u>	<u>Comments</u>
Kansas		Hazardous Waste	60 mil HDPE	Site upgrade, install liner over clay. The installation is monitored by a leak detection system
New Hanover County, N.C.	1980	MSW	Double Liner 36 mil Reinf. Hypalon 20 mil PVC	1st synthetically lined sanitary LF in N.C.
Cecos Site in Cincinnati, OH	1974	Hazardous Waste	HDPE	Superfund project - this site accepts hazardous waste from many parts of the country. Has a leak detection system.
Tampa, Florida		Flyash and Ash Residue	HDPE	Stone and Webster project; 2.5 million square feet of liner.
Cecos Site Niagara Falls	1981	Hazardous Waste	HDPE	Active permitted hazardous waste disposal site
SCA Site Pinewood S.C.	1984	Hazardous Waste	HDPE	Active permitted hazardous waste disposal site
SCA Site Model City, N.Y.	1982	Hazardous Waste	HDPE & Hypalon	Active permitted hazardous waste disposal site
Town of No. Hempstead, N.Y. Landfill	1983	MSW	PVC-OR	Next section will contain PVC-OR bottom liner and HDPE top liner with leak detection system
Croton Point Landfill Westchester Co. N.Y.	1983	MSW	PVC	Active permitted hazardous waste disposal site

- c. The selection of a liner material for a waste impoundment site should involve the following considerations:
- o The liner material should satisfactorily resist attack from all chemicals (solvents, oils, greases, etc.), ozone, ultraviolet radiation, soil bacteria, mold, fungus, and vegetation to which it will be exposed. Resistance can be determined by laboratory testing of the liner material in the waste that the liner will contain.
 - o The liner material should have ample strength and weather resistance to withstand the stresses associated with wetting and drying, freezing and thawing, subgrade conditions and settlement dictated by the geographic location and geologic setting of the impoundment site.
 - o The liner material should have adequate physical properties to withstand the stresses of installation from machinery or equipment.
 - o The liner material should be resistant to laceration, abrasion, and puncture during operations from any matter that may be found in the materials that it will contain. Landfill operation should be planned to protect the liner system.
 - o The liner material should be easily repairable at any time during its life (particularly when repairs are feasible), and it should be the most economical material that can adequately fill the specific application.
 - o The liner material should be properly installed. Improper installation of even the best material will defeat the purpose of the lining.
 - o To provide longer life and protection against mechanical damage and weathering, all flexible membrane liner materials, both exposable and unexposable, should be covered with a layer of sand or fine-textured soil.
 - o Drainage systems should be installed both above and below the liner in order to prevent fluid pressure buildup which can cause settlement or unnecessary pressure.

- o Proper filling and maintenance of the liner and impoundment site should be practiced.
- d. In addition, the EPA recognizes the use of synthetic liner materials as being the most acceptable method to prevent contamination of the groundwater at hazardous waste disposal sites. The following excerpts have been taken from the Federal Register dated July 6, 1982, the subject being "EPA Design Performance Requirements for Hazardous Waste Impoundments, Piles and Landfills."
- o "... in the cases of landfills and of surface impoundments used to dispose of hazardous waste, the regulations provide that the liner must be constructed of materials that prevent wastes from passing into the liner. Synthetic liners are the only commonly used materials of which EPA is aware that would meet this standard."
 - o "When a synthetic membrane liner... is installed in a landfill, the leachate collection and removal system installed above the liner (as required by today's regulations for landfills and piles) can achieve virtually a 100% removal efficiency. In contrast, if a clay liner is used, some leachate will seep into the liner rather than be removed through the drainage layer."

REFERENCES AND CORRESPONDENCES

1. USEPA Publications:

- a. Lining of Waste Impoundment and Disposal Facilities. EPA-530/SW-870, Revised March 1983.
- b. Liner Materials Exposed to Municipal Solid Waste Leachate. EPA-600/2-79-038. July 1979.
- c. State-of-the-Art Study of Land Impoundment Techniques. EPA-600/2-78-196. December 1978.
- d. Liner Materials Exposed to Hazardous and Toxic Sludges. EPA-600/20-77-081. June 1977.

2. Information provided in writing and during telephone interviews by the following synthetic Liner Manufacturers, Fabricators and Suppliers:

Schlegel Lining Technology, Inc.
Gundle Lining Systems, Inc.
Watersaver Company, Inc.
Staff Industries
B.F. Goodrich Company, Engineered Rubber Products Division

3. Information provided during telephone interviews with the following consulting firms and private testing laboratories.

E.A. Engineering
Matrecon, Inc.
National Sanitation Foundation

DER OPINION ON ASH RESIDUE

INTEROFFICE MEMORANDUM

For Routing To District Offices And/Or To Other Than The Addressee			
To:	<u>Mr. Fox</u>	Location:	
To:		Location:	
To:		Location:	
From:	<u>Mr. Hamilton</u>	Date:	
Reply Optional	☐	Reply Required	☐
Date Due:		Date Due:	
		Info. Only	☐

TO: Steve Fox *sf*
 FROM: Hamilton S. Owen, Jr. *HsO*
 DATE: April 19, 1983
 SUBJECT: Use of Fly Ash

RECEIVED
 APR 20 1983

DIVISION OF
 ENVIRONMENTAL PERMITTING

I have reviewed the material assembled by Bill Hennessey and Jim Estler concerning the use of flyash. Additionally, I have reviewed material supplied by Monier Resources, Inc. and an EPA guideline published in the January 28, 1983 Federal Register. It is my conclusion that the use of flyash mixed with lime or cement will have no significant adverse environmental impacts when used as a road or parking lot subbase or road base material.

I have also been studying the use of a flyash, lime or cement and flue gas desulfurization sludge mixture as a potential low strength soil cement material. This material sets up like a low strength concrete. It is a relatively impermeable (5×10^{-6} cm/sec - 5×10^{-8} cm/sec) material. The heavy metal species in the flyash are usually chemically bound during the cementing process.

In both the lime-flyash and lime-flyash-FGD sludge mixtures, the flyash becomes cemented together with aluminosilicates which reduces the surface area available for leaching. The low permeability of the resulting material also reduces the leaching potential.

It is my recommendation that the department allow use of flyash in construction products subject to the precautions outlined by Jim Estler's memo of 12/17/82 as follows:

Flyash may be used as a construction material when mixed with lime or cement, water, and aggregate in proper proportions to form a stable concrete like material with the following safeguards:

Page Two
Memo
April 19, 1983

1. Transportation of flyash from generator to a temporary storage site or batch plant must be accomplished in a dust free manner either by tank trucks or covered dump trucks with enough water to ensure dust free transport.
2. Generators should store flyash in an acceptable manner either in a dry state in an enclosed system with emissions controlled by approved dust collectors or in an approved landfill site with precautions taken to ensure no groundwater or surface water contamination. The landfill site should be provided with an irrigation system to control fugitive dust during storage and material handling.
3. Temporary storage site must be in conformance with No. 2 above.
4. Preparation of the flyash mixture must be accomplished at a permitted batch plant. Flyash should be stored in a silo equipped with a dust collector. Material transfer points, mixer, and any other potential source of particulate emissions should be adequately controlled. Open stock piling of flyash at the batch plant or construction site should be prohibited.
5. Flyash shall not be used as a fill or embankment material.
6. Flyash must be used in conjunction with lime or cement (not limestone unless mixed with lime or cement) and water to form a pozzolanic product.
7. Placement must be above the high groundwater table and should be underdrained if necessary.
8. Mixture must be covered by an impervious surface coat.

In regards to the request of Mr. E. Edward Holloway, Jr. to use a flyash material to consolidate phosphate slimes, I have several comments. The department might consider a test program to allow such grouting under certain conditions. Such conditions might include:

Page Three
Memo
April 19, 1983

1. A showing by the applicant that sufficient clay beds surround the site to preclude contamination of aquifers. The clay beds should be continuous at least two to five feet thick with a permeability not to exceed 1×10^{-7} cm/sec.
2. A pilot test should be done in which the clay slimes, flyash, lime and FGD sludge are mixed and allowed to cure for 28 days. After curing, the resulting mixture should be tested for leachability, compression strength, permeability, etc.
3. If the results of 1 and 2 above are satisfactory and indicate no potential leachate problems, then the grouting could be allowed under controlled conditions including monitoring of groundwater quality.

cc: Bill Hennessey

INTEROFFICE MEMORANDUM

For Routing To District Offices And/Or To Other Than The Addressee		
To: _____	Locn.: _____	
To: _____	Locn.: _____	
To: _____	Locn.: _____	
From: _____	Date: _____	
Reply Optional []	Reply Required []	Info. Only []
Date Due: _____	Date Due: _____	

TO: W. K. Hennessey

THROUGH: Dan Williams *DW*
Bill Thomas *BT*
Harry Kerns

FROM: Jim Estler *JE*

DATE: December 17, 1982

SUBJECT: Fly Ash

Pursuant to your request, a literature review was conducted on materials received from Monier Resources, Inc. and Power Plant Siting. The following is a brief review of my findings and recommendations:

I. Background Information:

Fly ash along with bottom ash and boiler slag are generated by the combustion of coal. Approximately 75-85% of the ash generated is fly ash. The chemical, physical and engineering properties of fly ash are influenced by many factors including: type and variability of coal composition; degree of coal pulverization; type of furnace; firing temperature and other operating parameters; characteristics of ash collection and disposal properties; environmental effect (eg: leaching, weathering, self-hardening, etc.); and time.

Fly ash is composed of fine particles that are predominately spherical in shape, solid or hollow, and of a glass or amorphous nature.

The chemical properties of fly ash vary from source to source. However, in general the primary constituents are silica, alumina, and iron oxide with lesser amounts of calcium, magnesium, sulfur and unburned carbon. Trace elements typically present are arsenic, boron, cadmium, chromium, copper, lead, selenium and zinc. The later are of little importance with respect to the use of fly ash for construction type applications; however, they are of a concern in an environmental sense. If these elements could be leached out of fly ash material in quantities which exceed environmental standards, then problems could be created for the commerical use of fly ash.

Fly ash is of interest in the construction industry because of its pozzolanic properties. A pozzolan is defined as a siliceous or aluminous and siliceous material which is in itself chemically

inert, and possesses little or no cementitious value, but, when in a finely divided form and in the presence of water, will react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties. Properties similar to the reaction products of Portland Cement.

Attachment I summarizes the coal fired utilities in the area and fly ash disposal/use practices.

II. Fly Ash Stabilization of Subgrade and Base Roadway Material:

The issue at hand is whether the District should allow, based on potential environmental problems, the use of fly ash as a subgrade and base material in roadway construction.

The representatives from Monier Resources, Inc. have related the following information to Harry Kerns:

1. Fly ash would be mixed with cement or lime, water, possibly some type of aggregate. Use would be restricted to road base and subbase material.
2. Mixing would be accomplished at a batch plant with the necessary controls taken to prevent air and water pollution. Fly ash would be stored in a silo and fugitive dust problems would be minimized.
3. Any temporary storage of fly ash material would be at an approved landfill site (i.e.: Parsons Pit).

To date, none of the literature reviewed has specifically addressed the environmental issues relating to the use of fly ash as a roadbase material. Buck Oven has expressed a concern over the general use of fly ash. The material he sent to the District pertained to the water quality issues related to wet and dry ash storage and stockpiling. We are aware of the potential leachate problem and it has been specifically addressed in Parson's Pit design. However, the disposal practices (either temporary or long term) of coal fired utilities in our area should be investigated to insure no degredation of groundwater and/or surface water quality.

Reports reviewed cover the use of fly ash (sometimes including bottom ash and coal slag) mixed with lime, limestone, and/or cement to form a cementitious compound. High performance base course applications are composed of mixtures with lime, cement or limerock (with cement or lime added).

In an EPA draft final report on "Data Collection and Analyses Pertinent to EPA's Development of Guidelines for Procurement of Highway Construction Products Containing Recovered Materials," in a section on fly ash used in structural fills the statement is made that "compacted fly ash has low permeability, particularly if it is self-hardening, and indications thus far are that the material does

not leach potentially hazardous concentrations of inorganic chemicals". This section also recommends that "the placement of fly ash in a fill or embankment must be accomplished above the anticipated high water table and the material must be underlain by a drainage blanket or opengraded granular material".

The EPA report referenced above made some very general statements about the uses of LFA (Lime-Fly Ash-Aggregate) mixtures. In regards to air pollution it states that some is generated and is a result of "aggregate mining and crushing, and that the handling of fly ash results in more particulate pollution than the asphalt option". "The dust problem created by material handling may cause some adverse impact in terms of air quality".

With regard to water pollution "No significant water pollution is generated directly by the LFA system, but some water pollution is generated by the production of fuels used in various steps".

EPA published the "Guideline for Federal Procurement of Cement and Concrete Containing Fly Ash" in the November 20, 1980 Federal Register (40 CFR 249). This document recommends the use of fly ash in cement and concrete material used in Federal projects and requires it to be included in the bid specifications.

The Federal Highway Administration is also promoting the fuller utilization of waste products (ie: fly ash), particularly where there is a potential for energy conservation. They are trying to convince the State DOT to develop this philosophy. The USDOT has published two volumes entitled: "Soil Stabilization in Pavement Structures A Users Manual" (FHWA-IP-80-2) dated October 1979, which includes a section on lime-fly ash stabilization.

Various states around the country use and have specifications to use fly ash in roadway construction activities. My understanding is the Florida DOT is reviewing the use of fly ash at this time and that they are somewhat hesitant to give an agency O.K.

III. Recommendations:

The following proposal addresses the environmental issues associated with the use of fly ash as a base and subgrade material in roadway construction (These recommendations do not reflect an endorsement nor has an evaluation been made in regard to its structural properties.)

A. Fly ash mixed with lime or cement, water, and aggregate does not pose an adverse environmental hazard if safeguard measures are undertaken.

B. Safeguards are:

1. Transportation of fly ash from generator to a temporary storage site or batch plant must be accomplished in a dust

free manner. Either by tank trucks or covered dump trucks with enough water added to ensure dust free transport.

2. Generators store fly ash in an exceptable manner. Either in a dry state in an enclosed system with emissions controlled by approved dust collectors or in an approved landfill site with precautions taken to ensure no groundwater or surface water contamination. The landfill site should be provided with an irrigation system to control fugitive dust during storage and material handling.

3. Temporary storage site must be in comformance with No. 2 above.

4. Preparation of the fly ash mixture be accomplished at a permitted batch plant. Fly ash to be stored in a silo equipped with a dust collector. Material transfer points, mixer, and any other potential source of particulate emissions should be adequately controlled. Open stock piling of fly ash at the batch plant or construction site should be prohibited.

5. Fly ash shall not be used as a fill or embankment material.

6. Fly ash must be used in conjunction with lime or cement (not limestone unless mixed with lime or cement) and water to form a pozzolanic product.

7. Placement must be above the high groundwater table and should be underdrained if necessary.

8. Mixture must be covered by an impervious surface coat.

C. Rational:

1. Water: Based on the information reviewed regarding the cementitious properties of fly ash when combined with cement or lime and water it appears reasonable to assume that the resultant compound would not be prone to leaching. Further, limiting its contact with groundwater and providing a impervious surface layer to prevent contact with precipitation, afords us with additional assurances of preventing leachate problems.

2. Air: Adequate controls of fly ash during storage, transfer, and transport will control fugitive dust problems.

D. Comments From Tallahassee:

Buck Oven's group has been reviewing a request from the Electric Power Research Institute about the potential use of fly ash. He advised me in our 12-16-82 telephone conversatio that its use as a fill or embankment material (ie: unstabilized) could create potential problems. However, in

stabilized form as a pozzolanic compound and with additional safeguards (ie: impervious top coat and above the high groundwater table) he saw no potential environmental problems with its use.

IV. General Comments on Fly Ash:

A. Monier Resources, Inc. has questioned whether DER would permit the dumping of FPL's fly ash from oil fired plants at Parsons's Pit.

1. Bill Deane advised me on 11-10-82 that since the source of fly ash (Crystal River) was specified in the landfill application (and not in the permit), the Department would require the permittee to request a formal modification of the permit to allow the site to be used to store fly ash from other sources. This would open the door to third party intervention.

2. The literature reviewed did not contain any information on fly ash generated from oil fired power plants. Therefore, it would be advisable to request ash analysis from several plants along with leachate tests.

B. Fly Ash Used as a Agricultural Soil Conditioner:

No information has been received regarding this issue and until such time as it is and has been reviewed by DER and the Department of Agriculture, its use should not be allowed. This is due to the potential negative environmental effect on groundwater quality. Plant take up may render some crops unfit for human consumption, and Cu and Zn may be absorbed in sufficient concentrations to be toxic to plants.

JE/scm

NOTES ON FLY ASH HANDLING - COAL FIRED POWER PLANTS

TECO (phone conversation with John Ramil on 10-27-82)

All coal fired plants (Big Bend 1&2 and Gannon 5&6) pneumatically convey the fly ash from the ESP to a storage silo(s).

Some units share a common silo. Emissions are controlled by baghouses.

They sell all their fly ash to a broker (Mineral Aggregates) which sells it to Florida Mining and Materials which uses it in the manufacturing of cement.

Fly ash is transported by an enclosed truck (tanker).
TECO produces 219,000 tons/year of fly ash.

City of Lakeland McIntosh Unit #3 (Phone conversation with Bill Rodrigues on 10-27-82)

Fly ash from the ESP is conveyed to a storage silo via a pneumatic system. Emissions are controlled by a series of baghouses. They are temporarily stock piling the ash in the landfill area. They use water sprays and a Nalco product to control emissions. Ultimately, they will mix the fly ash, bottom ash, scrubber sludge, and concentrate from the cooling tower to form a slurry which solidifies in 24-hours. This concrete like substance called Pozotech can be used as a road base material. Currently, have an agreement from Polk County to use the material. They are looking for someone to actually buy and use the substance. The system is designed to produce 83,516 tons of fly ash/year.

Florida Power conversation with Dennis Shantz on 10-21-82

Bartow No. 1 - Fly ash handling is part of the construction permit for the ESP, at least on baghouse involved. It is handled dry, using a solids pump from the ESP to a storage silo. Water spray is used at the end of the conveyor system from the silo as it is transferred to the stock pile in the landfill area. They have a fire hose at the landfill area to control fugitives should a problem develop.

They intend to sell the fly ash when they can locate a buyer.

Crystal River - Units 1 & 2 pneumatically convey fly ash to a series of storage silos. Fly ash is either transported dry in a tanker truck or wet in an open body truck to landfill site.

SIGNAL RESCO, Inc.

10 UOP Plaza
Des Plaines, Illinois 60016
312-391-2341
A Subsidiary of UOP Inc.

November 28, 1983

Mr. Ray Moreau
Environmental Supervisor, Resource Recovery Program
State of Florida Dept. of Environmental Regulation
Twin Tower Office Building
2600 Blair Stone Road
Tallahassee, FL 32301-8241

Subject: DER Questionnaire

Dear Mr. Moreau:

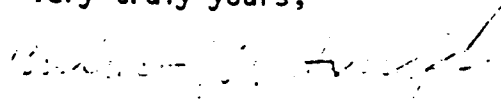
Your letter of October 13, 1983 to Mr. D. F. Acenbrack, Pinellas County Department of Solid Waste Management, was forwarded to me for response.

The information that you requested is contained on the attached eight pages.

I would appreciate receiving a copy of questionnaire results from other resource recovery facilities from around the country that are made available to your office.

I trust that the information we have supplied is adequate but if there is need for clarification please contact me directly at 312/391-3744.

Very truly yours,



Andrew M. Szurgot

mb

Attachment

C: D. F. Acenbrack (w/att.)
L. K. Batton (w/att.)

Subject: Pinellas County Project
DER Questionnaire Concerning
Ash Characteristics

A copy of the subject questionnaire is attached for reference. The answers to the questions follow.

1. Ash Analyses

The material discharged from the grate, referred to as bottom ash in the questionnaire, is combined with the fly ash collected from the various boiler and precipitator hoppers. The combined residue goes to a materials recovery system where metals are removed. The recovered metals comprise from 10% to 20% of the total mass of combined residue on a dry basis depending on the composition of the incoming municipal solid waste (refuse). The material remaining after the metals are recovered, referred to as aggregate, is sent to landfill for disposal. Table I identifies the elemental analysis of the combined hopper and flyash, and aggregate.

2. EP Toxicity Test Results

The EP Toxicity testing was conducted under the auspices of the County. A copy of the test report is attached.

3. Operating Parameters

a. Temperatures and Residence Times

The design temperature profile across the unit and the residence time at design conditions in each zone are shown in Table II for the case when firing municipal solid waste (refuse) having a higher heating value (HHV) of 5000 Btu/lb at a rate of 1000 TPD.

b. Air Requirements

Each unit operates at excess air rates in the range of 60% to 95%.

c. Burnout Efficiency

The percentage of inorganic carbon in the combined residue is guaranteed not to exceed 5.0% by weight (dry basis) when firing refuse with a higher heating value (HHV) of 4500 Btu/lb.

4. Other Information

a. Air Pollution Control Equipment

Each unit is equipped with an Air Correction Division, UOP Inc. electrostatic precipitator of the weighted-wire type. Each precipitator consists of 3 active/1 empty mechanical (6 active/1 empty electrical) fields. The outlet grain loading from each ESP is guaranteed not to exceed 0.08 gr/dscf corrected to 12% CO₂.

b. Ash Quench System

Burned out material from the grate is quenched in a water bath. Then it is allowed to drain in order to remove excess moisture. The collected fly ash is conditioned with water for dust control before adding it to the quenched material discharged from the grate. There is no water effluent from the ash quench and conditioning system.

c. Mixing Ratio of Fly Ash to Grate Ash

All of the collected fly ash is combined with all of the material discharged from the grate. Although the exact amount of fly ash will depend upon the characteristics of the refuse being fired, the fly ash will comprise approximately 11% by weight of the total combined residue.

d. Ultimate Disposal of the Combined Residue

The material discharged from the grate is combined with the fly ash collected in the various boiler and precipitator hoppers. The combined residue goes to a materials recovery system where metals are removed. The aggregate remaining is sent to landfill for disposal. The recovered metals are sold.

DER Questionnaire

1. Dry-weight analyses for combined fly and bottom ash. Same for each ash separately.
2. Any E.P. Toxicity test results.
3. Facility operating parameters, including:
 - temperature ranges
 - residence time
 - air requirements
 - burnout efficiency
4. Other information:
 - air pollution control train employed
 - ash quench systems utilized (and any reagents added and analyses available on the effluent)
 - mixing ratios of flyash to bottom ash
 - the form of residue ultimate disposal or reuse

NOTE: If any of the above information has already been generated in existing reports, you are welcome to send me copies of the reports instead of answering the questions directly in separate correspondence.

Table I
Elemental Analysis of Hopper Ash and Aggregate

Element	Concentration Unit	Concentration	
		Hopper Ash ⁽¹⁾	Aggregate
Cadmium	ppm	< 10.3	< 10
Magnesium	"	13,700	4,630
Zinc	"	10,640	1,330
Silicon	"	128,000	397,000
Copper	"	665	1,930
Nickel	"	156	39
Manganese	"	1,815	629
Calcium	"	109,700	62,900
Molybdenum	"	172	25
Cobalt	"	48.0	22
Aluminum	"	53,500	18,000
Titanium	"	14,600	3,690
Vanadium	"	87.9	26
Chromium	"	936	185
Iron	"	11,100	23,700
Lead	"	3,640	450
Barium	"	1,530	482
Beryllium	"	NR	11
Mercury	"	28.6	0.96

NOTES:

(1) Combined ash collected from the economizer and precipitator hoppers.

(2) NR = Not Reported.

(3) The results for each material represent the average of two grab samples.

EP Toxicity Test Report

ESE

**ENVIRONMENTAL SCIENCE
AND ENGINEERING, INC.**

June 21, 1983

ESE No. 83 405 400

Mr. William Dasher
Director Public Works Operations
Pinellas County Solid Waste Department
2800 110th Avenue North
St. Petersburg, FL 33702

Dear Mr. Dasher:

Enclosed are the results of the two waste samples collected on 5/27/83 and the two residue samples collected on 6/6/83 at the Pinellas County Refuse to Energy Facility. The samples can be described as follows:

<u>ESE Sample No.</u>	<u>Sample Description</u>	<u>Sample Date</u>
246902	Waste (5/26/83)	5/27/83
246903	Waste (5/27/83)	5/27/83
246904	Aggregate Residue	6/06/83
246906	Non Separated Residue	6/06/83

The maximum allowable concentrations are also provided on the data reports. Results from all four samples are below the maximum allowable concentrations.

Sample numbers 246904 and 246906 yielded a positive reaction to acid and a negative reaction to base when subjected to the reactivity test. The results indicate that the positive reaction is due to carbonates in the samples and hence the samples should not be considered hazardous for the reactivity criteria.

A third sample (#246905) of the non-ferrous residue was also collected on 6/6/83. This sample consisted of non-magnetic residue from two to ten inches in size. The nature of this sample made it impossible to sieve it to the required size as specified in the EP Toxicity Test. The DER recommended that this sample was not suitable for the test and hence no analysis was conducted.

Please call me if you have any questions.

Sincerely,

Karen Hatfield
Karen Hatfield
Project Manager

RECEIVED

KLH:ceg JUN 27 1983
Enclosures

U.O.P./S.W.S.D.

5723 **RECEIVED**
JUN 23 1983

**PINELLAS COUNTY
SOLID WASTE SYSTEM**

RESULTS OF ANALYSES

SAMPLES COLLECTED AT THE PINELLAS COUNTY REFUSE TO ENERGY FACILITY 5/27/83

ESE Sample No.	246902	246903	Max. Conc.
Sample Description	Dumped 5/27	Dumped 5/26	Allowed
Arsenic, Diss (ug/L)	<22	<22	5000
Barium, Diss (ug/L)	363	252	100000
Cadmium, Diss (ug/L)	4.2	4.9	1000
Chromium, Diss (ug/L)	170	160	5000
Lead, Diss (ug/L)	<30.0	<30.0	5000
Mercury, Diss (ug/L)	<12	<12	200
Selenium, Diss (ug/L)	<39	<39	1000
Silver, Diss (ug/L)	<4.0	<4.0	5000
Zinc, Diss (ug/L)	5.9	1.9	500000
Endrin, Diss (ug/L)	<0.010	<0.010	20
Lindane, Diss (ug/L)	<0.002	<0.002	400
Methoxychlor, Diss (ug/L)	<0.1	<0.1	10000
Toxaphene, Diss (ug/L)	<0.5	<0.5	500
2,4-D, Diss (ug/L)	<10	<10	10000
2,4,5-TP, Diss (ug/L)	<10	<10	1000
Gross Beta, Diss (ug/L)	112	150	100000
Radium 226, Diss (ug/L)	1.5	0.4	300
pH (Corrosivity)	12.2	12.0	2->12.5
Ignitability	>212°F	>212°F	>212°F
Reactivity	Neg	Neg	Neg

Karen Hatfield
Karen Hatfield, Project Manager

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5775 JUN 23 1983

PINELLAS COUNTY
SOLID WASTE SYSTEM

RESULTS OF ANALYSES

CERTIFICATION SAMPLES COLLECTED AT THE PINELLAS COUNTY REFUSE TO ENERGY FACILITY
6/6/83

ESE Sample No. Sample Description	246904 Aggregate	246906 Non Separated	Max. Conc. Allowed
Arsenic, Diss (ug/L)	<22	<22	5000
Barium, Diss (ug/L)	295	312	100000
Cadmium, Diss (ug/L)	169	494	1000
Chromium, Diss (ug/L)	8.2	91	5000
Lead, Diss (ug/L)	991	2110	5000
Mercury, Diss (ug/L)	<12	<12	200
Selenium, Diss (ug/L)	<39	<39	1000
Silver, Diss (ug/L)	<4.0	<4.0	5000
Zinc, Diss (ug/L)	6830	16600	500000
Endrin, Diss (ug/L)	<0.010	<0.010	20
Lindane, Diss (ug/L)	<0.002	<0.002	400
Methoxychlor, Diss (ug/L)	<0.1	<0.1	10000
2,4-D, Diss (ug/L)	<10	<10	10000
2,4,5-TP, Diss (ug/L)	<10	<10	1000
Gross Beta, Diss (ug/L)	132	426	100000
Radium 226, Diss (ug/L)	0.7	0.7	300
pH (Corrosivity)	12.2	10.6	2->12.5
Ignitability	>212°F	>212°F	>212°F
Reactivity	Neg/Pos*	Neg/Pos*	Neg
Toxaphene, Diss (ug/L)	<0.5	<0.5	500

* See explanation in attached letter

Karen Hatfield
Karen Hatfield, Project Manager

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JUN 23 1983
PINELLAS COUNTY
SOLID WASTE SYSTEM

Table II

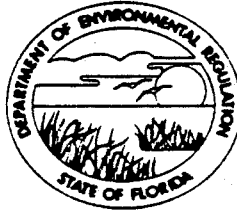
Temperature Profile and Residence Times

Refuse HHV: 5000 Btu/lb
Firing Rate: 1000 TPD

<u>Location</u>	<u>Parameter</u>	<u>Units</u>	<u>Value</u>
Combustion Chamber	Flue gas temperature above grate	^o F	~ 2010
	Flue gas temperature at flame end	^o F	1747
	Flue gas temperature at outlet	^o F	1539
	Total residence time combustion chamber	Sec.	4.1
Boiler	Flue gas temperature at boiler outlet	^o F	450
	Total residence time in boiler	Sec.	10.6

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

TWIN TOWERS OFFICE BUILDING
2600 BLAIR STONE ROAD
TALLAHASSEE, FLORIDA 32301-8241



BOB GRAHAM
GOVERNOR
VICTORIA J. TSCHINKEL
SECRETARY

MEMORANDUM

TO: District and Subdistrict Managers

THROUGH: Steve Fox *SH*
Howard Rhodes *HR*
Greg Parker *GLP*
Bob McVety *BM*
John Reese *JR*

FROM: Ray Moreau *RM*

DATE: December 19, 1983

SUBJECT: Agency Position on the Use of Fly Ash Material,
Including Aggregate from Resource Recovery Facilities.

There have been several inquiries from the districts concerning the above subject. In response, I have attached a package of information on fly ash for your use, review, and comment. This package includes the January 28, 1983 Federal Register, copies of memos on fly ash use from Buck Oven and Jim Estler, and copies of ash laboratory analyses from the Pinellas County Refuse-to Energy Facility.

The Solid Waste Section is revising Chapter 17-7, FAC, and the revisions will include specific regulations and guidelines on fly ash disposal and use (these revisions will be prepared for ERC adoption in April 1984). In the interim, this agency's position on the use of fly ash should be to follow the guidelines outlined in Buck Oven's memo which is attached. Disposal of fly ash material should be in a lined landfill.

If you have any questions or comments concerning this memo or the enclosures, please don't hesitate to contact John Reese or me at Suncom 277-1128.

RM/pe

Enclosures

cc: Marshall Mott-Smith
Jim Estler
Rodney DeHan
Buck Oven

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 249

[SWH-FRL 2176-8]

Guideline for Federal Procurement of Cement and Concrete Containing Fly Ash

AGENCY: Environmental Protection Agency.

ACTION: Final guideline.

SUMMARY: The Environmental Protection Agency (EPA) is today issuing final guidelines for the Federal procurement of cement and concrete containing fly ash, implementing Section 6002(e) of the Resource Conservation and Recovery Act of 1976, as amended (RCRA). Section 6002 of RCRA requires procuring agencies using appropriated Federal funds to purchase items composed of the highest percentage of recovered materials practicable. Section 6002(e) instructs EPA to prepare guidelines to assist procuring agencies in complying with the requirements of Section 6002. This guideline designates cement and concrete containing fly ash as a product area for which affirmative procurement actions are required, in accordance with Section 6002. Fly ash is a component of coal resulting from its combustion, and is the finely divided mineral residue which is typically collected from boiler stack gases. The guideline provides recommendations to procuring agencies which are expected to stimulate greater recovery and reuse of fly ash.

The preamble to the guideline explains EPA's regulatory strategy for fulfilling its responsibilities under Section 6002 of RCRA.

DATE: Effective February 28, 1983.

ADDRESS: Single copies of the final guideline, and RCRA, are available from:

RCRA Hotline (800) 424-9346 (In the Washington, D.C. area call 382-3000)

Public Docket: The public docket for this guideline is located in: Room S289C, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, D.C. 20460, and is available for viewing 9:00 a.m. to 4:00 p.m. Monday-Friday excluding holidays.

FOR FURTHER INFORMATION CONTACT: John Heffelfinger, Hazardous and Industrial Waste Division, Office of Solid Waste (WH-565), U.S. Environmental Protection Agency, 401 M Street, SW., Washington, D.C. 20460; (202) 382-4761.

SUPPLEMENTARY INFORMATION: Proposal and Comments: The proposed guideline

was published on pages 78906-78921 of the Federal Register of November 20, 1980, and invited comments from the public on its contents until January 15, 1981. At the request of some commenters the comment period was reopened until January 30, 1981. Notice of reopening of the comment period was published on pages 9132-9133 of the Federal Register of January 28, 1981. A total of 161 written comments were received on the proposed guideline, including 12 late comments. This is in addition to oral comments received at the public hearing held on January 8, 1981 at EPA Waterside Mall, where approximately 75 persons attended and 21 presented formal testimony. The public docket for this guideline is available for viewing as mentioned above.

Introduction

Purpose and Scope

The Environmental Protection Agency is today promulgating the first of a series of guidelines designed to encourage the use of products containing recovered materials. Section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended ("RCRA" or "Act"), 42 U.S.C. 6902, requires Federal, State, and local procuring agencies using appropriated Federal funds to purchase items composed of the highest percentage of recovered materials practicable. EPA is required to prepare guidelines to assist procuring agencies in complying with the requirements of Section 6002.

This preamble also explains EPA's regulatory strategy for fulfilling its responsibilities under Section 6002 of RCRA.

RCRA

The objectives of the Resource Conservation and Recovery Act are the protection of human health and the environment and conservation of valuable material and energy resources. The Act sets forth a national program to achieve these objectives by improving solid waste management practices. The provisions of the Act include: (1) Requirements for control of the generation, transportation, treatment, storage, and disposal of hazardous wastes, (2) establishment of environmentally sound disposal practices for all wastes, and (3) investigation and creation of incentives for resource recovery and conservation activities. These activities are to be carried out through a cooperative effort among Federal, State, and local governments, as well as private industry.

Requirements of Section 6002

Section 6002 of the Act, titled Federal Procurement, directs all procuring agencies which use appropriated Federal funds to procure items containing the highest percentage of recovered materials practicable, given that reasonable levels of competition, cost, availability, and technical performance are maintained. This requirement applies only to those products which are designated by guidelines issued by EPA under Section 6002(e). Further, only items where the purchase price of the item exceeds \$10,000, or where the quantity of such items purchased during the preceding year exceeded \$10,000, are subject to these purchasing requirements.

Federal procuring agencies responsible for drafting or reviewing specifications are required to review and revise specifications for products in order to eliminate any discrimination against the use of recovered materials. They are to remove specifications requiring that items be manufactured from virgin materials, and remove prohibitions against the use of recovered materials.

Vendors are required to estimate the percentage of recovered materials utilized for the performance of the contract and to certify that it is at least the amount called for by the specifications or other contractual requirements.

Section 6002 gives the Environmental Protection Agency responsibility for promulgating guidelines to assist procuring agencies in carrying out these requirements. The EPA guidelines are to designate those products which can be produced with recovered materials and whose procurement by procuring agencies will fulfill RCRA objectives. EPA guidelines are to provide specific recommendations with respect to the procurement of products containing recovered materials. In conjunction with the Office of Federal Procurement Policy in the Executive Office of the President, EPA has responsibility for implementing the policy and program at all levels of government.

Section 6002 is aimed at achieving the materials conservation goal. Its clear objective is to use the economic incentive of Federal procurement to increase the recovery of solid waste materials. Federal procurement of products made from recycled materials can demonstrate their technical and economic viability as they are used by Federal, State and local agencies.

Guideline for Federal Procurement of Cement and Concrete Containing Fly Ash

Purpose

The purpose of this guideline is to increase the use of cement and concrete containing fly ash which is purchased with Federal funds. Fly ash is a by-product of coal combustion. Its increased use in cement and concrete will help reduce this source of solid waste. At the same time this will conserve both significant amounts of energy and natural resources used in making cement. Cost savings can be achieved while providing a product that can be equivalent or even superior to cement and concrete made using only virgin materials.

This guideline will increase the demand for recovered fly ash in federally-funded construction. This increased demand should improve the marketability of fly ash and promote wider acceptance of it as a cement substitute and concrete additive. This together with the cost savings of fly ash in local markets may result in its more widespread use in non-federally funded construction as well.

Contents of the Guideline

This guideline designates cement and concrete, including concrete products such as pipe and block, containing fly ash as a product area for which procuring agencies must exercise affirmative procurement under Section 6002 of RCRA and presents recommendations for carrying out the requirements of Section 6002 with respect to fly ash used in cement and concrete. RCRA defines procuring agencies to include not only Federal agencies, but also State and local agencies, grantees, and contractors which are using Federal funds to purchase cement and concrete.

Section 6002 of the Act sets forth certain requirements for procuring agencies. These requirements include: (1) Eliminating from specifications any discrimination against the use of recovered materials; (2) purchasing products which contain recovered material if reasonable levels of technical performance, cost, availability, and competition can be achieved; and (3) obtaining certification from suppliers that they have met any minimum contractual requirements for including recovered materials.

To assist procuring agencies in achieving compliance with these requirements, this guideline recommends that procuring agencies which purchase cement or concrete adopt a procurement approach which

specifically allows that fly ash can be used as an optional or alternate material in the performance of the contract, either in a blended cement or as an admixture in concrete. This recommendation applies except in those cases where the use of fly ash would be technically inappropriate.

Flexibility is allowed procuring agencies in meeting this recommendation. For example, some agencies may prefer to allow for fly ash use through changes in contract specifications, with the option to use fly ash left to the discretion of the successful offeror. In other cases, agencies may prefer an alternate bid approach, and solicit bids for portland cement or concrete alone, and for portland cement or concrete containing fly ash.

In addition, this guideline recommends that procuring agencies revise their guide specifications and design guidelines to ensure that fly ash use is allowed, except where technically inappropriate. It suggests certification procedures which utilize the existing review and approval mechanisms already imposed by procuring agencies.

Phased-in implementation, with specification changes to be made in the first year after publication of this guideline and purchases to begin in the second year, is recommended.

Explanation of Current Regulatory Approach

General vs. Specific Guidelines

Soon after EPA undertook the effort to prepare procurement guidelines, it became clear that guidelines could not be developed for all 50,000 Federal product specifications and standards. EPA did not have the resources to review all 50,000 Federal product specifications and make decisions on what percentage of recoverable materials is technically and economically feasible, available in a reasonable amount of time, and produced by enough companies to guarantee that competition is maintained.

The Solid Waste Disposal Act Amendments of 1980 (Pub. L. 96-482) require a product-specific approach in issuing guidelines. These amendments key all of the purchasing requirements of Section 6002(c) to the preparation by EPA of guidelines for particular products and direct EPA to "designate those items which are or can be produced with recovered materials and whose procurement by procuring agencies will carry out the objectives of (Section 6002)."

Statute Requirements vs. Guidelines

A few commenters on the proposed guideline expressed confusion over the relationship between the requirements of Section 6002 and the recommendations of the guidelines. They asked for clarification of whether the recommendations contained in the guidelines must be adhered to.

EPA is of the opinion that the guidelines are, in general, voluntary. They contain recommendations for achieving compliance with the mandatory provisions of the statute, i.e., Section 6002. The mandatory provisions of the statute for a particular product area are triggered, for the most part, by EPA's designation of that product under Section 6002(e).

Although the guidelines contain recommendations rather than requirements, EPA is of the opinion that compliance with the guidelines constitutes compliance with the statute. However, there may be alternative methods of complying with the statute, not specifically addressed by the guidelines. As long as compliance with the intent of Section 6002 can be established, these alternative methods should be considered acceptable.

Criteria for Selection of Product Areas

In the proposed guideline, EPA proposed criteria to aid in the selection of product areas for which guidelines will be prepared. These criteria were:

- (1) The waste material must constitute a significant solid waste management problem due either to volume, degree of hazard or difficulties in disposal;
- (2) Economic methods of separation and recovery must exist;
- (3) The material must have technically proven uses; and
- (4) Federal purchasing power for the final product must be substantial.

In the main, these criteria incorporate all of the factors which the Solid Waste Disposal Act Amendments require EPA to consider in selecting products for the issuance of guidelines.

Some commenters suggested adding to or revising these criteria. One commenter suggested a criterion that the recycled product must not displace a currently recycled product, for example, home scrap as reused within a steel mill. EPA agrees in principle that by designating a product for affirmative procurement actions, a currently recycled product should not be precluded from use. By taking the product-specific approach which is required by Section 6002, sufficient investigations would be performed to assure that this does not occur. We

should add, however, that the definition of "recovered material" contained in RCRA " . . . does not include those materials and by-products generated from, and commonly reused within, an original manufacturing process." Thus, home scrap would not qualify as a recovered material for purposes of Section 6002.

Other commenters suggested that energy conservation be included as a criterion for product selection. EPA believes that while use of waste materials may indeed conserve energy, the overriding thrust of Section 6002 must be the impact on solid waste. Thus, it would be inappropriate to reject products from consideration which could result in a significant impact on the solid waste stream, but for which a slight increase in energy consumption would result. Likewise, if significant energy reductions could be achieved while having little or no impact on the solid waste stream, it would be inappropriate for EPA to issue procurement guidelines under Section 6002.

One commenter suggested revising the criterion of Federal purchasing power from being "substantial," to "a great deal." In considering this comment as well as suggestions for additional product areas for the issuance of guidelines, it became apparent that the criterion should focus on the extent to which the Federal government can affect use of waste materials through the procurement guideline mechanism. In some cases, changes resulting from direct purchasing with Federal funding may not be as significant as changes which may take place at State and local levels, and in the private sector, due to the "ripple effect" which changes in Federal procurement practices may have. Therefore, the fourth criterion has been revised to read as follows:

- (4) The Federal government's ability to affect purchasing or use of the final product or recovered material must be substantial.

One commenter suggested inclusion of a criterion for uses which may be expected to develop in the future. EPA rejected this suggestion because it is in opposition to the fundamental concept that the guidelines can only designate products which are technically and economically proven, and available in a reasonable period of time from enough persons to assure that competition is maintained. Other governmental programs may be aimed at demonstrating, for example, the technical feasibility of using a waste material in lieu of a virgin material in a pilot-scale project. Such use may be further developed in the future.

However, the mechanism of Federal procurement guidelines is inappropriate for such product development efforts. For the guidelines to be effective, products must have been fully developed and somewhat available, but suffering from resistance to their use. Experimental or developmental products do not fall into this category.

Product Areas Currently Under Study

With these criteria in mind, EPA has chosen four major product categories for the issuance of guidelines under Section 6002. These categories are cement and concrete containing fly ash, recycled paper products, spent pickle liquor from steel finishing processes as used in wastewater treatment operations, and highway construction products containing recovered materials, particularly lime-fly ash-aggregate road base and subbase mixtures. The issuance of a guideline for composted sewage sludge, as mentioned in the proposed guideline, has been deferred, due to higher priority commitments within EPA at the present time. EPA expects additional candidate products to surface through its industry solid waste studies program. As guidelines are completed in these areas, additional product areas may be selected for issuance of guidelines.

Some commenters suggested additional product areas which EPA should include in this and/or future guidelines. These products include petroleum products, petrochemicals, waste oil, metals, glass, tires, polyester bottles, salvaged materials, wood ash or coal/wood ash, and lead blast furnace slag.

These comments were not accompanied by any documentation as to how they meet the criteria for selection of product areas, as EPA specifically requested in the preamble to the proposed guideline. No information was presented as to why these products are good candidates for the procurement guidelines program. However, EPA has studied or considered some of these product areas for the issuance of guidelines. The only currently viable candidate on the list appears to be waste oil, i.e., Federal purchasing of rerefined oil. A guideline may be issued for this product area after completion of the already planned guidelines mentioned above.

Two major categories of metals, aluminum and ferrous scrap, have been considered for procurement guidelines and rejected. Aluminum does not constitute a significant solid waste management problem. Recycling programs implemented by the major aluminum producers during the past

decade have had a significant impact on the major source of aluminum scrap—the aluminum can. So valuable has this material become that its price has risen well over 100% during the past five years. Federal involvement would do little to promote further aluminum recycling, where the marketplace has already responded based on economics.

With regard to recycling ferrous scrap, although it is certainly technically and economically feasible, EPA has determined that the Federal government possesses very little ability to influence the amount of scrap which is currently recycled, through the procurement guidelines program. One reason for this is the technical capability of steel furnaces to use scrap. Basic oxygen and electric-arc furnaces currently are operated very close to their maximum technically feasible scrap utilization levels. The open hearth furnaces, on the other hand, have the capability to use additional amounts of scrap. This has been demonstrated in the past, where scrap has served essentially as the surge material when demand for steel increases. However, open hearth furnaces are slowly being phased out and replaced by basic oxygen and electric-arc furnaces. Open hearth furnaces account for less than 15 percent of domestic steel production today, compared to over 40 percent in 1969. Any expansion of production in the steel industry will take place by way of electric-arc and basic oxygen furnaces, which technically must use certain levels of scrap. Thus, Federal involvement would do little to promote further recycling of this material.

A second major reason for not issuing a guideline for ferrous metals is the number of distribution levels through which steel products must pass before receipt by the government. The criterion that the Federal government be in a position to affect purchasing of a recovered material product depends very much upon how directly the government can deal with the manufacturer of the product. For most of the products EPA has considered for the issuance of guidelines, the government purchases directly from the manufacturer or at most, from one intervening level. Although the government purchases such steel-containing products as automobiles, desks, and file cabinets, these are obtained from the final product manufacturers or distributors, very far removed from the steel production process. It is unlikely that the Federal government could influence raw materials utilization practices of steel manufacturers, with such reduced

leverage, or obtain meaningful certification of recovered material content.

With regard to government purchases of products containing recovered glass, the above discussion regarding levels of distributors applies here. The government purchases fabricated products which contain glass as one component or are packaged in glass. However, the government possesses very little leverage over the raw materials utilization decisions of glass manufacturers in such situations. There are some potential uses of recovered glass in construction products, such as in brick manufacture or as an aggregate in concrete block or in asphalt concrete. However, these applications have not yet proven themselves to be technically or economically viable enough to be commercially available for the purpose of Federal procurement.

Another waste material, tires, has potential for utilization. One promising application is the use of crumb rubber from waste tires in an asphalt-rubber mixture in highway construction. Such uses are referred to as stress absorbing membranes, involving a thin layer of asphalt-rubber used as surface material with chip seals or as an interlayer with a surface overlay. Asphalt-rubber has been demonstrated to be effective in preventing certain types of pavement cracking by improving the elasticity of the pavement and reducing the susceptibility of the pavement to temperature changes. However, technical feasibility and availability have not yet been demonstrated in wide areas of the country. Further, on an initial cost basis, asphalt-rubber systems appear to be more expensive than conventional pavements, although on a life-cycle cost basis asphalt-rubber may be less expensive. Insufficient data at the present precludes accurate cost comparisons.

This product area is one for which EPA may issue a procurement guideline in the future, as technical, economic, and availability factors are resolved. In the meantime, agencies responsible for highway construction programs at the Federal, State, and local level are urged to investigate the potential for use of asphalt-rubber through further demonstrations and evaluations in their particular regions.

With regard to using salvaged materials, i.e., used brick, old concrete crushed for aggregate, etc., no procurement guidelines are currently envisioned. Construction debris such as this has not been demonstrated to be a significant solid waste problem. This generally inert material is usually disposed of on contractor-owned land

and not in municipal landfills where it would consume sorely needed landfill space. Further, reuse of such materials, while potentially very desirable, is likely confined to project specific situations which lend themselves to this practice.

The suggestion for using wood ash or combinations of coal ash and wood ash for concrete, in similar fashion to fly ash from coal combustion, is not considered legitimate. It fails to recognize that fly ash must possess certain chemical and physical properties in order to react successfully in a concrete mix. While no documentation was provided, it is highly unlikely that wood ash or coal/wood ash possess these same properties.

Rationale for Choosing To Issue Guideline Pertaining To Fly Ash

Fly ash used in cement and concrete was chosen as a product area where Federal purchasing power could significantly increase the use of a recovered material. The following discussion demonstrates that fly ash meets the product selection criteria.

(1) Significant Solid Waste Problem

Fly ash is the term used to describe an ash component of coal which results from the combustion of coal. The vast majority of fly ash is produced in electric power generating plants, where powdered coal is burned to produce steam to drive the turbines. Fly ash, which is a finely divided mineral residue, is conveyed out of the boiler along with the stack gases. It is then collected from the gases by various means, including electrostatic precipitators, mechanical precipitators, cyclone separators, bag houses and scrubbers. It is stored in silos, awaiting reuse or disposal, or it may be conveyed directly to a disposal area. Fly ash typically represents about 70 percent of the ash generated by coal combustion, with coarser and heavier bottom ash accounting for the remaining 30 percent.

During 1979, 57.5 million tons of fly ash were generated, with over 82 percent disposed of as waste. The quantities of fly ash requiring disposal will increase dramatically during the 1980's with the construction of additional coal burning power plants. Estimates are for fly ash generation to be 70-80 million tons annually by 1985.

Current disposal practices for fly ash can have a negative effect on water quality (surface and groundwater contamination), air quality (increased dust), land use, noise, and aesthetic value.

(2) Feasible Methods of Recovery

Economically feasible methods exist for recovery of the fly ash waste stream.

Electrostatic precipitators or mechanical collection devices separate fly ash from boiler stack gases. More than two-thirds of the coal-fired generating stations have collection and loading facilities for fly ash. However, the majority of fly ash currently is combined with bottom ash, boiler slag, and/or scrubber sludge for disposal, making future recovery for cement and concrete use difficult and more expensive.

(3) Technically Proven Uses

Cement is a powder-like manufactured mineral product, usually gray in color. Cement is mixed with water and sand, gravel, crushed stone, or other aggregates to form the hard substance known as concrete. Cement is not used by itself for construction but is a component of concrete.

Cement is produced by first grinding a carefully proportioned mixture of raw materials such as limestone, silica, sand, clays, and iron ore. The mixture is heated in huge rotary kilns at temperatures approximating 1500°C (2700°F), where chemical reactions take place. The resulting marble-size pellets, or clinker, are ground with a small amount of gypsum (to control setting and hardening) to produce an extremely fine powder, known as "portland" cement. Portland cement is a generic term used to describe a particular type of inorganic hydraulic cement. A hydraulic cement is a cement which will combine with water and harden.

a. Raw Material. Several commenters pointed out that fly ash can be used as a raw material in the initial production stages of cement. Fly ash can be a source, for example, of iron and silica needed for cement manufacture. As such, fly ash can be used as a supplementary raw material feedstock which is proportioned with other raw materials and burned in the kiln to form clinker, which is then ground to produce cement.

Fly ash used in this manner loses its identity and becomes an integral part of the cement. Portland cement from such production is tested and certified according to ASTM standard C150 prescribed by the American Society for Testing and Materials. It is stored, transported, marketed, and used in the same manner as cement produced without using fly ash as a raw material. Such cement is generally not identified as being produced from fly ash.

Fly ash used as a raw material completely loses its identity by undergoing chemical reactions with other cement constituents, allowing further amounts of fly ash to be

incorporated into the cement, either to produce a blended cement containing fly ash, or as an admixture in concrete, as discussed below.

Although EPA strongly encourages the use of fly ash as a raw material in the production of cement, we feel it is unnecessary to recommend any changes in specifications, purchasing practices, or certification procedures for this application. The standard specification for portland cement, ASTM C150, currently allows for fly ash use in this manner. Solicitations typically request ASTM C150 as the controlling specification. Standard certification practices exist in the industry. Further, the extent to which fly ash can be used as a raw material is highly plant-specific, depending upon the mineral resource needs of any particular manufacturing plant. Thus, no Federal intervention is deemed appropriate for this application.

b. *Blends and Admixtures.* Although not cement itself, fly ash has the property of cementation when combined with lime and water, and this can complement the cementing action of portland cement. Fly ash combines with the water available during the reaction of portland cement with water, and forms insoluble cementitious compounds. This cementitious property gives fly ash two primary uses: as an ingredient in blended cements, and as a component of portland cement concrete. When used to produce blended cement fly ash is either interground with the portland cement clinker, or blended with the finely ground portland cement powder (or both). When used directly in concrete, fly ash is added to the standard concrete ingredients at the concrete mixing site. Fly ash can be used either as a partial cement replacement in concrete, or as an added ingredient to obtain certain desired concrete characteristics. Almost 3 million tons of fly ash were used in the production of cement or concrete during 1979.

1. *Blended Cement.* Several U.S. cement manufacturers produce a blended cement meeting the standards prescribed by the American Society for Testing and Materials (ASTM) for the use of fly ash in cement. Blended cement containing fly ash is included in ASTM specification C595 and is designated as "Type IP" or "Type I(PM)." Table 1 indicates the extent to which Type IP or Type I(PM) cement can be used as a substitute for ASTM cement Types I through V in general concrete construction.

TABLE 1

ASTM Cement type	Purpose	Substitute fly ash
I	General purpose	Yes.
II	Moderate sulfate resistance and heat of hydration	Yes.
III	High early strength	No.
IV	Low heat of hydration	Yes.
V	High sulfate resistance	Yes.

2. *Concrete Admixture.* Fly ash can also be used directly as an admixture in concrete, as a partial replacement for portland cement. ASTM specification C311 contains requirements for the sampling and testing of fly ash when in this manner. ASTM C618 is the standard specification for the use of fly ash as an admixture in concrete. In addition, the General Services Administration maintains Federal Specification SS-C-1980, which references ASTM C618, with minor differences for sulfur trioxide content, loss on ignition, and the pozzolanic activity index.

c. *Bottom Ash.* Bottom ash is the term used to describe an ash component of coal which results from the combustion of coal. The ash that is not fine enough to go up the stack with boiler gases in the form of fly ash instead solidifies and agglomerates into coarser heavier particles. These coarse particles fall into the ash hopper at the bottom of the furnace. The ash may be generated in a dry state or in molten form, where it is more accurately referred to as boiler slag.

Commenters stated that bottom ash and boiler slag can be used in the production of Type IP, portland-pozzolan cement. The cement is apparently marketed as Type IP and certified in accordance with ASTM C595. In this application, the ash is generally interground with cement clinker to produce blended cement. This application is possible because bottom ash is very similar to fly ash in chemical composition.

EPA feels it is inappropriate to include, at the present time, bottom ash or boiler slag as used in the production of Type IP cement, as a recovered material which is "designated" under this guideline. Although bottom ash and boiler slag generally meet the criteria discussed here as those criteria relate to fly ash, the recommendations which EPA makes in this guideline regarding specification and purchasing of Type IP cement are based solely on investigation related to fly ash. Because this is a relatively minor application at the present time, and in order to minimize confusion, the Agency has not included bottom ash and boiler slag as

"designated" materials in § 249.02 of the guideline. However, although the guideline language will continue to reflect emphasis on the use of fly ash, procuring agencies should be receptive to consideration of such bottom ash use, when it arises.

d. *Practical Applications.* Many ready mixed concrete producers and concrete product manufacturers have used fly ash for years, particularly in non-specification jobs where they are responsible for the performance of the product, but are able to choose the material content which will best suit their needs both technically and economically.

Several commenters provided EPA with names of specific projects or types of applications where fly ash has been used successfully in concrete. EPA feels that mention of these applications will be particularly useful to potential users of fly ash, particularly those who may possess doubts as to the legitimacy of using fly ash in concrete. The following list is by no means exhaustive, but indicates general areas where fly ash has been used on a commercial scale.

1. *Structural Building.* Structural concrete containing fly ash has been used extensively in certain regions of the country. Buildings in the Chicago area which contain fly ash include the Sears Tower, John Hancock Center, McCormick Place, Standard Oil Building, Prudential Building, Inland Steel Building, and First Wisconsin National Bank of Milwaukee. Other buildings include the Detroit General Hospital, the Atlanta Hilton Hotel, and the Davis-Bessie nuclear power plant near Toledo, Ohio.

2. *Wastewater Treatment Plants.* Locations of more than a dozen wastewater treatment plants, where concrete containing fly ash was utilized, were provided by commenters. These plants included both municipal and industrial treatment plants. Fly ash is sometimes specified or allowed for use as an alternate to ASTM Cement Types II or V, due to the often improved sulfate resistance which concrete containing fly ash can afford.

3. *Dams.* On a national level, the U.S. Army Corps of Engineers and U.S. Bureau of Reclamation have used fly ash in concrete in various projects, most notably dam construction, for many years. Some of these projects include:

Hungry Horse Dam—1953
Dworshak Dam—1973 (700' high)
Libby Dam—1975 (400' high)
Richard B. Russell Dam—under construction
Tombigbee Riverway—under construction (series of locks and dams)

A new project on which fly ash is permitted in concrete is the Central Arizona Project, designed to convey water from the Colorado River to the cities of Phoenix and Tucson. The \$2 billion project involves construction of over 300 miles of concrete aqueduct and four large pumping stations.

4. *Pavement.* Some State Departments of Transportation have approved fly ash use. For example, the Georgia Department of Transportation (DOT) revised its specifications in 1975 to allow fly ash to be used as a partial cement replacement. Since then, Georgia's DOT has placed over three million cubic yards of fly ash concrete pavement and road shoulders, and is now considering review of the specification to allow for a greater fly ash replacement rate.

5. *Concrete Block.* Many manufacturers of concrete block use fly ash at rates of 20-35% of total cementitious material. Some manufacturers use as much as 50% fly ash when employing high-pressure-steam cured processes.

6. *Concrete Pipe.* Some concrete pipe manufacturers use fly ash to obtain a better material flow in production, and to increase the density and decrease the permeability of their product.

e. *Performance of Fly Ash.* Some commenters pointed out that a distinction should be made between ASTM Class F ashes, obtained from the combustion of bituminous coal, and the ASTM Class C ashes, which are obtained from subbituminous and lignite coals. While both types of fly ash are composed of the same chemical components, the quantity of these chemical components as constituent elements of these two types of fly ash vary. The proposed preamble was primarily limited to a discussion of Class F ash, although some of the statements may be true for Class C. The following discussion has been revised to reflect the differences in performance of the two types of ash where information was available from commenters.

1. *Enhanced Performance.* As discussed in the proposal, the use of fly ash in cement and concrete may enhance the performance characteristics of the final products.¹ These advantages can be summarized as follows:

i. *Greater Ultimate Strength.* Proper mix design will achieve 28-day strength equal to or better than a typical Type I cement. Fifty-six day strength will be

superior in almost all cases. In the examples of structural applications listed above, use of fly ash was found to be the most practical and economical method of obtaining high strength mixes.

Class C ash concrete may attain early strengths equal to or greater than concrete utilizing portland cement only. This is likely due to the higher calcium oxide content of Class C ash, leading to more rapid development of cementitious compounds.

ii. *Improved Workability.*

Specification fly ash used in properly proportioned concrete mixes improves the pumpability, handling, placing, and finishing of fresh concrete, in part due to the glassy, spherical shape of fly ash particles, which add to the "plasticity" of the mix.

iii. *Reduced Water Requirement.* Due to improved workability, usually less water needs to be added to the mix, resulting in less drying shrinkage and less cracking.

iv. *Lower Heat of Hydration.*

Generally, less heat is generated during the chemical reactions between the cement and water, resulting in less thermal cracking—especially important in mass concrete applications such as dams, large beams, retaining walls, and foundations.

When using Class C ash, however, the prolific cementitious reactions which take place due to higher calcium oxide contents may not allow for achievement of lower heat of hydration. This characteristic of Class C vs. Class F should be noted where heat liberation is critical.

v. *Increased Sulfate Resistance.* A proper concrete mix with Class F fly ash will reduce the chemical attacks in concrete from sulfates contained in adjacent soil and groundwater. These reactions cause cracking and eventual disintegration of the concrete. Fly ash forms stable cementitious compounds with certain cement constituents, thus reducing the ability of sulfates to combine with these same cement constituents.

With Class C ash, there apparently is no improvement in sulfate resistance. One commenter claimed that subbituminous and lignite fly ashes generally lead to reduced resistance to sulfate attack in concrete.

vi. *Reduced Alkali-Aggregate Reactions.* Certain aggregates react with the alkalis generated during cement hydration, resulting in disruptive expansion and cracking of concrete. Class F fly ash reacts with these alkalis to form stable compounds, thus preventing or severely reducing the reaction with aggregates and the accompanying detrimental effects.

Commenters on Class C fly ash state it has negligible effect with regard to alkali-aggregate reactions. In any event, standard tests are available to determine if a reaction is likely to occur. This likelihood can be predicted as accurately with fly ash as with portland cement.

2. *Disadvantages.* Several disadvantages which are associated with the use of fly ash can be overcome through proper use.

i. *Variable Physical and Chemical Composition.* Fly ash from different sources can be highly variable in its physical and chemical composition. This variability can be due to several factors, such as coal source, combustion process, and collection method. This problem can be overcome through adequate testing and quality control of the ash. ASTM specifications C595, C311, and C818 should be used as minimum standards for acceptance of fly ash. However, these material standards by themselves will not guarantee satisfactory performance of a concrete mix, just as use of portland cement conforming to ASTM C150 will not assure production of a satisfactory concrete. Proper mix design, selection, and quality control of all materials, and expertise in mixing, placing, and finishing of concrete all play a role in achieving satisfactory performance.

The issue of ash variability and quality control was by far the technical issue of most concern to commenters. Many commenters who stated that use of fly ash results in deleterious performance of concrete based their concerns on situations where low quality, non-specification ash might be used in concrete. EPA agrees in principle with these commenters concerns. Therefore, EPA substantially revised the sections of this preamble and guideline entitled "Quality Control," which emphasize the need for quality control and quality assurance procedures on the part of all involved parties, particularly fly ash suppliers and material vendors.

ii. *Unfamiliar Users.* Due to lack of widely publicized and sometimes inadequate data on mix designs (as compared to general purpose concrete), fly ash concrete may be improperly prepared by an unfamiliar user. Mix designs do exist to produce fly ash concrete, and in most cases fly ash brokers/companies will provide manufacturing assistance and engineering design aid. The "References" section of this guideline refers to information on fly ash and its use in cement and concrete. Potential users should familiarize themselves with

¹ [The properties of cement and concrete which contain fly ash have been examined and documented. A report by the National Bureau of Standards entitled "Fly Ashes in Cements and Concretes: Technical Needs and Opportunities." NBSIR 81-2239, summarizes these properties.]

the information in those publications, seek assistance from suppliers of fly ash.

iii. *Special Storage and Transportation Equipment.* Due to its extreme fineness, fly ash requires the use of storage and conveying equipment with tight fittings. Equipment meeting these requirements is readily available.

iv. *Extended Curing Time.* Mix proportions have been developed which will achieve equal or superior strength to general purpose concrete at all ages, particularly if 10%-30% fly ash is added (not substituted) to a concrete mix, or if a blended cement with up to 10% fly ash content is used. However, when used as a cement replacement, superior strength is often not achieved until the age of 28 days.

As discussed earlier, commenters using Class C ash state that equal or superior strength gains can be achieved at all stages of development.

v. *Increased Demand for Air Entraining Agent.* Inadequate air content in concrete will significantly affect its durability and most likely result in premature deterioration. Fly ash used in blended cements and concrete will often cause an increased demand for air entraining agent. With proper testing and quality control, the need for entrained air can be satisfied. The cost of the additional air entraining agent and quality control is often balanced by the cost savings associated with fly ash use.

Commenters on Class C fly ash indicate that air entrainment is not a problem, due to the lower loss on ignition (LOI) of Class C ashes compared to Class F. The reason for a low LOI is likely not due to any inherent property of lignite or subbituminous coal. Rather, these coals are often burned in newer, more efficient, power plants, resulting in more complete combustion with less residual carbon. On the other hand, many of the power plants in the East burn bituminous coal. These plants are generally older and may combust less efficiently than the generally more modern plants found where the lignite and subbituminous coals reserves are located.

EPA cautions against making air content determinations based on the class of ash. Rather, marketers and users should be concerned with the properties of the particular ash at hand. Both types of ash, regardless of carbon level, can affect air entrainment levels and should be evaluated vis-a-vis compensating air entraining admixture levels. This is because any alteration in the mix properties affecting the fine aggregate particle distribution and heat

evolution has an effect on air entrainment.

(3) Federal Purchasing Power

Almost one-half of total U.S. cement consumption is in public construction projects (public buildings, public works, transportation). Since Federal funds account for nearly two-thirds of the funding for public construction nationally, approximately 23 million tons of cement is purchased annually either directly or indirectly with Federal funds. These 23 million tons mark the theoretical universe to which this guideline applies.

The actual figure may be lower, however, as some of these cement applications may not be technically appropriate for the use of fly ash. In addition, some of these Federally funded projects already incorporate fly ash. On the other hand, with the anticipated "ripple effect" of private purchases being influenced by these public purchases, the impact could be substantially increased. For example, commenters indicate in those areas where fly ash is accepted, contractors who use fly ash will tend to use it for all of their projects, public and private, where technically acceptable.

Discussion of Guideline

This section of the preamble summarizes and explains the guideline and its integration with the requirements of Section 6002 of the Act. The guideline recommends practices with regard to specifications, purchasing, and certifications which procuring agencies may employ in complying with the mandatory provisions of Section 6002. Adherence to the procedures suggested in the guideline will be deemed to constitute compliance with Section 6002.

Scope

The scope of this guideline is limited to the use fly ash in cement and concrete, including concrete products such as pipe and block. Several commenters agreed with this limitation. However, as discussed in this Preamble under the section entitled "Technically Proven Uses," commenters indicated that bottom ash and boiler slag are being used in production of Type IP, portland-pozzolan cement. Therefore, when reference is made in this guideline to Type IP or blended cements, bottom ash and boiler slag should be considered by procuring agencies as qualifying for those applications, if manufacturers/suppliers can provide satisfactory technical support.

Many commenters pointed out that fly ash and bottom ash can also be used in many other construction applications,

such as road base and subbase material, structural fill and embankment, soil stabilization, grouting, masonry cement, and as lightweight aggregate. However, the technical and economic issues related to these uses of coal ash are sufficiently different to warrant separate consideration by procuring agencies. The Agency intends to prepare guidelines on a product-by-product basis.

Guidelines on the use of fly ash in road bases and subbases are currently being drafted by EPA. The Agency believes such use can result in significant economic and energy savings nationwide. Interested persons should become aware of the recently enacted Federal Highway Administration demonstration program (Project 59) for fly ash in highway construction.

The fact that EPA has not issued guidelines for certain applications of fly ash should not be construed as preventing agencies from investigation and use of such materials. For example, one commenter indicated a history of successful use of fly ash in producing a masonry cement meeting the requirements of ASTM, C91, Standard Specification for Masonry Cement. Such uses are encouraged. Agencies should apply the general provisions of this guideline to such applications, in keeping with the intent of RCRA.

The Agency received comments on and considered expanding this guideline to include the use of granulated iron blast furnace slag in cement and concrete. Although major actions have recently been taken to increase the quality and quantity of granulated slag, EPA does not believe granulated slag is sufficiently available yet to warrant guidelines on a national scale. In addition, iron blast furnace slag is already reused at a very high rate, as aggregate and as fill material. Procuring agencies are strongly urged to apply the general provisions of this guideline in those cases where granulated slag suitable for use in cement becomes available.

Similarly, silica fume, the by-product dust resulting from the manufacture of silicon metal and collected in air pollution control devices, has been studied for its use in cement and concrete. The U.S. Army Corps of Engineers has developed results which indicate that silica fume can be extremely beneficial in increasing the resistance of concrete to sulfate attack, while generally maintaining early strength similar to that of portland cement concrete that does not contain the dust. However, additional technical information and standards need to be

developed before this material is used on a national scale. Thus, a specific procurement guideline is not currently envisioned for silica fume.

In the meantime, agencies should apply the general provisions of this guideline in those cases where silica fume or other recovered materials become available. This guideline should not be construed as preventing the procurement of other recovered materials suitable for use in cement and concrete.

Some commenters questioned why the use of shales and other naturally occurring pozzolans is not addressed by this guideline. Because the philosophy of the procurement guidelines program is to encourage recovery and reuse of solid waste materials, consideration of guidelines for natural materials which are not solid wastes is inappropriate.

One commenter suggested that EPA disallow the use of concrete containing fly ash in load bearing structures. In view of the successful structural applications mentioned elsewhere in this guideline, and with no documentation provided by the commenter to support the suggestion, EPA must reject it.

Several commenters requested that EPA exempt precast and prestressed concrete products from the guideline. The main concerns expressed by these commenters were that use of fly ash would cause delays in production of these products resulting in increased costs and loss of competitive edge vis-a-vis substitute products. Commenters stated that energy consumption would increase as a result of raising curing temperatures to achieve needed early strength gains. These commenters also expressed concern over the quality and variability of fly ash, which can affect performance and color of precast and prestressed concrete products.

The basis of these commenters' concerns stems from resistance to "mandatory" use of fly ash, i.e., a recommendation contained in the proposed guideline that procuring agencies solicit bids solely for cement or concrete containing fly ash when, in their judgement, those products were available, cost competitive, and technically acceptable. The commenters claimed this recommendation caused confusion and would lead to blanket requirements that fly ash be used in all precast and prestressed products.

EPA has deleted this recommendation in the final guideline, in favor of an approach which recommends that fly ash use be included in all solicitations, unless technically inappropriate. EPA believes that there are no good grounds for exempting precast and prestressed

concrete products from such solicitations. Several commenters stated that fly ash is currently being used by some manufacturers of precast and prestressed concrete, apparently with technical and economic success. EPA believes that persons who are willing and able to use fly ash, while guaranteeing performance of their product, should have the opportunity to do so. Thus, an exemption for this product area is not considered appropriate.

Applicability

The requirements of Section 6002 apply, for the most part, to "procuring agencies." The term "procuring agency" is defined by the Act as "any Federal agency, or any State agency or agency of a political subdivision of a State which is using appropriated Federal funds for such procurement, or any person contracting with any such agency with respect to work performed under such contract." The affirmative purchasing requirements of Section 6002 apply to procuring agencies' purchases exceeding \$10,000, or where that quantity of functionally equivalent purchases in the preceding fiscal year exceeded \$10,000.

This guideline recommends that any solicitations for purchases of cement or concrete made with Federal funds, either directly or indirectly, specifically allow for fly ash to be used as an optional or alternate material, unless it can be shown that the use of fly ash is technically inappropriate for a particular construction application.

(1) Procuring Agency

(a) *Direct purchases.* With regard to direct purchases, there are several situations to which the Agency believes this guideline should apply. Although the language on applicability in Section 6002 leaves room for interpretation, the Agency believes the recommendations here best describe the intent and practical application of Section 6002.

The first is where a Federal agency or other authority using Federal funds purchases cement, either in bag or bulk form. The agency may use this cement or it may supply the cement to other persons or the cement may be used by persons performing construction services for the agency. An example of this occurs where the Department of Defense, Army, purchases cement for use on a construction job, or its general contractor or subcontractor purchases cement for use on that job.

A second case occurs where ready mixed concrete is purchased directly by a Federal agency. The same scenarios applied to direct purchases of cement

apply here. If a Federal agency purchases ready-mixed concrete for its own use or, more likely, if a person under contract to or in support of a Federal agency purchases concrete, then the provisions of this guideline apply.

(b) *Indirect purchases.* Indirect purchases of cement and concrete by Federal or other procuring agencies are subject to this guideline. This is where the coverage of the term "procuring agency" becomes critical. Foremost among indirect consumers of cement and concrete are the Department of Transportation (including the Federal Highway Administration, Federal Aviation Administration, Urban Mass Transit Administration); the Department of Health and Human Services; the Department of Housing and Urban Development; and the EPA itself (wastewater treatment works construction grants program). All these agencies are involved in the Federal funding of construction programs for or through state and local governmental authorities. EPA believes that any purchase of at least \$10,000 worth of cement or concrete by States and localities or their contractors, subcontractors, grantee or other

persons which is funded by grants, loans, funds or similar forms of disbursements of monies from Federal agencies is subject to the provisions of this guideline.

EPA recognizes that these cases of indirect Federal funding may present the most difficulty for implementation. For instance, while the Federal Procurement Regulations and the Defense Acquisition Regulations control all Federal agencies in the case of direct procurement, each Federal agency establishes its own grant regulations. In addition, agency reviews appear to exert little influence over the composition of materials used in construction activities funded by that agency. An agency's primary interest is that the project performs as intended.

While some commenters expressed support for the above interpretation, other commenters had very differing viewpoints. One commenter, the Federal Highway Administration (FHWA) agreed that its direct procurement program for Federal roads and highways is subject to RCRA Section 6002 requirements. The direct-Federal program includes highway projects on Federally owned lands, such as national parks.

However, the FHWA has taken exception to the inclusion of the multi-billion dollar Federal-aid (Federal Highway Trust Fund) program under Section 6002. FHWA contends that State highway departments operating under

the Federal-aid program are not procuring agencies under RCRA because the State funds rather than appropriated Federal funds for any necessary procurement. A percentage of their expenses is later reimbursed by FHWA if the States have satisfactorily complied with applicable Federal laws, regulations, and FHWA/DOT policies. Thus, FHWA states that guidelines promulgated by EPA are not applicable to the Federal-aid program.

EPA does not agree with the above FHWA interpretation. Although the Trust Fund monies result from the Federal excise tax on gasoline, the monies are appropriated to projects before they are redistributed to the States. Further, these Federal funds are substantially being used for procurement of the highway projects in question. Long-established relationships indicate that States are virtually guaranteed of receiving the Trust Fund monies as long as their projects are approved by FHWA and they comply with the requirements specified by FHWA.

EPA does not believe that the legislative history of RCRA supports such a narrow interpretation of the term "procuring agency." Rather, the intent of RCRA Section 6002 is to use the influence which the Federal government can exert through its purchasing power to stimulate demand for and use of recovered materials. Therefore, EPA is of the opinion that the Federal-aid program for highway construction projects is subject to RCRA requirements. Those persons who believe they will suffer damage as a result of failure by a procuring agency to comply with Section 6002, are urged to review the section of this preamble entitled "Compliance and Monitoring."

(c) *Unrelated purchases.* One commenter suggested a very strict interpretation of the term "procuring agency." This commenter claimed that once an agency uses any Federal funds for any procurement (over \$10,000 total), all purchases (including non-designated items and those made with non-Federal funds) by it and any entities contracting with it become procuring agencies within the meaning of RCRA.

EPA disagrees with this interpretation. In the statute, Congress defined procuring agency to mean an Agency which "is using appropriated Federal funds for such procurement," thereby signalling an intention to exclude purchases made with non-Federal funds from the explicit reach of Section 6002.

Further, the RCRA amendments, discussed elsewhere in this preamble, key the purchasing requirements of

Section 6002 to the "designation" by EPA of certain candidate products by way of procurement guidelines. These amendments were passed, in part, because procuring agencies were pursuing inconsistent policies in attempting to implement RCRA purchasing policies throughout their procurement systems for all of their products. EPA is now given the responsibility for designating those items whose procurement will best carry out RCRA objectives.

Thus, this guideline should not apply to construction activities being performed which are unrelated to or incidental to Federal funding, or which include purchases on non-designated products. An example of an activity unrelated or incidental to Federal funding would be where a contractor performed laboratory experiments and bench-scale tests for the Government under a contract. In order to carry out his responsibilities he may need to expand his existing physical facility or construct a new one. The cement and concrete used in that structure would not be subject to the requirements of Section 6002 or this guideline, even though some of the funds received from Federal contract payments might be used to finance the construction.

Another commenter suggested regional instead of nationwide guidelines. The reason cited was that fly ash of the quality and quantity required for a construction project may not always be immediately available in certain parts of the country. Another commenter requested an exemption for city and county construction projects, citing a lack of expertise on their part.

These two comments serve to emphasize the "chicken and egg" dilemma for many recycled materials. Is fly ash not available because there is no demand or expertise to use it in a particular area, or is there no demand or expertise in those areas because fly ash is unavailable? The purpose of this guideline is to alter the status quo by stimulating demand for fly ash, thereby encouraging its availability and the development of the necessary expertise. EPA feels that by including fly ash in bid solicitations as an alternate or optional material, availability will be determined by whether any bids are received for it. Further, allowing for fly ash use will serve as an incentive to potential users in these areas. Contractors will not make the commitment necessary to use fly ash unless it is more readily accepted. Specifically allowing it to be used provides this incentive.

(2) \$10,000 Rule

An important issue is the applicability of the \$10,000 rule. Clearly, the guideline applies where a procuring agency directly purchases more than \$10,000 worth of cement or concrete during the course of any fiscal year. The rule is complicated, however, if a procuring agency purchases concrete "services," which would not only involve the supply of the product but also placement, finishing, etc. Even more complex is the common case where a contractor is assigned all construction activities for a particular agency project, including subcontracting authority for concrete work. In such cases the actual cost of the cement or concrete may not be readily determinable.

In the proposed guidelines, EPA recommended that the \$10,000 limitation include the cost of services related to the purchase of the product as well as to the cost of the product itself, at least in those cases where the separate cost of the materials cannot be practically determined.

EPA received several divergent comments on the issue of including concrete "services" in determining applicability of the \$10,000 rule. An equal number of commenters agreed and disagreed with this approach. EPA's purpose in including services in the \$10,000 limitation as stated in the proposal, was to allow flexibility to procuring agencies and reduce paperwork which might otherwise occur. The final guideline now leaves it at the discretion of an agency as to whether that agency chooses to separately cost-out all the elements of concrete work for purposes of determining RCRA applicability. In some cases, this calculation may be a simple task, particularly for direct purchases of concrete. On the other hand, it may be virtually impossible to obtain such detailed cost information where a general contractor has responsibility for all work on a project. Agencies may desire to establish procedures for estimating the proportion of a project which is represented by the material costs of cement and concrete.

In any event, EPA urges that agencies keep in mind the intent of RCRA, i.e., increased use of recovered materials, in developing their approach to determining RCRA applicability. Imposition of new paperwork or estimation procedures for this purpose should be avoided. Rather, EPA recommends that fly ash use be specifically allowed in all cases, except where technically inappropriate. EPA recommends that agencies develop and

issue policies to their construction directorates, field offices, grantees, etc. on this issue so that consistency will be maintained in applying this provision.

On a related topic, several commenters stated that the \$10,000 limitation was too low, because, it would subject too many small jobs to Section 6002 requirements. EPA cannot accept the commenter's rationale. Congress established the \$10,000 purchasing rule in Section 6002(a) of RCRA. The reason for setting a minimum was most likely so that incidental purchases would not be subject to specification changes purchasing requirements, and monitoring efforts. Furthermore, the \$10,000 limitation is not to be considered on a contract-by-contract basis, but rather is an aggregate total for the cost of cement and concrete materials during a fiscal year. In order for cement and concrete containing fly ash to be assimilated into the construction materials procurement system, it needs to be considered as an acceptable material on a regular, day-to-day basis. Fly ash should not merely be reserved for larger dollar value projects, as one commenter suggested.

Definitions

Of the definitions which were contained in the proposed guideline, most were self-explanatory and non-controversial and therefore need not be addressed in this preamble. In addition to the definition of "procuring agency" discussed above, the terms "recovered material" and "solid waste" deserve discussion, as EPA received comments on these particular definitions.

The requirements of Section 6002 apply to products containing recovered materials. The definition of "recovered material" contained in the proposed guideline was the same as that in RCRA. However, the definition of recovered material was revised by Congress in the Solid Waste Disposal Act Amendments of 1980. The current definition includes waste material and by-products which have been recovered or *diverted from* solid waste. It excludes materials and by-products—such as home scrap—generated from and commonly used within an original manufacturing process.

Some commenters argued that materials which were being recycled were not solid wastes, because they were not being discarded. The Agency has already dealt with this argument on numerous occasions (see, e.g. 45 FR at 33091 (May 19, 1980)). We think it clear from the language of the statute, the legislative history, judicial interpretation, and subsequent expressions of Congressional intent that

Congress intended that materials being used, reused, recycled, or reclaimed be solid wastes. These activities are types of waste management which, if properly conducted, can avoid environmental hazards, protect scarce land supply, and reduce the nation's reliance on foreign energy and materials.

Some commenters on this guideline specifically took exception to the definition of "solid waste" and EPA's authority to regulate reuse and recycling. Rather, they argued that EPA's authority to designate products for procurement guidelines should be based on whether those products are, or contain, recovered materials, i.e., according to the revised definition of "recovered material."

EPA disagrees, in general, with these commenters' opinions. Based on the reasons presented above, EPA maintains its authority to regulate solid wastes which are used, reused, recycled, or reclaimed. In fact, the revised statutory definition of "recovered material" makes clear materials can be recovered from "solid waste," so that the material need not be thrown away to be a solid waste. However, in order to reduce the unnecessary confusion which has arisen in this guideline due to the definition of solid waste, and any revisions to this definition which may occur in the future, EPA has eliminated the definition of "solid waste" from this final guideline.

Specifications

Section 6002(d) of the Act requires revision of all specifications for cement and concrete for which Federal agencies have drafting and review responsibility so that they no longer exclude the use of fly ash—and so that they incorporate the use of fly ash to the maximum extent.

While this requirement applies nominally only to Federal agencies, EPA believes that the elimination of specifications which unreasonably discriminate against the use of fly ash is implicitly required by the affirmative procurement provisions of Section 6002(c) as well. A procuring agency could not realistically fulfill its Section 6002(c) obligation to procure items composed of the highest percentage of recovered materials practicable if, in procuring cement or concrete, it relied upon specifications which unreasonably discriminated against fly ash use. Accordingly, EPA construes the specifications requirement to apply to all procuring agencies.

To assist procuring agencies in achieving compliance with this requirement, the guideline makes several recommendations on

specifications. There are three major categories of specifications for which recommendations are made:

- Guide specifications—typically, model standards or specification issued by a procuring agency, which are suggested or required for use in the design of all of the construction projects of an agency (these are often referred to as design standards or design guidelines).
- Contract specifications—a precise set of specifications prepared for a particular construction project, which contains such items as design, performance, and material requirements for that project.
- Material specification—a specification that stipulates the use of certain materials to meet the necessary performance requirements.

Guide Specifications

Procuring agencies will need to review and revise guide specifications in order to reflect the recommendations of this guideline. In doing this, the agencies will need to eliminate any discrimination, either direct or indirect, against the use of fly ash in cement and concrete. In addition they must ensure that guide specifications require that the use of fly ash be considered and incorporated, where appropriate, into contract specifications for individual construction projects. EPA recommends a period of six months after the effective date of this guideline to complete review and revision of guide specifications.

One commenter requested that EPA publish a sample guide specification for use by Federal agencies. EPA has chosen not to follow this suggestion. As mentioned above, guide specifications are usually maintained by individual agencies and can take various forms, such as specifications, standards, or narrative guidelines. It seems undesirable for EPA to develop one guide specification which would be recommended to all agencies. Rather, EPA prefers to allow procuring agencies the flexibility to develop their own specific policies in this area, taking into account types of construction projects, degree of control exercised over specifying architects and engineers, and other such factors. Procuring agencies are expected to reflect the intent of RCRA and policies of this guideline in making whatever changes are necessary in guide specifications.

Several commenters stated that standards of the American Concrete Institute (ACI) currently allow for fly ash use. These commenters specifically mentioned ACI Standard 301, "Specifications for Structural Concrete

for Buildings," and ACI Standard 318, "Building Code Requirements for Reinforced Concrete." Such standards apparently do allow for fly ash use, at the discretion of the specifying engineer. However, agencies should still be prepared to make modifications to these and other standards, when and if necessary, particularly if the standards are shown to contain provisions which in some way indirectly discriminate against fly ash use. Specification of minimum cement contents may be one example of such indirect discrimination.

Contract Specifications

This guideline will have its greatest effect on contract specifications which are prepared for each individual construction project. The guideline recommends that agencies make sure that specifications for individual construction contracts specifically include provisions for the use of fly ash as an optional or alternate material, unless it can be shown that this would be technically inappropriate.

Many commenters stated that the most frequent obstacle to fly ash use on an individual project is the specifying architect or engineer. If this person does not specifically allow for fly ash to be used, it is inevitably excluded from use.

The guideline addresses this problem by advising procuring agencies that they are responsible for assuring that these individuals are aware of the statutory requirements of Section 8002 and the policies of this guideline with regard to fly ash. Thus, it is critical that the technical officer or engineer on a contract work closely with the contracting or grant officer to assure that fly ash is appropriately considered. The guideline also recommends that procuring agencies document decisions to exclude fly ash from contract specifications, in order to build a base of technical information on this subject, as well as to respond to possible protests or inquiries. Placing the burden upon the procuring agency to assure that fly ash is allowed in contract specifications is particularly important where the design function is outside the agency or where construction projects are being performed as a result of grants, loans, funds, etc.

Several commenters objected to EPA's recommendation that procuring agencies justify exclusion of fly ash from contract specifications, asserting instead that justification to use fly ash should be the subject of documentation. The Agency disagrees with these commenters. Since the technical feasibility of using fly ash in cement and concrete has been adequately demonstrated, agencies should not require a supplier to

"reinvent the wheel" for each project. The recommended approach permits fly ash to be evaluated on a job-by-job basis. It doesn't preclude restriction of fly ash as long as it is justifiable and documented. EPA urges procuring agencies to require that individual suppliers of cement or concrete containing fly ash demonstrate a history of satisfactory technical performance with this material and their ability to meet performance requirements for the particular application at hand, just as they would for portland cement or concrete.

Typically, if use of fly ash is not initially allowed, the time period during which bids are officially open is insufficient to allow for consideration of fly ash use and amendment of solicitations. Consideration of changes can often not be accomplished until after the fact, which can lead to contracting problems and invite protests from losing bidders if change orders are issued at a later time without formal resolicitation. Thus, EPA maintains that consideration should be given to using fly ash during development of the contract specifications, and that cement or concrete containing fly ash should be considered acceptable unless the agency demonstrates otherwise.

EPA agrees with a commenter on a related issue, which is that legitimate documentation of infeasibility for fly ash can be for certain types of applications rather than on a job-by-job basis. By referencing this documentation in individual contract specifications, an agency can avoid extensive repetition of previously documented points. An agency should be prepared to submit such documentation to outside review and scrutiny.

EPA recommends that procuring agencies take no more than 12 months from the effective date of this guideline to assure that contract specifications reflect the requirements of Section 8002.

Material Specifications

Both Federal specifications and national voluntary consensus standards exist for the use of fly ash in blended cement and in concrete. Rather than actually revise existing material specifications for portland cement, procuring agencies are expected to make maximum use of these existing material specifications.

In the proposal, EPA recommended that procuring agencies use only fly ash which, as a minimum, meets ASTM standards. Some commenters agreed that use of ASTM specifications as a minimal standard is appropriate, in that they are national voluntary consensus standards which have been developed

over a period of time. A few commenters, however, suggested that EPA reference the ASTM standards, but with recommendations for tighter parameters. While EPA discusses such tighter parameters for information purposes in this preamble, the Agency feels it is inappropriate to make recommendations which override national consensus standards.

One commenter requested that compliance with ASTM standards not be made mandatory, because the commenter has been able to use fly ash, which does not conform to the standards in one aspect, very successfully in concrete. EPA agrees with this approach. While the guideline recommends adherence to ASTM and/or Federal specifications, the ultimate determinant of acceptability should be concrete performance. Accordingly, the guideline permits use of non-specification fly ash where the procuring agency has developed sufficient expertise to use it in particular applications.

Mix Design Standards

This guideline suggests no minimum, maximum, or absolute level of fly ash content in blended cement or concrete which is subject to this guideline. Flexibility is necessary because of variation in fly ashes and cements, strength requirements, relative costs, and even local and regional construction practices and climatic conditions.

The provisions of ASTM specification C595 for blended hydraulic cement require that Type IP cement contain 15-40% fly ash and that Type I (PM) cement contain 0-15% fly ash by weight, thus allowing fly ash content to be specified in a range from 0 to 40%. A typical blending rate in the industry appears to be around 20%. However, the actual proportion to use needs to be determined on a job-by-job basis in accordance with established mix design procedures and performance needs.

When used directly in the manufacture of concrete, industry practice indicates that more fly ash should be used than the amount of cement replaced, at least when using Class F ash. This ratio should be at least 1.25-1.50 fly ash to 1.00 unit of cement. Commenters on Class C ash provided data to indicate that pound-for-pound replacement of cement with fly ash can be used to achieve early strengths equivalent to that of portland cement alone. Typical replacement rates in concrete are around the 15% level, but the actual percentage needs to be determined on a job-by-job basis.

Allowing the use of low levels of fly ash in cement and concrete may encourage additional companies to experiment with the product and gain expertise. This could ultimately increase the number of companies using fly ash, and the amount of fly ash they use.

Information contained in the "References" can be used as guidance in determining proper fly ash content.

While some commenters agreed with this flexible approach to fly ash content and mix design, a few disagreed with it. The dissenters argued that RCRA requires procurement of products containing the *highest* percentage of recovered materials practicable. Thus, if fly ash can be used at a blending rate of 20%, these commenters suggest EPA specify 20% as the minimum level of fly ash content which must be supplied in order to qualify for award.

EPA prefers to interpret RCRA with emphasis on the word *practicable*. EPA feels that the highest percentage of fly ash practicable is determined by such factors as price, availability, competition, and technical performance. For instance, if a higher level of fly ash content is only available at a much higher price, EPA considers it impractical to purchase the higher priced material, although it is technically available. With the open bidding approach recommended in this final guideline, EPA believes that persons willing and able to supply cement or concrete containing fly ash will do so. Normal bid evaluation procedures will then determine practicality based on price, availability, etc. and not on an arbitrarily established limit on fly ash content which considers only technical potential.

Concrete specifications which specify minimum cement contents could potentially discriminate against the use of fly ash. Such provisions may deter substitution of fly ash for cement. To address this problem the proposal recommended changing such specifications to permit the substitution of fly ash for cement.

An equal number of commenters agreed and disagreed on this issue. The opposing commenters stated that minimum cement factors are often based on the need not only for strength but for durability and that an agency should be permitted to specify some level of minimum cement content (which may reflect the substitution of fly ash for a portion of the cement). The commenters were willing to agree with EPA's recommendation on this issue, provided that adequate testing or local experience showed that concrete durability is not affected. EPA feels this is a reasonable approach, and that minimum cement

contents may be retained, provided they reflect a substitution of fly ash for a portion of the cement.

Of the commenters supporting EPA's recommendation on minimum cement contents, most stated that minimum cement contents and maximum water:cement ratios discriminate against use of fly ash, and suggested a shift from prescription specifications to those based on performance. A wholesale revision in concrete specifications to those based totally on performance is beyond the scope of this guideline and the jurisdiction of EPA. However, such a shift may be appropriate in particular instances. Thus, this final guideline recommends that procuring agencies change mix design standards which unfairly discriminate against the use of fly ash, such as those which unnecessarily specify minimum cement content or maximum water:cement ratios.

Performance Standards

It is often claimed that designs of construction projects are conservative and, as a safeguard, intentionally increase the strength requirements beyond what the design criteria actually require. Setting concrete strengths which are higher than actually needed during the several days following concrete placement (i.e., "high early strength") can deter the use of fly ash. Although fly ash will generally enable a concrete to achieve a higher ultimate strength (e.g., at 28, 56, and 90 days), very high early strength can be achieved, with Class F ash, only by adding fly ash to the mixture without reducing the cement content. In this situation, the economic and energy conservation advantages of using fly ash are sharply diminished.

In the proposed guideline EPA recommended revising certain performance standards, where appropriate, primarily to extend the period for strength evaluation. Numerous comments were received on this issue, primarily opposing EPA's recommendation. A variety of reasons were given for not extending strength evaluation periods. Foremost among these was a claim that increased costs and delays in schedules would occur as a result of delays in stripping forms or awaiting approval before proceeding with further construction. Some commenters pointed out that strength development is a key factor, in determining durability of concrete. The commenters urged EPA to maintain the current, standard strength evaluation periods, citing their existence as providing a good balance between costs, performance, and timeliness.

Some commenters agreed with EPA's recommendation to extend strength evaluation periods, while others commented this practice should only be allowed for certain applications, such as non-flexural members.

In this final guideline, EPA has retained the general concept that performance requirements which arbitrarily restrict the use of fly ash, either intentionally or inadvertently, should be revised. However, the Agency has removed the specific recommendations for extension of strength evaluation periods. We feel the performance requirements for a project should be assessed based on the specific technical design needs of that project.

The Agency still maintains that a need exists for recognizing that concrete containing fly ash can perform successfully, although it may not always achieve the early strength gains of portland cement concrete. Methods of predicting strength, such as past experience, laboratory design results and accelerated test procedures can be used to estimate the strengths which concrete containing fly ash will attain at specified intervals.

Thus, although concrete containing fly ash may exhibit lower strengths than portland cement concrete, at 3-day and 7-day test periods for example, an agency may consider accepting the product provided the supplier has satisfactorily demonstrated the later day strengths which are expected to be achieved, and the strengths at all ages are satisfactory from a safety standpoint. Of course, in allowing slower early strength development, the contractor is still responsible for performing under the contract in a cost effective, safe, and timely manner. EPA feels this can and is being done.

Purchasing

EPA is designating cement and concrete containing fly ash as a product area for which procuring agencies must exercise affirmative procurement actions under Section 6002 of RCRA. As discussed in this Preamble under the section entitled "Statute Requirements vs. Guidelines," when EPA "designates" a product area through the issuance of guidelines, RCRA requires that procuring agencies take positive step to purchase that product. This section of the guideline contains recommendations for satisfying the affirmative procurement requirement.

Bidding Approach

In the proposed guideline, EPA recommended that procuring agencies

utilize a dual bid approach for cement and concrete purchases. The Agency recommended that all bid solicitations for cement and concrete should solicit bids for both portland cement or concrete and cement or concrete containing fly ash, where technically appropriate. Award would be made to the lowest priced responsible offeror.

In the proposal, EPA further recommended that where the application was technically appropriate and where a procuring agency was satisfied that cement or concrete containing fly ash was reasonably available and its bid price would be competitive with that of portland cement or concrete, only bids for cement or concrete containing fly ash should be solicited. Award would still be made to the lowest priced responsible offeror.

The issue of affirmative purchasing and what most negative commenters characterized as the "mandatory use" provision of the proposed guideline, § 249.20(b), was by far the issue of most concern to commenters. At the public hearing, the Agency pointed out that § 249.20(b) is a "mandatory use" provision only if the individual procuring agency chooses to solicit bids only for cement or concrete containing fly ash, while excluding portland

cement. This is not the same as the stricter approach which the Agency had considered taking in the proposal, which was to recommend that all agencies always require the use of cement or concrete containing fly ash, except where technically inappropriate.

Nevertheless, over half of the commenters considered the proposed § 249.20(b) as undesirable, arguing that cement and concrete containing fly ash should never be the only material specified, except in those very rare instances where it provides a property which portland cement alone cannot, such as low internal heat generation during construction of dams. Although EPA would have left this decision at the discretion of the procuring agencies, EPA now believes it is inappropriate to recommend it at all.

Despite the negative criticism of the "mandatory use" provision in the proposed guideline, a majority of commenters on this issue indicated support for an optional or alternate bid approach which allows for fly ash use.

EPA's recommendation in this final guideline is that procuring agencies specifically include provisions in individual contracts to allow for fly ash use as an optional or alternate material, unless the application is shown to be technically inappropriate. Award can then be made in accordance with normal and customary bid evaluation

procedures, since these procedures (which generally require award to the lowest priced responsible offeror) tend to insure the purchase of cement or concrete containing fly ash only when it is reasonably priced (i.e., priced at or below the price of portland cement or concrete), reasonably available (i.e., offered by a responsible offeror) and technically appropriate. By notifying potential bidders that fly ash use is acceptable, the procuring agency thus essentially complies with its affirmative procurement obligation to purchase cement or concrete containing fly ash, except where not reasonably available, reasonably priced, or technically appropriate, since the natural operation of the bidding system tends to make this determination for the agency.

After reflection, EPA is convinced that the marketplace provides the best gauge of reasonable price, availability, and competition. It is inappropriate to artificially restrict the marketplace through limitation of bids, even where the procuring agency has independent knowledge that the cement or concrete containing fly ash is reasonably priced, available, etc. The reasons for this are discussed below.

Lock of Availability

Commenters claimed that the "mandatory use" proposal was inappropriate because quality controlled fly ash is not always available in every part of the country. As discussed previously, this is the "chicken and egg" dilemma for many recycled materials, i.e., is fly ash not available because there is no demand in those areas, or is there no demand in those areas because fly ash is unavailable? Supporters of fly ash use argue that if fly ash is more universally accepted, it will easily be more available.

Under the proposal, procuring agencies were required to restrict the bidding to fly ash where they knew it to be available. Nevertheless, the local unavailability situation does exist and procuring agencies can be mistaken in their assessment of reasonable availability. Agencies feel it is a waste of time and money to prepare and solicit bids solely for fly ash, only to find out there are no offerors. However, if fly ash is not the only product included in bid solicitations, availability will be determined by whether any bids are received for it, without the need for resolicitation. Allowing fly ash will also serve as an incentive to potential users in that area. Contractors will not make the commitment necessary to use fly ash unless it is more readily accepted. Including it in bid solicitations and

allowing it to be used provides this incentive.

Cost Issues

The negative commenters almost always cited the potential for cost increases as a reason for never mandating sole use of fly ash. While the Agency did not propose to mandate sole use of fly ash, regardless of cost, it is true that use of certain classes of fly ash can cause a delay in early strength gains in concrete. This can lead to longer production times and may lead to cost increases. In addition, as noted in the proposed preamble, some equipment and technical expertise may have to be purchased in order to use fly ash successfully. Further, because of local unavailability, quality fly ash may only be available at a premium in certain areas.

If fly ash were required to be used, regardless of cost, some contractors would undoubtedly be left with no alternative but to raise their bid prices, without making the prices extraordinarily high or infeasible. However, if fly ash is merely allowed to be used but not required, portland cement concrete contractors will still be able to bid and award can be made to the lowest priced responsible bidder. Many fly ash concrete suppliers can economically compete, if given the chance to do so. If a builder can use fly ash in a cost effective manner, and guarantee performance and timeliness of the work, this is what the Government should be concerned with. An open bidding process successfully addresses the negative commenters' contentions that cost increases are the inevitable result of fly ash use.

Technical Considerations

Many commenters voiced concern over technical problems which can arise when fly ash is used and which might be exacerbated under the "mandatory use" provision. These problems can often be attributed to use by inexperienced persons or use of low quality ash. However, there are legitimate technical concerns which do exist even when using high quality ash, for which mandatory use causes a dilemma—largely because the mandatory use provision requires the issue of technical appropriateness to be resolved at the outset, thus reducing flexibility.

One technical concern is the effect which climate can have. Use of fly ash can delay the curing time of concrete. Cold temperatures can compound this effect even further. Some manufacturers of blended cement containing fly ash recommend that their product should

not be used at less than 50°F, except under close supervision. Flexibility to revert to portland cement concrete would be needed in such instances. On a long-term contract which spans the winter months, it is possible that fly ash concrete should most likely not be used. Serious contractual problems could arise if fly ash were specified as the mandatory material for that contract, and award made on that basis, while precluding portland cement suppliers. Procuring agencies would likely exclude fly ash altogether as an alternative, since it could not be used as the sole material for the entire contract.

One solution, however, is to allow that fly ash be used, at the option of the contractor, subject to approval of mix designs by the engineer. As materials change on a project, due to availability, cost, etc., new designs are often approved. In the case of fly ash, this flexibility should be permitted to the contractor.

Another technical problem is that fly ash may not be suitable for all uses within a project. A contractor bids on the entire project. Therefore, requiring a bid for either fly ash or not raises serious technical questions. Again, as an alternative, a procuring agency would likely exclude the use of fly ash altogether, since it could not be used for the entire project. However, with the more flexible approach EPA suggests in this guideline, the contractor and/or engineer can decide on which uses may not lend themselves to fly ash, on an item-by-item basis, after award of the contract.

Inexperienced Users and Ash Variability

Many commenters expressed concern that the so-called "mandatory use" provision might encourage use by inexperienced persons. As noted in the preamble to the proposed guideline, many contractors still lack knowledge of the proper use of fly ash in concrete and of the means of ensuring quality control. Commenters claim that if businesses are faced with the choice of either using fly ash or not bidding on a job, they will tend to use fly ash. EPA agrees that this could definitely lead to the use of low quality ash by unsophisticated users, or the failure to otherwise provide a satisfactory product. While ash from a single source may be of consistently high quality, a great deal of the fly ash generated is not suitable for use in concrete.

Although contractors are responsible for obtaining suitable materials and applying them properly, EPA believes that the problem of inexperienced users can best be avoided by employing an

open bidding process in which bids for cement or concrete containing fly ash and portland cement or concrete are accepted. Furthermore, since fly ash does not currently enjoy widespread use, this solution will, in the long run, create greater acceptance by procuring agencies, engineers and contractors.

Restricts Use of Other Materials

Several commenters stated that the "mandatory use" provision, by restricting bids to the use of fly ash as a partial cement replacement in cement and concrete, would effectively preclude use of other recovered materials in cement and concrete. There are other waste materials, particularly blast furnace slag from iron production, which can be used successfully in cement production. Any suggestion on EPA's part that fly ash should always or even sometimes be the only material specified could be a major setback to development of other materials suitable for use in cement. It would be improper for EPA to create such barriers.

This problem can be overcome through allowing, not requiring, fly ash to be used. Contract specifications should be written incorporating references to both portland cement specifications and those for fly ash. As iron blast furnace slag is developed and becomes more readily available for this use, it should be included as a third optional material, at the discretion of procuring agencies. The American Society for Testing and Materials is actively working on development of such a standard for slag.

Competition Would Be Restricted

While adequate competition may exist (i.e., two or more bidders with reasonable prices) when soliciting bids only for fly ash, producers of portland cement concrete would be precluded from bidding. The primary purpose of the guideline is to work fly ash into the bidding system, because it is typically the excluded product at the current time. EPA would be reversing this situation with a mandatory fly ash use provision. We feel such an approach is unnecessary in the case of fly ash. With the approach that fly ash be included in the bidding system as an optional or alternate material, competition and business opportunities will increase, by allowing persons who are willing and able to use fly ash to bid on contracts on which they are now often precluded.

Bid Alternatives

Commenters have made EPA somewhat aware of the various methods which can be used to achieve the objectives expressed above. EPA

discusses these methods in the guideline, and has left flexibility to procuring agencies in deciding which mechanism can best be implemented in their existing procurement system.

One approach is to allow for the use of fly ash through changes to contract or guide specifications, as discussed in this preamble in the section entitled "Specifications." Under this approach, the contractor would secure award of a contract based on normal bid evaluation procedures. At a later time, the contractor can exercise his option to use or not to use fly ash. Regardless of the choice made, normal quality assurance procedures apply, and review and approval of mix designs, materials, etc., must be performed by the project engineer. Some commenters characterized this method of solicitation as the "optional" approach.

A second purchasing method which some commenters suggested can be characterized as an "alternate bid" approach. Under this approach, a procuring agency would solicit bids requesting separate price quotations for either portland cement concrete or concrete containing fly ash. As in the case of the "optional" approach, award would be made in accordance with normal and customary evaluation procedures—typically to the lowest priced responsible bidder—regardless of whether fly ash is used.

The difference between this approach and the optional approach is that the contractor typically would be obligated to supply the material for which award is made for the duration of the contract, whether it be portland cement or fly ash. However, in order to accommodate situations in which fly ash may not be technically suitable for use in all phases of a project, or it becomes unavailable, EPA recommends that the winning contractor be allowed flexibility in amending his selection of materials planned for use, subject to approval of the procuring agency/project engineer, as long as he supplies at the agreed to bid price (or less).

EPA believes that the "alternate" approach holds most promise where the procuring agency is directly purchasing cement or concrete for a particular project, as where the U.S. Army Corps of Engineers purchases cement or concrete for a dam. In such a face-to-face bidding situation, where the procurement is strictly for cement or concrete, the procuring agency is in a position to directly evaluate the bids, make award, and evaluate requested material changes based upon the relevant factors.

The "optional" approach, on the other hand, holds most promise where the procuring agency is not directly purchasing cement or concrete, as in the situation where the procuring agency solicits bids for a construction project, such as a building, only one component of which is cement or concrete. In this situation, the price for cement or concrete is generally imbedded in the total bid price and the ultimate procurement of cement or concrete is by the contractor or the subcontractor, making evaluation of fly ash use in awarding the bid difficult or impossible. Indeed, commenters asserted that if the contractor bidding on the project had to commit to using fly ash or portland cement at the outset, the contractor would tend to specify portland cement, because fly ash may not be suitable for all construction applications on a given project. This, of course, would tend to retard fly ash use. Allowing the contractor to decide whether to use fly ash corrects this problem.

The "optional" approach should not be construed as a repudiation of the affirmative procurement requirements of Section 6002(c). Where cement or concrete is purchased ultimately by a contractor or subcontractor, whether by the Federal or state procuring agency, the contractor or subcontractor becomes a "procuring agency" for purposes of Section 6002 and the obligation to purchase fly ash is imposed on them as well. To insure that the contractor or subcontractor complies with this obligation, the guideline recommends that procuring agencies using the optional bid approach add a statement to their bid solicitations urging contractors and subcontractors to actively seek out suppliers of cement and concrete containing fly ash, and to solicit bids for these materials.

Regardless of the method of solicitation used, situations may occur where two or more low bids are received which offer different levels of fly ash content. While it generally would be desirable to make award to the bidder offering the highest fly ash content (assuming technical performance is maintained), there is a problem if that bid price is higher than that of other technically qualified suppliers.

The Agency considered establishing some type of "sliding scale" which would allow credits, and in effect additional payment for the supply of various ranges of fly ash in cement and concrete. This alternative was rejected because use of fly ash is cost competitive with portland cement use, rendering a price preference scheme

unnecessary as a means of stimulating fly ash use.

The only so-called "preference" for fly ash which EPA has retained in this final guideline is in the case of identical low bids. In such instances award should be made to a contractor who plans to utilize the highest percentage of fly ash, all other factors being equal.

Recommendations as to Price, Competition, Availability, and Performance

Prices

Section 6002 raises the issue of "reasonable" price. Congress did not say that a recovered material product need cost less than or the same as the virgin material product it replaces, but merely that its cost be reasonable. Although a few commenters recommended that bonuses or premiums be paid to those persons using fly ash, the Agency rejected this idea for this guideline. Payment of premiums is generally unnecessary since the use of fly ash in cement and concrete is itself cost competitive. No price premium should be necessary to obtain cement or concrete containing fly ash. Indeed, to allow a premium on a regular basis may be unnecessarily inflationary.

This guideline leaves the determination of reasonable price to the discretion of the procuring agency, although the guideline does suggest general procedures for determining reasonable prices and price competition, based on procedures contained in the Federal Procurement Regulations applicable to certain types of procurements. The Agency cautions against determining reasonableness of price by comparing spot prices for relatively small quantities of cement or concrete containing fly ash with competitive bids for volume purchases of portland cement or concrete.

Competition

The primary purpose of competition is to secure the lowest price for a given product. Federal procurement procedures state that adequate competition is usually presumed to exist if: (i) At least two responsible offerors (ii) who can satisfy the Government's requirements (iii) independently compete for a contract to be awarded (iv) by submitting priced offers responsive to the expressed requirements of a solicitation. In addition, the prices should be examined for reasonableness.

Using the alternative bid approaches recommended by EPA, there should be no problem in achieving reasonable competition. Solicitation of bids for both

portland cement or concrete and cement or concrete containing fly ash is recommended in all cases, thus enabling the procuring agency to better guarantee overall competition.

The existing Federal procurement procedures do not suggest comparing contracts with respect to numbers of bidders. They merely require that there be a sufficient number of bidders for adequate price competition for the particular contract at hand. EPA feels that as long as prices can be determined to be reasonable for cement and concrete which contain fly ash, then competition should be presumed to exist, no matter what the number of prospective offerors.

Availability and Delays

The Agency does not feel that procuring agencies should have to tolerate any unusual or unreasonable delays in obtaining cement or concrete which contain fly ash, other than delays which may be typically associated with portland cement and concrete. As specifications and purchasing practices are revised to allow for the use of fly ash, this material should become more widely available both geographically and in terms of the number of businesses willing and able to supply it.

Performance

The issue of reasonable performance is addressed in this preamble under the subsections on "Technically Proven Uses," "Specifications," and "Quality Control." Additional technical performance information is contained in the "References" section of this guideline.

In general, fly ash blended cement can be considered substitutable for all ASTM cement types except Type III, High Early Strength (and even these requirements can be met by adding, but not substituting, fly ash to a portland cement mixture). However, from a practical standpoint, the use of fly ash should be determined on a job-by-job basis, as there may be specific technical applications which would preclude the use of fly ash. As discussed in this preamble under "Contract Specifications," a procuring agency may document technical infeasibility for certain types of applications, rather than on a job-by-job basis. This practice should be considered acceptable as long as the purpose is not to circumvent the intent of RCRA.

The purpose of comparison to "reasonable" performance standards as required in Section 6002(c) of RCRA is to eliminate those standards, specifications, procedures, and practices

which are overly restrictive and which unfairly discriminate, either directly or indirectly, against the use of fly ash. The use of reasonable performance standards is also intended to assure that the necessary technical performance requirements are still maintained, and that product quality is not reduced below acceptable limits.

Time-Phasing

Although the requirements of Section 6002 and the recommendations of this guideline should be implemented as quickly as possible, the Agency recognizes that problems could occur—in both the marketplace and governmental procurement systems—if implementation is pushed too rapidly. For example, the cost of fly ash suitable for use in cement and concrete could rise dramatically until the supply of suitable ash and storage capacity has a chance to increase. Construction contracts might include allowance for fly ash where it is technically inappropriate. Thus, this guideline recommends a phased-in approach to implementation.

The first year after the effective date of final publication of this guideline is reserved for specification review and revision. Beginning in the second year, procuring agencies should take affirmative action in their purchases of cement or concrete, using the recommendations of this guideline, in the manner discussed above.

A few commenters specifically supported EPA's recommended phasing-in approach. However, two commenters requested that delays be granted in implementing the guideline so that use of fly ash could be evaluated. In light of the discussions throughout this preamble regarding the technical and economic feasibility of using cement and concrete containing fly ash, EPA feels such delays would be unnecessary and counterproductive.

The Agency realizes that testing programs and the need for quality assurance are always necessary to assure the acquisition of acceptable materials. Such programs have been developed for fly ash.

Local and regional variations in the components of concrete always need to be taken into account when designing and approving concrete mixes, regardless of whether fly ash is used. EPA feels the one year implementation period is adequate for agencies to begin providing for fly ash use.

Another commenter suggested a two year implementation period, instead of one year, to allow voluntary consensus standards organizations an opportunity to react to guideline recommendations.

EPA does not agree. Based on comments received from some of the major consensus standards organizations (ASTM, ACI), their standards often allow for fly ash to be used, subject to specific approval by the design engineer. However, if procuring agencies find revisions to consensus standards necessary, the guideline recommends that agencies reflect those revisions in their guide or material specifications, or on a contract-by-contract basis.

Certification

Section 6002 of RCRA requires vendors to certify that the percentage of fly ash to be included in the cement or concrete supplied under the contract is at least the amount required by applicable specifications or other contractual requirements. Further, vendors must estimate what this percentage is. This certification requirement is to take effect after a date to be specified in the guideline.

Some commenters objected to certification of fly ash content, stating it is a meaningless paperwork burden. Other commenters suggested use of simple certification clauses or procedures normally used by industry. EPA is leaving the exact certification language and format to the discretion of procuring agencies, but has provided suggestions here.

A simple certification clause is contained in the Code of Federal Regulations, 41 CFR Part 1-1, Subpart 1-1.2504, which states:

The offeror/contractor certifies that recovered materials will be used as required by specifications referenced in the solicitation/contract.

The opinion of the Agency is that by signing the bid document/solicitation, the fly ash cement or concrete supplier is in effect agreeing to meet the fly ash content requirements. Thus, no separate form, signature, etc. is needed.

In addition to the inclusion of such a certification clause in solicitations, the supplier should certify the percentage of fly ash used. This should normally be done on a per project or per shipment basis, as opposed to certification of the average amount to be used over the course of a year, for instance. Except for technical performance purposes in concrete mix design, a procuring agency may allow the percentage to be certified within a small range, rather than requiring an exact percentage. The purpose of this flexibility is to not discourage potential suppliers who may be fearful that if an exact percentage is certified for a government contract, *only* that exact percentage may be supplied. Weather conditions or material

variations, for example, may require modification of the concrete mix design and therefore the fly ash content.

This certification information is likely a necessity in evaluating concrete mix designs. However, procuring agencies can also use it in evaluating future contract requirements and in maintaining a record of fly ash use. Such information should be useful to procuring agencies in fulfilling their obligations under Section 6002(g) of RCRA, which requires agencies to submit annually a report to the Office of Federal Procurement Policy on actions taken by the agency to implement Section 6002.

Quality Control

The subject of quality control was of great concern to commenters. Some commenters misconstrued EPA's recommendations and thought that EPA was proposing to relieve suppliers of cement and concrete containing fly ash from many of the standard industry quality control and quality assurance procedures. These commenters apparently thought that EPA was replacing these standard procedures by the certification requirements discussed above. This is not the case. The certification procedures for fly ash content are entirely separate in purpose and format from quality control and quality assurance procedures.

EPA emphasizes that nothing in this certification section should be construed to relieve the contractor of responsibility for providing a satisfactory product. Cement and concrete suppliers are already responsible both for the quality of the ingredients of their product and for meeting appropriate performance requirements and will continue to be under this guideline.

Some commenters on the proposed guideline stated that EPA was incorrectly attempting to shift responsibilities and liabilities from fly ash suppliers to concrete producers and builders. EPA intends that no such shift take place. Responsibilities and liabilities are assumed to be in accordance with normal industry procedures.

Some commenters felt that fly ash should be subject to the same quality control/quality assurance provisions as for cement and other materials of construction. Many commenters felt that fly ash suppliers should be required to certify the physical and chemical characteristics of their material to users. EPA generally agrees with these commenters. Because the characteristics of fly ash can vary considerably

between sources, knowledge of those characteristics is essential to assuring appropriate use of fly ash in cement and concrete. The Agency is recommending that fly ash suppliers be asked by users to provide a statement of the important characteristics of their fly ash. These characteristics are the chemistry of the material, loss on ignition (LOI), and fineness. Other characteristics should be requested as needed by the procuring agency. Further, EPA agrees with commenters who suggested that fly ash suppliers should be prepared to demonstrate the adequacy of their quality control programs, at least for new suppliers or those unfamiliar to the procuring agency.

The responsibility for insuring the quality of blended cement lies with the supplier. ASTM specification C595 specifies adequate requirements for quality control of fly ash used in blended hydraulic cements. Most blended cement manufacturers maintain quality control programs. No additional testing above that which would be required of any cement should be necessary on the part of the user/builder to insure compliance with this specification. Users must be conscious of any differences which may exist in the field application of blended cement containing fly ash vs. portland cement.

The responsibility for insuring the quality of fly ash to be used as an admixture in concrete is that of the fly ash supplier. Although many suppliers of fly ash have their own quality control program, commenters pointed out that ASTM specification C618 may not be sufficiently stringent to ensure all ashes which comply are really suitable for general use as mineral admixtures in concrete, particularly when chemical admixtures such as air-entraining agents are to be used. Further, there is no assurance that all ashes which comply with specifications will be suitable for all uses. Thus, unfamiliar users must acquire the necessary technical expertise if they are to use fly ash successfully.

Some commenters suggested that States approve sources of fly ash. While EPA is not specifically recommending an "approved source" approach, the Agency does believe that fly ash and concrete suppliers should be expected to demonstrate (through reasonable testing programs or previous experience) the performance and reliability of their product. The judgement of the contractor/builder must be used in evaluating:

(1) Whether additional testing is necessary to insure the performance of the concrete, and

(2) Whether such testing is cost effective when compared with the cost of using other materials.

Fly ash which does not satisfy at least ASTM specifications should not be used in cement or concrete on Federal construction projects.

For those agencies desiring a testing or quality assurance program for cements, blended cements, or pozzolans, the U.S. Army Engineer Waterways Experiment Station (WES), P.O. Box 631, Vicksburg, Mississippi 39180, may be contacted. WES is the agency responsible for testing such materials for Federal agencies.

Date

EPA is charged with designating a time after publication of this guideline at which certification requirements will take effect. Certification of fly ash content should be a part of any solicitation which allows or requires the use of fly ash in cement or concrete. This guideline recommends a 12-month period after the effective date for review and revision of all guide and continuing contract specifications. After this 12-month period any solicitations/contracts issued should include provisions which allow that fly ash be supplied, and thus should incorporate certification requirements.

Compliance and Monitoring

EPA expects full cooperation from all Federal agencies in implementation of this guideline. The Office of Federal Procurement Policy (OFPP) has the major responsibility for overseeing implementation of Section 6002 of RCRA. The OFPP has indicated it will direct the Defense Acquisition Regulations and Federal Procurement Regulations overseeing bodies to immediately implement the final guideline.

The OFPP is responsible for monitoring and reporting annually to Congress on the actions taken by procuring agencies in implementing Section 6002 of RCRA. Under its Policy Letter 77-1, OFPP has imposed a reporting requirement upon the procuring agencies to gather this information. EPA, in conjunction with the OFPP, will monitor the impact of this particular guideline on the procurement practices of Federal agencies and on fly ash use. Thus, agencies are encouraged to develop procedures for gathering and maintaining such information.

A few commenters urged strict and active enforcement of the guideline by EPA. Among the specific suggestions

were debarment of contractors for major certification violations, provision by EPA of technical assistance to States and other agencies in the revision of specifications and the use of fly ash, and monitoring by EPA of its own contractors and grantees.

EPA expects a high level of compliance with the guideline. If necessary, the Agency is prepared to take appropriate measures to ensure that the objectives of the guideline are met. In addition, there are other methods available to interested parties to encourage compliance with Section 6002. One of these methods is the citizen suit provision of Section 7002 of RCRA, which states:

(a) * * * any person may commence a civil action on his own behalf—(1) against any person (including (a) the United States, and (b) any other governmental instrumentality or agency * * *) who is alleged to be in violation of any permit, standard, regulation, condition, requirement, or order which has become effective pursuant to this Act.

A second method which may be useful in encouraging compliance with Section 6002 is the filing of formal protests by aggrieved bidders. A bidder who is willing and able to supply a designated reserved material product to procuring agencies and who is precluded from bidding by failure of a procuring agency to comply with Section 6002, may be able to obtain satisfaction through this process.

Regulatory Analysis

In this and other sections, the preamble contains discussions of the elements required in a Regulatory Analysis: (1) The program objectives, (2) our consideration of regulatory alternatives, (3) a general assessment of our choices, (4) a description of potential benefits and costs and (5) the rationale for our decisions. EPA believes it is complying with the intent of Executive Order 12291 because of this and other efforts, including the preparation of a more detailed background document to support the analyses below. This document may be examined at the RCRA Public Docket Office, at the place and times listed previously in this preamble.

Effects

(1) *Economic savings.* This guideline should help the cement industry by reducing both energy costs and capital investment requirements for capacity expansions. Adding effective capacity by using fly ash to produce blended cement is a viable alternative to new kiln construction. Adding capacity with fly ash involves about ten percent of the

capital cost of a new plant (\$5-\$15 per ton added capacity using fly ash vs. \$125-\$185 per ton for a new cement plant).

The purchased energy cost associated with cement production represents one-third of the finished value of the cement—very high in relation to other building materials. At a typical blending rate of 20 percent, fly ash in cement can reduce total energy use about 15 percent. The portion of total cost represented by this energy savings—currently five percent—will grow as the cost of purchased energy increases.

For cement consumers, i.e. ready mixed concrete producers, concrete product manufacturers, and highway contractors, fly ash can reduce raw material costs. Cement prices range from \$40-\$90 per ton, while the price of fly ash suitable for use in concrete may range from about \$15-\$50 per ton. Depending on the replacement rate and relative price of the two materials, substituting fly ash can save 5 to 15 percent of the cost.

Procuring agencies may not be in a position to realize the savings described here with respect to their purchases of blended cements. Because of the pricing structure and concentrated nature of the

properly blended cement containing fly ash may perform as well or better than portland cement—blended cements containing fly ash (ASTM Types IP and I(PM)) are likely to be priced at the same level as ASTM Type I portland cement. However, concrete producers are able to take direct advantage of decreased raw materials cost by purchasing fly ash as a partial cement replacement. Given the greater competition among the large number of firms in these industries, bid quotations for concrete may reflect part of these savings.

(2) *Energy Conservation.* In 1976, the portland cement industry accounted for two percent of total energy used by U.S. industry. Although the cement industry has steadily reduced its energy consumption per unit of product over the past several years, the use of fly ash in producing blended cements can still save a significant amount of energy.

Seventy to eighty percent of the energy used in cement production is consumed during the pyroprocessing stage, where raw materials are subjected to intense heat and chemically react to form cementitious compounds, or clinker. The clinker is ground into the fine powder known as cement. Replacing the cement clinker with fly ash (on a one-to-one ratio by weight) reduces the amount of clinker production required per ton of finished cement. Energy savings are proportioned

to the percentage of fly ash used in the blend. Assuming a 20-percent replacement rate, the savings may range from about 13 to 19 percent of total energy used in production.

Concrete producers can save energy indirectly, on a nationalized basis, if fly ash is used as an admixture at their plant. Replacing a portion of cement with fly ash in the final product would reduce the production needed from the cement industry, and thus would reduce energy consumption. Each ton of cement replaced would save approximately 5,750,000 BTU's of energy.

One commenter pointed out that the energy savings presented here are not totally achievable for new cement plants which have been designed to take advantage of energy conserving technologies. While this statement is true when considering BTU's, the percentage energy savings are nevertheless achievable by bypassing the pyroprocessing stage, regardless of the efficiency of the plant involved.

Another commenter claimed that increased energy consumption would take place in the precast and prestressed concrete industry, due to the higher temperatures needed to achieve equivalent early strengths when using

considered to be at the manufacturer's option under this guideline. EPA feels that if increased energy consumption is prohibitive for precast and prestressed manufacturers, concrete containing fly ash will not be utilized.

(3) *Environmental Issues.* (a) *Benefits.* The use of fly ash in cement and concrete will have a positive effect on the environment, reducing pollution of the land, air, and water. It will do this by reducing: (1) The quantities of fly ash requiring disposal, (2) the mining and processing of raw materials used in cement production, and (3) the cement plant emissions per ton of blended cement produced or per ton of cement replaced with fly ash.

If current usage rates continue, by 1985 60-65 million tons of fly ash annually will require disposal. Approximately 10-20 million tons of this fly ash are estimated to be suitable for use in concrete. This guideline can affect the practices of collecting fly ash, especially from new sources, and can reduce the quantities which require ultimate disposal. Thus, the use of fly ash in cement and concrete will provide a more environmentally acceptable way to manage these substances than would otherwise be available.

Current practices for cement manufacturing, and current disposal practices for fly ash, can have a negative effect on air quality (increased

dust), water quality (surface and groundwater contamination), land use, noise, and aesthetic value. The use of fly ash in cement and concrete can reduce these effects in several ways. For example, it would reduce the need for such raw materials as limestone and clay, whose mining and processing can harm the environment through the creation of increased dust, erosion, runoff, and noise, disturbance of natural habitats, and degradation of potential land use. Use of fly ash reduces the potential for leaching of trace heavy metals, which could occur as a result of indiscriminate fly ash disposal.

Requiring less cement for the same quantity of "cementitious" end product may reduce the amount of cement kiln dust which requires disposal (currently 6-8 million tons per year). The disposal of cement kiln dust can have the same harmful effects (i.e., air quality, water quality, land use, aesthetic value, etc.) as the disposal practices of fly ash. In addition, using fly ash to increase the capacity of a cement plant would most likely reduce the need for air pollution control since it would not require the air pollution control associated with new kiln construction. This approach to expanding capacity may be especially attractive in nonattainment areas where new kiln construction is effectively precluded.

(b) *Impact of RCRA, Subtitle C.* In May 1980, EPA promulgated regulations for the control of hazardous waste pursuant to Subtitle C of RCRA. In the Solid Waste Disposal Act Amendments of 1980, Congress directed EPA not to regulate fly ash as a hazardous waste until such time as EPA investigates the environmental hazards, if any, posed by fly ash disposal. Findings to date indicate that little, if any, fly ash exhibits characteristics defined as hazardous in the Federal regulations. Therefore, Subtitle C regulations will have no significant impact on the use of fly ash in cement and concrete.

A few commenters suggested that EPA limit the use of fly ash in concrete, restricting its use in potable water sources or in storage areas for food. The rationale given for these suggestions was the potential for leaching of trace metal elements out of the fly ash. The commenters provided no documentation as to the likelihood or extent of leaching when fly ash is used in concrete.

While it is true that fly ash contains trace amounts of certain elements, which can be toxic in larger concentrations, it is unlikely that fly ash as used in concrete would exhibit leaching characteristics. First, the permeability of concrete containing fly

ash is negligible compared to the permeability of fly ash as typically proposed. This reduced permeability prevents water or other liquids from penetrating concrete and providing a leaching medium through which contaminants could travel.

Second, when used in concrete, fly ash becomes an integral part of the final product. The surface area of individual fly ash particles, from which leaching of trace constituents takes place, is so greatly reduced in this application as to be almost nonexistent. It is not possible through conducting leaching tests of raw fly ash to estimate the leaching, if any, which would take place in a concrete containing fly ash. Thus, the commenter's suggestion that dams and pipes not be constructed using fly ash appears to have no technical basis.

(c) *Radioactivity Issues.* At the same time as original proposal of the hazardous waste regulations (December 18, 1978), EPA issued an advance notice of proposed rulemaking that it was considering establishing 5 picocuries per gram (pCi/g) of radium-226 as a criterion for listing wastes as hazardous. The notice also requested comment on other criteria which might tend to affect the emanation rate of radon from the waste. Agency has, at this date, taken no further action on this proposed rulemaking to establish general criteria for hazardous radioactivity levels in wastes.

Where resource recovery is practiced, an important consideration in assessing the hazard is the proposed use of the waste material. While some proportion of fly ash generated in the U.S. has more than 5 pCi/g of radium-226, the physical structure of fly ash is such that its contribution to radiation exposure is probably less than that of most normal constituents of concrete which generally fall below this level. This is explained below.

A few commenters expressed concern to EPA that fly ash used in the construction of habitable structures could pose a threat to public health due to radioactivity. The source of the radiation threat is due to radium-226, a radioactive isotope which occurs naturally in soil, sand, and mineral deposits as well as in fly ash. The radium-226 content of soil generally ranges from 2 to 3 pCi/g. Limited measurements of radioactivity in cement show that the radium-226 content of cement can be as high as 5 pCi/g, but typically averages close to 1 pCi/g. Tested measurements of fly ash presently generated in the U.S. show a radium-226 content ranging from 1 to 8

pCi/g with an average of roughly 4 pCi/g.

There are two pathways of radiation exposure from radium-226 in building materials. The pathway of primary concern is from inhalation of radon-222 and its short-lived decay products. Radon-222, an inert gas with a radioactive half-life of 3.8 days, is the first generation decay product of radium-226. Because it is an inert gas, it can readily migrate from the building material into the indoor air of a home. Although the rate at which radon is created within a building material is proportional to its radium content, the intrinsic structure of the material may, in some cases, prevent most of the radon from escaping. When air containing radon and its radioactive decay products is breathed for long periods of time, a person's risk of lung cancer is increased.

Gamma radiation from radium-226 and its decay products is the other exposure pathway. The amount of gamma radiation emission from a building material is proportional to its radium content, but the total exposure a person receives will also depend on other factors such as shielding, distance from the material, and exposure time. Exposure to gamma radiation results in an increased risk of many types of cancer.

When fly ash is used as a partial cement replacement in concrete, the fly ash content of the final concrete product is between 2 and 3 percent (assuming a 15 to 25 percent cement replacement rate and an 8 to 1 ratio of aggregate and water to cementitious material). Since the average radium-226 content of fly ash exceeds that of cement by a few pCi/g, the use of fly ash as a cement replacement in habitable structures will, on the average, result in a slight increase in the gamma radiation exposure to people (less than a milliroentgen per year). However, in some instances, where fly ash with a lower than average radium content replaces a cement with a higher than average radium content, the result would be less gamma radiation exposure.

The use of fly ash as a cement replacement will also affect the quantity of radon emitted by the building material. Although the rate at which radon is created is directly proportional to the radium content, other factors may inhibit radon emanation from a material. Because fly ash is produced at high temperatures, it has a glassy structure which keeps most of the radon from escaping. The fraction of radon which escapes from fly ash (emanation

fraction) has been measured at no more than a few percent. In contrast, typical soil and soil like materials tend to have an emanation fraction in the neighborhood of 20 percent. Thus, although fly ash, on the average, has a greater radium content than the cement it replaces, the use of fly ash as a partial cement replacement is likely to reduce the radon gas contribution of the final concrete product.

During the proposal period for this guideline, EPA has been investigating this issue more thoroughly. Tests recently conducted for EPA substantiate the conclusions above, i.e., that the radon emanation rate of fly ash in its raw state and as used in concrete is only a few percent compared to the absolute radium concentration. Thus, while fly ash use in cement would, on the average, result in a small increase in gamma radiation exposure, this small increase in gamma exposure is likely to be offset by a decreased radon exposure. In light of this, EPA believes that the use of typically-occurring fly ash in concrete does not constitute a significantly different radiation risk than the risk from the cement it replaces, and neither of these is significantly different from the radiation risk posed by common soil.

Institutional Issues

In spite of proven technical performance and favorable economics, the use of fly ash in cement and concrete has had only limited acceptance. This can be attributed in part to potential consumers' unfamiliarity with fly ash, and their reluctance to aggressively investigate or readily accept new materials where an existing product—in this case portland cement—has traditionally been accepted. In some cases there may be outright discrimination against this use of fly ash, because of attitudes, personalities of individuals involved, and political and economic pressures. Several commenters stated that this Federal procurement guideline is necessary to overcome the lethargy of specifying engineers, inertia of the construction industry, unfair competition from vested interests, and resistance to use by some factions of State highway departments and the Federal Highway Administration.

It is difficult to obtain quick approval for a new product or material specification in the construction field, given the requirements for experimentation, demonstration, field evaluation and finally specifications changes. However, it should be recognized that fly ash has already gone

through these steps. There are established specifications and standards for the testing and use of this material. Sources of ash must be acceptable and EPA emphasizes that only ash which meets established specifications should be used. However, a procuring agency need not "reinvent the wheel" by requiring extensive and expensive reevaluation of the basic feasibility which has already been proven. This applies to all government agencies, but especially to state and local entities, which use such instruments as building codes to regulate construction activities.

Design engineers generally have the final say on the materials to be specified for a particular construction job. Typically, until a majority of peer engineers accept a "new" material there is reluctance to use it. However, an engineer can meet his or her responsibility for the performance of a structure by conducting a thorough review of the concrete mix design before placing the concrete, and assure that the materials and mix design meet, as a minimum, ASTM, Federal, and/or American Concrete Institute specifications. The intent of this guideline is to help overcome certain of these institutional barriers which may have no adequate foundation, while maintaining satisfactory product quality.

Resource Requirements

The cost to procuring agencies of compliance with this guideline will be minimal. The price of cement and concrete containing fly ash should be less than or equal to the price of portland cement and concrete. The start-up costs of revising specifications and assimilating fly ash into the procurement system should be relatively minor but are not readily measurable.

The Office of Federal Procurement Policy (OFPP) is responsible for submitting an annual report to Congress on actions taken by Federal agencies and the progress made in implementation of the resource recovery policy of Section 6002. As a result, OFPP already requires an annual report from each Federal agency on actions taken in the implementation of Section 6002. By working closely with OFPP, information relevant to the implementation of this guideline can be obtained. The costs to OFPP and EPA of implementing this guideline are expected to be relatively minor.

EPA's efforts during the first year following promulgation of the final guideline will focus on explaining the guideline provisions to interested persons and responding to inquiries regarding implementation of the guideline. The Agency urges individuals

with an interest in seeing the guideline implemented to deal directly with those persons responsible for compliance with Section 6002, i.e., procuring agencies, and ultimately with architects, engineers, etc.

Public Participation

Prior to proposal, an interagency work group, including representatives from most of the Federal agencies which will be directly affected by this guideline, assisted in development of the proposed guideline. In addition, a draft of the proposed guideline package, including a summary development plan, preamble, rule, and background documents was circulated to well over 200 interested persons for comment. Public participation regarding formal proposal and comments on the proposed guideline was presented at the beginning of the section of this preamble entitled "SUPPLEMENTARY INFORMATION."

Compliance With Executive Order

Under Executive Order 12291, EPA must judge whether a regulation is "Major" and therefore subject to the requirement of a Regulatory Impact Analysis. This guideline is not major because it is not likely to result in:

- (1) An annual effect on the economy of \$100 million or more;
- (2) A major increase in costs or prices for consumers, individual industries, Federal, State, or local government agencies, or geographic regions; or
- (3) Significant adverse effects on competition, employment, investment, productivity, innovation, or on the ability of United States-based enterprises to compete with foreign-based enterprises in domestic or export markets.

This guideline recommends that procuring agencies include provisions in construction contracts which specifically allow for fly ash to be used, with the contractor retaining the option to use fly ash. Typically, fly ash is currently precluded from use on construction projects unless it is specifically called for in the contract specifications. As discussed in other sections of the preamble, particularly "Regulatory Analysis," this guideline should not adversely affect competition. With the approach that fly ash be allowed into the bidding system as an alternate material, competition and business opportunities are increased by allowing persons who are willing and able to use fly ash to bid on contracts, while still allowing suppliers of conventional portland cement and concrete to compete.

With regard to costs, this guideline should help the cement industry by reducing both energy costs and capital investment requirements for capacity expansions, through the blending of fly ash with cement. For cement consumers, i.e., ready-mixed concrete producers, concrete product manufacturers, and highway contractors, use of fly ash can reduce raw material costs, as fly ash is generally priced less than the cement it replaces, although savings will vary. On a micro-scale, however, individual companies may be placed in the position of losing bids to competitors who choose to use fly ash, and who bid lower.

EPA has prepared a detailed background document supporting the above analysis. This document may be examined at the RCRA Public Docket Office, at the place and times listed above.

This guideline was submitted to the Office of Management and Budget (OMB) for review as required by Executive Order 12291.

Dated: January 21, 1983.

Anne M. Gorsuch,
Administrator.

List of Subjects in 40 CFR Part 249

Resource recovery, Recycling, Fly ash, Procurement.

Title 40 CFR is amended by adding a new Part 249 reading as follows:

PART 249—GUIDELINE FOR FEDERAL PROCUREMENT OF CEMENT AND CONCRETE CONTAINING FLY ASH

Subpart A—Purpose, Applicability, and Definitions

Sec.

- 249.01 Purpose.
- 249.02 Designation.
- 249.03 Applicability.
- 249.04 Definitions.

Subpart B—Specifications

- 249.10 Recommendations for guide specifications.
- 249.11 Recommendations for contract specifications.
- 249.12 Recommendations for material specifications.
- 249.13 Recommendations for fly ash content and mix design.
- 249.14 Recommendations for performance standards.

Subpart C—Purchasing

- 249.20 Recommendations for bidding approach.
- 249.21 Recommendations for reasonable price.
- 249.22 Recommendations for reasonable competition.
- 249.23 Reasonable availability.
- 249.24 Recommendations for time-phasing.

**FRED C. HART ASSOCIATES, INC. REPORT TO NEW YORK CITY
DEPARTMENT OF SANITATION**

Assessment of Potential Public Health Impacts
Associated with Predicted Emissions of
Polychlorinated Dibenzo-Dioxins and
Polychlorinated Dibenzo-Furans from the
Brooklyn Navy Yard Resource Recovery Facility

Prepared for:

New York City Department of Sanitation

Prepared by:

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August 17, 1984

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TABLE OF CONTENTS

	<u>Page</u>
Executive Summary	1
Chapter 1 Introduction.	1-1
1.1 Purpose.	1-1
1.2 Description of the Facility.	1-1
1.3 Contents of the Report	1-2
1.4 Considerations in Risk Assessment.	1-4
1.5 Technical Review	1-7
Chapter 2 Properties of Polychlorinated Dibenzo-p-dioxins . . .	2-1
2.1 Background	2-1
2.1.1 Introduction.	2-1
2.1.2 Nomenclature.	2-2
2.1.3 Sources in the Environment.	2-6
2.2 Physical and Chemical Properties	2-10
2.2.1 Physical Properties	2-10
2.2.2 Chemical Properties	2-11
2.3 Environmental Fate	2-12
2.3.1 Environmental Half-Life	2-12
2.3.2 Air	2-14
2.3.3 Water	2-15
2.3.4 Soil.	2-17
2.3.5 Summary	2-18
2.4 Toxicology	2-19
2.4.1 Principal Concerns and Issues	2-19
2.4.2 Animal Toxicology	2-21
2.4.3 Human Toxicology.	2-25

TABLE OF CONTENTS (CONTINUED)

		<u>Page</u>
	2.4.4 Carcinogenicity	2-32
	2.4.5 Teratogenesis and Other Reproductive Effects	2-35
	2.4.6 Mutagenicity.	2-36
	2.4.7 Mechanisms of Toxicity.	2-37
	2.4.8 Summary	2-38
Chapter 3	Dioxin Emissions from Incineration.	3-1
	3.1 Introduction	3-1
	3.1.1 Purpose	3-1
	3.1.2 Approach.	3-1
	3.2 Factors that Influence Rates of Dioxin Emission	3-2
	3.2.1 Formation (Occurrence).	3-2
	3.2.2 Destruction	3-6
	3.3 Emission Test Data from Municipal Waste Incineration	3-10
	3.4 Factors Influencing Rates of Dioxin Emission from Incinerators.	3-15
	3.5 Brooklyn Navy Yard Facility Design	3-17
	3.6 Predicted Emissions from Brooklyn Navy Yard Facility	3-19
	3.7 Assessment of Predicted Emissions.	3-29
	3.8 Summary.	3-33
Chapter 4	Exposure Assessment for the Emissions from the Proposed Brooklyn Navy Yard Resource Recovery Facility	4-1
	4.1 Introduction	4-1
	4.1.1 Purpose	4-1
	4.1.2 Approach.	4-1

TABLE OF CONTENTS (CONTINUED)

		<u>Page</u>
	4.2 Air Dispersion Model	4-2
	4.3 Deposition Model	4-6
	4.4 Predicted Maximum Concentrations of PCDFs and PCDDs in Soil, Dirt and Dust	4-13
	4.5 Summary.	4-16
Chapter 5	Risk Assessment	5-1
	5.1 Background	5-1
	5.1.1 Introduction.	5-1
	5.1.2 Limitations of the Risk Assessment Process	5-2
	5.2 Determination of "Risk".	5-3
	5.2.1 ADI/NOEL Approach	5-4
	5.2.2 Extrapolating Risks from High Dosage Carcinogenic Bioassays.	5-5
	5.2.3 Multiple Components	5-10
	5.3 Current Standards and Guidelines	5-16
	5.3.1 EPA Risk Assessment for Municipal Waste Combustors.	5-17
	5.3.2 NYSDEC Ambient Air Guideline.	5-17
	5.3.3 Canadian Ambient Air Quality Provisional Guideline for Chlorinated Dibenzodioxins and Dibenzofurans.	5-19
	5.3.4 The Netherlands Dioxin Standard	5-20
	5.3.5 N.Y.S. Department of Health Risk Assessment	5-20
	5.4 Comparison of the Annual Average Concentrations of PCDDs and PCDFs at the Point of Maximum Impact with Standards and Criteria	5-22
	5.4.1 Comparison with Canadian Standard	5-23

TABLE OF CONTENTS (CONTINUED)

		<u>Page</u>
	5.4.2 Comparison with the Netherlands Standard	5-23
	5.4.3 Comparison with the NYSDEC Guideline	5-24
	5.4.4 Comparison with the NYSDOH Guideline	5-24
	5.5 Computation of a "Worst-Case" Upper Bound to the Level of Risk Associated with Emissions from the BNYRRF	5-24
	5.5.1 General Approach	5-25
	5.5.2 General Assumptions	5-27
	5.5.3 Inhalation Exposure	5-27
	5.5.4 Ingestion and Dermal Exposure	5-35
	5.5.5 Additional Issues	5-49
	5.6 Summary and Conclusions	5-51
Chapter 6	Comparative Risks	6-1
	6.1 Introduction.	6-1
	6.2 Risk Evaluations for Dioxin Exposure Performed by Other Regulatory Agencies	6-2
	6.3 Current Regulatory Policy or Practice Regarding Acceptable Risk Levels	6-4
	6.4 Risks from Non-dioxin Related Events	6-6
	6.5 Comparison with Overall Cancer Rates	6-6
	6.6 Other Sources of Dioxin	6-8
	References	R-1
	Appendix A Compilation of PCDF and PCDD Emission Data	A-1
	Appendix B Example Calculations	B-1

TABLE OF CONTENTS (CONTINUED)

LIST OF FIGURES

<u>Figure</u>	<u>Title</u>	<u>Page</u>
2-1	2,3,7,8-Tetrachlorodibenzo-furan 2,3,7,8-Tetrachloro-dibenzo-dioxin	2-3
2-2	2,4,5-Trichlorophenol, 2,4,5-T and Esters and Salts. . .	2-8
4-1	Annual Fly Ash Deposition Rates.	4-9

TABLE OF CONTENTS (CONTINUED)

	<u>Page</u>
Appendix C Issues Related to Dioxin Emissions from BNYRRF	C-1
Appendix D Comments of Peer Review Panel Members on this Report.	D-1
Appendix E <u>Curriculum Vitaes</u> of Peer Review Panel Members.	E-1
Appendix F Qualifications and Experience of Fred C. Hart Associates.	F-1

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

<u>Table</u>	<u>Title</u>	<u>Page</u>
2-1	A List of Polychlorinated Dibenzo-p-dioxin Homologues by Congener and Isomer.	2-4
2-2	Abbreviations for Various Chlorodibenzo-p-dioxins . . .	2-5
2-3	Physical Properties of Two Chlorinated Dioxins.	2-13
2-4	Photodegradation of 2,3,7,8-TCDD.	2-16
2-5	An Outline of Acute and Chronic Animal Toxicity Tests .	2-22
2-6	Relative Toxicity of Various PCDDs as Indicated by Several Tests.	2-23
2-7	LD ₅₀ s for Several Animal Species	2-24
2-8	Chronic Effects in Various Animal Species.	2-26
2-9	Acute and Chronic Human Health Effects of Halogenated Dioxins and Related Compounds	2-28
2-10	Studies of Occupational Exposure to 2,3,7,8-TCDD	2-31
2-11	Total and Individual Tumors in Male and Female Rats of Significantly Different Incidence than Non-treated Control Rats (After Kociba <u>et al.</u> , 1978).	2-34
3-1	Estimated or Measured Destruction Efficiencies for PCDF and PCDD Compounds	3-8
3-2	Predicted PCDF and PCDD Emissions from BNYRRF.	3-22
3-3	Particle Size Distribution Resource Recovery Stack Emissions	3-26
3-4	Calculated as Concentrations of PCDF and PCDD in Fly Ash Emissions as Function of Particle Size	3-28
3-5	Predicted PCDF/PCDD Emission Rates from BNYRRF - Function of Particle Size	3-30
3-6	Predicted PCDF and PCDD Emissions from BNYRRF.	3-31
3-7	Concentration of PCDF and PCDD in Fly Ash from Data in Available Literature	3-34
3-8	Summary of Predicted PCDF and PCDD Emissions - BNYRRF. .	3-36

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

<u>Table</u>	<u>Title</u>	<u>Page</u>
4-1	Annual Average Concentrations of PCDF and PCDD Materials at Ground-level and Elevated Receptors - BNYRRF.	4-5
4-2	Annual Average Concentrations of PCDF and PCDD Materials at Ground-level and Elevated Receptors - BNYRRF.	4-7
4-3	Characteristics of Particle Aerodynamics	4-11
4-4	Maximum and Average PCDF/PCDD Deposition Rates	4-12
4-5	Concentrations of PCDF and PCDD Materials in Soil-Areas of Maximum Deposition Rate	4-14
4-6	Concentrations of PCDF and PCDD Materials in Settleable Particulate Areas of Maximum Deposition Rate	4-15
4-7	Amount of PCDD and PCDF Accumulation on Indoor Surfaces-- Area of Maximum Deposition Rate.	4-17
4-8	Summary of Maximum Impacts	4-19
5-1	Dioxin Standards and Criteria Using ADI/NOEL Approach. .	5-6
5-2	Extrapolated Human Equivalent Dose-Response Data to Estimate an Upper Bound to Carcinogenic Risk	5-9
5-3	Factors Used by Various Agencies in Calculating their Upper 95% Upper-Limit Unit Risk Estimates for TCDD	5-11
5-4	Calculation of Toxic Equivalents	5-15
5-5	Range of Maximum Average Annual Ground-Level Concentrations of TCDD Isomers Using PTMAX Air Dispersion Model	5-18
5-6	Range of Upper Bounds of TCDD Carcinogenic Risks Derived from Various Extrapolation Models	5-18
5-7	Upper Bound Estimated Percentage of Acceptable Daily Intake (ADI) Attributable to Inhalation of PCDD and PCDF Emissions from the BNYRRF at Ground-Level and Elevated Receptors	5-30
5-8	Upper Bound Estimated Increased Cancer Risk for Population of One Million People Exposed for a 70-Year Period to the Maximum Daily Intake	5-32

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

<u>Table</u>	<u>Title</u>	<u>Page</u>
5-9	Gastrointestinal Absorption of 2,3,7,8-TCDD.	5-39
5-10	Estimated Daily Intake of 2,3,7,8-TCDD through the Ingestion Pathway (Weight Approach).	5-42
5-11	Estimated Daily Intake of 2,3,7,8-TCDD through the Ingestion Pathway (Surface Area Approach).	5-43
5-12	Daily Intake from Dermal Absorption (Weight Approach). .	5-46
5-13	Daily Intake from Dermal Absorption (Surface Area Approach).	5-46
5-14	Calculation of a Total Daily Intake for Inhalation, Ingestion, and Dermal Absorption Pathway	5-47
6-1	Estimated Lifetime Risk of Death for Persons in New York State.	6-7
6-2	2,3,7,8-TCDD Levels in 62 Samples of Great Lakes Fish from Lake Ontario.	6-11
6-3	Average Contaminant Levels in Striped Bass -- 1982 (2,3,7,8-TCDD and 2,3,7,8-TCDF).	6-12

Executive Summary

A. Introduction

The purpose of this report is to assess the potential health risks associated with the emission of polychlorinated dioxins (PCDDs) and polychlorinated furans (PCDFs) from the proposed Brooklyn Navy Yard Resource Recovery Facility (BNYRRF). This document was prepared at the request of the New York City Board of Estimate.

A panel of nine technical experts was assembled to provide guidance in the preparation of this report and to review and comment on its approach and conclusions. This review panel is composed of local, national, and international authorities in both scientific and regulatory areas of dioxin research. Meetings were held with the panel on February 28th to review the scope of this study, and on April 29th, 1984 to receive comments on a preliminary draft, prior to review of the final document in July. These comments, and the panel's evaluation of the report's technical and scientific merit appear as an appendix to the report.

The information contained in this document was gathered through an extensive review of the available literature on the properties of dioxins and their emission from resource recovery facilities. Where appropriate, this data was supplemented by conversations with technical and regulatory authorities. This report is not, and was not intended to be, a product of original research.

B. Approach

In order to assess the potential risks associated with the predicted BNYRRF emissions, the report was divided into five separate work elements: (1) a review of the literature on the chemical, physical, and toxicological properties of PCDDs and PCDFs; (2) an analysis of available data pertaining to the high-temperature behavior of PCDF and PCDD and the prediction of PCDD and PCDF emission rates for the proposed BNYRRF; (3) a detailed modeling program to predict maximum annual downwind concentrations of PCDFs and PCDDs in the ambient air, soil, dust and dirt; (4) a risk assessment which compared the concentrations of contaminants known or predicted to cause a toxic effect to the predicted level of exposure of local populations; (5) an evaluation of the upper limit excess cancer risk predicted by the risk assessment in the context of comparative risks.

In addition, this report contains the following appendices:

- (A) a compilation of published PCDD and PCDF emission data;
- (B) example calculations to show how quantitative results were derived;
- (C) a discussion of certain issues related to facility operations; an evaluation of the impact of operating and emissions controls on PCDD and PCDF emissions; an evaluation of potential occupational and public health risks associated with fly ash disposal; recommendations for facility operations;
- (D) the written comments of the peer review panel members on the final draft of this report;

- (E) the curriculum vitae of the peer panel members;
- (F) a statement of the qualifications and experience of Fred C. Hart Associates.

C. Findings

C.1 Properties of Dioxins

Data on the toxicity, persistence, bioavailability, and transport characteristics of PCDDs and PCDFs was reviewed to provide background information necessary to conduct a risk assessment of dioxin emissions from the BNYRRF.

"Dioxin" is a generic term for a family of compounds known as polychlorinated dibenzo-p-dioxins (PCDDs). Altogether, there are a total of 75 different PCDDs which can vary in the number of attached chlorine atoms and the positions of attachment. There are eight possible locations for chlorine atoms on dibenzo-p-dioxin. "Furans" are a family of 135 similar chlorinated compounds, the polychlorinated dibenzofurans (PCDFs), differing chemically from dioxin in that the two constituent benzene rings are linked by one, rather than two, oxygen atoms.

Congeners of dioxin differ from one another by the number of attached chlorine atoms. Those compounds with four chlorine atoms are known as "tetra-chlorinated" dioxins or furans (TCDD and TCDFs or T₄CDDs and T₄CDFs), those with six chlorine atoms are known as "hexas" (HCDDs and HCDFs or H₆CDDs or H₆CDFs), etc. Isomers of dioxins have the same number of chlorine atoms but vary in their position of attachment.

PCDDs and PCDFs are present in the environment from several sources. Dioxins have been produced largely as unwanted contaminants from the manufacture of trichlorophenols, herbicides such as 2,4,5-T, and chlorobenzenes and polychlorinated biphenyls. In addition, both chlorinated dioxins and furans are associated with a variety of combustion sources.

Little is known about the actual fate of dioxins in the environment. Most of the available data, which is often conflicting, is for the 2,3,7,8-TCDD isomer. The properties of the other isomers frequently are inferred based upon structural/functional similarities with 2,3,7,8-TCDD and other highly chlorinated aromatic hydrocarbon species. It is known that all PCDDs and PCDFs are resistant to chemical, physical, and biological degradation and thus are very stable in the environment. They have a strong affinity for binding to organic substrates, such as soil and sediment, and to fly ash. Due to their low water solubility and high binding affinity for soils, they do not migrate substantially in soils.

Volatilization from soils through vapor phase transport is dependent on ambient temperature and is thought to be a major removal pathway. The primary removal mechanism of dioxin from water is through adsorption by sediment or biota, although volatilization and photodegradation may occur to some extent.

Polychlorinated dioxins in the atmosphere are present in the particulate-sorbed or vapor phase. They may be removed from the air by atmospheric deposition or photochemical degradation. The environmental half-life has been reported to range from one-half year up to twelve years.

Animal studies, which are limited primarily to testing 2,3,7,8-TCDD, indicate that this compound shows considerable variation in toxicity among different species, as well as a delay between administration and the manifestation of a toxic effect. The acute toxicity of different PCDDs varies widely (e.g., in guinea pigs by six orders of magnitude), depending on the number and the location of the chlorine atoms.

Relatively little is known about the effects of PCDDs and PCDFs on humans. Most information on human health effects is derived from cases of accidental exposure to chemical mixtures containing PCDDs and other compounds. Correlating the effects of these uncontrolled exposures to exposure to PCDDs is difficult. The symptom most frequently associated with exposure to PCDDs (and some related chlorinated hydrocarbons) is chloracne, a skin condition.

2,3,7,8-TCDD has been proven carcinogenic in several animal models. Although there is some indication of a relationship between human exposure to phenoxy herbicides (contaminated with trace levels of dioxins) and the development of certain cancers, notably soft-tissue sarcomas, most data are inconclusive. In general, evidence for human carcinogenic effects is not as substantive as that for animal models. At this time, it is not clear whether PCDDs act as promoters or initiators of carcinogenesis. (An "initiator" of carcinogenesis is a substance which directly induces cancer; a "promoter" is a substance which, by itself, does not directly induce cancer, but which, in combination with known carcinogens, may increase the probability that cancers will be induced. While most initiators of carcinogenesis are considered to pose some cancer risk at any level--no matter how

small the dose--many promoters are thought not to have a deleterious effect at levels below a certain threshold dosage.)

Teratogenesis and other reproductive effects have been noted in mice and rats. However, studies of human populations conducted to date have not shown a significant increased risk of spontaneous abortions and birth defects for populations exposed to PCDDs.

Available data on the mutagenicity of 2,3,7,8-TCDD seem to indicate that this compound is not mutagenic in the test systems used. Chromosomal analysis of plant workers exposed in an industrial accident at Seveso, Italy, did not reveal statistically significant increases in chromosome damage.

C.2 Dioxin Emissions From Incineration

An extensive examination of literature focusing on the high temperature behavior of dioxins in incinerators was conducted. Reports of laboratory studies as well as sampling and analysis data on flue gases from actual full-scale incinerators were included.

The literature indicates that PCDF and PCDD emissions in incinerator effluents can originate from a number of sources and/or chemical reactions, such as being a part of raw refuse, being formed from precursors, and being formed from degradation products of materials commonly found in solid waste.

It is unlikely that trace amounts of dioxin present in the raw refuse are the source of dioxin emissions from municipal solid waste combustion. Although some dioxin emissions may originate with the raw refuse, it is more likely that precursor compounds in the refuse become chlorinated during the combustion process to form dioxin.

There have been investigations, therefore, of ways to control dioxin formation by separating either the oxygen-benzene-type precursor compounds to which chlorine may become attached, and/or by separating the chlorine sources such as polyvinyl chloride (PVC) from the raw waste stream. Both laboratory data and field measurements of existing incinerators and combustion processes, however, indicate that pre-separation of specific refuse types from the waste stream before combustion is not likely to have an appreciable affect on dioxin levels. One investigator, for instance, spiked waste burned in a waterwall incinerator with three times the normal amount of PVC and found no significant difference in dioxin levels.

Dioxin levels do seem to be affected, however, by a series of combustion conditions which can be controlled and monitored in modern resource-recovery incinerators. The combustion conditions necessary for destruction of PCDDs and PCDFs include a minimum of one to two seconds of gas residence time at a combustion temperature of 900-1,000°C, very turbulent conditions in the high-temperature zone, and an air/fuel mixture with a slight excess of oxygen.

The incinerator design selected for the BNYRRF appears to fulfill the requirements for efficient combustion and maximum destruction of PCDFs and

PCDDs. Furthermore, the planned use of auxiliary burners will help assure that the minimum combustion temperature is consistently maintained. Continuous monitoring of temperature, oxygen and carbon monoxide levels will allow combustion conditions to be maintained within specific parameters, as long as operators response is effective and immediate to deviations from the optimum levels.

The BNYRRF will utilize a more efficient fly ash pollution control device than is generally used on incinerators. Since at least some of the PCDF and PCDD materials will be adsorbed on particulates, less of these materials will be emitted than if the less efficient electrostatic precipitator had been selected.

Of the available technologies, the system design for the BNYRRF appears to minimize potential PCDF and PCDD emissions to the greatest extent feasible. While it is possible that the addition of a dry scrubber (acid-gas-control) technology in combination with the fabric-filter air pollution control device might further limit these emissions, there is not sufficient data currently available to allow an accurate prediction of the actual effectiveness of this relatively costly alternative.

Emission test data from a number of incinerators has demonstrated a wide range of PCDF and PCDD emissions spanning several orders of magnitude. However, the lowest emissions were observed from incinerators with the same basic design as the BNYRRF.

Actual emission data from operating municipal resource recovery facilities were used to predict PCDD and PCDF emission rates from the BNYRRF. In selecting the test data, the objective was to utilize data from facilities similar in design, operations, and waste types to the BNYRRF. Furthermore, the test data had to be obtained using sampling methods that are compatible with methods approved by USEPA for sampling organics in flue gases under rigorous quality control procedures.

The emission data selected as the most representative of the BNYRRF are the data from the Chicago Northwest facility and the Zurich-Josefstrasse facility. Both of these facilities use a furnace design similar to that proposed for the BNYRRF. The sampling of the Chicago Northwest facility was performed under sponsorship of the USEPA, using approved methods and quality assurance protocols in order to assure representativeness. The Zurich-Josefstrasse facility was tested by the Swiss counterpart to the USEPA. However, both of these facilities utilize electrostatic precipitators for fly ash control, while a fabric filter has been proposed for the BNYRRF.

Because there are no appropriate dioxin emission data available for incinerators with fabric filters, two emission scenarios had to be developed in order to model the BNYRRF emissions: (1) based on the assumption that all PCDF and PCDD materials observed in previous tests were gaseous in nature and pass through the fabric filter without collection, and (2) based on the assumption that all PCDF and PCDD materials observed in previous tests were adsorbed onto fly ash, part of which was subsequently assumed to be trapped in the fabric filter. The second case is believed to be the more likely alternative. The actual emissions from the BNYRRF could fall between

these values, depending upon the portion that is gaseous and the portion that is particulate-bound. Both cases are examined in the risk assessment.

Since there is consensus in the literature that, where PCDDs and PCDFs are adsorbed on fly ash, the concentrations are higher on the smallest particles, and the adsorption is a particle surface phenomenon, it was assumed that PCDF/PCDD concentrations on particles were proportional to the surface area available for a given particle size. Test data from incinerators with electrostatic precipitators were used to derive a concentration distribution by particle size. This distribution was then used with particle size data from a unit with a fabric filter to calculate the amount of particle entrapment and, therefore, the amount of PCDF/PCDD entrapment in a fabric filter over and above that which would be trapped in a comparable electrostatic precipitator. This formed the basis for the predicted emission rates under the scenario where all PCDFs and PCDDs are particulate-bound.

C.3 Exposure Assessment for Emissions from the Proposed BNYRRF

Impacts of PCDD and PCDF emissions from the BNYRRF can be manifested in two ways: (1) as above background concentrations of PCDDs and PCDFs in ambient air; and (2) as deposition of PCDD and PCDF particulate emissions on horizontal surfaces.

To assess the impact of the proposed BNYRRF on the general population, the ambient air concentrations were evaluated at a large number of ground-level and evaluated receptors using the MPTER-Urban computer dispersion model. The PCDD/PCDF deposition rates at a large number of ground-level

receptors were calculated using the deposition option of the ISC computer dispersion model. The deposition rates were used to calculate maximum annual downwind dioxin concentrations in soil, street dirt, and house dust. The following assumptions were made based on the best available data and modeling techniques:

- Available studies do not show definitively the amount of isomer transformation, or biological, chemical, or photolytic degradation of PCDFs and PCDDs in the atmosphere. Therefore, the conservative approach of assuming no isomer transformation or degradation was taken to compute both dispersion concentrations in air and deposition rates on the surface.
- Although it is known that particle size, shape, and weight may change during transport from source to receptor, there are no methods available to compute these physical particle changes. The deposition analysis assumes that particles do not change in size and weight, and the dispersion analysis assumes that all particles are so small that they are transported in the same way as a gas molecule would be transported.
- The deposition analysis method does not consider the aerodynamic influences of elevated terrain, buildings, or resuspension and re-entrainment of particles. Since this is the best method available at this time to compute deposition rates from a point source, there has been no attempt to change this method of analysis.

C.4 Risk Assessment

A risk assessment was performed to estimate the risks associated with predicted maximum PCDD and PCDF concentrations in ambient air, soil, dust and dirt downwind of the BNYRRF. The assessment compared the predicted ambient air concentrations and estimated daily intake levels for PCDDs and PCDFs with: (1) applicable standards and criteria; and (2) concentrations of PCDDs and PCDFs known or suspected to cause a toxic effect.

In reviewing the findings of our risk assessment it is important to keep in mind the methodological limitations of the risk assessment process.

First, a risk assessment, while based upon scientific considerations, often requires the application of sound technical and scientific judgement or assumptions. The use of assumptions rather than scientific data is often necessary because frequently there is an inadequate data base on the environmental fate, transport, and bioavailability of contaminants such as PCDDs and PCDFs.

Second, a risk assessment frequently requires extrapolation from high-dose animal feeding studies to estimate risk to humans at the extremely low dosages or concentrations of contaminants found in the environment. Data are not available to determine the actual shape of a dose/response curve (i.e., the level of risk), or the best method to extrapolate risk. Accordingly, there is a great range of uncertainty regarding actual risk (at very small concentrations) for a given contaminant.

In the absence of sufficient data or knowledge about the degree of exposure, intake, and bioavailability of contaminants, the typical risk assessment uses the most reasonable assumptions possible. Typically, "worst-case" scenarios or conservative assumptions are used in the assessment process. A conservative assumption is one which increases the likelihood that a substance will represent a hazard to public health.

However, the use of a number of "worst-case" or conservative assumptions carries the danger that the estimate of risk can become vastly overstated and therefore unrealistic. Risk assessments relying upon "worst-case" scenarios must be evaluated critically regarding the degree of realism in the model used to estimate risk.

Several conservative assumptions were incorporated into our assessment. They include the following:

- Use of worst-case assumptions for three potential pathways of exposure: inhalation of gaseous or particulate emissions, and ingestion or dermal absorption of particulates deposited on outdoor and indoor surfaces. Typically, risk assessments of point-source emissions assess risks only for the inhalation pathway.
- Application of a toxic equivalency multiplier equal to 59. This number provides an estimate of the non-carcinogenic toxicity of the complex mixture of PCDDs and PCDFs compared with the concentration of 2,3,7,8-TCDD. This equivalency factor was also used to estimate carcinogenic equivalency as a worst-case assumption although such an application is speculative.

- Reductions in potential PCDD and PCDF concentrations in the environment due to volatilization or degradation or losses due to such actions as rainfall, were not considered.
- Exposure assessments were done for both indoor and outdoor exposure; although buildings may have filtering effect on airborne particles, indoor dioxin concentrations were assumed to be as high as outdoor ambient concentrations.
- Risks were calculated based on exposure for 24-hours a day, over a 70 year lifetime, at the point of maximum impact.
- No threshold for a safe level of dioxin exposure was assumed; any exposure to dioxin was assumed to pose some health risk. Moreover, of the accepted models for extrapolating the potential risk of very low level exposure, the most conservative model factor was used.
- Conservative assumptions for bioavailability, and rates of ingestions and dermal contact were included to estimate worst-case daily intakes of PCDDs and PCDFs.

The results of our risk analysis are summarized below. Maximum average ambient air concentrations were predicted for ground-level and elevated receptors assuming that all PCDDs and PCDFs are emitted as a gas. The maximum average annual ambient air concentrations are predicted to be well below existing standards and guidelines typically less than 1 percent. Only

the NYSDEC performance guideline for evaluating combustion sources is approached, but at only 28 percent of the guideline.

Risks associated with inhalation of PCDDs and PCDFs at the maximum average annual concentrations were determined by comparing a predicted maximum daily intake through inhalation (DI_{inh}) with Acceptable Daily Intakes (ADIs) and cancer dose/ response extrapolations.

The maximum daily intake DI_{inh} of 2,3,7,8-TCDD, T_4 CDD, and TCDD toxic equivalents are predicted to be well below (less than 1%) any ADI promulgated by any regulatory agency. These ADIs provide a margin of safety and they identify a very safe dose, below which risks are insignificant for non-carcinogenic toxic effects.

An upper-bound to carcinogenicity risk was also determined by comparing DI_{inh} with three different cancer dose/response extrapolations. The upper-bound excess risk due to exposure to 2,3,7,8-TCDD and HCDD, at the point of maximum impact, ranges from less than .0019 to less than 0.055×10^{-6} or less than six cases per 100 million people exposed to the maximum concentration over a 70-year lifetime.

The sensitivity of the risk estimates derived for the inhalation pathway, to the additional risks that might be attributable to the ingestion and dermal pathways was tested. These two pathways were not considered in the initial risk assessment of the inhalation pathway due to the high degree of uncertainty in the estimates of ingestion, absorption, and bioavailability rates and due to the difficulties in modeling PCDD concentrations in soil,

dirt and dust. A range of daily intake estimates was calculated (DI_{ing} and DI_{derm}).

For the low end of this range, the data indicate that the predicted additional 2,3,7,8-TCDD intake from ingestion or dermal absorption of particulate emissions from the BNYRRF would be negligible. Using worst-case assumptions regarding the maximum rates of exposure, the total daily intake of 2,3,7,8-TCDD would increase by 2.4 times the amount from inhalation alone. Under the "worst-case" scenario, ingestion becomes the major pathway of exposure.

The general conclusions regarding the level of risk posed by the BNYRRF are not significantly altered if the maximum total daily intake of 2,3,7,8-TCDD increases 2.4-fold. This additional daily intake of 2,3,7,8-TCDD equals only 0.036% of the most conservative ADI (1.8 pg/kg-day) and a toxic equivalent daily intake which is only 2.1% of this ADI.

The upper-bound carcinogenic risk estimates will also increase by a factor of 2.4 assuming the most conservative estimates for the ingestion and dermal absorption pathways. This would result in an upper-bound increased cancer risk for a population exposed to the maximum 2,3,7,8-TCDD and HCDD concentrations over a 70-year lifetime ranging from $.0046 \times 10^{-6}$ to less than 0.13×10^{-6} .

As a further measure of conservatism, we examined the potential carcinogenic risks due to exposure to the complex mixture of PCDDs and PCDFs emitted from the BNYRRF for all three potential pathways of exposure.

Because no actual animal studies have been conducted to assess the carcinogenicity of most of the individual PCDD/PCDF isomers on the complex mixtures present in fly ash emissions another conservative assumption was made: that the carcinogenic effect of these compounds is equivalent to their toxic effect (i.e., that carcinogenic equivalency equals a toxic equivalency). However, this assumption is highly speculative. With these conservative assumptions, the maximum increased cancer risk due to the complex mixture of PCDDs and PCDFs present in the emissions ranges from less than 0.24 to an upper-bound limit of less than 5.9×10^{-6} for all these pathways combined.

In our opinion, within the context of the assumptions used in the risk assessment, and the conservative methods used to estimate risk, and considering current regulatory practice regarding acceptable versus unacceptable health risks, a worst-case upper bound excess cancer risk less than 5.9×10^{-6} is below levels found by many regulatory agencies to require additional review and probable action to reduce risk.

1.0 Introduction

1.1 Purpose

The purpose of this report is to provide an assessment of the potential health risks associated with the emission of polychlorinated dioxins (PCCDs) and furans (PCDFs) from the proposed Brooklyn Navy Yard Resource Recovery Facility (BNYRRF).

The report was composed through a literature search of existing information on dioxins and their emission from resource recovery facilities, supplemented by conversations with technical and regulatory authorities. The report is not, and was not intended to be, a product of original research.

Generally, the type of analysis contained in this report is included in the formal environmental impact statement for a point source of airborne pollution. However, in response to public concern over dioxin emissions and in view of the large population which could be affected by these emissions, New York City's Department of Sanitation was requested by the Board of Estimate to fund an independent study of the dioxin risks of the proposed BNYRRF.

1.2 Description of the Facility

Dioxin levels for the proposed BNYRRF were derived from the emission data of existing facilities using a mass-burn technology and an incinerator design similar to the proposed Brooklyn facility.

The proposed resource recovery facility is designed to handle 3,000 tons of municipal waste each day. The plant will have four separate incinerators or combustion units, each sharing a 500-foot tall stack.

The system will utilize a mass-burn technology--burning raw municipal solid waste without sorting or separation. It incorporates a Martin stoker system as has been used elsewhere in the United States, Europe, and Japan. The plant will also include a high-efficiency fabric filter and auxiliary burners designed to maintain a minimum temperature of 980° C.

1.3 Contents of the Report

This report contains an executive summary, this brief introductory chapter, and the scientific report contained in Chapters 2 through 6. Appendix C provides a discussion of some related issues.

Chapter 2 begins the scientific report with a discussion of the chemical and physical properties of dioxin and its toxicological effects. The presentation of dioxin's chemical and physical properties includes sections on both the sources of dioxin in the environment and the environmental fate of dioxin in the environment.

The section on toxicology considers human as well as animal data on the effects of dioxin. Both the toxic effects and the carcinogenic effects of dioxin are examined. Teratogenic, reproductive effects and mutagenic effects are also discussed.

Chapter 3 analyzes the literature regarding the emission of dioxins from different types of resource recovery facilities and incinerators. The chapter begins with a theoretical discussion of the mechanisms responsible for the formation of dioxin in incinerators. Requirements for the effective destruction of dioxins through incineration are also discussed.

These theoretical considerations are followed by a presentation of dioxin emission data from other resource recovery facilities using a mass-burn technology and an incinerator design similar to the proposed BNYRRF. As an important part of this discussion, the applicability of emission data from different facilities to the BNYRRF is discussed.

Chapter 3 concludes by describing the design of the BNYRRF and calculates the projected emissions from that facility.

Using the data presented at the conclusion of Chapter 3, the rates of dioxin dispersion and deposition throughout the New York City area are calculated in Chapter 4. Computerized models for the dispersion of airborne pollutants and their deposition were applied to BNYRRF emissions in order to estimate dioxin levels in the ambient air, soils, dust, and dirt at the point of maximum impact. These levels were then used as the basis for a risk assessment to evaluate risks at the point of maximum impact, assuming maximum exposure, 24-hours a day over a 70 year lifetime.

Chapter 5 evaluates risk from two perspectives. First, the risk from projected dioxin emission levels is compared to the existing acceptable levels defined by state, national, and international regulatory agencies.

In a second consideration of risk, the effects of projected emissions from the facility are estimated by comparing the "worst case" exposure levels to levels of dioxins known or suspected to have toxic or carcinogenic effects.

Chapter 6 places in perspective the upper limit to excess cancer risk predicted in Chapter 5. The projected risks are compared with risks inherent in everyday activities, with existing cancer incidence data, and with risks projected from other routes and sources of dioxin exposure.

Appendix C provides an evaluation of additional methods that have been proposed for reducing dioxin emissions. It also contains an evaluation of the potential health risks associated with disposal of fly ash and bottom ash produced by incinerators and provides recommendations for future sampling.

1.4 Considerations in Risk Assessment

Several difficulties confront the assessment of hazards posed by the low-level PCDD and PCDF emissions from municipal waste-burning facilities. In general, data is sparse regarding such important factors as environmental fate, transport, uptake and bioavailability of PCDDs and PCDFs. Because of this lack of data, estimates, or a range of estimates, must be used to analyze risk.

A risk assessment frequently requires extrapolation of high dose animal feeding studies to estimate risk to humans at the extremely low dosages or concentrations of contaminants found in the environment. Data are not

available to determine the actual shape of a dose/response curve (i.e., the level of risk), or the best method to extrapolate risk. Accordingly, there is a great range of uncertainty regarding actual risk (at very small concentrations) for a given contaminant.

Also complicating the assessment of dioxin hazards is the fact that although there are many different PCDDs and PCDFs, adequate toxicity data exists only for the most toxic isomer 2,3,7,8 TCDD, which represents less than 1 percent of these PCDD emissions. Evidence suggests that other PCDDs, and the PCDFs in general, are not as toxic as 2,3,7,8 TCDD.

A risk assessment, however, should adopt some type of toxic equivalency to take into account the possible toxic effects of the complex mixture of PCDDs and PCDFs. Although there is some limited experimental data to quantify the toxic equivalency of the mixture for non-carcinogenic toxic effects, data is not available on the carcinogenic equivalency.

Due to the necessity of using estimates or assumptions, the degree to which predictions of risk conform to actual risk, (i.e., the quality of the assessment) can only be as good as the quality and degree of accuracy in the assumptions applied. Clearly, any assumptions used in risk assessment can have significant impacts on the overall findings and determination of levels of risk.

In the absence of sufficient data or knowledge about such issues as the degree of exposure, intake, fate and bioavailability of contaminants, the typical risk assessment uses the most reasonable assumptions possible,

erring on the side of public health. Typically, "worst-case" scenarios or conservative assumptions are used in the assessment process to provide an added safety factor. A conservative assumption is one which increases the likelihood that a substance represents a hazard to public health.

To provide an element of conservatism, the following safety factors were incorporated into our risk assessment:

- ° Risks were calculated based on maximum 24 hours a day exposure, over a 70 year lifetime at the point of maximum impact.
- ° Assessment of three potential pathways of exposure: Inhalation of gaseous or particulate emissions, and ingestion or dermal absorption of particulates deposited on outdoor and indoor surfaces.
- ° Application of a toxic equivalency multiplier equal to 59. This number provides an estimate of the non-carcinogenic toxicity of the complex mixture of PCDDs and PCDFs compared with the concentration of 2,3,7,8-TCDD. This equivalency factor was also used to estimate carcinogenic equivalency as a worst-case assumption although such an application is speculative.
- ° No losses of PCDDs were assumed through volatilization or degradation or losses from such actions as rainfall.
- ° Indoor ambient air quality was assumed to equal outdoor air quality.
- ° The most conservative cancer risk extrapolation model was included to estimate an upper bound limit to increased cancer risk.
- ° Conservative assumptions for bioavailability, and rates of ingestions and dermal contact were included to estimate worst-case daily intakes of PCDDs.

However, the use of a number of "worst-case" or conservative assumptions carries the danger that the estimate or risk can become vastly overstated and therefore unrealistic. Risk assessments relying upon "worst-case" scenarios must be critically evaluated with regard to the degree of realism in the model used to estimate risk.

In reading and examining the risk assessment, it is important to remember that risk figures and calculations represent an "upper limit" to risk. They do not represent the most probable or average predicted risk level from dioxin emissions from the Proposed BNYRRF.

1.5 Technical Review

An important element on the preparation of this report was the selection of a panel of technical and scientific experts to provide independent review and ensure the accuracy and impartiality of the report.

The nine-member panel is composed of scientific, technical, and environmental experts from New York City and State, the United States and Europe. (A curriculum vitae for each panel member appears in Appendix E.)

Members include:

Thomas C. Chalmers, M.D.--President Emeritus, Dean Emeritus and Distinguished Service Professor at the Mount Sinai School of Medicine of the City of New York; Visiting Professor of Public Health and Management, Harvard School of Public Health.

Douglas Costle, J.D.--Former Regional Administrator, USEPA; former Chairman, U.S. Regulatory Council, and of the U.S. Radiation Policy Council; former Commissioner, State of Connecticut Department of Environmental Conservation.

Theodore Goldfarb, Ph.D.--Associate Professor of Chemistry, SUNY at Stony Brook. Member of the review panel for the Hempstead, Long Island resource recovery facility; former Visiting Professor, Queens College Center for the Biology of Natural Systems. Expert in the environmental effects of various energy-producing technologies.

Raymond Harbison, M.D.--Professor and Director of the Interdisciplinary Toxicology Program at the University of Arkansas for Medical Research. Consultant to the USEPA on safety procedures for management of dioxin contamination at Times Beach, MO, and elsewhere. Member of the National Institute of Safety and Health advisory group, which is involved in dioxin-related issues.

Clark Heath, M.D.--Professor of Community Health, Emory University School of Medicine; community health consultant and former Program Development Officer, Centers for Disease Control.

Otto Hutzinger, Ph.D.--Professor of Ecological Chemistry and Geochemistry, University of Bayreuth, Germany. Advisor on dioxin to: Ministry of the Environment, Canada, the National Research Council of Canada, the Ontario Scientific Advisory Committee on Dioxins and Furans; the Dutch Ministry of the Environment; the Ministry of the Environment, Rheinland Pfalz, and the German EPA; the USEPA.

Louis J. Thibodeaux, Ph.D.--Professor of Chemical Engineering, University of Arkansas. Has published extensively on the environmental fate and transport of dioxins and other chemicals.

Arthur Upton, M.D.--Professor and Chairman, Department of Environmental Medicine, New York University School of Medicine. Former Director, National Cancer Institute.

Charles Velzy, P.E.--President, Charles R. Velzy and Associates, Inc. Extensive experience in design and operation of solid waste incineration facilities and air pollution control technologies.

The panel met to review and comment on the proposed scope and approach of this report on February 28, and reconvened on April 29 to review the first draft. The written comments of the panelists on the final version of this report appear as Appendix D.

CHAPTER 2

Properties of Polychlorinated Dibenzo-p-dioxins

2.1 Background

2.1.1 Introduction

The purpose of this chapter is to provide a brief overview of the physical, chemical, and toxicological properties of polychlorinated dioxin relevant to this risk assessment. It is not an attempt to reiterate the literature on dioxin, but to provide information on the major concerns pertinent to this study.

Concern over polychlorinated dibenzo-p-dioxins arose when toxicological effects were noted as a result of the presence of TCDD in the widely used herbicide 2,4,5-T. 2,3,7,8-TCDD is formed as a contaminant during the production of 2,4,5-trichlorophenol from tetra-chlorobenzene and 2,4,5-T from 2,4,5-trichlorophenol. The major sources of polychlorinated dioxins in the environment are associated with the production, use, and disposal of chlorophenols and their derivatives. Polychlorinated dibenzofurans, (PCDFs) have been associated with the manufacture and destruction of polychlorinated biphenyls (PCBs). PCDFs also have been detected in emissions from combustion sources, primarily municipal and chemical waste incinerators. In addition, chlorinated dioxins have been reported in samples taken from incinerator stacks, chemical tar burners, and fossil-fueled power plants. One study reported trace amounts of dioxins in samples from vehicle mufflers, fireplaces, chimneys, cigarette smoke, and charcoal-broiled steaks (Bumb, 1980). Some of these data have been disputed and research is being conducted to refute or support the presence of dioxins in these sources.

The chemical, physical, and toxicological properties of PCDDs and PCDFs most relevant to this study include the following:

- ° PCDDs and PCDFs are present in the environment from several sources.
- ° PCDDs and PCDFs are resistant to chemical, physical, and biological degradation and thus are very stable in the environment.

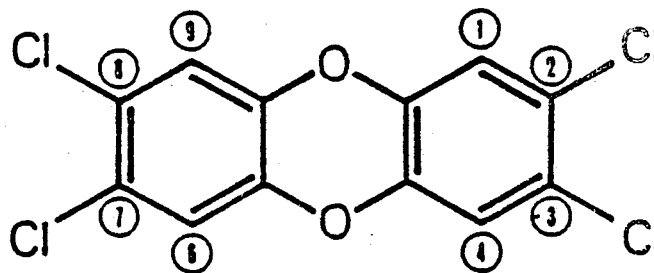
- ° PCDDs and PCDFs are lipid (fat) soluble and tend to bioconcentrate.
- ° PCDDs and PCDFs have an affinity for binding strongly to organic substrates, such as soil and sediment, and to fly ash.
- ° Due to the variability of environmental conditions and the complex chemical and physical properties of dioxins, the environmental half-life has been reported to range from one-half year up to twelve years.
- ° Dioxins, although not typically known as volatile compounds, may volatilize from soil surfaces in the environment. Evaporation may be a significant removal pathway.
- ° PCDDs and PCDFs are relatively stable to thermal destruction. Laboratory tests have demonstrated that dioxins are relatively stable up to a temperature of approximately 700°C and decompose at a temperature of approximately 800°C. Destruction efficiency varies with dwell time, temperature, mixing, availability of oxygen, and catalysts.
- ° At this time it is not clear whether PCDDs act as promoters or initiators of carcinogenesis.
- ° The toxicity of complex mixtures of PCDDs and PCDFs can be calculated using a toxic equivalency method based on the relative abilities of these compounds to induce microsomal enzymes.

2.1.2 Nomenclature

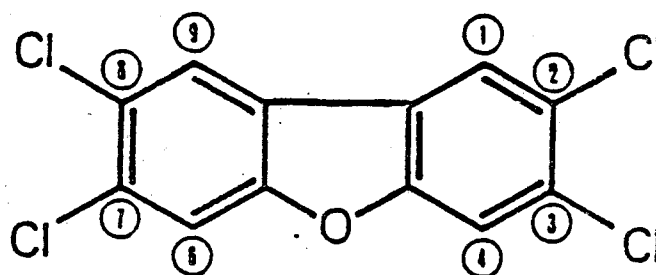
Polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs) are tricyclic organic compounds which exhibit similar physical and chemical properties. As shown in Figure 2-1, dioxins consist of two benzene rings connected by two oxygen atoms, while furans consist of two benzene rings connected by only one oxygen atom. The isomers of each compound differ only by the number and position of chlorine atoms around the benzene rings. Both dioxins and furans may contain from one to eight chlorine atoms.

There are 75 chlorinated dioxin congeners and 135 chlorinated furan congeners. The tetrachlorodibenzo-dioxin (TCDD) congener class has 22 isomers. Table 2-1 is a list of all chlorodibenzo-p-dioxins. Table 2-2 is a list of the abbreviations for the various chlorodibenzo-p-dioxins. For the purposes of this study, the following terms are defined:

FIGURE 2-1



2,3,7,8-TETRACHLORODIBENZODIOXIN



2,3,7,8-TETRACHLORODIBENZOFURAN

TABLE 2-1
A LIST OF POLYCHLORINATED DIBENZO-P-DIOXIN HOMOLOGUES BY
CONGENER AND ISOMER (Number of isomers)

MONOCHLORO-(2)	TETRACHLORO-(22)
1; 2;	1,2,3,4; 1,2,3,6;
DICHLORO-(10)	1,2,3,7; 1,2,3,8;
1,2; 1,3; 1,4;	1,2,3,9; 1,2,4,6;
1,6; 1,7; 1,8;	1,2,4,7; 1,2,4,8;
1,9; 2,3; 2,7;	1,2,4,9; 1,2,6,8;
2,8;	1,2,6,7; 1,2,7,8;
TRICHLORO-(14)	1,2,6,9; 1,2,8,9;
1,2,3; 1,2,4;	1,2,7,9; 1,3,6,9;
1,2,6; 1,2,7;	1,3,6,8; 1,3,7,9;
1,2,8; 1,2,9;	1,3,7,8; 1,4,7,8;
1,3,6; 1,3,7;	1,4,6,9; 2,3,7,8;
1,3,8; 1,3,9;	
1,4,6; 1,4,7;	PENTACHLORO-(14)
1,7,8; 2,3,7;	1,2,3,4,6; 1,2,3,4,7;
HEXACHLORO-(10)	1,2,3,6,7; 1,2,3,6,8;
1,2,3,4,6,7;	1,2,3,6,9; 1,2,3,7,8;
1,2,3,4,6,8;	1,2,3,7,9; 1,2,3,8,9;
1,2,3,4,6,9;	1,2,4,6,7; 1,2,4,6,8;
1,2,3,4,7,8;	1,2,4,6,9; 1,2,4,7,8;
1,2,3,6,7,8;	1,2,4,7,9; 1,2,4,8,9;
1,2,3,6,7,9;	
1,2,3,6,8,9;	HEPTACHLORO-(2)
1,2,3,7,8,9;	1,2,3,4,6,7,8;
1,2,4,6,7,9;	1,2,3,4,6,7,9;
1,2,4,6,8,9;	OCTACHLORO-(1)
	1,2,3,4,6,7,8,9;

Source: NRCC, 1981.

TABLE 2-2

ABBREVIATIONS FOR VARIOUS CHLORODIBENZO-P-DIOXINS

<u>Material or Material Group</u>	<u>Abbreviation</u>
- for polychlorodibenzo-p-dioxins in general:	PCDD
- for tetrachlorodibenzo-p-dioxins in general:	TCDD
- for a specific tetrachlorodibenzo-p-dioxin, the 2,3,7,8 isomer, for instance:	2,3,7,8 TCDD
- for pentachlorodibenzo-p-dioxins in general:	P ₅ CDD
- for a specific pentachlorodibenzo-p-dioxin, the 1,2,3,7,8, isomer, for instance:	1,2,3,7,8 P ₅ CDD
- for hexachlorodibenzo-p-dioxins in general:	H ₆ CDD
- for heptachlorodibenzo-p-dioxins in general:	H ₇ CDD
- for octachlorodibenzo-p-dioxin:	OCDD

Source: Kemp, 1983.

- ° An isomer is defined by the numerical arrangement of chlorine atoms within the homologue.
- ° A homologue is defined as a group of isomers having a specified number of chlorine atoms; thus the tetrachloro homologue has 22 isomers.
- ° A homologue is a general term used to mean any isomer of any homologue; thus, there are a total of 75 PCDD congeners.

PCDFs use the same abbreviation system as PCDDs. For both PCDDs and PCDFs, the number and position of the chlorine atoms also may result in differences in chemical, physical, and biological properties.

2.1.3 Sources in the Environment

Polychlorinated dioxins and furans in the environment are associated with a variety of sources including manufacture of chlorophenols and chlorophenol derivatives, herbicide application, incineration of certain industrial wastes, chemical waste sites, municipal incinerators, and combustion of natural wood.

Incineration Sources. It has been shown that polychlorinated dioxins and furans are produced as contaminants from the incineration of municipal waste (NRCC, 1981; Lustenhouwer, et al., 1980). Emission rates are highly variable and may depend on the combustion methodology. It has been indicated that formation of chlorinated organic compounds is favored by poor combustion efficiency due to low temperatures and inefficient mixing (Somers and Douglas, 1983).

PCDDs, as well as PCDFs were first discovered on fly ash from municipal incinerators by Olie et al. (1977). Buser et al. (1978) then reported that PCDDs were present on the particulate matter from a municipal incinerator and industrial heating facility in Switzerland. Subsequent reports confirming the presence of PCDDs and PCDFs in combustion emission products include data from Canada, Japan, France, and the United States (Eiceman, et al., 1979, 1981; Karasek, 1980; Bumb, et al., 1980; Lamparski and Nestrick, 1980). PCDDs are also found in industrial incinerators where materials containing chlorinated phenols and polychlorinated diphenyl ethers are burned.

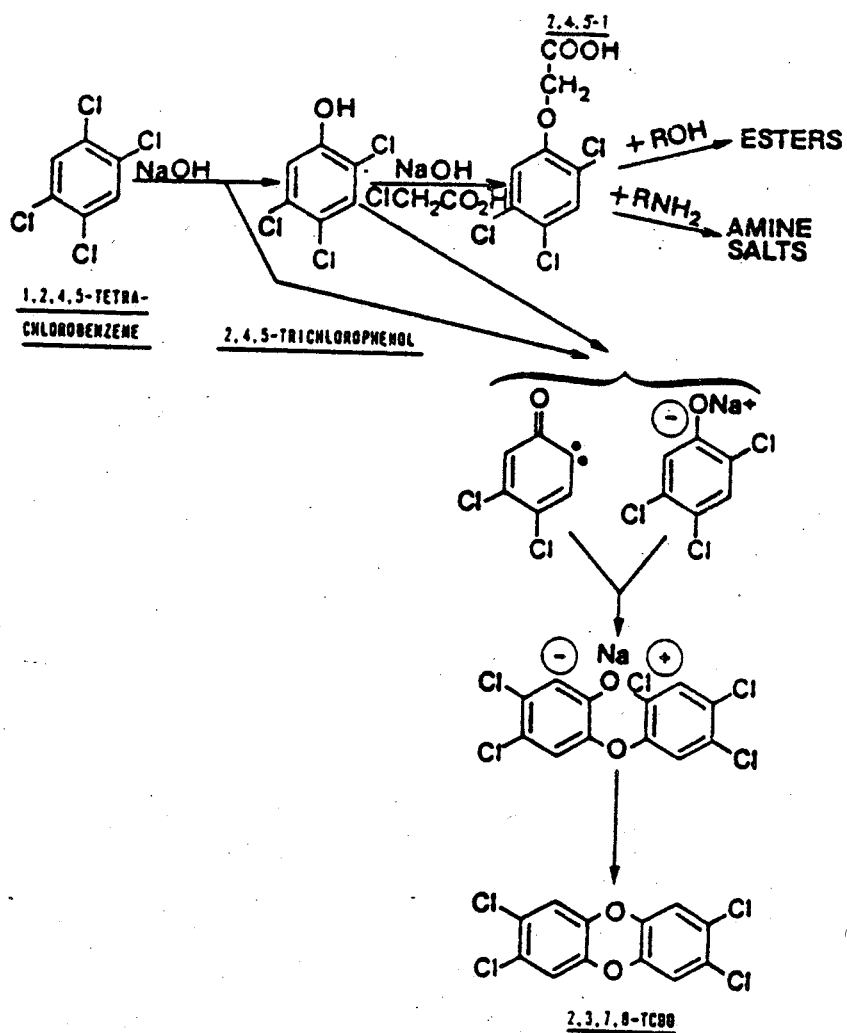
The greatest concentrations of PCDDs and PCDFs are associated with the smaller particles emitted in the flue gas of incinerators, since these particles have the greatest surface area (Lustenhower, et al., 1980; Ballschmiter, as reported by CARB, 1983; Kemp, 1983). Therefore, the larger particles collected by electrostatic precipitator (ESP) control devices do not have as high a concentration as the fine particles found in flue gas (ASME, 1981). Although some of the PCDD and PCDF emissions may be gaseous, the evidence indicates that a very significant amount is associated with fly ash or ultra-fine particulates.

Manufacturing Processes. Dioxins are also inadvertently produced during the formulation of chlorinated phenols, and in chemicals utilizing the chlorophenols, such as 2,4,5-T and 2,4-D.

Chlorophenols may be produced by either the chlorination of phenols or by the alkaline hydrolysis of chlorobenzenes. Dioxins may be formed during either process. Polychlorinated dioxins may also be produced during the hydrolytic production of chlorinated benzenes, such as hexachlorobenzene (Esposito, et al., 1980. 2,3,7,8-TCDD has been identified in commercial trichlorophenols, but is not associated with the manufacture of the pentachlorophenols (Josephson, 1983). Figure 2-2 shows the chemical reaction for the production of 2,4,5-trichlorophenol and 2,4,5-T and for the formation of 2,3,7,8-TCDD.

Herbicide Application. Agent Orange, which is a 1:1 mixture of the butyl esters of 2,4-D and 2,4,5-T has been shown to contain 2,3,7,8-TCDD at a range of concentrations from 0.1 to 47 ug/g. Dioxin was shown to originate from 2,4,5-T, and, as a result, efforts were made by manufacturers during the 1970's to control and minimize the formation of 2,3,7,8-TCDD. Producers have claimed that the products currently contain less than 0.1 ug/g (Rappe, et al., 1979). 2,4-D, however, became contaminated with TCDD because the equipment used to manufacture the 2,4-D was previously used to formulate dioxin-contaminated 2,4,5-T (Federal Register, 1980). The bactericide, hexachlorophene, also is prepared from 2,4,5-trichlorophenol and has been shown to contain trace amounts of TCDD (Rappe, 1984).

FIGURE 2-2

2,4,5-TRICHLOROPHENOL, 2,4,5-T AND ESTERS AND SALTS

Due to the presence of chlorinated dioxins, many of the domestic uses of 2,4,5-T, including use on home lawns, recreational areas, and food crops, were suspended by the USEPA in 1970. Use of 2,4,5-T in forests, on right-of-ways, and on turfs was restricted in 1979. The herbicide may still be used on rice fields, rangelands, industrial sites, vacant lots, parking lots, storage areas, fences, and hedgerows (Mays, 1984). Chlorinated dioxins have been found in foodgrade oleic acids, fleshing greases isolated from hides treated with PCP, and in some commercially available gelatin samples (Firestone, 1977). Hexa-, hepta-, and octa-CDDs and CDFs were found in samples of two kinds of latex nipples purchased in a Warsaw, Poland department store. Concentrations ranged from 0.03 ppb for hexa-CDD to 11.2 ppb for octa-CDD and 0.02 ppb for hexa-CDF to 3.1 ppb for hepta-CDF (Gorski, 1981).

Non-incineration Combustion Processes. Nestrick, et al. (1980) reported dioxins in samples from wood-fueled stoves and from the chimneys of wood-fueled furnaces. The samples were collected from rural areas of the United States where fuel wood was expected to have had minimal exposure to pesticides and herbicides and where no industrial or municipal incinerators were located nearby. The wood was not treated or processed. Concentrations of dioxins in the samples from the stoves were 170 ppt TCDD, 260 ppt HCDD, 330 ppt H₇CDD, and 210 ppt OCDD. Samples of chimney particulates around the region contained dioxin concentrations as high as 4,925 ppt for TCDD, and 12,400 ppt for OCDD. Levels of 2,3,7,8-TCDD as high as 100 ppt of 2,3,7,8-TCDD were also detected. Other samples showed no detectable levels of TCDDs and only 14 ppt of OCDD. Additional data suggest that the production of PCDDs from the combustion of natural wood may be a general phenomenon (Ahling, 1981; Tiernan, 1980).

In a recent study, Czuczwa and Hites found a series of chlorinated dioxins and furans in sediment samples from several locations in the Saginaw River, Saginaw Bay and Southern Lake Huron in Michigan. The levels ranged from 100 ppb near urban areas to 100 ppt in remote areas. The analytical profiles (isomer ratios) in the sediments corresponded closely to those found in samples from combustion sources. Analyses of sediment cores showed a dramatic increase in the levels of dioxin at a depth corresponding to a

date of approximately 1940. The levels remained high for the more recent cores up until the present (Rappe, 1984). The concentrations over time also corresponded very closely to the production of chloro-aromatics and were concluded to be present as a result of combustion of these chlorinated organic products (Czuczwa and Hites, 1984).

Chemical Waste Sites. Other sources of dioxins in the environment are chemicals contaminated with dioxins which are awaiting disposal and disposal sites where dioxin - contaminated chemicals have been dumped. At a refuse dump near Amsterdam, wastes that were heavily contaminated with organo-chlorine compounds from 2,4,5-T production were disposed. Bottom sediments of a drainage ditch from the site contained 2,3,7,8-TCDD at concentrations of 50 ppt up to 5000 ppt (Heida, 1983).

Photochemical Processes. Photochemical processes also can lead to the formation of dioxins. Crosby and Wong (1976) have studied the dimerization of chlorophenols to octa-CDD. Lamparski, et al. (1980) have reported that photolysis of PCP-treated wood may form dioxins. Rappe, et al. (1979) has indicated that exposure of "predioxin" impurities in chlorophenols may produce chlorinated dioxins.

2.2 Physical and Chemical Properties

The physical and chemical properties of dioxins will determine how they will react in the environment, i.e. destruction, half-life, bioavailability, and transport.

2.2.1 Physical Properties

The physical properties of 2,3,7,8-TCDD and OCDD are shown in Table 2-3. These are lipophilic compounds and are only very slightly soluble in water. Lipophilic compounds are compounds which have an affinity for fats. As a result dioxins will tend to be absorbed in fatty tissue. In general, as the chlorine content of the PCDD and PCDF increase, their vapor pressures

and water solubilities decrease and their octanol/water partition coefficients and solubilities in organic solvents increase (NRCC, 1981; IARC, 1977; ASME, 1981). The octanol/water partition coefficient is a general measure of a substance's affinity for organic compounds or water. As a result of these properties, as the chlorine content of PCDDs and PCDFs increase, they generally are adsorbed onto an organic substrate, such as sediment, and volatilize less from water or wet surfaces.

It has been demonstrated that both PCDDs and PCDFs have a propensity for binding to soils, sediments, and fly ash (NRCC, 1981). The extent of this adhesion appears to be a function of the type of particulate matter in question and may be correlated with the percent carbon in the particle, the particle size, and the particle morphology (structure) (Barnes, 1983). This affinity is demonstrated further by the lengthy, difficult, and harsh sample preparation procedures used to extract dioxins and furans from fly ash. Kooke *et al.* (1981) used pretreatment with hydrochloric acid prior to extraction.

Based on knowledge of the physical properties of dioxins and on various laboratory experiments, it can be assumed that dioxins in fly ash increase in concentration with the surface area of the particulates and the corresponding large number of reactive binding sites. This is due to the fact that the ratio of surface area to weight increases as particle diameter decreases. The strong affinity of dioxins for organic matter and fly ash will make them less bioavailable.

2.2.2 Chemical Properties.

In general, dioxins are relatively stable toward harsh treatment with acids, bases, and heat and are stable to chemical oxidation and reduction (NRCC, 1981). Heat treatment with alkali will, however, destroy octa-CCD (Albro, 1979). The chlorinated dibenzodioxins appear to be fairly resistant to thermal degradation. From kinetic and thermodynamic principles, Shaub and Tsang (1983) estimated that 99.99 percent destruction of TCDDs in the gas phase at 727°C may require about 15 minutes. At 977°C, however, the decomposition may require less than one second. PCDDs may photodecompose to produce less chlorinated species. According to a study by Buser and Rappe

(1978) it is unlikely that the most toxic isomers (i.e., 2,3,7,8-TCDD) will be formed through the photolysis of the higher PCDDs. Dioxin also will undergo photoreductive dechlorination (loss of chlorine in the presence of light) in the presence of a hydrogen donor (Crosby and Wong, 1977). This is the general mechanism for photoreaction.

2.3 Environmental Fate

As a result of the strong chemical stability of the dioxins, as demonstrated under severe laboratory conditions, it is expected that destruction under environmental conditions would be very slow.

2.3.1 Environmental Half-Life

The half-life of 2,3,7,8-TCDD in soil has been reported to range from one-half year up to twelve years (Kearney et al., 1972; IARC, 1977; Young, 1983; Di Domenico et al., 1980). Based on these studies it can be concluded that the environmental half-life of dioxins is a complex issue and a general half-life cannot be used because too many variable conditions exist. This was further substantiated by a study by Freeman and Schroy (1984) of contaminated oil sprayed on Times Beach soil in 1973. A model was developed based on actual soil samples collected ten years after spraying. It was determined that a simple half-life model was inadequate due to temperature fluctuations throughout the year. As a result of this study the following conclusions were drawn:

- Volatilization of TCDD may be a major removal pathway.
- Temperature is the driving force behind the transport of TCDD into and from the soil column.
- TCDD will volatilize from soils most rapidly during summer months, but not to any appreciable extent during winter months.
- Over 50 percent of the total applied TCDD volatilized during the first summer after initial application at Times Beach.
- Over 90 percent of the applied TCDD volatilized from the top 1 cm of soil during the first summer.

TABLE 2-3

PHYSICAL PROPERTIES OF TWO CHLORINATED DIOXINS

	<u>2,3,7,8-TCDD</u>	<u>OCDD</u>
Empirical formula	$C_{12}H_4Cl_4O_2$	$C_{12}Cl_8O_2$
Percent by weight		
C	44.7	31.3
O	9.95	7.0
H	1.25	
Cl	44.1	61.7
Molecular weight	322	459.8
Melting point, °C	305	130
Description	Colorless Needles	Colorless Solid
Decomposition temperature, °C	Above 700	Above 700
Solubilities, gram/liter		
O-Dichlorobenzene	1.4	1.83
Chlorobenzene	0.72	
Anisole		1.73
Xylene		3.58
Benzene	0.57	
Chloroform	0.37	
n-Octanol	0.048	0.56
Methanol	0.01	
Acetone	0.11	
Dioxane		0.38
Water	0.000000 (0.2 ppb)	
Vapor pressure ^a		
(mm of Hg)	1.7×10^{-6} 1×10^{-6}	-
Octanol/Water	1.4×10^6	
Partition coefficient	6.9×10^6 1.9×10^7	-
Sorption partition	9.9×10^5	
Coefficient (K_{oc})	3.3×10^6	

Sources: (NRCC, 1981; USEPA, 1981, Esposito, 1980)

^a Freeman and Schroy (1984) have reported a lower vapor pressure of 1.5×10^{-9} mm Hg at 25°C.

By analogy with this soil study, it can be anticipated that dioxin in fly ash will not build up infinitely in the environment but will volatilize over time at some yet undetermined rate.

Photolytic degradation may be another mechanism for removal of dioxins from the environment. According to a study by Crosby and Wong (1977), 2,3,7,8-TCDD will photolyze in sunlight in the presence of a hydrogen donor, i.e., methanol. Dioxin also may photolyze in surface waters. However, dioxins adsorbed onto particulate matter or sediment may be unavailable for degradation by photolysis. Although an increase in chlorine content may tend to decrease photodegradation, the position of the chlorine atoms on the molecule may be critical (Nestrick *et al.*, 1981; Crosby *et al.*, 1971). Preferential loss of chlorine has been demonstrated to be from the 2,3,7, and 8 positions (Nestrick *et al.*, 1981). Since the photodegradation of dioxin varies with the exposure to sunlight and the availability of a hydrogen donor, it is not expected that a simple model for the photolytic half-life of dioxins can be developed.

2.3.2 Air

Polychlorinated dioxins are likely to be removed from the atmospheric environment by wet and dry deposition of particulates and by photodegradation. Dioxins also may volatilize from particles and surfaces although they have low vapor pressures. Nash and Beall (1980) have demonstrated volatilization of TCDD from soil in both field and environmental chamber studies. Although they found the rate of evaporation to be low, they detected TCDD in air during a microcosm experiment approximately 8×10^{-11} g/m³ on Day 0 to 1.6×10^{-14} g/m³ on Day 203.

Photolysis appears to be the most significant natural destructive mechanism for removing dioxin from the environment, although the extent to which this occurs is difficult to assess (Esposito, 1980). Higher chlorinated isomers have been determined to degrade to less chlorinated isomers. 2,3,7,8-TCDD has not been detected in the decomposition products since chlorine atoms in lateral positions are removed preferentially. Degradation has been documented by many laboratory studies and was found to range from 0% of TCDD crystals on a glass plate exposed to sunlight for 14 days up to

50% of TCDD in isooctane and 1-octanol irradiated for 40 minutes under an artificial sunlamp. Results of various studies are summarized in Table 2-4.

Based on available laboratory and field data, it can be assumed that dioxins which have volatilized from particles or surfaces would be more susceptible to photolytic degradation than dioxins adsorbed on particles.

2.3.3. Water

Polychlorinated dioxins may enter the aquatic environment through leaching of chemical dumps, industrial effluents, atmospheric fallout of contaminated particulates, and erosion of contaminated soil (Esposito, 1980). The ultimate sinks for PCDDs include aquatic systems. Since PCDDs have very low solubilities and bind rapidly and strongly to soils or sediments, actual concentrations in water will be low (NRCC, 1981). Matsumura and Ward (1976) showed, that after separation from lake-bottom sediment, water contained 0.3 to 9% of the original dioxin added to the sediment (Esposito, 1980).

The mechanisms for removal of polychlorinated dioxins from water include adsorption, volatilization, photodegradation, biodegradation, and bioaccumulation. Adsorption to sediment and suspended particles is expected to be the primary means of removal of 2,3,7,8-TCDD from water (ASME, 1981). More than 90% of 2,3,7,8-TCDD in an aquatic environment may be present in the adsorbed state (Ward and Matsumura, 1978; Matsumura et al., 1983). Some removal also may be attributed to volatilization, but highly organic sediments and suspended solids may reduce this process. Reducing the organic matter in water from 10 percent to one percent may reduce the residence time of dioxin in the aquatic environment from seven years to one-half year (NRCC, 1981). Ward and Matsumura (1978) observed that the half-life of 2,3,7,8-TCDD in lake waters with sediment was 550 to 590 days. The half-life in waters without sediment was longer. The shorter half-life was probably due to the adsorption of dioxin from the water onto the sediment.

There is some evidence that TCDD is metabolized very slowly in sediment and the metabolites are released into the water. Aquatic plants may uptake most of the TCDD and release it back into the sediment when they die (Matsumura, et al., 1983). Of approximately 100 strains of microorganisms known

TABLE 2-4
PHOTODEGRADATION OF 2,3,7,8-TCDD

Physical Conditions	Light Source	Length of exposure	Amount degraded (%)	Reaction products	Reference
TCDD in methanol	Natural sunlight	7 h	100	NR	Crosby et al., 1971
TCDD (crystalline) in water	Artificial (sunlamp)	NR	0	NA	Crosby et al., 1973
TCDD crystals on glass plate	Natural sunlight	14 days	0	NR	Crosby et al., 1971
TCDD in Herbicide Orange, on glass	Natural sunlight	6 h	60		Crosby and Wong, 1977
TCDD in Herbicide Orange, on plant leaves	Sunlight	6 h	100		Crosby and Wong, 1977
		6 h	70		
TCDD in Herbicide Orange, on soil	Sunlight	6 h	10		Crosby and Wong, 1977
TCDD in Seveso soil with ethyl oleate-xylene mixture	Sunlight artificial	7 days	90	NR	Bertoni, 1978
		3 days	100		

NR = Not Reported
NA = Not Applicable

SOURCE: Esposito, 1980

to degrade persistent pesticides, only five were shown to degrade 2,3,7,8-TCDD slightly under laboratory conditions (USEPA, 1981). Biodegradation of dioxins in the environment under natural conditions does not appear to be a major degradation pathway.

2.3.4 Soil

According to Thibodeaux (1984), the active mechanisms influencing the fate of dioxin emissions from an incinerator are atmospheric fallout, evaporation, photodegradation, particle resuspension by wind, runoff by water, and bioturbation into underlying soil layers. Bioturbation is defined as the mixing of the upper layers of soil or sediment by the community of organisms that reside on or near the surface. In urban environments, human activity would be more significant in mixing dioxins into the soil than bioturbation. Dioxins have a higher affinity for soil than they do for water and, therefore, will not migrate substantially into soil. According to a theoretical equation developed by Karickhoff *et. al.* (1979), a soil/water partition coefficient of 4.8×10^4 for 2,3,7,8-TCDD was predicted for a soil containing only 10% organic matter (NRCC, 1981). This indicates that although a soil may be poor in organic matter, the dioxin has an affinity for the soil of approximately 50,000 times greater than for water. Dioxins applied to the surface of soils having a high organic content generally remain in the upper six to twelve inches of the soil. In more sandy soils, they migrate to three feet or more (Thibodeaux, 1983). Lateral movement of TCDD in soil may occur via erosion or through contaminated airborne dust (USEPA, 1981; Helling, *et. al.*, 1973). Vertical movement in soil may occur due to saturation of the sorption site of the soil matrix, migration by organic solvents (NRCC, 1981), human activity, or bioturbation (Thibodeaux, 1984). Vertical migration may be enhanced by heavy rainfall.

Photolysis of TCDD in soil was found to be less than for other substrates, possibly due to a shading effect (Crosby and Wong, 1977). In urban areas, shading from buildings and other objects will reduce photodegradation even more. However, in a small scale study in Seveso, Italy, a hydrogen donor in an aqueous solution was applied to a heavily dioxin-contaminated area of grassland in order to enhance photodegradation. After nine days, 80 to 90 percent of the 2,3,7,8-TCDD was destroyed (Wipf *et al.*, 1978; Crosby, 1978).

According to Thibodeaux (1984) and Freeman and Schroy (1984), dioxins may volatilize from soil surfaces to an appreciable extent, especially during summer months. Volatilization during winter months would not be expected to be significant. Most of the volatilization would occur from the uppermost surface of the soil.

Microbial attack of TCDD in soil was found to be very slow under laboratory conditions. Only approximately one percent was transformed to an assumed metabolite of TCDD within several months of incubation (Hutter and Philippi, 1982). Inoculation with favorable organisms or enrichment with nutrients had no effect on stimulating the microbial degradation of 2,3,7,8-TCDD in contaminated soils (Pocchiari, 1978). In addition, laboratory data show that addition of organic compost to contaminated soil had no appreciable influence on the degradation of TCDD (Camoni, et al., 1982). Therefore, it is expected that biodegradation of dioxins in the soil environment is insignificant.

2.3.5 Summary. Polychlorinated dibenzo-p-dioxins are produced largely as unwanted contaminants from the manufacture of trichlorophenols and the herbicide, 2,4,5-T. In addition, both chlorinated dioxins and chlorinated furans are associated with a variety of combustion sources. Little is known about the actual fate of dioxins in the environment and the data are conflicting. Dioxins are relatively persistent compounds which are comparatively stable to environmental degradation. They have an affinity for binding to soils, sediments, and particulate matter, such as fly ash. Since dioxins are not very water soluble and they bind to soils, they do not migrate substantially either vertically or horizontally. Volatilization from soils through vapor phase transport is dependent on ambient temperature and is thought to be a major removal pathway. The half-life of dioxin in soil depends on complex environmental conditions and has been reported to range from one-half year up to twelve years. The primary removal mechanism of dioxin from water is through adsorption by sediment or biota, although volatilization and photodegradation may occur to some extent. Polychlorinated dioxins in the atmosphere are present in the particulate-sorbed or vapor phase state. They may be removed from the air by atmospheric deposition or photochemical degradation.

2.4 Toxicology

The toxicity of polychlorinated dioxins is a critical factor in evaluating the potential risks related to emissions from the proposed BNYRRF. The following sections address the principal concerns and issues surrounding the toxicity of PCDDs, present summaries of major animal and human toxicological studies, and discuss the carcinogenicity, teratogenicity, mutagenicity, and toxicity mechanisms of these materials.

2.4.1 Principal Concerns and Issues

In examining the risks associated with the BNYRRF, several major issues pertaining to the toxicology of PCDDs will be discussed.

Type of Effects. Animal and human studies ascribe both acute (short-term) and chronic (long-term) effects to exposure to PCDDs. Although short-term effects have been noted at high doses, the major concern associated with the BNYRRF is the potential for chronic effects following extended exposure to low levels.

Scarcity of Data on Human Toxicology. Most of the information pertaining to the toxicity of PCDDs is derived from animal studies. While these studies do not provide direct estimates of risks to humans, properly conducted, they can yield results which can improve estimates of the risk to human populations. At the same time, however, there are difficulties in extrapolating results of these studies from animals to humans (NAS, 1977).

- ° Humans, unlike laboratory animals, are not genetically homogeneous. These differences in genetic makeup, particularly genetic differences in metabolism, can affect human responses to toxicity.
- ° The environment in a laboratory experiment is strictly controlled, while humans are exposed to a wide range of environmental conditions, including intake of chemicals in addition to the ones under study.
- ° Differences in life span, size, weight, and metabolism between test species and humans present problems in dose vs. duration. Since humans generally excrete compounds more slowly than rodents, humans, with a small daily intake, can develop a higher accumulation of a compound over a number of years.

In areas where human data is insufficient, the BNYRRF risk assessment utilizes information obtained from animal studies, primarily in the areas of bioavailability through ingestion and dermal exposure. (Piper et al., 1973; Fries and Marrow, 1975; Rose et al., 1976; Nolan et al., 1979).

Animal data was also utilized in the calculation of upper-bound cancer risk estimates. These risks are derived from models which utilize extrapolations from high dosage carcinogenic animal bioassays. The models apply a conversion factor, based on relative weights or surface areas, to convert animal dosage to human dosage.

Promoter vs. Initiator of Carcinogenesis. Potentially cancer-causing compounds can cause carcinogenesis through initiation or promotion of tumor formation. A promotor is defined as an agent which results in an increase in cancer induction after long-term application subsequent to treatment of an animal with an initiator. Under otherwise identical conditions, neither initiator nor promoter alone induces many tumors. Some initiators are capable at high doses, however, of producing a carcinogenic effect without the addition of a promoting agent.

Although 2,3,7,8-TCDD is carcinogenic to animals, it is not clear whether it can act both as an initiator and as a promoter of carcinogenesis. One study (Pitot et al., 1980), shows that 2,3,7,8-TCDD is a potent promoter of liver cancer after initiation with diethylnitrosamine. Another study indicates a potent promoter effect using 3-methyl chloranthrene as an initiator (Kouri et al., 1978). Other investigations, however, have produced negative results (NTP, 1980b; Berry et al., 1979). This issue currently remains open to question.

There are, however, relatively little data to suggest that 2,3,7,8-TCDD is an initiator of carcinogenesis. In the risk assessment, a linear non-threshold model is used to extrapolate risk. This model is believed to overestimate risks for carcinogens which act as promoters, hence the risks derived in Chapter 5 may be overstated.

Toxicity and Carcinogenicity of Complex Mixtures. One of the critical issues pertaining to the BNYRRF is the toxic and carcinogenic potential of the complex mixture of PCDDs which will be emitted.

Given the difficulties in assessing the potential synergistic and antagonistic effects of mixtures, the concept of toxic equivalency has been developed. Briefly stated, toxic equivalency assigns a value to the toxicity of a mixture by evaluating the relative ability of the isomer components to induce microsomal enzymes and initiate a toxic effect. The ability of PCDDs to induce enzymes is discussed in Section 2.4.7 and the method used to calculate toxic equivalency is presented in Chapter 5.0.

2.4.2 Animal Toxicology.

As previously stated, acute and chronic animal studies provide most of the current data regarding the toxicity of PCDDs. Most of this information pertains to 2,3,7,8-TCDD, the most widely studied of these compounds. Table 2-5 outlines the characteristics of both acute and chronic toxicity testing. Relative toxicities for the various PCDD isomers are provided in Table 2-6. The major focus of the risk assessment is long-term effects due to prolonged low doses. Therefore, the following sections will emphasize chronic effects.

Acute Lethality. 2,3,7,8-TCDD has been demonstrated to be acutely toxic to a variety of animal species. In acute toxicity studies, the test chemical is administered in a single dose, and the endpoint is the LD₅₀, the dose causing death in 50 percent of the test animals. Several characteristic features of acute 2,3,7,8-TCDD toxicity include:

- ° Considerable variation in toxicity (LD₅₀s) among species. The LD₅₀ of 2,3,7,8-TCDD ranges from 0.6 ug/kg-body weight in the most sensitive species, (the guinea pig), up to approximately 5000 ug/kg-b.w. in the hamster. Toxicity to mice, monkeys, and rabbits falls near the middle of this range. LD₅₀'s for several test species appear in Table 2-7.
- ° Varying effects among test species. TCDD causes a number of similar acute toxic effects in different test animals. Nearly all test animals lose body fat and show involution (shrinkage) of the thymus and atrophy of the body tissues. Other effects, however, are not found in all species. Chloracne, a clinical marker of human dioxin exposure, also occurs in some mice, rhesus monkeys, and rabbits. It has not been observed in guinea pigs, hamsters and some test strains of mice.
- ° Delay between dose and effect. The toxic effects of TCDD develop slowly when compared with those from other highly toxic materials. Depending on the test animal, the interval between exposure and

TABLE 2-5

AN OUTLINE OF ACUTE AND CHRONIC ANIMAL TOXICOLOGIC TESTS

I. Acute Tests (single dose)

- A. LD₅₀ determination (24-hour test and survivors followed for 7 days)
 - 1. Two species (usually rats and mice)
 - 2. Two routes of administration (one by intended route of use)
- B. Topical effects on rabbit skin (if intended route of use is topical; evaluated at 24-hours and at 7-days)

II. Chronic Tests (daily doses)

- A. Duration - 2 to 7 years depending on species
- B. Species--selected from results of prior prolonged tests, pharmacodynamic studies on several species of animals, possible single dose human trial studies. Otherwise use of two species.
- C. Minimum of two dose levels.
- D. Route of administration according to intended route of use
- E. Evaluation of state of health
 - 1. All animals weighed weekly
 - 2. Complete physical examination weekly
 - 3. Blood chemistry, urinalysis, hematologic examination and function tests on all animals at 3- to 6-month intervals and on all ill or abnormal animals
- F. All animals subject to complete autopsy including histologic examination of all organ systems.

Source: Adapted from Loomis, Essentials of Toxicology

TABLE 2-6

RELATIVE TOXICITY OF VARIOUS PCDDs AS INDICATED BY SEVERAL TESTS

Material	AHH Induction Relative to 2,3,7,8 TCDD	Acute Lethality Vertebrates LD50 ^a		Carcinogenicity Rat-Minimum Observed Dosage ^b	Reproductive Minimum Observed Dosage in Rat ^b	Teratogenic Minimum Observed Dosage in Rat ^b
2,3,7,8 TCDD	1	0.6	- 5,000	1×10^{-2}	1×10^{-1}	
1,2,3,7,8 P ₅ CDD	15	3	- 338			
1,2,3,4,7,8 H ₆ CDD	21	70	- 800	36×10^{-2}	100	1-10
1,2,3,6,7,8 H ₆ CDD	85	70	- 1,300			
1,2,3,7,8,9 H ₆ CDD	130	60	- 1,400			
1,3,7,8 TCDD	240					
1,2,3,4,6,7,8 H ₇ CDD	370	600	-			
1,2,3,8 TCDD	1,700					
2,3,7 T ₃ CDD	3,000	30,000	-			
1,2,3,4,6,7,9 H ₇ CDD	10,000					
1,2,3,4 TCDD	33,000		- 1,000,000			800,000 +
2,8 DCDD	33,000	300,000	-			
2,7 DCDD	33,000		- 2,000,000			100,000 +
O ₈ CDD	53,000		- 1,000,000			
1,2,3,6,7 P ₅ CDD	220,000					
1,2,4,7,8 P ₅ CDD	330,000	1,000	- 5,000		500,000	

a nanograms per gram of body weight; a number preceding the dash (-) is for guinea pig (the most sensitive of experimental animals) and a number after the dash is the highest LD50 for any vertebrate tested for acute toxicity to PCDDs.

b nanograms per gram of body weight per day.

Source: NRCC, 1981.

TABLE 2-7

LD₅₀S FOR SEVERAL ANIMAL SPECIES

<u>Species</u>	<u>Sex</u>	<u>LD₅₀(ug/kg-bw)</u>
Guinea Pig	M	0.6 - 2.1
	F	3
Rabbits	Mixed	115
Rat, Sherman	M	22
	F	45
Rat, Charles River	Mixed	100
Rat, Porton	F	190
Mouse	M	114
Dog	Mixed	300-3,000
Monkey, Rhesus	F	70

Source: Harding, 1982

death ranged up to 45 days. During this interval, test animals exhibit a general wasting syndrome, associated with poor weight gain or loss of weight. This effect appears to be unrelated to food intake. (Poland and Glover, 1980). Mean time to death was unaffected by increasing the dose of 2,3,7,8-TCDD. (McConnell et al., 1978).

Chronic Non-Carcinogenic Effects. Four major feeding studies have been performed in order to assess the chronic effects of 2,3,7,8-TCDD. These studies involve administration of the test chemical on repeated occasions over a substantial portion of the lifetime of the test animal.

Although most long-term studies of 2,3,7,8-TCDD were designed to evaluate its carcinogenic potential, these investigations have also produced some data regarding non-carcinogenic toxic effects. These effects included reduced survival rates (Van Miller et al., 1977, Kociba et al., 1978), toxic hepatitis (NTP, 1980), dermatitis (Toth et al., 1978, 1979). Table 2-8 presents an overview of the chronic effects observed in animal studies.

Chronic toxicity data from these long-term studies are used to derive the NOEL (No Observed Effect Level) and ADI (Acceptable Daily Intake) that are utilized in the risk assessment. The ADI applies a safety factor to the NOEL.

2.4.3 Human Toxicology

The bulk of the data regarding human exposure to 2,3,7,8 TCDD derives from accidental exposures of workers or the general population. Most cases involved exposure to a mixture of chemicals, thus enabling only inexact estimates of TCDD exposure. In addition, these mixed exposures make it difficult to relate symptoms solely to effects of TCDD. In general, symptoms observed during these incidents include (NRCC, 1981):

- ° skin lesions, including chloracne, hyperpigmentation and thickening of the skin

TABLE 2-8

CHRONIC EFFECTS IN VARIOUS ANIMAL SPECIES

<u>Symptom</u>	<u>Monkey</u>	<u>Guinea pig</u>	<u>Cow</u>	<u>Rat</u>	<u>Mouse</u>	<u>Rabbit</u>	<u>Chicken</u>	<u>Hamster</u>
Abnormal cell proliferation or organ enlargement								
Gastric mucosa	++	0	+	0	0			0
Intestinal mucosa	+							++
Urinary tract	++	++	++	0	0			
Bile duct/gall bladder	++		+		++			
Lung				++				
Skin	++		a	0	0	++		
Atrophy or decreased cell proliferation								
Thymus	+	+	+	+	+		+	+
Bone marrow	+	+			+		+	
Testicle	+	+		+	+		+	
Other Effects								
Liver lesions	+	0		++	+	+	+	+
Edema	+	0		0	+		++	+

Note: 0 - Indicates lesion not observed;
 + - Indicates lesion observed (number of plusses notes severity)
 a - Skin lesions are observed in cattle, but they are different from the lesions seen in other species.

Source: Poland and Knutson, Annual Review of Pharmacology & Toxicology, 1982.

- hair loss and hirsutism (excessive hair growth)
- porphyria cutanea tarda
- central and peripheral nervous disorders
- liver, kidney and gastrointestinal disturbances
- neurasthenia, including lack of drive and vigor, sleep disturbances, emotional instability and altered basic frame of mind
- respiratory and cardiac disorders
- hypothyroidism

Reggiani (1983) tabulates a more extensive list of effects which have been observed in persons exposed to products containing halogenated dioxins (Table 2-9).

Acute. Several instances of acute human exposure are discussed in the following sections.

Oliver (1975) performed a clinical assessment of three scientists involved in two laboratory accidents in which an undetermined quantity of PCDD was released. The two scientists involved in one incident developed chloracne within three weeks and one displayed gastrointestinal problems, fatigue, headaches, and some neurological effects. The third scientist, exposed in a second accident, did not develop chloracne, but did show signs of excess hair growth, lack of coordination, and blurred vision. Most of these symptoms subsided over time.

A number of industrial accidents have been associated with acute symptoms in worker populations. Holmstedt (1980) and Zack and Suskind (1980), investigating five separate incidents reported chloracne as the major effect. Other symptoms noted in some cases included nervous system and internal organ damage, abnormal liver function, and altered blood parameters.

TABLE 2-9
ACUTE AND CHRONIC HUMAN
HEALTH EFFECTS OF HALOGENATED DIOXINS AND RELATED COMPOUNDS

<u>System or finding</u>	<u>Signs of lesion</u>	<u>Chemical Product</u>
Skin	Chlor- or bromacne, hyperpigmentation, hair loss, nail growth, porphyria	Penta- and hexachloronaphthalenes, tetrachlorodibenzofuran, hexa- and heptachlorobiphenyls, tetrabromodibenzofuran, polybrominated naphthalene
Hepatic	Liver enlargement, impaired liver function, fatty degeneration, fibrosis, hepatocellular necrosis	Chlorinated naphthalenes, tetrachlorodibenzo-dioxin, technical pentachlorophenol
Respiratory	Reduced vital capacity, chronic bronchitis	Technical pentachlorophenol, polychlorinated and polybrominated biphenyls
Central and peripheral neurological	Muscle and joint pain, numbness and spasm in the limbs, reduced sensory and motor conduction velocity, sensory disturbances (taste, hearing, smell, sight impairment)	Polychlorinated biphenyls, -dibenzofurans, -dibenzodioxin
Endocrine system	Irregular menstrual cycle, retarded growth	Polychlorinated biphenyl and -dibenzofurans
Ocular manifestations	Several degrees of inflammation with burning, discharge, edema of eyelid, cyst formation of tarsal glands and pigmentation of eyelid and conjunctiva	Technical pentachlorophenol, polychlorinated biphenyls, -dibenzofurans and -dibenzo-dioxin
Stomatological alterations	Pigmentation of oral mucosa, anomalies in number and growth of teeth	Polychlorinated biphenyls and -dibenzofurans

TABLE 2-9 (Continued)

ACUTE AND CHRONIC HUMAN
HEALTH EFFECTS OF HALOGENATED DIOXINS AND RELATED COMPOUNDS

<u>System or finding</u>	<u>Signs of lesion</u>	<u>Chemical Product</u>
Clinical chemistry laboratory findings	Increased serum tri- glycerides, decreased serum bilirubin	Polychlorinated biphenyls, -dibenzofurans and -dibenzo- dioxins

Source: Reggiani, 1983

The most extensively studied release of TCDD occurred in Seveso, Italy in 1976. Workers and residents, exposed to the contents of an exploded reactor, developed chloracne, nausea, vomiting, headaches, diarrhea, excessive sweating, and eye irritation. Most of these symptoms were reported within several weeks. Pocchiari et al., (1979) cites data which report some neurological effects. Most of these acute effects, in particular chloracne, had healed within three months after the incident. The 15 cases characterized as "severe" healed within five years. (Wipf and Schmid, 1983).

Effects of exposure of up to 30 ppm of 2,3,7,8-TCDD in soil in horse arenas was documented by Kimbrough et al. (1977). A six-year-old child developed headaches, diarrhea, nosebleeds and lethargy. Two small boys developed skin rashes, while three other persons suffered from headaches, skin lesions and pain in some joints. The six year old was reexamined five years later and showed no sign of residual toxicity (Beale, et. al, 1977).

Chronic. Long-term contact with TCDD is primarily due to occupational exposures during the use or manufacture of TCDD-containing products. Results of several studies of chronic exposure are outlined in Table 2-10.

In recent years, past exposure of Vietnam veterans to Agent Orange has received a great deal of attention. Agent Orange (Herbicide Orange) is a 1:1 mixture of 2,4 dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) which was used in Southeast Asia during 1965-1972. This material is contaminated with 2,3,7,8-TCDD in amounts ranging from 0.02 to 15 ppm (AMA, 1981). TCDD was also a contaminant of the approximately 276,000 gallons of Agents Green, Pink, and Purple, which were used in Vietnam from 1962 through 1964.

A number of Vietnam veterans who may have been exposed to Agent Orange have complained of various effects. Many of the reported symptoms (nausea, joint pains and stiffness, headaches, dizziness) are difficult to ascribe to TCDD exposure due to their non-specificity and widespread occurrence in the general population. Follow-up studies on these personnel have not, as yet, shown a significant increase in TCDD-related symptoms. A number of other studies are ongoing.

TABLE 2-10

STUDIES OF OCCUPATIONAL EXPOSURE TO 2,3,7,8-TCDD

<u>Author(s) (date)</u>	<u>Type of Exposure</u>	<u>Reported Effects</u>
Poland <u>et al.</u> (1971)	Manufacture of 2,4,5-T	Chloracne, acne, eye irritation, hyperpigmentation, hirsutism, gastrointestinal effects
Walker and Martin (1979)	exposure to 2,3,7,8-TCDD	elevated triglyceride levels, abnormal lipid levels
Ott (1980)	manufacture of 2,4,5-T (22 months)	No reported effects
Cook <u>et al.</u> (1980)	manufacture of trichlorophenol	chloracne
Pazderova Vejlupkova (1981)	manufacture of 2,4,5 sodium trichlorophenoxyacetate and trichlorophenoxyacetate butyl ester	Hypercholesteremia, hyperlipemia, hyperphospholipemia, increased plasma alpha and gamma globulins, and decreased plasma albumin 5 years after exposure - abnormal lipid metabolism and glucose tolerance and high urinary excretion of uroporphyrins

Much of the current knowledge regarding chronic effects of TCDD exposure in humans has resulted from data gathered in the aftermath of the Seveso incident. In 1976, uncontrolled exothermic reactions in a trichlorophenol reactor released a mixture of trichlorophenol and reaction products, including up to several pounds of 2,3,7,8-TCDD. Approximately 37,000 people were exposed to these materials. Two years later the resultant health effects were assessed. The chloracne, which had occurred primarily in children, had healed. Subclinical neurological and liver effects remained, but their significance is unclear. Immunoresponse was not altered, nor was there a noted increase in susceptibility to infectious diseases. At present, a NIEHS/IARC group is conducting an epidemiologic survey of the 220,000 residents of the Seveso vicinity. Their preliminary findings confirm those stated above. No organs or body functions appear to be impaired, nor have spontaneous abortions and birth defects appeared to increase. These findings are, as yet, preliminary and studies of long-term effects, such as cancer, cannot be conclusive until a sufficient latency period has passed.

2.4.4 Carcinogenicity

Animal Studies. Four major long-term animal studies (Van Miller et al., 1977; Kociba, et al., 1978; Toth, et al., 1979; Huff et al., 1980) determined that 2,3,7,8-TCDD is carcinogenic in certain animal models. The Kociba study, in particular, provides substantial evidence that TCDD is a carcinogen in rats, a result confirmed by NCI's investigations.

A carcinogenesis study was conducted by Toth et al. (1979) in three groups of 48 male mice and an equal number of controls which were fed TCDD in doses of 0.001, 0.1 and 1.0 ug/kg/bw/day. Tumor incidence was significantly increased in the 0.1 ug/kg/bw group (48 percent) as compared to 18 percent incidence in the controls.

One of the most widely cited studies is that conducted by Kociba et al. (1978). By using an adequate sample size (50 male and 50 female Sprague-Dawley rats), Kociba overcame some of the methodological problems in earlier studies. As a result, his investigation is frequently utilized in health risk assessments. Over a two-year period, the rats were administered doses of 0, 0.001, 0.01, and 0.1 ug 2,3,7,8-TCDD/kg b.w./day. Effects associated

with each dose are given in Table 2-11. No carcinogenic effects were noted at the lower dose levels. An independent pathology review by Squire confirmed Kociba's findings. (Squire, 1980).

As part of its carcinogenesis testing program, the National Cancer Institute (NCI) fed 50 male and 50 female Osborne-Mendel rats doses of TCDD in the amounts 0.0015, 0.0071, and 0.071 ug/kg b.w./day. Male rats exhibited a dose-related increase in follicular cell adenoma (thyroid) and an increased incidence of tissue fibromas. Female rats fed the high dosage showed increases in hepatocellular carcinoma, neoplastic nodules, subcutaneous fibromas, and adrenal cortical adenomas. These results confirm Kociba's findings in all but one respect. Kociba observed a significant tumorigenic response at a slightly lower dosage (0.01 ug/kg b.w. as opposed to 0.07 ug/kg b.w.).

The studies discussed above indicate that rats and mice exposed to 2,3,7,8-TCDD develop an increased incidence of cancers, particularly those of the liver. Most of the data indicate no tumorigenic response at levels below 0.01 ug/kg-b.w./day. The exception is Van Miller et. al who noted a tumorigenic effect at these lower doses.

Human Epidemiology. As with non-carcinogenic chronic effects, most data regarding human carcinogenesis pertains to occupational exposures during the use and manufacture of PCDD-contaminated materials. Several studies suggest a link between exposure to phenoxy herbicides and the induction of soft tissue sarcomas, a rare tumor type affecting the connective and other soft tissues. Hardell (1977) observed a total of seven patients with soft tissue sarcomas. Each patient had an occupational history involving exposure to phenoxy herbicides ten to 20 years earlier. A subsequent case control study indicated that persons in occupations involving exposure to phenoxy herbicides (i.e., 2,4-D and 2,4,5-T) had a higher relative risk of developing this type of cancer. Although questions have been raised concerning aspects of Hardell's methodology (e.g., use of questionnaires based on subject recall), the clustering of the sarcomas has raised considerable concern. Another study (Smith et al., 1983;) of New Zealand herbicide sprayers did not indicate a relationship between exposure of these materials and soft-tissue sarcomas.

TABLE 2-11

TOTAL AND INDIVIDUAL TUMORS IN MALE AND FEMALE RATS OF SIGNIFICANTLY DIFFERENT INCIDENCE THAN NON-TREATED CONTROL RATS (AFTER KOCIBA ET. AL. 1978)

<u>Tumor or Tumor-Like Lesion</u>	<u>Dose Level (ug 2,3,7,8-TCDD.kg.bw⁻¹/d⁻¹)</u>							
	<u>-0^a</u>		<u>0.001^B</u>		<u>0.01^B</u>		<u>0.1^B</u>	
	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>
Hepatocellular hyperplastic nodules	6	8	0	3	3	18 ^y	2	23 ^y
Hepatocellular carcinoma	2	1	0	0	0	2	1	11 ^y
Stratified squamous cell carcinoma of hard palate or nasal turbinates	0	0	0	0	0	1	7 ^y	4 ^y
Keratinizing squamous cell carcinoma of lung	0	0	0	0	0	0	7 ^y	1 ^y
Benign tumor of uterus	-	28	-	12	-	11	-	7 ^s
Benign neoplasm of mammary gland	-	73	-	35	-	36	-	24 ^s
Mammary carcinoma	-	8	-	4	-	4	0	0 ^s
Pituitary adenoma	26	43	6	18	11	13	13	12 ^s
Subcutaneous carcinoma	10	1	1 ^s	1	5	0	6	0
Acinar adenoma of pancreas	14	0	7	1	5	0	2 ^s	1
Adenoma of adrenal cortex	0	9	0	6	2	2	5 ^y	5
Pheochromacytoma of adrenal	28	7	6	3	10	1	4 ^s	2

^a Total (sex and group) 85 animals.

^B Total (sex and group) 50 animals.

^y Statistically greater than control data when analyzed using the Fischer exact probability test, p 0.05.

^s Statistically less than control data when analyzed using the Fischer exact probability test, p 0.05.

Source: National Research Council of Canada, 1981

Zack and Suskind (1980) also reported one soft-tissue sarcoma death in their study of the Nitro explosion. Other studies which observed soft-tissue sarcomas possibly related to exposure to TCDD-contaminated materials are Moses and Selikoff (1981), Johnson, et al. (1981), and Sarma and Jacop (1981).

The other forms of cancer possibly associated with exposure to TCDD-contaminated materials include: non-Hodgkins lymphomas (Bishop and Jones, 1982); Olsson and Brandt, 1982), and Hodgkins and non-Hodgkins lymphomas (Hardell, 1979), stomach cancers (Axelson, et al., 1980; Thiess and Frentzel-Beyme, 1977). These results are contradicted by studies which do not show increased stomach cancer mortality rates (Riihimaki et al., 1978; Zack and Suskind, 1980; Cook et al., 1980; and Ott et al., 1980). Another study by Riihimaki et al. (1983) failed to detect a relationship between exposure to chlorinated phenoxyacids and increased overall cancer risks. However, the authors expressed reservations regarding the ten-year latency period as being adequate to allow a true assessment of these exposure risks.

Taken as a whole, the evidence for the human carcinogenicity of TCDD is not as substantive as that for animal models. The problems inherent in these investigations mirror those encountered in any environmental epidemiology: lack of data regarding the etiology of the specific cancer, the validity of self-administered questionnaires, the presence of confounding factors (e.g., occupation, other chemical exposures), estimation of exposure levels, and the lack of information on the latency period of that cancer. However, it is generally agreed that the Swedish case-control studies are suggestive of an association between soft-tissue sarcomas and long-term occupational exposure to phenoxy acids and chlorophenols contaminated with dioxin.

2.4.5 Teratogenesis and Other Reproductive Effects

High doses of 2,4,5-T containing 0.1 ppm of TCDD are embryotoxic and produce cleft palate in mice (Moore, 1978). Kociba (1976) also noted reduced fertility and survival of the young at doses of 0.01 and 0.1 ug/kg/day in Sprague-Dawley rats. Experiments on rhesus monkeys, using relatively low

doses, do not show similar effects, suggesting that the teratogenic potential of TCDD may be a species-specific phenomenon (Dougherty, et al., 1975).

Several studies have investigated the potential for teratogenic and reproductive effects in humans. Two independent surveys of South Vietnamese hospital records (Cutting et al. 1970, Meselson et al. 1971) did not reveal any marked increase in birth defects. A National Academy of Sciences committee which also examined medical records did not observe a conclusive relationship between exposure to herbicide (i.e., Agent Orange) and birth defects. They did, however, assert that the available birth records were not adequate to permit definite conclusions.

A reportedly high incidence of miscarriages was observed among a small group of women living in Alsea, Oregon. One of the two studies conducted by EPA showed a statistically significant relationship between the spraying of 2,4,5-T and the incidence of miscarriages. The study was later discredited due to a number of methodological problems including lack of proper controls and inadequate data regarding both the spraying and the usual incidence of miscarriages.

2.4.6 Mutagenicity

Hussain, et al. (1972) observed a high frequency of reversion to streptomycin independence (a reverse mutation) in Escherichia coli (Sd-4) following exposure to 2 ug 2,3,7,8-T₄CDD.mL⁻¹ of incubation medium. 2,3,7,8-T₄CDD also produced reverse mutations at the histidine locus of Salmonella typhimurium (strain TA1532) but no mutagenic effects were observed using S. typhimurium (strain TA1530) (Hussain, et al., 1972). Since the 2,3,7,8-T₄CDD used in these studies was reportedly 99 percent pure, it was unlikely that the positive mutagenic responses were due to impurities in the test material.

Seiler (1973) assessed the mutagenicity of 2,3,7,8-T₄CDD in several strains of S. typhimurium without metabolic activation. Positive mutagenic responses were reported in strain TA1532, questionable responses in strains TA1531 and TA1534 and negative responses in strains GA6 and TA1530.

More recent studies with S. typhimurium (strain TA1532) (with and without metabolic activation) indicate that 2,3,7,8-T₄DD is not mutagenic (Nebert, et al., 1976; Wassom, et al., 1977; Mercier, et al., 1978). Negative mutagenic effects have also been reported in other strains of S. typhimurium, including TA1535, TA1537 and TA1538, tested with 2,3,7,8-T₄CDD (Nebert, et al., 1976; Wassom, et al., 1977, 1978; Mercier, et al., 1978).

Except for the early results obtained by Hussain, et al. (1972) and Seiler (1973) using S. typhimurium (strain TA1532), the available data on the mutagenicity of 2,3,7,8-T₄CDD indicate that this compound is not mutagenic. The discrepancy in results for strain TA1532 could be attributable to the solubility of the 2,3,7,8-T₄CDD sample, its purity, different treatment protocols or differences in the test organism (Wassom, et al., 1977, 1978). There is very little data regarding mutagenicity in humans. Chromosomal analysis of plant workers exposed during the Seveso incident did not reveal differences in the statistical norm for chromosome damage.

2.4.7 Mechanisms of Toxicity

Receptor-Mediated Toxicity. 2,3,7,8-TCDD is an example of a large class of halogenated hydrocarbons which appear to bind to a specific receptor (a soluble protein) within the cytoplasm of the cell. Once the TCDD and receptor are bound together, the dioxin-protein complex moves into the cell's nucleus where it activates a specific set of genes referred to as the Ah (aromatic hydrocarbon) locus. These genes control the production of cytochrome P-450, an enzyme which reacts with foreign substances in the cell. Although the primary function of cytochrome P-450 is electron transport, this enzyme also enables the toxic material to be metabolized and eventually excreted. In the case of dioxin, one of the metabolites triggered by cytochrome P-450 is toxic and manifests its presence as a toxic effect.

At present, the relationship between enzyme induction by TCDD and the degree of toxicity is unclear. In addition, as shown in Table 2-6, there is wide variability in AHH induction among the various PCDD isomers tested. Oral administration of TCDD in rats and mice produces a dose-related induction of AHH activity which seems to correspond with the toxic potency of

specific dioxin congeners. However, although TCDD is an extremely potent enzyme inducer in cell cultures, there is no demonstrated correlation between enzyme induction and cytotoxicity. This observation implies that despite the observed correlation in animal models, there may be no direct connection between enzyme induction and the degree of toxicity of 2,3,7,8-TCDD.

Vitamin A Depletion. Many of the toxic effects of 2,3,7,8-TCDD resemble the effects of Vitamin A (retinol) deficiency. These include epithelial lesions, keratosis and immunosuppressive effects. It has been demonstrated that the administration of a single oral dose of 2,3,7,8-TCDD produces a dose-related increase in the hepatic (liver) storage of Vitamin A in rats (Thunberg *et al.* 1979, 1980). These results suggest that an induced Vitamin A deficiency may be responsible for some of the toxic effects produced by 2,3,7,8-TCDD.

Lipid Peroxidation. Sweeney and Jones (1983) have suggested increased lipid peroxidation as a possible mechanism of 2,3,7,8-TCDD toxicity. Based on limited data, it appears that iron deficiency inhibits *in vitro* lipid peroxidation and reduces the hepatotoxic effects of 2,3,7,8-TCDD. Also lipofuscin pigments, by-products of lipid peroxidation, are increased in the heart muscle of rats treated with 2,3,7,8-TCDD. Thirdly, administration of an antioxidant to mice provided some protection from porphyria induced by 2,3,7,8-TCDD. More recent studies (Stohs *et al.*, 1983) indicate that 2,3,7,8-TCDD may accelerate lipid peroxidation in Sprague-Dawley rats.

2.4.8 Summary. Relatively little is known regarding the effects of PCDDs and PCDFs on humans. Animal studies, which are limited primarily to 2,3,7,8-TCDD, indicate that this compound shows considerable variation in toxicity and varying effects among species, as well as a delay between the administration of this material and the manifestation of a toxic effect.

As regards humans, most information is derived from cases of accidental exposure to mixtures containing PCDDs. Assessing the effects of these uncontrolled exposures and relating effects solely to exposure to PCDDs is difficult. The symptoms observed in these incidents include skin conditions; hair loss and excess hair growth; nervous disorders; respiratory

problems; liver, kidney, and gastrointestinal conditions; and hypothyroidism. The symptom most frequently associated with exposure to PCDDs is chloracne.

2,3,7,8-TCDD has been proven carcinogenic in several animal models. With one exception, these studies do not indicate tumor formation at levels below 0.01 ug/kg-b.w./day. There is some indication of a relationship between exposure to phenoxy herbicides and the development of certain cancers, notably soft-tissue sarcomas in humans. Other studies, however, seem to contradict these findings. In general, evidence for human carcinogenic effects is not as substantive as that for animal models.

Although teratogenesis and other reproductive effects have been noted in mice and rats, studies conducted to date of human populations have not shown a significant increased risk of spontaneous abortions and birth defects.

Available data on the mutagenicity of 2,3,7,8-TCDD seem to indicate that this compound is not mutagenic in the test systems used. Chromosomal analysis of plant workers exposed at Seveso did not reveal statistically significant increases in chromosome damage.

3. Dioxin Emissions from Incineration

3.1 Introduction

3.1.1 Purpose. This chapter presents an analysis of available data pertaining to the high-temperature behavior of PCDF and PCDD compounds. The data was derived from the sampling and analysis of municipal incinerator effluents and laboratory tests.. The results of this analysis will be used to predict PCDD and PCDF emission rates for the proposed Brooklyn Navy Yard Resource Recovery Facility (BNYRRF). These emission rates will then be used to develop the exposure assessment presented in Chapter 4 and the risk assessment presented in Chapter 5.

3.1.2 Approach. In order to predict behavior of PCDF and PCDD materials at high temperature, this analysis identifies the factors that influence their rates of formation and destruction. Laboratory studies which attempt to provide insight into these processes have been reviewed, and the information has been used to predict the impact of the BNYRRF emissions on the environment. Sampling and analysis data at other resource recovery facilities were reviewed in order to obtain the possible range and expected magnitude of emissions from the BNYRRF. Due to the lack of data, as well as to the differences in sampling techniques, incinerator design, and control equipment design in the reports from the various facilities tested, this is not a straightforward task.

The factors affecting high-temperature formation and destruction of PCDF and PCDD materials are correlated with actual test data in an attempt to identify factors influencing emission rates of these materials from incinerators. These factors are compared to the proposed design of the BNYRRF and emissions are predicted based upon test data from other facilities of similar design. Finally, an assessment is made based upon comparisons of data from other facilities, to determine if the emission prediction is a realistic one.

3.2 Factors That Influence Rates of Dioxin Emission

3.2.1 Formation (Occurrence). The PCDFs and PCDDs found in incinerator effluents are compounds that, once formed, are very stable and resist degradation. The exact formation and occurrence mechanisms are not thoroughly understood; however, an extensive examination of the data by researchers has led to the development of three theories to account for the presence of PCDF and PCDD compounds in the incineration effluent (Choudhry et al. 1980):

- the compounds are trace components of refuse and do not undergo thermal transformation;
- the compounds are produced from precursors such as PCBs, chlorophenols, and similar materials; and
- the compounds are formed de novo from materials that are unrelated to PCDF and PCDD compounds, such as PVC and other plastics, petroleum products, chlorocarbons, and inorganic chloride ions.

The first theory postulates that PCDF and PCDD materials are fed into the municipal incinerator with the raw refuse. Since PCDFs and PCDDs have been frequently formed as byproducts and contaminants of some chemical intermediates, (e.g. polychlorophenols, polychlorinated biphenyls, and hexachlorophene, and products made from these intermediates, such as herbicides, sanitizers, and heat transfer fluids), it is possible that some of these products can find their way into the solid waste of a municipal incinerator. Some researchers report that PCDD and PCDF compounds have occurred as contaminants in commercially available chlorinated phenols in concentrations up to 1,380 ppm for octa-CDD in pentachlorophenol (Rappe et al. 1979).

Most studies have not detected PCDF and PCDD materials in raw municipal solid waste (Lustenhower et al. 1980). However, in one recent study where three samples of raw waste were analyzed (Tosine et al. 1983), hepta-CDF and octa-CDD were detected. Concentrations ranged from 0.4 to 0.6 ng/g for octa-CDD and from 0.1 to 1.0 ng/g for hepta-CDF. Since municipal refuse is

a highly variable and heterogeneous material, it is difficult to assess average concentrations of any component without taking a large number of representative samples. The Tosine study, however, shows that it is possible for some PCDF and PCDD materials to find their way into refuse. Since the discovery of PCDF and PCDD contaminants in certain products and intermediates, manufacturing controls have improved and contamination rates have decreased. Therefore, the incidence of PCDF and PCDD in refuse may decrease in the future.

In order for the quantity of hepta-CDF and octa-CDD found in the Tosine study to result in the low concentrations observed in municipal incinerator emissions, it would have to pass through the entire combustion system unchanged. As will be shown in this section, laboratory studies have shown that the flame temperatures found in municipal incinerators are capable of destroying 99 percent or more of these materials. Therefore, unless the incinerator combustion conditions are radically different than these laboratory studies, it is not likely that this is the primary source of PCDF and PCDD in incinerator emissions.

The second theory, which involves thermal transformation of PCDF and PCDD precursors, could account for formation of these materials in the combustion system. If the precursors, which are generally the materials described above as having PCDF and PCDD materials as contaminants, are heated to decomposition temperatures, but not heated to combustion temperatures, PCDFs and PCDDs can be formed. In addition, volatilization of those PCDF and PCDD contaminants in the precursors can also occur.

Swiss and Swedish researchers (Jansson et al. 1978) found PCDD compounds in the emissions from a laboratory combustor when wood chips treated with tri-, tetra-, and penta-chlorophenol were burned. The researchers found amounts of PCDD up to several hundred ppm on the fly ash when the incinerator operated with tri- and tetra-chlorophenol treated wood chips in the temperature range of 500-600°C. Above 750°C the emissions of PCDD were very low. (However, as described below, pyrolysis of lignin from virgin wood can form PCDF and PCDD when exposed to chlorine in the combustion process. This demonstrates that the precursors in this study may not have been the source of the PCDF and PCDD materials detected).

Combustion of grass and paper coated with the herbicide 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) at 600-800°C generated traces of TCDD materials in the ppm range (Stehl and Lamparski 1977). Since 2,4,5-T has been found to contain TCDD as a contaminant, the 2,4,5-T can contain TCDD precursors. However, it is not clear whether the TCDD materials were formed from the precursors or from a combination of chlorine and other decomposition products resulting from the combustion process.

Polychlorinated biphenyl (PCB) heat transfer fluid has been found to convert to PCDF compounds during transformer fires and explosions when the PCB was exposed to relatively low temperatures and restricted oxygen conditions (Rappe et al. 1979, 1982). Since no other materials were combusted during these episodes, it is clear that the source of PCDF materials was indeed the fire/explosion of PCB. It is apparent through laboratory studies that the pyrolysis and combustion of PCDF and PCDD precursors can result in emissions of these materials. There are, however, no studies that have shown that this occurs in full-scale incinerators. Obviously, the conditions found in the laboratory studies would have to be reproduced in a full-scale unit. As described in Section 3.3, there is a wide range of combustion conditions found in full-scale units, depending upon both design and operation of the incinerator. These conditions can profoundly affect the concentrations of PCDF and PCDD materials in the emissions.

The third theory for the occurrence of PCDFs and PCDDs in municipal incinerator emissions suggests that these materials are formed from unrelated materials under specific conditions. Pyrolysis of uncontaminated pure vegetable extracts (from wood) in a laboratory combustor has yielded phenolic compounds which, when exposed to chlorine, resulted in ppm-range PCDF and PCDD emissions (Liberti et al. 1983). These researchers have postulated that degradation products which react with chlorine are the result of pyrolysis of the lignin binder from the wood extracts. Since chlorine is obviously a necessary component in the formation reactions under this theory, the source of chlorine in a typical municipal incinerator is an important topic. Generally, organic chlorine makes up one-half or more of the total chlorine in solid waste, with the remainder being inorganic salts

(Freeman 1978, Velzy 1984). Until a few years ago it was felt that chloride salts did not break down in incinerators; it was felt that the salts remained in the bottom ash (Freeman 1978). However, recent research in Japan has revealed that virtually all chlorine from salt can be liberated to form hydrogen chloride if the salt is exposed under heat to other components typically found in solid waste (Uchida et al. 1982). These components are silica (sand) and alumina (aluminum oxide). It is also known that reactions between gaseous sulfur dioxide and salt under heat can yield sodium sulfate and hydrogen chloride (Uchida et al. 1982). Therefore, chlorine in any form in solid waste can potentially contribute to the formation of PCDDs and PCDFs in incinerators under the right conditions.

Another interesting study concerning chlorine in solid waste is one where polyvinyl chloride (PVC) was added to the raw waste of a full-scale Martin incinerator in proportions of 5.33 kg per ton of waste (a 300 per cent increase over normal levels) and fly-ash samples were taken. The authors state that there were no significant increases in PCDF/PCDD concentrations over emission levels without added PVC in the waste (Karasek et al. 1983). Although PVC is not a PCDF and PCDD precursor, PVC has been reported as a potential source of chlorine for the formation of PCDDs and PCDFs (Liberti et al. 1983). However, at least in the incinerator tested, this did not occur.

Another study which adds insight to this formation theory is one reported by Olie et al. (1983), where hexachlorobenzene was added to the fuel of a municipal incinerator in proportions of 400 g to 2 m³ of raw waste, while fly-ash samples were taken. Chlorobenzenes are known precursors of PCDFs and PCDDs (Lustenhouwer et al. 1980); however, there was no significant increase in PCDF or PCDD concentrations emitted with the fly ash when the hexachlorobenzene was added. This indicates that waste input composition is probably not the single most significant cause of PCDF and PCDD emissions from municipal incinerators.

Experiments were also performed with a small fluid-bed incinerator by burning wood that was treated with pentachlorophenol preservative (a known PCDF/PCDD precursor) and 60-year old painted wood that was not treated with preservatives. There were no significant increases in PCDF/PCDD levels on the fly ash from the treated wood over the levels from the untreated wood (Olie et al. 1983). Furthermore, paper treated with a hypochlorite solution was burned and only traces of PCDF and PCDD compounds were emitted. The authors even state that the traces could have occurred as artifacts of the previous tests with wood burning. These experiments indicate that the occurrence of PCDF/PCDD emissions from municipal incinerators is not necessarily a direct result of a limited number of specific compounds in the raw solid waste, since the addition of known precursors did not necessarily cause higher emissions.

Also, studies on residential wood combustors (Nestrick and Lamparski 1983) showed that even when burning untreated virgin wood, PCDD materials at the part-per-trillion level could be detected in the soot and ash. This indicates that even trace amounts of chlorine from soil, air, construction materials, etc. can contribute to the formation of PCDDs and PCDFs.

These results show that PCDF and PCDD materials may occur in incinerator effluents by one or more mechanisms. It is important to remember, however, that laboratory and pilot-scale studies do not necessarily reflect conditions in a full-scale modern municipal combustion system. The specific conditions prevailing during PCDF and PCDD formation in a full-scale combustion system are difficult to measure and little is known about the components and kinetics of reactions within these systems. But while information is incomplete regarding the formation of PCDFs and PCDDs, some information is known about conditions necessary for their destruction. This information is discussed in the following sections.

3.2.2 Destruction. Since the discovery of PCDFs and PCDDs as environmental contaminants, researchers have been investigating the physical, chemical, and toxicological properties of these contaminants. As described above, the reaction processes involved in the formation of this group of

compounds are not precisely known. Once formed, it is very clear that these materials have an extremely high degree of thermal stability. This means that they retain their chemical structure at thermal conditions up to temperatures that are quite high. As more knowledge is becoming available concerning the conditions necessary for the thermal destruction of PCDFs and PCDDs, however, it is clear that these materials can be destroyed by the conditions present in a resource recovery plant.

This section contains a discussion of available information concerning conditions necessary for the destruction of PCDFs and PCDDs. A USEPA report on high-temperature destruction (Duvall and Rubey, 1977) estimates 99 percent destruction for dibenzodioxin and dibenzofuran materials at 700°C, and 99.9 percent destruction at 725°C (assuming one second residence time and effective mixing). However, these values are for monochlorinated materials and the thermal stability may increase with the number of chlorine substitutes. Therefore, the higher chlorinated materials such as the tetra, penta, hexa, hepta, and octa forms, may require higher temperatures for destruction. The study also reported that at 704°C the residence time necessary to destroy PCDD and PCDF could range from one to four seconds, with higher residence times necessary for the higher chlorine substitutes (assuming effective mixing).

Researchers conducting studies on 2,3,7,8 tetra-CDD (Bumb et al., 1987) determined that 99.95 percent of this material decomposes above 800°C, while at lower temperatures it is relatively stable (i.e., does not burn easily). Calculations based on reaction kinetics have also been performed; the researcher has estimated that 99.99 percent of all forms of PCDDs can be destroyed at a combustion temperature of 957°C and a gas residence time of one second. (Schaub and Tsang, 1981). This is very close to the design temperature (980°C) of the BNYRRF furnace zone. A summary of these destruction parameters is shown in Table 3-1.

It must be noted that these are the results of theoretical analyses or laboratory studies where temperatures, air supply, air/fuel mixing, and residence time are much more closely controlled than would be the case in an incinerator burning heterogeneous waste. Therefore, these estimates can

TABLE 3-1

ESTIMATED OR MEASURED DESTRUCTION EFFICIENCIES FOR PCDF AND PCDD COMPOUNDS

<u>Compound</u>	<u>Destruction Efficiency(%)</u>	<u>Destruction Temperature(°C)</u>	<u>Conditions</u>
dibenzodioxin/ ^(a) dibenzofuran	99	700	perfect mixing, one second residence time
dibenzodioxin/ ^(a) dibenzofuran	99.9	725	perfect mixing, one second residence time
2,3,7,8 TCDD ^(b)	99.95	800	laboratory combustor
PCDD ^(c)	99.99	957	reaction kinetics of typical combustion system, one second residence time
chlorinated compounds ^(d)	minimum emissions	800	well-mixed, one to three seconds residence time

(a) Duvall and Rubey, 1977 (higher chlorinated isomers of CDDs and CDFs will require higher destruction temperatures)

(b) Bumb et al., 1980

(c) Schaub and Tsang 1981

(d) CARB 1983

only be used as guidelines, since high temperature in an incinerator does not always coincide with optimum air supply, air/fuel mixing, and residence time. The following discussion pertains to actual incinerators and the requirements for effective PCDF and PCDD destruction in full scale units.

The California Air Resources Board (CARB) suggests that effective destruction of chlorinated compounds can occur at temperatures of 800°C at residence times of one to three seconds, under extremely well-mixed conditions (CARB, 1984). Properly designed and operated incineration facilities can achieve maximum flame temperatures in excess of 1300°C with average combustion chamber temperatures of 980°C and residence times greater than one second (CARB 1984). This report also states that these conditions can be expected to result in minimum emissions of PCDFs and PCDDs. It is probable that neither zero formation nor complete destruction of PCDF and PCDD emissions will occur in any municipal incinerator, although studies of coal/solid waste combustion emissions have resulted in no detectable PCDF and PCDD emissions (Redford et al. 1981).

It is apparent that, if these PCDFs and PCDDs are formed from solid waste degradation products, as the third formation theory of Section 3.2.1 postulates, they can be thermally destroyed upon exposure to the proper combination of combustion conditions. Degradation products are generally formed in all incinerators at the fuel bed because underfire air flow is purposely kept low, causing starved-air conditions in order to drive off volatiles without entraining solid unburned particles. The difference in rates of PCDF and PCDD emissions per ton of solid waste from different incinerators is primarily caused by combustion conditions downstream of the fuel bed. The downstream or secondary combustion zone is where effective incinerators are designed to destroy these materials. Incinerators can be designed to promote maximum PCDF and PCDD destruction by controlling the amount and injection method of secondary combustion air supply, the temperature and length of time the combustible gases remain at the minimum combustion temperature, and the effectiveness of the secondary air in mixing with the fuel gases. The goal for minimum PCDF and PCDD emissions is to keep the air/fuel mixture just slightly oxygen-rich at all times in order to burn the fuel completely at the hottest temperature within the design limits.

Regardless of the source and amount of PCDF and PCDD in the combustion system, maintenance of these secondary combustion conditions will ensure minimum emissions.

In addition to incinerator design factors, the method of operation will affect the ability to destroy PCDFs and PCDDs. For example, if too much fuel is charged to the combustion chamber and not enough air is supplied (fuel-rich mixture) the oxygen content of the gas will go down and carbon monoxide content will go up. This will require adjustments in the charging rate, the air supply, or both. Too much air supply will result in an oxygen-rich mixture, causing flame chilling and subsequent temperature drop. Obviously, in order to control the combustion process it is imperative that the operator of an incinerator know at all times exactly how much oxygen and carbon monoxide are in the furnace gases and at what temperature the combustibles are burning. Therefore, an effective incinerator design would include reliable instruments for measuring these parameters with displays in an area easily seen by the operator at all times. Failure to control the combustion process using these measurements will result in PCDF and PCDD emissions significantly higher than the minimum rates.

3.3 Emission Test Data from Municipal Waste Incineration

Beginning in the mid-to-late 1970s, it was reported by European researchers (Olie et al. 1977) that PCDDs and PCDFs were detected, but not quantified, in the fly ash collected in electrostatic precipitators in several of the Netherlands municipal incinerators. Other researchers also quantified trace levels of PCDDs and PCDFs in the collected fly ash (Buser and Bosshardt 1978, as reported by Lustenhouwer et al. 1980) of a municipal incinerator. In the Buser study, tests in the high-temperature zone of the boiler gas passage indicated low levels of only the octa-CDDs on the fly ash, while simultaneous samples at the lower-temperature electrostatic precipitator fly ash hoppers showed significant levels of all PCDFs and PCDDs from tetra- through octa- on the fly ash.

As the sensitive analytic techniques necessary to detect these compounds in trace quantities were developing, actual concentrations of PCDDs

and PCDFs in fly ash were determined by other researchers in the ng/g range (Bumb et al. 1980; Eiceman et al. 1979; Lustenhouwer et al. 1980). It became apparent that municipal solid waste incineration could be a potentially significant source of tetra-CDD emissions when the quantities of emissions from the Hempstead, Long Island, resource recovery facility were determined in 1979 (Tiernan et al. 1982). About this time, the emission data from Italian incinerators were made public (Cavallaro et al. 1980), showing that PCDFs and PCDDs may apparently be present in both the adsorbed state (on particulate) and the vapor phase. This apparently supported the Buser data, where PCDF and PCDD materials were not found on the fly ash in the high-temperature combustion zone but were subsequently found on particulate fly ash as the temperature decreased. There is also the possibility, however, that in the Buser study the PCDF and PCDD materials were adsorbed on particulates in the hot zone but were thermally desorbed when drawing hot sample gas past the particulates collected on the filter medium.

The sampling method used to obtain fly-ash samples from flue gas streams consists of drawing a sample of gas from a stack through a nozzle and probe before filtering the fly ash from the sample gas. The entire system from nozzle to filter is kept at an elevated temperature, typically 120° C to 250° C for stack gases, or higher for a very hot gas stream. After passing through the filter, the sample stream is typically cooled to below ambient temperature so that moisture is condensed and collected to prevent damage to sensitive pumps and meters downstream of the filter. Condensable moisture will readily drop out of the stream, but only a small portion of the organic material will be removed. The remainder passes through the sample train as a gas or a very small-size aerosol. Typically, after a volumetric measurement, the condensed water is discarded. All the researchers mentioned above, except Cavallaro and Tiernan, use this method to obtain flue gas fly ash samples.

Modern refinements to the sampling system have been made in recent years to trap the portion of PCDDs and PCDFs that would previously have been collected in the condenser or would have passed through the train. The USEPA has developed and tested a method which collects the gaseous and condensable organics in a specially-cooled condensate trap between the

heated filter and the moisture condenser. This trap collects the condensed organics on polymer resin beads, which are then extracted with a solvent prior to analysis. This method can collect condensibles and gases that escaped the older method. Only this method, or one similarly designed to collect gaseous material as well as fly ash, should be used to assess total PCDD and PCDF emissions from incinerators.

However, the partition factor between the amount of gaseous PCDF/PCDD and the amount on fly ash is very strongly linked to the temperature profile and residence time in the sampler. Therefore, small changes in sample flow rate, temperature, or dimensions of the hand-blown glassware in the sample train can change the partition factor. For this reason, some researchers, including the USEPA, refuse to report the partition of PCDF and PCDD emission as gaseous or as fly ash. In accordance with this position, there will be no attempt in this report to presume that PCDF/PCDD emissions are in any particular proportion between gaseous and solid state. Only samples where both solid and gaseous forms were obtained are used to develop predicted emission rates, and only total gaseous-plus-fly-ash emission rates and/or concentrations form the predicted emissions for the BNYRRF.

Data has been published by both European and United States researchers showing that PCDFs and PCDDs can be emitted from municipal waste combustion systems in amounts ranging from very low levels to potentially significant levels. As described in Section 3.2, significant emissions can potentially occur during periods of poor combustion, e.g. insufficient combustion air or low combustion temperatures. Also, potentially significant emissions could occur if the incinerator is designed with low gas residence time and is subsequently overcharged or operated with a different type of waste than the waste for which it was designed. Unfortunately, the combustion conditions are frequently not thoroughly described when emission data is reported. This prevents a thorough comparative analysis of each test report.

One study on one incinerator over a long-time period (Benfenati et al. 1983) showed an inverse relationship between minimum combustion temperatures observed during sampling and both PCDF and PCDD emissions. Obviously, with a complex combustion facility, this could only occur when all other

combustion parameters, such as excess air and degree of air/fuel mixing, remain within the desired ranges. Another study on an incinerator in the Netherlands over a long period of time (Olie et al. 1980) reported average combustion temperatures and PCDD/PCDF emissions. The difference between average and minimum combustion temperature may be a significant factor in the different results from these two studies. It is more likely, however, that factors other than temperature, such as availability of combustion air, air/fuel mixing, gas residence time, or a complex combination of factors that were not monitored, were responsible for the variation. This comparison of contrasting results indicates the extreme importance of combustion monitoring and close control of combustion conditions. Slow operator response to temperature excursions and poor control of the air/fuel mixture may potentially result in significant increases in PCDF and PCDD emissions.

Virtually all available PCDF and PCDD emission data from municipal incinerators, where both gaseous and solid (i.e., adsorbed onto particulate fly ash) components are included in the results, are compiled from published literature and presented in Appendix A. Most data where stack fly ash only was measured, or where fly ash collected in the precipitator was measured, are not included in this compilation.

The results of some studies have been converted in order to present the data in common units. Since most of the data is reported by European researchers, the results are presented in units commonly used by the Europeans (i.e. ng/m^3 normalized to 0°C and 1 atmosphere pressure). Where data is available concerning the separation of the gaseous and solid phases, it is reported as total PCDF and PCDD emissions. Since the partition factor between the gaseous and solid phase is temperature-dependent and the sampling method significantly changes the temperature characteristics from the characteristics that occur when the emissions traverse the system, the gaseous and solid partition cannot be representative.

Some data is presented which includes analyses of the solid phase only. Since the results are averaged from a large number of samples, the data is statistically representative even though it is not ideal for predicting emissions. If these samples were taken from a system where all condensation

and adsorption had occurred prior to the sampling point, then these data are representative of total emissions. Since it is impossible to tell if this occurred in the test systems, this data is presented for comparison purposes only. All facilities tested were equipped with electrostatic precipitator air pollution control equipment for particulate collection and samples were taken downstream of the collectors.

Since the incinerator design and operation characteristics can affect the magnitude of PCDD and PCDF emissions from municipal waste combustors, it is important to identify the type of combustion system and the prevailing operating conditions during the tests. Unfortunately, this data is often lacking when emission test results are published. Therefore, much of the data is not suitable for use in predicting emissions from the BNYRRF. However, some data has been taken from incinerators similar to the one proposed for the Brooklyn Navy Yard and this data is considered the most suitable in assessing the BNYRRF emissions.

A certain amount of information has been collected concerning incinerator types and operating conditions at the facilities tested. The Chicago Northwest facility is a Martin combustion system that had been in operation about nine years when it was tested; and the Zurich-Josephstrasse combustor is also a Martin design. Both of these systems are similar in design, operation, and waste type to the proposed Brooklyn Navy Yard Facility. Both were also sampled for gaseous and solid PCDD and PCDF components and the results presented reflect total emissions.

The Como, Italy, incinerator is a relatively simple refractory-lined unit that generates a small amount of steam for in-plant use. This facility was sampled for condensable solid and liquid effluents. The Hampton, Virginia plant is a refuse-fired steam boiler that was found to be firing refuse above its efficient capacity and at relatively low temperatures during testing by the USEPA. The owners of the Hampton plant have been requested by USEPA to revise their operating conditions in order to reduce the PCDF and PCDD emissions, and the facility is due to be re-tested. Clearly, the emissions from this incinerator are not representative of normal emissions under generally acceptable operating conditions. However,

this facility was sampled for both particulate and gaseous forms of PCDFs and PCDDs, and the data reflects total emissions. The two plants in Milan, Italy, are resource recovery steam plants with Volund combustion systems. The Eskjo, Sweden, plant is a refuse-fired fluidized-bed boiler operating at 700°C and two seconds gas retention time. Both gaseous and condensable forms of PCDFs and PCDDs were measured at these Italian plants and at the Sweden plant. The Zaanstad, Netherlands plant is a simple refractory-lined furnace. The effluent was sampled and analyzed for solid PCDD and PCDF forms only. Of these systems the Chicago Northwest facility and the Zurich-Josefstrasse facility are the closest in design and operation to the BNYRRF. In addition, these facilities were sampled using methodology which includes gaseous and solid forms of PCDFs and PCDDs. Of note, the emissions from these facilities are among the lowest of all those tested. The highest values were obtained from incinerators about which absolutely no information was presented regarding furnace combustion conditions during testing.

3.4 Factors Affecting Rates of Dioxin Emissions from Incinerators

From Section 3.2 it is clear that a complex set of circumstances influence the rate of PCDF and PCDD materials in incinerator effluents. The results of the laboratory studies indicate that the primary method of achieving minimum emissions is a maximization of combustion efficiency. That is, with combustion temperatures of about 900°C, the air/fuel mixture must be just slightly oxygen-rich, the mixture must be homogeneous (no stratification), and the gas residence time at the average combustion temperature must be at least one second. These conditions are not extreme; they are attainable with fully developed and tested technology. This is demonstrated by the emission data obtained from the Chicago Northwest facility (Redford et al., 1981) and the Zurich-Josefstrasse facility (SFOEP, 1982).

The system central to these facilities, the Martin stoker-grate, has been developed over many years with the goal of promoting optimum combustion efficiency.

In contrast, many other incinerators were designed with the primary goal of reducing waste volume. It is cheaper and easier to design and build

an incinerator that effectively reduces waste volume without providing a high combustion efficiency. These facilities do not have the high-velocity secondary air nozzles to provide air/fuel mixing, or the larger dimensions to provide long gas residence times, or the sophisticated control systems necessary to keep conditions from exceeding their desired ranges. Two relatively simple incinerators without resource recovery are the Como, Italy and the Zaanstad, Netherlands facility. Emissions from these plants are one to two orders of magnitude greater than the Chicago, Northwest facility.

However, a resource recovery design in itself does not assure that PCDF and PCDD emissions will be minimal. Three systems that were designed for resource recovery emitted relatively high PCDF and PCDD emissions. These are the two plants in Milan, Italy (Cavallaro et al. 1980) with Volund steam generation systems and the Hampton, Virginia refuse-fired steam boiler (Tiernan et al. 1983). Emissions from these systems are two to three orders of magnitude higher than the Chicago, Northwest facility emissions. Six Italian plants were tested but the types of incinerators were not described (Cavallaro et al. 1982). The concentrations of PCDF and PCDD ranged several orders of magnitude from moderate ($10\text{-}20 \text{ ng/Nm}^3 \text{ TCDD}$) to very high levels ($38,635 \text{ ng/Nm}^3 \text{ HCDD}$).

The extreme range of emissions shown in these studies demonstrates that the factors influencing PCDF and PCDD emissions are complex. Although design can play a significant role in the magnitude of emissions, it is not probable that design alone can assure low emissions. The most probable cause of the wide range of emissions is fluctuations in operating conditions from plant to plant and from day to day. This shows that the most important factors of any incinerator operating plan are the operating procedures, knowledgeable operating personnel, and well-maintained equipment. It is encouraging that a design similar to the BNYRRF proposal, the Chicago, Northwest facility, has the lowest PCDF and PCDD emissions of all those tested, and that it was tested after nine years of operation. This clearly demonstrates that an effective design can be combined with good operations to minimize PCDF and PCDD emissions.

3.5 Brooklyn Navy Yard Facility Design

The proposed 3,000 ton per day (tpd) Brooklyn Navy Yard resource recovery facility is to be developed under a full-service contractual arrangement, including 20 years of commercial operation by the contractor. The proposed processing system will include four 750 tpd combustion units, and each unit will consist of an individual combustion chamber, boiler, air pollution control device, and ash-handling equipment. The four units will share one 500-foot stack equipped with four flues.

The proposed facility will incorporate the Martin stoker system, a mass-burn technology similar to that currently employed at three facilities in the United States and many more throughout the world, including comparably-sized units in Europe and Japan. The U.S. facilities which are currently in operation are the Northwest Waste-to-Energy Facility in Chicago, the City of Harrisburg, Pennsylvania's, Resource Recovery Facility, and the Pinnellas County, Florida Resource Recovery Facility. The Florida facility is currently being enlarged to 3,000 tpd capacity. All three facilities incorporate a furnace stoker mechanism (a critical component in mass-burning) which is the same as that proposed for the Brooklyn Navy Yard operation.

Combustion controls are an inherent part of the facility design. Certain design features of this system optimize combustion efficiency in order to maximize steam output, while minimizing pollutant formation. Underfire air jets and the reverse-reciprocating action of the Martin stoker-grate agitate the fuel bed continuously in a manner to cause refuse burning from the bottom of the refuse bed, thus resulting in an effective burnout rate. The grate is inclined downward, toward the discharge end, and consists of both fixed and moving rows of grate bars. The moving grate pushes upward against the natural gravitational movement of the refuse at 30 to 50 strokes per hour. This movement agitates the burning refuse in an attempt to form an even depth of fuel bed. Burning refuse is pushed back underneath the freshly fed refuse to achieve continuous drying, volatilization, ignition, and combustion.

The occurrence of hot-spots, which can generate excessive nitrogen oxides, and starved air spots, which can generate excessive carbon monoxide, is minimized by the action of the stoker-grate. In the combustion chamber, all smoldering and unburned gases from the discharge end are led back under the rear arch directly into the high-temperature combustion zone. This increases the residence time and enhances combustion of suspended combustible matter. At the furnace throat, where the high-intensity combustion takes place, closely spaced high-pressure overfire air jets on the front and rear furnace walls cause intense flame turbulence and prevent stratification of unburned gases, thus increasing the likelihood of complete combustion before passage into the boiler.

Continuous monitoring instrumentation for oxygen, carbon monoxide, and temperature of the furnace gases will be provided for instantaneous measurements. These instruments will supply information on the state of the combustion process and will give the operators the knowledge necessary to control the combustion for the most efficient operation.

In addition, natural gas auxiliary burners will be located at the point where secondary air will be injected, to maintain a minimum secondary combustion temperature at 980° C, even during startup and shutdown. This is a new application for auxiliary burners. Resource recovery plants in the past have not used auxiliary burners in this manner. The auxiliary burners will enable the plant to maintain residence time at design temperature even when burning wet solid waste. Combustion controls based upon temperature and flue gas composition will be used to operate the plant. Although not fully designed yet, these operating controls will probably include a combination of automatic and manual functions during operations. The selection of an efficient mass-burn technology with thermal combustion controls is consistent with current state-of-the-art technology.

The post-combustion particulate control equipment chosen for this facility is a high-efficiency (greater than 99.5 percent) fabric filter, designed to meet an outlet particulate emission loading of 0.015 gr/dscf at 12% CO₂. This particulate emission rate is well below the Federal New Source Performance Standard (40 CFR 60.52) and the New York State emission limitation (Part 222).

3.6 Predicted Emissions From Brooklyn Navy Yard Facility

In order to generate representative emissions for the BNYRRF, a set of data were developed from the available literature. In selecting the test data, the objective was to find similarity in design, operations, and waste type. Furthermore, test data obtained using sampling methods that are compatible with methods approved by USEPA for sampling organics in flue gases were considered desirable. Unfortunately, there are no test data which meet all these criteria. For example, there are no data on any incinerators which use auxiliary burners for secondary combustion control or fabric filters for particulate emission control.

The auxiliary burners are essentially a backup system for situations where the secondary combustion temperature falls below the design level. Therefore, no emissions data correction is required in order to account for the use of auxiliary burners. The use of fabric filters, on the other hand, requires some additional calculations from the test data in order to present a realistic picture of emissions, since fabric filters collect more particulate matter than the more commonly used electrostatic precipitators.

If the PCDF and PCDD materials are adsorbed onto particulate matter, more of these materials will be trapped in the fabric filter than in a comparably sized electrostatic precipitator. By utilizing particle-size data and an assumption that PCDF and PCDD materials are adsorbed onto fly ash in proportion to the available particle surface area, calculations are made concerning the amounts collected and emitted. Since the partition between gas and solid forms is not known, emissions are calculated in two ways: (1) assuming all PCDF and PCDD materials observed at the test facilities are gaseous, and (2) assuming all PCDF and PCDD emissions observed at the test facilities are particulate. If the emissions contain both gaseous and particulate PCDFs and PCDDs, then the emission rates will fall between these values.

After examining all PCDF and PCDD emission data available in the literature, the emission data selected as the most representative of the BNYRRF are the data from the Chicago, Northwest facility and the Zurich-Josef-

strasse facility. Both of these facilities use a furnace design similar to that proposed for the BNYRRF. The Chicago Northwest facility is located in an environment similar to that of the Brooklyn Navy Yard, i.e., a large U.S. metropolitan area; therefore, the waste is more likely to be similar to New York City waste than is the European. Furthermore, the sampling of the Chicago, Northwest facility was performed under sponsorship of the USEPA, using sampling methods designed to capture both gaseous and particulate forms of PCDFs and PCDDs. In addition, stringent quality assurance controls were used in order to assure representativeness. The Zurich-Josefstrasse facility was tested by the Swiss counterpart to the USEPA. The sampling method included both gaseous and particulate PCDFs and PCDDs in the sample, although the method is different from the USEPA method. Sampling of both gaseous and solid forms of PCDFs and PCDDs is important to ensure that the emission data are complete. Therefore, the Chicago Northwest data is the first choice, while the Zurich-Josephstrasse data is the second choice. It would be desirable to obtain test data from more facilities; however, the specific type of data necessary for an assessment of this type is scarce.

The referenced emission data (Redford et al. 1981) includes tri-CDF and tri-CDD emissions (which were not analyzed by any other researcher), but does not include penta-CDF or penta-CDD emissions. In order to complete the PCDF and PCDD emission data, the Chicago Northwest data is supplemented by the Zurich-Josefstrasse data for penta-CDF and penta-CDD emissions. It should be noted that these emissions were obtained from resource recovery facilities that use electrostatic precipitators for fly ash collection. Therefore, this data is conservative in comparison to the BNYRRF with a fabric filter for particulate control, unless the PCDF and PCDD emissions measured at the facilities with electrostatic precipitators were entirely gaseous, in which case they would pass through the BNYRRF's fabric filter without being collected. The fabric filter, however, will emit less than half the weight of fly ash emitted by a precipitator comparable in efficiency to those used on facilities mentioned above. Therefore, unless the PCDF and PCDD emission concentrations from the referenced test facilities are all gaseous, the PCDF and PCDD emission concentrations from the BNYRRF would be less than those observed at the test facilities.

These emissions, corrected for the size of the BNYRRF, are shown in Table 3-2 as concentrations in the flue gas and as mass rates per unit time. In order to arrive at these latter values, the projected flue gas emission rate of $9,990 \text{ Nm}^3/\text{min}$ provided the quantification of carrier gas flow. This value was calculated from values presented in the Preliminary Draft Environmental Impact Statement (PDEIS) previously submitted to the New York City Department of Environmental Protection (NYCDEP). The emissions presented in Table 3-2 assume no more PCDF and PCDD collection in a fabric filter than that observed in an electrostatic precipitator.

The evidence shows that the conditions assumed for Table 3-2, (i.e., that all PCDF and PCDD emissions are gaseous) are not realistic. This was shown by Lustenhouwer et al. (1980); Eiceman et al. (1979); Karasek et al. (1983); Olie et al. (1980); and others when they sampled fly ash emissions and/or fly ash from electrostatic precipitators at incinerators, and extracted PCDFs and PCDDs from the fly ash particles up to several hundred nanograms per gram. These tests did not attempt to collect gaseous and condensible materials; therefore, at least some portion if not all of the PCDFs and PCDDs leaving an incinerator stack will be adsorbed on fly ash. A more realistic scenario than the assumption that all PCDDs and PCDFs are gaseous is that some PCDF and PCDD materials are adsorbed on fly ash and some are gaseous or adsorbed on ultra-fine particulates.

PCDF and PCDD compounds are volatile at temperatures well above ambient, but lower than those at which they would be destroyed. Once the compounds are cooled, they condense and, if particles are available, condense onto the particle surfaces (CARB, 1984; Kemp; 1983; ASME, 1981). The materials would then be relatively stable compared to the volatility and adsorption/desorption reactions occurring at elevated temperatures. One study (CARB, 1984) proposes that the finer particles, which have the greatest surface area, must be controlled as much as possible in order to minimize PCDF and PCDD emissions. This study also draws the parallel of heavy metals adsorption onto the fine particles and states that PCDF and PCDD materials behave similarly.

TABLE 3-2

PREDICTED PCDF AND PCDD EMISSIONS FROM BNYRRF
(Assuming all PCDDs and PCDFs emitted
are in gaseous form)

	Concentration in Flue Gas (ng/Nm ³)(c)	Mass Emission Rate (ug/sec)
Tri-CDF	307.4(a)	51.18
Tetra-CDF	92.2(a)	15.35
Penta-CDF	26.6(b)	4.43
Hexa-CDF	63.5(a)	10.58
Hepta-CDF	7.7(a)	1.28
<u>Octa-CDF</u>	<u>0.6(a)</u>	<u>0.10</u>
Total-CDF	498.0	82.92
Tri-CDD	13.3(a)	2.22
Tetra-CDD	6.5(a)	1.07
Penta-CDD	10.7(b)	1.79
Hexa-CDD	16.4(a)	2.73
Hepta-CDD	7.8(a)	1.30
<u>Octa-CDD</u>	<u>2.6(a)</u>	<u>0.43</u>
Total-CDD	57.3	9.54
2,3,7,8 Tetra-CDD	0.42	0.07

NOTES:

Nm³ = Normalized cubic meters, 0°C and 1 atm pressure.

Flue gas flow rate = 166.5 Nm³/sec

(a) Calculated from data published by Redford et al. 1981.

(b) Calculated from data published by SFOEP, 1982.

(c) Corrected to flue gas conditions projected for BNYRRF; i.e. 10.5% CO₂ (dry basis) and 13.63% H₂O.

This suggests that the PCDF and PCDD compounds are adsorbed on fly ash before entering the pollution control device. Since there is a design temperature difference between the pollution control device and the stack of the BNYRRF of only ten degrees, it is unlikely that condensation occurs in the stack. Therefore, if PCDF and PCDD materials are adsorbed before entering the pollution control device, some portion of these materials will be trapped in the fabric filter because the fabric filter is more efficient at collecting fly ash than the electrostatic precipitator.

There are a number of researchers who have reported higher concentrations of PCDDs and PCDFs emitted on fly ash from incinerator stacks than on fly ash collected in electrostatic precipitator hoppers. The increase in concentration has been reported to be from 2 to 12 times, depending upon the study, with 5 to 10 times being the most common range. Lustenhouwer et al. (1980) reports that stack fly ash emissions are significantly more concentrated than collected fly ash. Data presented in this study shows an average of 4.5 times more PCDF and PCDD on stack fly ash than on precipitator ash. Taylor et al. (1983) reports data from one test at the Hampton, Virginia municipal incinerator with an average of six times more PCDD and PCDF on stack fly ash than on precipitator ash. Ballschmitter (reported by Kemp 1983, CARB 1984, and Hutzinger 1984) reports that concentrations of TCDD on fly ash leaving an electrostatic precipitator in Hamburg, West Germany were 300 ng/g, while TCDD concentration on fly ash collected in the precipitator hoppers was 25 ng/g, representing a factor of 12.

Trace metals also behave in this manner, by increasing concentrations as particle size decreases. This has been reported by CARB (1984) as being analogous to the PCDF and PCDD behavior on incinerator fly ash. Trace metal concentration distributions on fine particles have been documented for incinerator emissions (Law and Gordon 1979) and for coal ash (Natusch et al 1974). Depending upon the volatile metal involved, the concentrations on incinerator-emitted ash can be one to ten times the concentration on fly ash trapped in the precipitator hoppers.

One researcher is known to have performed a study of PCDF and PCDD concentrations on incinerator ash as a function of particle size. Karasek

et al. (1982) obtained sieved fractions of fly ash from electrostatic precipitators (not stack fly ash) at two incinerators. Analyses were performed for PCDDs on each fraction. These particles are larger than the airborne fractions emitted from the stack. Results from a French incinerator showed a clear trend of increasing concentration with decreasing particle size. Concentrations increased by three times for every particle size reduction of one-half. The incinerator on which these tests were performed is reported to be the Paris-Ivry facility, which is a Martin plant (Miller 1984). The other incinerator ash analyzed by Karasek did not show a clear trend between PCDD concentrations and particle size.

Other researchers (Tiernan et al. 1982) report that TCDD concentrations in the emissions of 3 μ m and 10 μ m particulate fractions from the Hempstead, L.I. plant were two and one-half times higher than TCDD concentrations in the 1 μ m and smaller fractions. However, this was a refuse derived-fuel (RDF) boiler plant, and not a mass-burn incineration plant. In addition, the process included the application of a chlorinated biocide to the waste to retard putrefaction. These factors alone indicate that particle structure and PCDF/PCDD emissions may be significantly different from that associated with a mass-burn plant. Furthermore, the plant was found to be emitting much more TCDD than was considered safe for nearby residents and was shut down pending reconstruction as a mass-burn plant. Barnes (1983) postulates that the carbon composition and the specific morphology of the particle in question has a significant effect on the adhesion qualities of PCDDs and PCDFs on particles. The differences in the process between the RDF and the mass-burn plants, as well as the extremely high emission rates of TCDD and other organic components, indicating poor combustion controls, suggests that the Hempstead, L.I. data may not be suitable for comparison to the BNYRRF.

For every increase in particle diameter by a factor of two, there is a commensurate increase in the particle surface area by a factor of four and an increase in weight by a factor of eight. If PCDF and PCDD are related to available particle surface area, as suggested by CARB (1984) and Kemp (1983), then a second particle twice as large as the first would have four times as much PCDF and PCDD, but it would also have eight times as much

weight. Since the concentration is on a weight basis, the second particle would have four-eighths or one-half the concentration of the first.

Due to the similarity of the Paris-Ivry facility to the BNYRRF, the trend of increasing concentration with decreasing particle size is believed to be representative of conditions at the BNYRRF. This is further supported by the CARB study and the numerous studies that show higher concentrations in stack fly ash than in precipitator fly ash on currently operating mass-burn plants (Lustenhouwer et al. 1980; Taylor et al. 1983; Kemp 1983).

In order to predict the effect of the fabric filter on PCDF and PCDD emissions, the best approach available at this time is to calculate concentrations as a function of surface area. This shows a concentration increase factor of two for every size reduction of one-half (given the same weight of particles in each size category). Since this fits the general trend reported by researchers in this field, this approach has been taken in this assessment. Furthermore, it is assumed that all PCDDs and PCDFs are adsorbed on particulates and that there are no gaseous emissions. However, in actuality, it is likely that some portion of PCDFs and PCDDs will be in gaseous form.

In order to calculate the amount of adsorbed PCDF and PCDD materials that would be collected in a fabric filter, over and above that which would be collected in an electrostatic precipitator, relationships between particle size and PCDF/PCDD concentrations were developed. The following assumptions were made: (1) that all PCDF and PCDD compounds (observed by the Redford Study) are adsorbed on fly ash, and (2) that PCDF and PCDD materials on fly ash are distributed in proportion to the percent of total particle surface area available in each particle size category, and (3) additional fly ash collected by the fabric filter (over and above that which would have been collected by an electrostatic precipitator) has the same PCDF and PCDD concentration as calculated in (2) above.

Table 3-3 shows a particle size distribution of stack-emitted particulates from the Braintree Municipal Incinerator, which is a mass-burn resource recovery facility with an electrostatic precipitator. Also shown in Table 3-3 is the proportion of total particle surface area available for

TABLE 3-3
PARTICLE SIZE DISTRIBUTION
RESOURCE RECOVERY STACK EMISSIONS
(Electrostatic Precipitator Outlet)

<u>Geometric Mean Particle Diameter (um)</u>	<u>Percent of Total Weight (%)</u>	<u>Percent of Total Surface Area (%)</u>
15.0	12.8	1.5
12.5	10.5	1.5
8.1	10.4	2.2
5.5	7.3	2.3
3.6	10.3	5.0
2.0	10.5	9.2
1.1	8.2	12.9
0.7	7.6	16.6
LT 0.7	22.4	48.8

LT - Less than

Average of six test runs at resource recovery plant electrostatic precipitator outlet.

Actual test data from Braintree Municipal Incinerator, Braintree, MA. This is a mass-burn incinerator producing steam for industrial use. The incinerator has an electrostatic precipitator for fly ash control.

Ref: Golembewski et al. 1980

each particle size category, assuming spherical particles. This electrostatic precipitator has a lower particulate collection efficiency (75-90 percent) than an electrostatic precipitator that would be designed today (99+ percent). However, the basic performance characteristics still apply, i.e., high collection efficiency in the large particle size ranges and low collection efficiency in the small particle sizes. Since only the fraction representing the individual particle sizes emitted from the electrostatic precipitator is used in this analysis, and not the overall emission rate, the difference in efficiency between the Braintree facility and a more efficient unit would not significantly affect the analysis presented here. The particle size distribution would be shifted to a smaller size in a modern unit, meaning that the PCDDs and PCDFs would be concentrated in even smaller particles than those presented. Since the fabric filter is very efficient in the smaller particle size categories, the PCDD and PCDF emissions would then be even lower than presented. The particle size distribution data from Table 3-3 is combined with the Chicago Northwest and the Zurich-Josefstrasse PCDF and PCDD test data (Table 3-2) to predict how the PCDFs and PCDDs are concentrated within the individual size categories.

Under assumption (2) described above the controlling factor in the PCDF and PCDD concentration on fly ash particles is the available surface area. For example, 12.8 percent of the emitted fly ash weight and 1.5 percent of the particle surface area is comprised of the 15 μ m particles. From assumptions (1) and (2) above, 1.5 percent of the PCDD emitted from the stack is adsorbed on these particles. Similarly, 22.4 percent of the weight and 48.8 percent of the surface area of fly ash is comprised of particles less than 0.7 μ m. Assuming a 7.94 g/sec fly ash emission rate from the BNYRRF if an electrostatic precipitator were used (from PDEIS submitted previously), then for 15 μ m particles the PCDD concentrations are calculated as follows: the emitted PCDD, 0.015 times 9,540 ng/sec (Table 3-2), is divided by the weight of total fly ash in that size category, 7.94 g/sec times 0.128, to yield a concentration of 141 ng PCDD per g of fly ash. Similarly, for particles less than 0.7 μ m, 0.488 times 9,540 ng/sec, divided by 7.94 g/sec times 0.224, yields 2,618 ng PCDD per g fly ash. The results of these calculations are shown in Table 3-4.

For the case of a fabric filter instead of an electrostatic precipitator, the concentrations calculated above were used to compute emission

TABLE 3-4

CALCULATED CONCENTRATION OF PCDF AND PCDD IN FLY ASH EMISSIONS
FUNCTION OF PARTICLE SIZE (ng/g)

<u>Mean Particle Diameter</u> <u>(μm)</u>	<u>PCDD Concentration</u> <u>(ng/g)</u>	<u>PCDF Concentration</u> <u>(ng/g)</u>
15.0	141	1,224
12.5	172	1,492
8.1	254	2,209
5.5	379	3,291
3.5	583	5,070
2.0	1,053	9,150
1.1	1,890	16,429
0.7	2,624	22,812
LT 0.7	2,618	22,751

LT - Less than

Concentrations calculated from emission data in Table 3-2 and particle data in Table 3-3

rates of PCDD and PCDF from the BNYRRF. Particle size distribution by weight and a total fly ash emission rate was provided by the selected contractor (Signal-Resco). The total fly ash emission rate is 3.97 g/sec, while particle size distribution is shown in Table 3-5, first two columns. For 15 μ m particles the fly ash emission rate is 24 percent of 3.97 g/sec or 0.953 g/sec; the PCDD concentration on 15 μ m particles is 141 ng/g as calculated above and shown in Table 3-4. The PCDD emission rate for 15 μ m particle, therefore, is 141 ng/g times 0.953 g/sec., or 134 ng/sec. Similarly, for particles less than 0.7 μ m, 15 percent of 3.97 g/sec, or 0.596 g/sec, times 2,618 ng/g yields a PCDD emission rate of 1,560 ng/sec. The PCDD and PCDF emission rates are presented in the last two columns of Table 3-5; the total emission rates are 4,463 ng/sec PCDD and 38,791 ng/sec PCDF. These rates are slightly less than half the rates calculated for a similar resource recovery system with electrostatic precipitators (Table 3-2). Assuming the ratios between groups of isomers with the same number of chlorine substitutes, shown in Table 3-2, remains unchanged following collection by the fabric filter, the emissions of isomer groups from the fabric filter outlet would be as presented in Table 3-6.

3.7 Assessment of Predicted Emissions

From the data presented in Section 3.2.2 and Section 3.3, it is clear that PCDFs and PCDDs can be destroyed in a municipal combustion system. It is also clear that the most important consideration is not the source of the PCDFs and PCDDs but rather the creation of combustion conditions favorable for maximum destruction. These conditions apparently occur at the incinerators in Chicago and Zurich, both of which were tested and found to emit low levels of PCDF and PCDD. These systems include the same basic design as the proposed BNYRRF. In addition, the BNYRRF has further design improvements for the purpose of achieving lower emissions.

Combustion temperature of 650°C reported for the Chicago Northwest data is significantly lower than the design temperature of 980°C for the BNYRRF. The relationship between combustion temperature and PCDD emissions (Benfenati et al. 1983), determined through long-term testing on an incinerator in Italy, suggests that an 80 percent reduction in PCDD emissions on that

TABLE 3-5

PREDICTED PCDF/PCDD EMISSION RATES FROM BNYRRF
FUNCTION OF PARTICLE SIZE
(Outlet of Fabric Filter)

<u>Mean Particle Diameter (um)</u>	<u>Weight^(a) Percent %</u>	<u>Fly Ash Emission (g/sec)</u>	<u>PCDD Emission (ng/sec)</u>	<u>PCDF Emission (ng/sec)</u>
15.0	24	0.953	134	1,166
12.5	11	0.437	75	652
8.1	7	0.278	71	614
5.5	5	0.199	75	655
3.5	7	0.278	162	1,409
2.0	7	0.278	293	2,544
1.1	14	0.556	1,051	9,135
0.7	10	0.397	1,042	9,056
LT 0.7	<u>15</u>	<u>0.596</u>	<u>1,560</u>	<u>13,560</u>
TOTAL	100	3.972	4,463	38,791

LT - Less than

(a) Weight percent fractions for particle sizes were calculated from data contained in personal communication from Mr. Andrew Szurgot, Signal-Resco to Ms. Susan Raila, Department of Sanitation, May 23, 1984.

TABLE 3-6

PREDICTED PCDF AND PCDD EMISSIONS FROM BNYRRF
(Assuming that all PCDFs and PCDDs
emitted are on particulate)

	<u>Fraction</u>	<u>Concentration on Fly Ash (ng/g)</u>	<u>Mass Emission Rate (ug/sec)</u>
Tri-CDF	.6173	6,029	23.946
Tetra-CDF	.1851	1,808	7.180
Penta-CDF	.0534	521	2.071
Hexa-CDF	.1275	1,245	4.946
Hepta-CDF	.0155	151	0.601
<u>Octa-CDF</u>	<u>.0012</u>	<u>12</u>	<u>0.047</u>
Total CDF	1.0000	9,766	38.791
Tri-CDD	.2321	261	1.036
Tetra-CDD	.1135	127	0.507
Penta-CDD	.1867	210	0.833
Hexa-CDD	.2862	322	1.277
Hepta-CDD	.1361	153	0.607
<u>Octa-CDD</u>	<u>.0454</u>	<u>51</u>	<u>0.203</u>
Total CDD	1.0000	1,124	4.463
2,3,7,8 Tetra-CDD	0.0073	8	.0326

This data assumes that all PCDF and PCDD emissions observed by Redford et al. 1981 were adsorbed on fly ash. The use of more efficient fabric filter would reduce PCDF and PCDD emissions from those levels.

incinerator would be achieved by raising the minimum combustion temperature from 650°C to 980°C. If this trend could be applied to both the Chicago, Northwest facility and the BNYRRF, then the emission data developed for the BNYRRF, which was based on the Chicago Northwest data, may be conservative. However, the location and accuracy of the temperature sensor at Chicago may be responsible for the difference. Whether the 650° C measurement at Chicago and the 980° C projection for BNYRRF are comparable or not, the use of auxiliary burners to ensure a minimum combustion temperature of 980°C at the secondary combustion zone at all times is a step aimed at assuring that emissions from BNYRRF will be at least as low as those from the Chicago Northwest facility.

Another positive step to minimize PCDF and PCDD emissions is the use of a fabric filter to collect ultra-fine fly ash particles. Since it is evident that these materials are more heavily concentrated in the sub-micron, or respirable size range, the use of a collector that is much more efficient in capturing particles in this range will further minimize PCDF and PCDD emissions.

In order to show the effects of the fabric filter, emissions are presented in two ways: (1) assuming all PCDFs and PCDDs observed from the test facilities pass through the collector in gaseous form and is emitted to the atmosphere, and (2) assuming that all PCDF and PCDD are adsorbed on fly ash particles, and therefore the emissions are reduced by the amount of fly ash and PCDD/PCDF collected in the fabric filter unit. As described above, it is apparent from test data that a portion of PCDF and PCDD emissions from incinerators are adsorbed onto fly ash. These two emission predictions will provide a range of estimates between a scenario where no more emissions are collected in the fabric filter in excess of the amount that would be collected in an electrostatic precipitator and a scenario where the fabric filter effectively reduces PCDF and PCDD emissions.

Another method of assessing the predicted emissions from the BNYRRF is a comparison of the concentrations of PCDF and PCDD on fly ash particles. Most of the data available from other incinerator systems consists of concentrations on particles collected in electrostatic precipitators. As

described above, the concentrations on particles emitted from the stack are typically five to ten times those found on particles collected in electrostatic precipitators.

A compilation of PCDF and PCDD concentrations in fly ash is shown in Table 3-7, along with predicted concentrations from the BNYRRF. When the concentrations from the electrostatic precipitators are multiplied by five to ten times, the resulting estimated PCDF stack concentrations from the low and medium categories representing the 25 plants (Lustenhouwer, Olie, and Hutzinger 1980) compare favorably with the BNYRRF emission concentrations. This same comparison for PCDD, however, results in estimated stack concentrations that are five to ten times higher than the predicted BNYRRF concentrations. However, the PCDD data from the Buser study and the Karasek study (a Martin plant) compare favorably with the BNYRRF. Therefore, the predicted emissions from the BNYRRF appear to be in the same range as other comparable incinerators.

3.8 Summary

In summary, PCDF and PCDD emissions in incinerator effluents can originate from a number of sources and/or chemical reactions, such as being a part of raw refuse, being formed from precursors, and being formed from degradation products of materials commonly found in solid waste.

Whatever the cause of formation or occurrence, the combustion conditions necessary for destruction include a minimum of one to two seconds of gas residence time at a minimum combustion temperature of 900-1,000°C, very turbulent conditions in the high-temperature zone, and an air/fuel mixture with a slight excess of oxygen.

The incinerator design selected for the BNYRRF appears to fulfill the requirements for efficient combustion and maximum destruction of PCDFs and PCDDs. Furthermore, the use of auxiliary burners will assure that the minimum combustion temperature is consistently maintained. In addition, a more efficient fly ash pollution control device than is generally used on incinerators has been selected. Since at least some of the PCDF and PCDD

TABLE 3-7

CONCENTRATION OF PCDF AND PCDD IN FLY ASH
FROM DATA IN AVAILABLE LITERATURE (ng/g)

	Boiler Passage (a)	Electrostatic Precipitator Fly Ash (a)	Electrostatic Precipitator Fly Ash (b)			Stack Flue Gas Fly Ash (b)	Electrostatic Precipitator Fly Ash (c)	Electrostatic Precipitator Fly Ash (d)	Predicted Stack Flue Gas BNYRRF
			Low	Med.	High				
Tri-CDF	--	--	--	--	--	--	--	--	6029
Tetra-CDF	ND	1	13	111	223	460	170	--	1808
Penta-CDF	ND	4	42	196	510	960	--	--	521
Hexa-CDF	ND	30	109	361	870	1600	315	--	1245
Hepta-CDF	ND	40	89	177	407	1130	--	--	151
Octa-CDF	ND	10	20	18	26	140	48	--	12
Tri-CDD	--	--	--	--	--	--	--	--	261
Tetra-CDD	ND	2	5	54	110	100	126	ND	127
Penta-CDD	ND	8	31	182	488	800	--	8	210
Hexa-CDD	ND	30	80	326	1200	1370	443	28	322
Hepta-CDD	ND	60	190	288	902	1370	--	75	153
Octa-CDD	6	120	266	106	110	310	389	180	51

ND - Not detected (no detection limit reported)

Note: All data presented includes only solid particulate analysis; gaseous portion not included.

- Ref. (a) Buser and Bosshardt 1978; simultaneous tests on boiler passage and stack
 (b) Lustenhouwer et al. 1980; representing 80 analyses at 25 plants
 (c) Olie et al. 1982; average of nine Dutch incinerators
 (d) Karasek et al. 1982; average of three samples from a French Martin plan

materials will be adsorbed on particulate, less of these materials will be emitted and the exposure to the public will be less than if the less efficient electrostatic precipitator had been selected. However, the exact portion of PCDFs and PCDDs in the environment which can be attributed to any single source or process is impossible to determine.

Emission test data from a number of incinerators has demonstrated a wide range of PCDF and PCDD emissions spanning several orders of magnitude. High levels of emissions have been observed from several types of incinerators, indicating that operational factors have as much or more effect on PCDF and PCDD emissions than incinerator design. However, the lowest emissions were observed from incinerators with the same basic design as the BNYRRF. This is an encouraging point and may mean that effective operation and maintenance is easier on these units. The BNYRRF has also been designed with additional control features not found on the incinerators tested with even the lowest emissions.

The predicted PCDF and PCDD emissions from the BNYRRF are presented in Table 3-8. These emissions are presented in two ways as described in Section 3.6: (1) as if all PCDF and PCDD materials observed in previous tests were gaseous in nature and pass through the fabric filter without collection, and (2) as if all PCDF and PCDD materials observed in previous tests were adsorbed onto fly ash, part of which was subsequently assumed to be trapped in the fabric filter. The second case above is believed to be the most likely alternative. Given the uncertainty about the partitioning between gaseous and particulate PCDDs and PCDFs, it is not advisable to choose an amount of gaseous and particulate emissions, even though some data on this is presented in the literature. Obviously, the actual emissions from the BNYRRF could fall between these values if there is indeed a portion that is gaseous and a portion that is particulate in nature. Both cases are used in the following chapters to develop an exposure assessment and risk assessment.

TABLE 3-8

SUMMARY OF PREDICTED PCDF AND PCDD EMISSIONS
BROOKLYN NAVY YARD RESOURCE RECOVERY FACILITY
(Outlet of Fabric Filter)

	Case 1 All Gaseous Emissions (ug/sec)	Case 2 All Particulate Emissions (ug/sec)
Tri-CDF	51.18	23.95
Tetra-CDF	15.35	7.18
Penta-CDF	4.43	2.07
Hexa-CDF	10.58	4.94
Hepta-CDF	1.28	0.60
Octa-CDF	<u>0.10</u>	<u>0.05</u>
Total-CDF	82.92	38.79
Tri-CDD	2.22	1.03
Tetra-CDD	1.07	0.51
Penta-CDF	1.79	0.83
Hexa-CDD	2.73	1.28
Hepta-CDD	1.30	0.61
Octa-CDD	<u>0.43</u>	<u>0.20</u>
Total-CDD	9.54	4.46

2,3,7,8 Tetra-CDD

Case 1 - assumes all PCDF and PCDD materials are gaseous, therefore no additional collection occurs in fabric filter above that collected by an electrostatic precipitator.

Case 2 - assumes all PCDF and PCDD materials are adsorbed on particulates, therefore additional fly ash collection in fabric filter reduces PCDF and PCDD emission.

The emission rates may vary between these values if there are gaseous and particulate fractions of PCDF and PCDD emissions.

4. Exposure Assessment for Emissions from the Proposed Brooklyn Navy Yard Resource Recovery Facility

4.1 Introduction

4.1.1 Purpose. In order to assess the impact of the emissions from the proposed BNYRRF on the general population, computer modeling was performed on the emission data in Chapter 3 to predict downwind concentrations of PCDFs and PCDDs in the ambient air, soil, dust and dirt. The predictions of ambient air concentrations of PCDFs and PCDDs quantifies potential population exposure through the inhalation pathway, while the deposition analysis provides a quantification of potential human exposure through the ingestion of contaminated dirt and dust, as well as through the dermal contact with these materials. This chapter provides discussions of these analyses and presents the results for use in the risk assessment in Chapter 5.

4.1.2 Approach. As discussed in Chapter 3, it is not known what fraction of the PCDF and PCDD emissions will be in gaseous form and what fraction will be adsorbed on fly ash. For that reason, the emissions from the BNYRRF were predicted in Chapter 3 according to two scenarios which define the limits of each of these possibilities: in the first scenario, emissions were calculated as if all PCDFs and PCDDs were gaseous and, in the second, as if all were adsorbed on particulates. The exposure assessment follows this same approach, designed to define the two scenarios of exposure possibilities. Exposures are calculated as if all PCDFs and PCDDs in the emissions are gaseous and as if all are adsorbed on particulates in proportion to available particle surface area.

Obviously, if all PCDFs and PCDDs are gaseous the only exposure pathway will be inhalation, while if they are all adsorbed on particulates, the pathways will include inhalation (of small respirable particles) and ingestion and dermal absorption (of deposited fly ash). If, in fact, the PCDFs and PCDDs in the emissions are partially gaseous and partially adsorbed on particulates, then the exposures will fall between the two cases presented here. Chapter 5 presents the risks projected for each of these cases.

4.2 Dispersion Model

The ambient air quality concentrations resulting from the BNYRRF were calculated using an air dispersion model that was deemed suitable by the regulatory agencies responsible for reviewing the environmental impacts of this project. The model calculated concentrations at several hundred ground-level and elevated locations. These locations are termed receptors, and the purpose in analyzing several hundred of them is to ensure that the concentrations at the areas of highest impact are calculated. Five years of meteorological data, measured at two nearby observation stations and reduced to magnetic tape, were used in the computer program to calculate impacts from the specific air pollutant source. Emissions were predicted for both conditions described above (in which all PCDFs and PCDDs are in gaseous form and in which all are adsorbed on particulate) were calculated and the highest impacts of each case are presented separately.

In conjunction with preparation of the Preliminary Draft Environmental Impact Statement (PDEIS) for the Brooklyn Navy Yard, the consultant to the New York City Department of Sanitation (NYCDOs) prepared an air quality dispersion analysis designed to assess impacts at ground-level and at elevated (building rooftop) receptors. The model selected by the consultant and the New York City Department of Environmental Protection (NYCDEP), as the most appropriate for analyzing all air quality impacts resulting from the BNYRRF stack emissions, was the Multiple Point Source Gaussian Dispersion Algorithm with Optional Terrain Adjustment (MPTER).

MPTER is a computer dispersion program developed by the USEPA Meteorological Laboratory for analyzing air quality impacts from a number of emission sources at both ground-level and elevated receptors. The terrain adjustment feature allows the program to estimate the amount of plume reflection (and subsequent concentration increase) at elevated terrain points. Elevated receptors, such as building rooftops, balconies, windows, etc., are analyzed as if they are points in space, unaffected by aerodynamic impacts from the buildings themselves.

The MPTER model has been further modified specifically for use in the urban environment. The steady-state Gaussian dispersion algorithm, which is the basis for the MPTER program, was originally used only with the Pasquill-Gifford (P-G) dispersion coefficients. Dispersion coefficients are the factors that determine the dilution rates along each trajectory evaluated in the model. Therefore, these coefficients are a key aspect to any dispersion modeling analysis. The P-G coefficients were empirically developed by ambient testing in rural terrain. These coefficients provide the amount of pollutant dispersion as a function of atmospheric conditions and downwind distance, as if the source and receptor were located in a rural area.

The modification of MPTER to MPTERU, which was undertaken by the NYCDEP, Bureau of Science and Technology, allows the user of the program the option of P-G dispersion coefficients or McElroy-Pooler (M-P) coefficients. The M-P coefficients were also empirically determined by ambient testing, but the testing was performed in an urban area (St. Louis, Missouri). The M-P coefficients are therefore considered by the NYCDEP to be more appropriate for dispersion analyses of point sources in New York City. This model is considered to be a conservative model and is used for most source-receptor analyses performed for review by the NYCDEP's, Office of Environmental Impact.

The MPTERU program with the M-P coefficients was used to determine the concentrations at all potential receptors in the area of significant impact, including ground-level receptors within 25 km of the Brooklyn Navy Yard, as well as elevated receptors in Brooklyn, Queens and Manhattan.

Meteorological data collected at LaGuardia Airport and Fort Totten was selected as the most representative data for the study area. The wind, temperature, mixing height, and sky condition data collected during the period 1975-1979 is the most recent available data in the format suitable for MPTERU, and was used to compute hour-by-hour impact concentrations at each receptor. The hourly concentrations at each receptor were then averaged for each year to arrive at the annual average concentration.

Normalized concentrations were developed by the model in order to address the various pollutants that may be emitted by the Brooklyn Navy Yard facility. Normalized concentrations (using a gram per second emission rate), were calculated for each potential receptor and each hour of meteorological data used by the program. After compiling the results, the maximum annual average ground-level and maximum annual average elevated-receptor normalized concentrations were determined. The concentration of a particular pollutant could then be determined by multiplying the normalized concentration times the emission rate of that pollutant (g/sec) to obtain the ambient concentration $\mu\text{g}/\text{m}^3$. The maximum ground-level annual average normalized concentration was $0.0238 \times 10^{-6} \text{ g}/\text{m}^3$, and occurred approximately 900 meters southeast of the stack; the maximum elevated-receptor normalized concentration was $.0240 \times 10^{-6} \text{ g}/\text{m}^3$, and occurred at the same location three stories above the maximum ground-level impact. For all the purposes of the following analyses, both ground-level and elevated receptor impacts are considered to be $0.024 \times 10^{-6} \text{ g}/\text{m}^3$ for a one g/sec emission rate.

When using this dispersion analysis impact methodology and the PCDF and PCDD emission calculations from Case 1 of Table 3-8, it is assumed that all PCDFs and PCDDs are emitted, and that they behave in the atmosphere, as a gas. Application of these emission rates to the maximum normalized concentrations results in the impact concentrations shown in Table 4-1. Since these concentrations are extremely small, the units presented are picograms per cubic meter (pg/m^3 or $10^{-12} \text{ g}/\text{m}^3$).

The second case is that in which all the PCDF and PCDD emissions are adsorbed onto fly ash particles. In this case, the emissions would be as presented in Table 3-8, Case 2, where PCDFs and PCDDs are assumed to be emitted as particulate matter. Several important differences between this case and the one described above would prevail, including:

- ° some portion of the total mass of PCDF and PCDD emissions as presented in Case 1, would be trapped by the fabric filter;
- ° some of the heavier particles would settle to and remain on the ground and would not be available for inhalation;

TABLE 4-1

PREDICTED MAXIMUM ANNUAL AVERAGE CONCENTRATIONS OF
PCDFs AND PCDDs AT GROUND-LEVEL AND ELEVATED RECEPTORS
DUE TO EMISSIONS FROM THE BROOKLYN NAVY YARD FACILITY

Case 1: All PCDF and PCDD Emissions Are Gaseous

	<u>Maximum Concentration at Ground- Level and Elevated Receptors (pg/m³)</u>
Tri-CDF	1.2283
Tetra-CDF	0.3684
Penta-CDF	0.1063
Hexa-CDF	0.2539
Hepta-CDF	0.0307
Octa-CF	<u>0.0024</u>
Total-CDF	1.9900
Tri-CDD	0.0533
Tetra-CDD	0.0257
Penta-CDD	0.0430
Hexa-CDD	0.0655
Hepta-CDD	0.0312
Octa-CDD	<u>0.0103</u>
Total-CDD	0.2290
2,3,7,8, Tetra-CDD	0.00168

pg/m³ - picograms per cubic meter (10^{-12} g/m³)

NOTE: These concentrations were calculated from mass emission rates in Table 3-8 and normalized concentrations presented in the PDEIS. These concentrations assume no chemical/biological degradation or transformation of PCDF and PCDD compounds.

- some particles that are reflected from the ground (remaining suspended in the ambient air) may not be inhalable and/or respirable because the size would exceed that which is generally accepted as possible for pulmonary deposition.

The amount of particles and PCDF/PCDD that would be deposited on the ground in this case is discussed in Section 4.3.

In order to present a conservative analysis of the inhalation exposure in this case, the particulates that deposit on the ground are also assumed to be available for inhalation. However, since the larger particle deposit and the smaller particles have the higher concentrations, this is only one to two percent of the total PCDDs and PCDFs emitted. Therefore, there is a slight double-count in the inhalation exposure. A mass balance of the process would show the amount deposited on the ground should be subtracted from the amount available for inhalation. However, since this is a small amount, it was not subtracted, adding to the conservatism of the model.

The ambient air PCDF and PCDD concentrations for Case 2, where all PCDFs and PCDDs are adsorbed onto particulates, are shown in Table 4-2. As described above, for any single receptor the ambient concentrations are directly proportional to the emission rates. Since the emission rates for Case 2 are slightly less than half the emission rates under Case 1, so are the ambient concentrations. If the total PCDF and PCDD emissions contain fractions of gaseous and particulate materials, the actual concentrations will be between the values presented in Table 4-1 and those presented in Table 4-2.

4.3 Deposition Model

The pathway of ingestion and dermal exposure for particles emitted from the Brooklyn Navy Yard facility stack would originate with solid particulates that settle to the ground and are mixed with ambient dust, dirt and soil. In order to determine the rate at which the particles settle to the ground surface, a computer model with specific capability to analyze particulate deposition rates was selected. This model is the Industrial Source

TABLE 4-2

PREDICTED MAXIMUM ANNUAL AVERAGE CONCENTRATIONS OF
PCDFs AND PCDDs AT GROUND-LEVEL AND ELEVATED RECEPTORS
DUE TO EMISSIONS FROM THE BROOKLYN NAVY YARD FACILITY

Case 2: All PCDF and PCDD Emissions
Are Adsorbed on Particulate

	<u>Maximum Concentration at Ground- Level and Elevated Receptors (pg/m³)</u>
Tri-CDF	0.5747
Tetra-CDF	0.1723
Penta-CDF	0.0497
Hexa-CDF	0.1187
Hepta-CDF	0.0144
Octa-CF	<u>0.0011</u>
Total-CDF	0.9309
Tri-CDD	0.0249
Tetra-CDD	0.0012
Penta-CDD	0.0120
Hexa-CDD	0.0306
Hepta-CDD	0.0146
Octa-CDD	<u>0.0049</u>
Total-CDD	0.0882
2,3,7,8, Tetra-CDD	0.000782

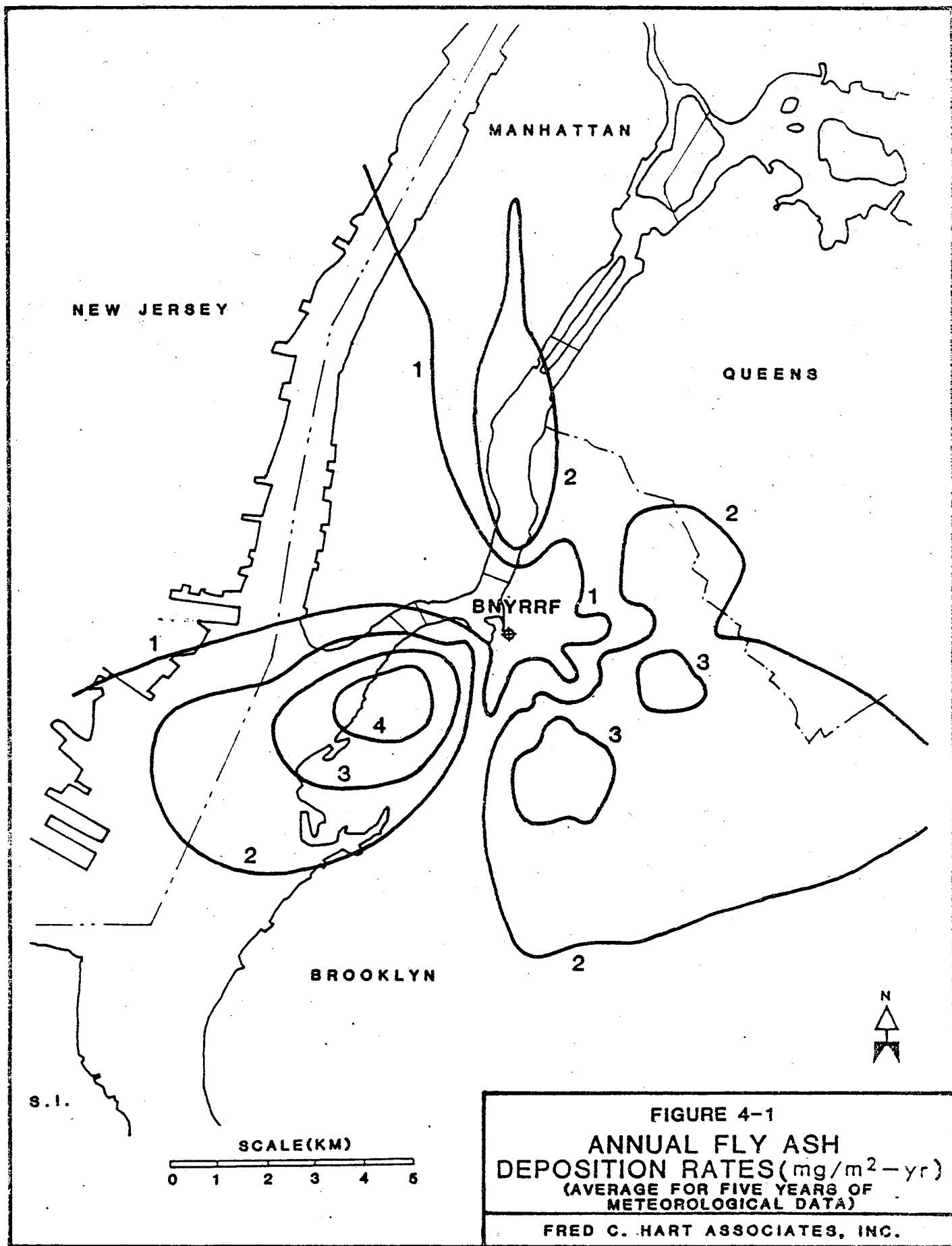
pg/m³ - picograms per cubic meter (10^{-12} g/m³)

NOTE: These concentrations were calculated from mass emission rates in Table 3-8 and normalized concentrations presented in the PDEIS. These concentrations assume no chemical/biological degradation or transformation of PCDF and PCDD compounds.

Complex (ISC) model developed under the sponsorship of USEPA by a private contractor (H.E. Cramer Co. 1979). A deposition prediction methodology is an optional feature of that model. The deposition algorithm was developed under contract to the U.S. Army (Dumbauld et al. 1976). The model is not equipped to handle terrain features or elevated receptors when calculating deposition rates, and the model is not able to account for any physical transformation or change in particle size occurring in the atmosphere. Therefore, some inaccuracies may be introduced due to flow obstruction by buildings, and by particle size changes. However, the USEPA technical branch of the Office of Air Quality Planning and Standards recommends that this model be used whenever the assessments of impacts caused by dry deposition from a stationary point source are necessary. Although this model is not as easily validated as the more commonly used dispersion model, it is the only one available that can quantify deposition rates near a point source.

The long-term (ISCLT) model version was used to calculate annual deposition rates at ground-level receptors. The annual deposition rates were computed at 612 receptor points extending out to 12 km from the proposed site. The deposition rates were calculated using meteorological conditions observed over a five-year period from 1966 to 1970 at the LaGuardia Airport weather station. The emission rates from Case 2 in Table 3-8, where all PCDFs and PCDDs were assumed to be adsorbed on fly ash, were used in this analysis. If only a portion of the PCDFs and PCDDs are adsorbed on fly ash, then the deposition rates will be less than those presented.

Figure 4-1 shows the distribution of annual deposition rates around the Brooklyn Navy Yard. The units of these lines of constant deposition are milligrams of particulate fly ash deposited per square meter per year. The point of maximum deposition is located approximately 3 km southwest of the Brooklyn Navy Yard near the waterfront and Atlantic Avenue. Other points of high deposition occur 3 km east-southeast and 3 km south-southeast of the facility. The maximum annual particulate fly ash deposition rate is 4.613 mg/m² per year. The deposition rate gradually decreases between 3 km distance from the BNYRRF to 9 km, where it is 1-2 mg/m² per year, and decreases



even more gradually from that distance. This is due to the fact that very small particles are emitted from the fabric filter, and most of these small particles will either travel long distances before settling or will not settle at all. From the empirical relationship reported by Dumbauld et al (1976), the proportion of fly ash emitted from the BNYRRF that will ultimately settle to the ground is determined as shown in Table 4-3. This is computed from the reflection coefficients, i.e., the fraction of fly ash in a particular particle size category that is reflected from the ground when the carrier (air) is reflected from the ground surface. This is also the fraction of fly ash which remains suspended in air and does not settle at all. The reflection coefficient is a function of the particle settling velocity, which is a function of particle size and density.

The distribution of fly ash particles that deposit on the ground surface is a function of the emitted particle size distribution and the reflection coefficients for each particle size category. For example, from Table 4-3, 20 percent by weight (100 minus reflection coefficient) of the particles with a mean diameter of 15 μm will deposit. Since, from Table 3-5, 24 weight percent of the fly ash emission from the BNYRRF are in the 15 μm category, then 0.20 times 0.24 times 3.97 g/sec emitted fly ash, or 0.191 g/sec, will settle and will comprise the 15 μm category of the deposited fly ash. This calculation was performed for each particle size category, yielding a total of 0.346 g/sec or 9 percent of the fly ash emitted.

The fraction of depositing particles in the 15 μm size category is 0.191 g/sec divided by 0.346 g/sec, or 55 percent by weight of all particles that settle, while the concentration of PCDD is 141 ng/g (Table 3-4). For each particle size category, the fractions of total deposition weight times the PCDD concentrations were calculated, and these values were summed. The results were 194 ng/g PCDD and 1,682 ng/g PCDF; multiplying these concentrations by the total fly ash deposition rate of 0.004613 g/m^2 per year yields 0.895 ng/m^2 PCDD and 7.759 ng/m^2 PCDF per year. The breakdown of isomer groups of PCDF and PCDD are shown in Table 4-4 for the highest deposition rate.

TABLE 4-3

CHARACTERISTICS OF PARTICLE AERODYNAMICS

Mean Particle Diameter ^(a) (μm)	Aerodynamic Settling Velocity (m/sec)	Reflection Coefficient ^(b) (Dimensionless)	Fraction of Particles Deposited **
15.0	0.007	0.80	0.20
12.5	0.005	0.82	0.18
8.1	0.002	0.85	0.15
5.5	0.001	0.90	0.10
3.6	0.0004	0.95	0.05
2.0	0.0001	1.0	0
1.1	0.00004	1.0	0
0.7	0.00002	1.0	0
LT 0.7*	0.000004	1.0	0

LT - Less than

* Estimated at 0.35.

** Fraction of particles deposited equals one minus the refraction coefficient.

Ref: (a) Golembiewski et al 1980
(b) Dumbauld et al 1976

TABLE 4-4

PREDICTED MAXIMUM ANNUAL PCDF/FCDD DEPOSITION RATES
BROOKLYN NAVY YARD FACILITY

	Maximum Annual Deposition Rate (ng/m ²)
Tri-CDF	4.790
Tetra-CDF	1.436
Penta-CDF	0.414
Hexa-CDF	0.990
Hepta-CDF	0.120
Octa-CDF	<u>0.009</u>
Total-CDF	7.759
Tri-CDD	0.208
Tetra-CDD	0.101
Penta-CDD	0.167
Hexa-CDD	0.256
Hepta-CDD	0.122
Octa-CDD	<u>0.041</u>
Total-CDD	0.895
2,3,7,8, Tetra-CDD	0.0065

4.4 Predicted Maximum Concentrations of PCDFs and PCDDs in Soil, Dirt, and Dust

Where the fly ash particles land on ambient soil, a conservative interpretation would be that the fly ash particles mix within the top centimeter of ambient soil or dust by mechanical means without resuspension and reentrainment. A typical soil density is 1.6 g/cm^3 , and the concentrations of PCDF and PCDD compounds mixed in a layer of soil one centimeter thick are presented in Table 4-5 for accumulations after one year. Subsequent accumulations can be determined by multiplying these values by the number of accumulating years. Of course, this would not account for any degradation or volatilization during this time period. Due to the extremely low PCDF and PCDD concentrations observed, the units presented are femtograms per gram of soil (fg/g or 10^{-15} g/g).

Particles depositing on hard smooth surfaces outdoors will settle at the rates presented in Table 4-4 along with total particulate from other sources. These particles would be subject to frequent washout due to deliberate washing and natural rains. Therefore, an accumulation rate would not be appropriate. Instead, the fly ash particles are assumed to be diluted with settleable ambient particulates at all times. Exposure concentrations will conservatively remain the same even though the particles may be further diluted by surface dirt and dust. The settleable particulate data has been provided by the City of New York Department of Environmental Protection as total dustfall data actually measured in Brooklyn. This was 0.62 mg/cm^2 per month, or 74.4 g/m^2 per year (Nudelman 1984). The concentrations of PCDFs and PCDDs in settleable dirt are presented in Table 4-6 based upon fly ash dilution with this settleable particulate dustfall rate from other sources. These concentrations are not likely to change over time because total particulate and fly ash will be depositing (and washing away) at steady rates. The units are in picograms per gram of dirt.

It is inevitable that some street dirt and soil will enter the homes in the area and it is possible that some of this soil and dirt will contain deposited particulate fly ash from the Brooklyn Navy Yard stack emissions. Because of the highly variable nature of the independent parameters, it is

TABLE 4-5

CONCENTRATIONS OF PCDF AND PCDD MATERIALS IN SOIL
AREAS OF MAXIMUM DEPOSITION RATE

BROOKLYN NAVY YARD FACILITY

Concentrations in Soil After One Year(fg/g)

Tri-CDF	299
Tetra-CDF	90
Penta-CDF	26
Hexa-CDF	62
Hepta-CDF	8
Octa-CDF	<u>0.6</u>
Total-CDF	486
Tri-CDD	13
Tetra-CDD	6
Penta-CDD	10
Hexa-CDD	16
Hepta-CDD	8
Octa-CDD	<u>3</u>
Total-CDD	56

2,3,7,8 Tetra-CDD 0.41

NOTE: The concentrations presented in this analysis assume no chemical/biological degradation or transformation of PCDF and PCDD compounds.

fg/g - femtograms per gram (10^{-15} g/g)

TABLE 4-6

CONCENTRATIONS OF PCDF AND PCDD MATERIALS
IN SETTLEABLE PARTICULATE ON OUTDOOR SURFACES
AREAS OF MAXIMUM DEPOSITION RATE

BROOKLYN NAVY YARD FACILITY

Concentrations in Dirt (pg/g)

Tri-CDF	64
Tetra-CDF	19
Penta-CDF	6
Hexa-CDF	13
Hepta-CDF	2
Octa-CDF	<u>0.1</u>
Total-CDF	104
Tri-CDD	3
Tetra-CDD	1
Penta-CDD	2
Hexa-CDD	3
Hepta-CDD	2
Octa-CDD	<u>0.6</u>
Total-CDD	12
2,3,7,8 Tetra-CDD	0.087

NOTE: The concentrations presented in this analysis assume no chemical/biological degradation or transformation of PCDF and PCDD compounds.

pg/g - picograms per gram (10^{-12} g/g)

impossible to determine through physical modeling how much of this material will enter homes. A number of studies, however, that have been performed correlating ambient lead concentrations in outdoor dirt and soil with ambient lead concentrations in interior house dust, have been used to estimate the amount of particulates entering the home.

Assuming that the relationship between indoor/outdoor levels of PCDF and PCDD correspond to the relationships for environmental lead, the proportion of the amount of lead found indoors compared with the amount found outdoors can be used to estimate the amount of PCDF/PCDD materials deposited indoors. In a recent Dutch study (Brunekreef et al. 1983), where the home environments of 195 children were analyzed, the proportions of lead on the floors of suburban and inner city homes were 10-25 percent of the lead on city streets. Furthermore, deposition rates were measured in the Dutch study, which correspond to accumulation times of 13-30 days; i.e., after 13-30 days the floors would be cleaned of accumulated dust. Assuming the highest values of these ranges for conservatism, 25 percent of outdoor deposition and 30 days accumulation time, the amount of PCDF/PCDD materials found indoors in the area of maximum deposition from the Brooklyn Navy Yard would be as presented in Table 4-7. A number of researchers have concluded that the weight concentrations (g/g) of lead and other toxic metals in household dust were approximately equal to those in street dust. Therefore, the concentrations presented in Table 4-6 on a weight basis can be assumed to be equivalent to the PCDF/PCDD concentrations in household dust.

4.5 Summary

Impacts of PCDF and PCDD emissions from the BNYRRF are manifested in ambient air concentrations (inhalation exposure) and particle deposition on horizontal surfaces (ingestion and/or dermal exposure). Maximum inhalation exposure would occur if the PCDFs and PCDDs observed through actual testing of other incinerators were entirely gaseous in nature. This maximum impact, although extremely low, would occur at ground-level approximately one kilometer Southeast of the plant site, and at rooftop level 2.27 km Southwest of the site. Obviously, if these materials were gaseous in nature there would be no deposition, and therefore, there would be no ingestion and/or dermal

TABLE 4-7

PREDICTED AMOUNT OF PCDD AND PCDF
ACCUMULATION ON INDOOR SURFACES
AREA OF MAXIMUM DEPOSITION RATE

BROOKLYN NAVY YARD FACILITY

	<u>Accumulation</u> <u>(pg/m²)</u>
Tri-CDF	100
Tetra-CDF	30
Penta-CDF	9
Hexa-CDF	21
Hepta-CDF	2.5
Octa-CDF	<u>0.2</u>
Total-CDF	163
Tri-CDD	4
Tetra-CDD	2
Penta-CDD	3.5
Hexa-CDD	5
Hepta-CDD	2.5
Octa-CDD	<u>0.9</u>
Total-CDD	18
2,3,7,8 Tetra-CDD	0.135

NOTE: Indoor deposition rate is equal to 25 percent of outdoor deposition rate and accumulation time equals 30 days.

exposure. Therefore, maximum inhalation exposure does not necessarily indicate maximum health risk since the exposures resulting from deposition would not occur. However, if the PCDFs and PCDDs are particulate in nature, total PCDF and PCDD emissions would be roughly halved, due to high efficiency fabric filter collection of fine particles on which PCDFs and PCDDs would be concentrated, with a concomitant reduction in ambient air concentrations. In this case, the deposition rates would be at the highest levels. Unfortunately, with the state-of-the-art sampling technology, it is impossible to assess the actual partition between gaseous and particulate PCDF and PCDD emissions. Only total emissions are quantifiable; therefore, both cases have been evaluated and represent a range of potential exposure.

If the PCDD materials are emitted as particulate matter, deposition of particles would occur with the points of maximum deposition occurring approximately three kilometers from the stack between the southwest and southeast quadrants. Three pathways have been evaluated for the exposure from deposition of PCDF and PCDD materials: (1) concentration in soil, (2) concentration in street dirt, and (3) concentration in house dust. All pathways have been evaluated using the maximum deposition rates and the conservative assumption that no isomer transformation, volatilization, chemical degradation, biological degradation, resuspension, or reentrainment occurs. Despite the conservatism applied in this assessment, the impacts are extremely low as shown in Table 4-8. These impact data are utilized in Chapter 5 to calculate risk levels based on accepted modeling techniques and available information.

TABLE 4-8

SUMMARY OF MAXIMUM IMPACTS
FROM BROOKLYN NAVY YARD EMISSIONS

	Ambient Air Concentration (pg/m ³)(a)	Concentration in Soil (pg/g)(b)	Concentration in Street and Household Dirt (pg/g)(c)
<u>Case 1: Gaseous PCDF and PCDD</u>			
PCDF	1.9900	-	-
PCDD	0.2290	-	-
2,3,7,8 TCDD	0.00168	-	-
<u>Case 2: Particulate PCDF and PCDD</u>			
PCDF	0.9309	0.486	104
PCDD	0.0882	0.560	12
2,3,7,8 TCDD	0.000782	0.00041	0.087

- (a) Annual average concentration at point of maximum impact.
 (b) After accumulation of one year at point of maximum impact.
 (c) Annual average deposition concentration at point of maximum impact.

CHAPTER 5.0Risk Assessment5.1 Background5.1.1 Introduction.

The purpose of this chapter is to provide an evaluation of the potential hazards associated with the predicted dioxin emissions from the BNYRRF. The process by which this evaluation will be performed is known as a risk assessment. A risk assessment compares the concentrations of contaminants known or predicted to cause a toxic effect to the predicted level of exposure of local populations. The difference between the two levels constitutes the level of risk projected for the facility.

The risk assessment in this chapter will be performed in four steps. First, we will identify levels of estimated "risk" to human health associated with different concentrations of PCDDs and PCDFs. The definition of risk will be based upon the toxic effect dose/response data, standards, criteria, and guidelines of various state, federal, and international regulatory agencies.

Next, utilizing the data in Chapter 4 to predict the maximum concentration of PCDDs and PCDFs in the air, dirt, soil and indoor surfaces, we will determine predicted levels of exposure calculated as a "worst case" daily intake for residents located in the areas of highest potential impact.

The third step in the risk assessment will compare the maximum ground-level ambient air concentrations of PCDDs and PCDFs resulting from predicted emissions from the BNYRRF, with standards and guidelines promulgated by different regulatory agencies in this country and abroad. This comparison will constitute one criterion of risk.

Finally, risk levels will be estimated by comparing predicted worst-case daily PCDD and PCDF intake levels to levels or concentrations known or suspected to cause a toxic effect. This will act as a second criterion of risk.

5.1.2 Limitations of the Risk Assessment Process.

In reviewing the following risk assessment it is important to keep in mind the methodological limitations of the risk assessment process.

First, a risk assessment, while based upon scientific considerations, often requires the use of assumptions derived using sound technical and scientific judgement. The use of assumptions rather than scientific data are often necessary because frequently there is an inadequate data base on the environmental fate, transport, and bioavailability of contaminants such as PCDDs and PCDFs. For example, the bioavailability of PCDD adsorbed to fly ash (i.e. the amount of PCDD that can be absorbed through the skin, digestive or pulmonary system) is not known. In the absence of direct experimental data, an estimate or range of estimates is applied, based on the best available data. For example, we might have to use existing information on the bioavailability of PCDDs adsorbed to soils to extrapolate to fly ash.

Second, a risk assessment frequently requires extrapolation of high-dose animal feeding studies to estimate risk to humans at the extremely low dosages or concentrations of contaminants found in the environment. Data are not available to determine the actual shape of a dose/response curve (i.e., the level of risk), or the best method to extrapolate risk at low dosages. Accordingly, there is a great range of uncertainty regarding actual risk (at very small concentrations) for a given contaminant (OSTP, 1984; EPA, 1984a; NRC, 1983).

Due to the necessity of using such estimates or assumptions, the degree to which predictions of risk conform to actual risk, (i.e. the quality of the assessment) can only be as good as the quality and degree of accuracy in the assumptions applied. Clearly, any assumptions used in risk assessment

can have significant impacts on the overall findings and determination of levels of risk.

In the absence of sufficient data or knowledge about such issues as the degree of exposure, intake, fate and bioavailability of contaminants, the typical risk assessment uses the most reasonable assumptions possible, erring on the side of public health. Typically, "worst-case" scenarios or conservative assumptions are used in the assessment process rather than most probable case scenarios to provide an added safety factor. A conservative assumption is one which increases the likelihood that a substance represents a hazard to public health.

However, the use of a number of "worst-case" or conservative assumptions carries the danger that the estimate of risk can become vastly overstated and, therefore, unrealistic. Risk assessments that rely upon "worst-case" scenarios must be critically evaluated with regard to the degree of realism in the model used to estimate risk.

To summarize, the product of a risk assessment is typically a description of the worst possible scenario or upper bound to risk, coupled with an assessment of the accuracy of the assumptions used to estimate the risk. Actual risks are likely to be substantially lower. These results of a risk assessment are then used for risk management purposes, to judge whether the upper bound of risk levels are acceptable in comparison to any proposed benefits.

5.2 Determination of "Risk"

Historically, there have been two approaches to estimating risk levels for exposure to toxic agents. One approach involves calculating an "Acceptable Daily Intake" (ADI) by applying a safety factor to doses of the agent that did not produce an observed effect in laboratory animals (no observed effects level, NOEL). This approach is typically used for non-carcinogenic toxic effects. The second approach relies on the use of mathematical models to extrapolate experimental dose-response information obtained from animal exposure studies using high dosage levels, to the low levels likely to be

encountered by human populations. This latter approach is used for carcinogens and generally assumes that there is no threshold for the response being extrapolated, i.e., that any dose, no matter how small, will pose some risk. It was originally used for radiation damage, but has found widespread use for estimating risks due to chemical carcinogens.

5.2.1 ADI/NOEL Approach. As discussed previously, 2, 3, 7, 8-TCDD has a variety of toxic effects on laboratory test animals, including embryotoxicity and teratogenicity. Effects have also been observed in various organs and systems including the thyroid, liver, and skin, as well as the immunologic system. The 2,3,7,8-TCDD isomer has also been demonstrated to be an animal carcinogen.

Normally, an ADI is not derived from a NOEL for compounds which have been found to be carcinogenic. However, 2,3,7,8-TCDD has not been proven to be an initiator of neoplastic growth (Kim, 1984; Kimbrough, 1983; NRCC, 1981). In light of this fact, several agencies have found it appropriate to use a NOEL to calculate a guideline or standard. For 2,3,7,8-TCDD, a no-observed-effect level of 1 nanogram per kilogram of body weight per day (1×10^{-9} g/kg-day) in rats has been reported in both a three generation reproduction study (Murray, et al., 1979) and a two year oncogenic study (Kociba et al., 1978). On the basis of these studies, regulatory agencies in Canada, the Netherlands, and elsewhere have developed guidelines or standards by applying safety factors ranging from 100 to 250 to the NOEL. For example, the Netherlands has developed an ADI for 2,3,7, 8-TCDD of 0.004 ng/kg/day.

Several authors have questioned whether 1 ng/kg/day represents a true NOEL (Kimbrough, 1983; EPA 1984). They cite Allen, et al. (1979), who observed effects on reproductive outcomes in female rhesus monkeys fed 1.8 ng TCDD/kg-day over a six-month period. These effects indicate that a no-effect level has not been determined in this primate species. In addition, no long-term multigeneration studies have been conducted in this species. Accordingly, they recommend a more conservative approach to establishing an ADI by applying a 1,000-fold safety factor to the NOEL reported by Allen of 1.8 ng/kg-day. This would result in an ADI equal to 1.8 pg/kg-day. NOELs have not been determined for other PCDD and PCDF isomers.

A list of the standards and guidelines established by regulatory agencies or published by various authors using the ADI/NOEL approach is provided in Table 5.1. The assumptions made in converting an ADI to a standard are provided in Section 5.3.

5.2.2 Extrapolating Risks from High Dosage Carcinogenic Bioassays.

For suspected carcinogens, the approach used to determine excess carcinogenic risk is to extrapolate dose/response (i.e. tumor count) data from high-dose animal studies to low-dose risk levels by application of various mathematical extrapolation models. [The true shape of the dose/response curve at low dosages is not known. From a mathematical point of view, determining the actual shape of the dose/response curve at low dosages through low-dose animal feeding studies, is probably impossible due to the enormously large and costly number of animals that would be required (NRC, 1983)]. A conversion factor is then applied to convert animal dosage to human dosage. The conversion factor is often based upon relative differences in weights or surface areas.

A number of mathematical models can be applied to the dose-response extrapolation. The linear non-threshold model has been adopted as the primary basis for risk extrapolation in the low-dose region of the dose/response relationship. Despite its somewhat limited scientific basis, it is considered the best of any of the current mathematical extrapolation models. The risk estimates resulting from this model should be regarded as conservative, representing the most probable upper limit for the risk; i.e., the true risk is not likely to be higher than the estimate, but it could be lower.

The use of the linear non-threshold model to extrapolate risk may be a particularly conservative assumption for TCDD since TCDD may act as a promoter rather than as an initiator in carcinogenesis (Kimbrough, 1983). The use of the linear extrapolation model is believed to produce an overestimate of risk for carcinogens that are primarily promoters. This argument, however, is open to challenge. (NRC, 1983)

TABLE 5-1

DIOXIN STANDARDS AND CRITERIA USING ADI/NOEL APPROACH

<u>Agency</u>	<u>Description</u>	<u>Basis for Standard</u>	<u>Standard/Criteria/or ADI</u>
Canada ¹	Ambient air quality guideline for mixture of PCDDs and PCDFs	NOEL of 1 ng/kg-day safety factor of 100	30 pg/m ³ PCDDs in ambient air or $\frac{[\text{PCDD}]}{30 \text{ pg/m}^3} + \frac{[\text{PCDF}]}{30 \text{ pg/m}^3 \times 50} = 1$
Netherlands ²	Acceptable daily intake	NOEL of 1 ng/kg-day safety factor of 250	12 pg/m ³ PCDD in ambient air [Derived from ADI-assumes 60 kg person ventilating at 20m ³ /day. PCDD 100% bioavailable]
Kimbrough ³ (CDC)	Used ADI as one method to determine health implication of dioxin contaminated soil	LOEL of 1.8 ng/kg-day safety factor of 1000.	ADI equals 1.8pg/kg-day
NYSDOH ⁴	Developed ADI to determine re-entry criteria for Binghamton office building closed down due to a transformer fire.	NOEL of 1 ng/kg safety factor of 500	ADI equals 2 pg/kg-day 15 pg/ ³ -TCDD Equivalents; Standard for Worker exposure 40-hour work week

1. Harding, D.H. 1982. Chlorinated dioxins and chlorinated dibenzofurans: ambient air guideline. Health Studies Service, Special Studies and Services Branch, Ministry of Labor.

TABLE 5-1 (Continued)

DIOXIN STANDARDS AND CRITERIA USING ADI/NOEL APPROACH

2. Heigden, et al. 1982. Report DOC/LCM 300/292, Royal Institute of Public Health, Bilthoven, The Netherlands.
3. Kimbrough et al. 1983. Health implications of 2,3,7,8-Tetrachloro dibenzodioxin (TCDD) contamination of residential soil. Atlanta, Center for Environmental Health, Center for Disease Control.
4. Kim, N.K. and J. Hawley. 1984. Revised risk assessment: Binghamton State Office Building. Albany, Bureau of Toxic Substance Assessment, New York State Department of Health.

Several agencies, including The U.S. Environmental Protection Agency (USEPA), Centers for Disease Control (CDC), New York State Department of Health (NYSDOH) and the National Research Center of Canada (NRCC) have published excess carcinogenic risk estimates for 2,3,7,8-TCDD. The basis for these risk estimates include the two year rat feeding study published by Kociba et al. (1978), with an independent pathology review performed by Squires and an NCI study using rats and mice. A carcinogenic risk estimate for a mixture of HCDD isomers has also been published by EPA, based on one NCI study in rats and mice (USEPA, 1984b).

The carcinogenic risk estimates published by these agencies, using essentially the same data bases, vary over three orders of magnitude as shown in Table 5-2. This data are presented in terms of the estimated quantity of 2,3,7,8-TCDD or HCDD in fg/kg of body weight which, if consumed each day over a 70 year lifetime, would cause one increased case of cancer for every one million people exposed to that concentration.

There are several factors that account for differences in the risk estimates. First, extrapolations from animals to humans can be done on the basis of either relative weights or surface areas. The latter approach may more closely approximate human pharmacological responses. However, it is not clear which of the two approaches is more appropriate for carcinogens. In the absence of information on this point, it seems appropriate to apply the most generally used and more conservative method. In the case of TCDD studies, the use of extrapolation based on surface area rather than weight increases the unit risk estimates by a factor of 5.8 for rats and about 13 for mice (Bayard, 1984).

Second, extrapolations can be performed by using the most sensitive responders or by averaging responses of all adequately tested bioassays. Similarly, these extrapolations can be performed by either grouping different lesion sites to average the risk, or by fitting the tumor evidence data from each lesion site. This last procedure can suggest the most sensitive risk levels and target organs (OSTP, 1984). The CDC fitted separately, the tumor data for each lesion site thereby providing for a range of extrapolated risk estimates.

TABLE 5-2

Extrapolated Human-Equivalent Dose/Response Data to Estimate
An Upper Bound To Carcinogenic Risk*

PCDD Isomer	Agency	10^{-6} cancer risk	Method Used To Extrapolate Risk
2,3,7,8,-TCDD	Canada ⁽¹⁾	30-90 fg/kg/day	Linearized Extrapolation and Multi-stage models
	USEPA ⁽²⁾	6.4 fg/kg/day	Linearized Multi-stage model
	CDC ⁽³⁾	28-1428 fg/kg/day	Linearized Multi-stage model
	FDA ⁽²⁾	57 fg/kg/day	Linearized Multi-stage model
HCDD**	USEPA ⁽⁴⁾	161 fg/kg/day	Linearized Multi-stage model

*Extrapolated from long-term animal feeding studies. Data are provided as that quantity of PCDD isomer in fg/kg-body weight per day which if ingested over a 70-year lifetime would cause one additional case of cancer for every one million people exposed to that dose.

**Mixture of 1,2,3,6,7,8 and 1,2,3,7,8,9 isomers.

fg = 10^{-15} grams

- 1) NRCC, 1981
- 2) USEPA, 1984a
- 3) Kimbrough, 1983
- 4) USEPA, 1984b

Third, corrections for high early mortality of animals in the high dose group was used by the EPA to provide an adequate fit of the data to the dose/response extrapolation.

Finally, several different extrapolation models can be used to provide a best fit for the data. Results of the different methods used to calculate the carcinogenic risk are discussed in Table 5-2. It is apparent from this table that the most conservative assessment of carcinogenic risk for 2,3,7,8-TCDD is the risk estimate published by EPA. It should be reiterated that the true shape of the dose/response curve at low doses cannot be determined experimentally (NRC, 1983). Moreover, several extrapolation models fit the data equally well.

In January, 1984, three agencies (EPA, FDA, CDC) met to review the differences in carcinogenic potency estimates. All agreed that correcting for high early mortality is appropriate. The remaining differences were judged to be within the range of uncertainty in the risk assessment process (EPA, 1984). A summary of the different factors used by the various agencies to calculate a 95 percent upper limit unit risk estimate is provided in Table 5.3 (Bayard, 1984). In this context, the EPA extrapolated dose response data, which is the most conservative extrapolation, must be regarded as an upper bound to cancer risk. Actual risk may be significantly lower.

5.2.3. Multiple Components. As noted in Section 2.0, toxicity data required to evaluate risks exists principally for the 2,3,7,8-TCDD isomer, which represents only a small fraction (less than 1%) of the total PCDD emissions predicted from the BNYRRF. The PCDD emissions, in turn, are present in smaller amounts than PCDFs. Therefore, the overall toxicity of the complex mixture of PCDDs and PCDFs predicted in the emission products remains in question. Several approaches have been used to deal with this uncertainty. These approaches were recently reviewed by Barnes (1983) and are described below.

First, all isomers of TCDD can be regarded to be as toxic or carcinogenic as 2,3,7,8-TCDD. This approach is likely to significantly overestimate risks, since the available data suggests that substitution in three or four of the 2,3,7,8-positions influences toxicity significantly (Harding, 1982).

TABLE 5-3

FACTORS USED BY VARIOUS AGENCIES IN CALCULATING THEIR 95% UPPER-LIMIT UNIT RISK ESTIMATES FOR TCDD
(From Bayard, 1984)

<u>FACTOR</u>	<u>EPA</u>	<u>FDA</u>	<u>CDC</u>	<u>Effect of Difference on 95% Upper-Limit Unit Risk Estimate</u>
1. All used Dow Chemical Co. feeding study on female Sprague-Dawley rats. All used linearized multi-stage model.	--	--	--	Same factors
2. Pathologist - Kociba or Squire.	Both	Kociba	Squire	Less than 10%
3. Adjustment for high early mortality in dose group.	Yes	No	No	Adjustment increases estimate by 1.7 to 2.6 ^a
4. Selection of tumor types	All Significant tumors	Liver only	Liver only	Less than 10%
5. Animal-to-man dose equivalence	$\frac{\text{dose}}{\text{surface area}}$	$\frac{\text{dose}}{\text{body weight}}$	Liver concentration	Using administered dose decreases estimate by a factor of 5.38 over the other two.
6. Dose used for curve fit	Administered	Administered	Liver concentration at terminal sacrifice	Using administered dose decreases estimate by a factor of 2.
7. 95% upper-limit unit risk estimate (fg/kg/day) ⁻¹	1.56×10^{-7}	1.75×10^{-8}	3.6×10^{-8} (when converted to administered dose)	

^a Adjustment increases estimate by factor of about 1.7 if high dose is included in unadjusted analysis; increases estimate by factor of 2.6 if high dose is excluded from unadjusted Squire analysis due to poor fit.

TABLE 5-3 (Continued)

FACTORS USED BY VARIOUS AGENCIES IN CALCULATING THEIR 95% UPPER-LIMIT UNIT RISK ESTIMATES FOR TCDD
(From Bayard, 1984)

<u>FACTOR</u>	<u>EPA</u>	<u>FDA</u>	<u>CDC</u>	<u>Effect of Difference on 95% Upper-Limit Unit Risk Estimate</u>
8. Virtual safe dose for upper-limit risk of 10^{-6} ; units of fg/ kg/day	6.4	57.2	27.6	

^a Adjustment increases estimate by factor of about 1.7 if high dose is included in unadjusted analysis; increases estimate by factor of 2.6 if high dose is excluded from unadjusted Squire analysis due to poor fit.

A second approach is to use one of several methods for calculating a toxic equivalent of the complex mixture. For example, the Swiss EPA evaluated the toxicity of the mixture of PCDDs and PCDFs emitted from a resource recovery facility by taking into account the relative ability of the various isomers to induce microsomal enzymes.

The estimation was imprecise, being scaled in order of magnitude. It was conservative in the sense that an entire homologous group was assigned the weighting appropriate for the most potent inducer in that group. These factors were then used as weighting factors to convert the mass of each of the different homologues of PCDDs and PCDFs to 2,3,7,8-TCDD equivalents. Using this approach they estimated total 2,3,7,8-TCDD equivalents to be 60 times the amount of measured 2,3,7,8-TCDD (SFOEA, 1982).

Similarly, Olie has approached the problem by accepting Poland's hypothesis on the toxicity of PCDDs being related to substitution in three or four of the 2, 3, 7, and 8 positions. These congeners were the ones considered to be of concern; the rest were ignored. Olie, then used a method suggested by Grant (1977) to calculate a toxic equivalency factor for a complex mixture of PCDDs and PCDFS. The method assumes a toxicity factor of 1 for 2,3,7,8-TCDD and 0.1 for the other isomers with three and four chlorine atoms in the lateral positions. Further, the method assumes that all isomers are equally distributed in each isomer group. Applying this method, Olie estimated that fly ash and flue gas extracts from a municipal incinerator tested in the Netherlands contained 2,3,7,8-TCDD equivalents equal to 50 and 80 times, respectively, the analyzed amounts of 2,3,7,8-TCDD (Olie, 1980).

A third approach uses bioassay systems to test for 2,3,7,8-TCDD equivalency. For example, a bioassay method has been developed to investigate the ability of complex mixtures of PCDDs and PCDFS to displace radiolabeled 2,3,7,8-TCDD from a cytosol receptor. Binding to this receptor may be the first step in the mechanism of toxicity. Using this bioassay the estimated amount of 2,3,7,8-TCDD equivalents in a fly ash extract was found to be about 40 times the actual amount of 2,3,7,8-TCDD found in the sample (Sawyer et al., 1983).

Similarly, a bioassay has been developed to test the ability of PCDD and PCDF mixtures to induce the aryl hydrocarbon hydroxylase (AHH) enzyme system. The 2,3,7,8-TCDD isomer is a potent inducer of this enzyme system. This induction is thought to result from formation and transport of the 2,3,7,8-TCDD/cytosol receptor complex to the cell nucleus. Use of two different techniques for measuring the AHH induction indicated that a fly ash extract was 8 and 26 times stronger an inducer for the 2,3,7,8-TCDD equivalents as compared to the 2,3,7,8-TCDD (Sawyer et al., 1983).

An acute toxicity bioassay was performed by the New York Department of Health. The NYSDOH took PCDD- and PCDF-containing material released during a transformer fire in an office building and found that it behaved in their bioassay systems with about 50 times the potency expected from the 2,3,7,8-TCDD content alone (Eadon, 1982).

As described above and as summarized by Barnes, using different bioassay systems and different methods the toxic equivalency of complex mixtures of PCDDs and PCDFs was estimated to vary within an order of magnitude. Values ranged from 8 to 80 times greater than the toxicity due strictly to the 2,3,7,8-TCDD concentration (Barnes, 1983).

For the purposes of risk assessment, we used one of these techniques to estimate the toxicity of the complex mixture of PCDDs and PCDFs predicted in BNYRRF emissions. We selected an approach used by the Swiss EPA to calculate a toxic equivalency of the multiple components equal to 59 times the toxicity of 2,3,7,8-TCDD alone (SFOEP, 1982). The basis for these calculations is presented in Table 5-4. The reason for selecting this Swiss approach is that it readily provides a mechanism for estimating the relative toxicity of complex mixtures containing differing ratios of PCDD and PCDF homologues. The method was modified somewhat because the Swiss EPA approach did not address the weighting factor of TriCDDs or TriCDFs. Based upon the limited experiments with 2,3,7,TRI-CDD reported by NRCC, however, the relative toxicity and enzyme induction capacity of the TRI-CDDs are at least three orders of magnitude less than 2,3,7,8-TCDD. Based on this data, a weighting factor of .01 was applied as the appropriate weighting factor for the TRI-CDDs and TRI-CDFs.

TABLE 5-4

CALCULATION OF TOXIC EQUIVALENTS
BROOKLYN NAVY YARD FACILITY

	<u>Concentration in Flue Gas (ng/Nm³)</u>	<u>Relative Toxicity</u>	<u>Toxic Equivalent Concentration</u>
Tri-CDF	307.4	.01*	3.07
Tetra-CDF	92.2	.1	9.22
Penta-CDF	26.6	.1	2.67
Hexa-CDF	63.5	.1	6.35
Hepta-CDF	7.7	.01	0.08
Octa-CDF	0.6	0	0.0
Tri-CDD	13.3	.01*	0.13
Tetra-CDD	6.5	.01	0.06
Penta-CDD	10.7	.1	1.07
Hexa-CDD	16.4	.1	1.64
Hepta-CDD	7.8	.01	0.08
Octa-CDD	2.6	0	0.0
2,3,7,8 TCDD	0.42	1	0.42
Total			<u>24.79</u>

$$\frac{[\text{Total Toxic Equivalent}]}{[2, 3, 7, 8\text{-TCDD}]} = \frac{24.79}{0.42} = 59$$

* Relative Toxicity for Tri-CDD and Tri-CDF assumed based on 3000 fold difference in enzyme induction and 30,000 fold difference in acute toxicity (NRCC, 1982).

** From Table 3-2

It should be stressed that the selection of a toxic equivalency factor of 59 is somewhat arbitrary. The data base is too limited to provide experimentally determined (i.e. bioassays) upper and lower limits to toxic equivalency for incinerator emissions.

Furthermore, calculations of toxic equivalency on the basis of various assumptions regarding the toxicity of isomers containing chlorine in 3 or 4 of the lateral ring positions should be examined critically. The data are quite complex regarding the biological activity of each of the isomers, which can vary widely (Sawyer, 1983).

Nonetheless, in accordance with procedures used in risk assessment, we related a factor that provides an estimated upper limit for predicting toxic equivalency.

A toxic equivalency of 59 is believed to be reasonable on the basis of the limited experiments using fly ash or soot in animal feeding or enzyme bioassay experiments (Sawyer et al., 1983; Eadon, 1982). As discussed previously, toxic equivalencies less than 60 were observed in these experiments.

In order to address the multiple components problem, we will assess risks due to PCDD and PCDF emissions from the BNYRRF using three different models. The first model will assume that exposure to 2,3,7,8-TCDD constitutes the only significant PCDD related risk. The second model will assume that all the TCDDs (tetras) are as toxic as 2,3,7,8-TCDD. The third model will use the Swiss approach to calculate a toxic equivalency of the multiple components equal to 59 times the toxicity of 2,3,7,8-TCDD alone.

5.3 Current Standards and Guidelines

As part of the risk assessment, the daily intake levels or exposure levels were compared with applicable standards and guidelines. These include the following.

5.3.1 EPA Risk Assessment for Municipal Waste Combustors (MWC's).

EPA has issued a risk assessment on the dioxin related risks for 5 different MWC's (USEPA 1981). The agency presented data showing that the average annual ground level concentrations of TCDD, using the PTMAX air dispersion model, ranged up to 3.8×10^{-5} ng/m³ for 2, 3, 7, 8-TCDD and up to 9.2×10^{-5} ng/m³ for total TCDDs.

With this exposure data, EPA used 5 different mathematical models to determine an upper bound for cancer risk. This data and the assumptions are shown in Tables 5-5 and 5-6. The calculations use the conservative assumption that all TCDDs are as carcinogenic as 2, 3, 7, 8-TCDD. EPA found that the increased cancer risks ranged from 8 to 19×10^{-6} depending upon the risk extrapolation model used. On the basis of these results, EPA concluded that the risks to public health from these MWC's was minimal.

Recently, EPA performed a risk assessment at a sixth MWC (USEPA, 1983). Higher TCDD emission levels were detected at the facility than had been reported in the earlier assessment. These higher levels were attributed to the failure of the operator to adhere to the design requirements of the facility. The operator was feeding municipal waste to the incinerator at a rate significantly above its design capacity. The operator has since modified his procedure, and the facility will be retested.

Nonetheless, using the assumptions and modeling techniques described in Tables 5-5 and 5-6, EPA found that the extrapolated upper bound to the increased cancer risks was calculated as 4.6×10^{-5} for the sixth facility. Although the estimated risks were nearly six times higher than for the earlier MWC study, EPA concluded that, "...in light of...the conservative assumptions...the steps being taken to ameliorate this situation...the Agency does not believe that this most recently completed MWC represents a significant health concern..." (USEPA, 1983).

5.3.2 NYSDEC Ambient Air Guideline.

NYSDEC established an annual average ambient air concentration at ground level of 9.2×10^{-5} ng/m³ TCDD as a performance guideline in evaluating the issuance of permits for combustion facilities. This guideline is primarily based on EPA's evaluation

TABLE 5-5

RANGE OF MAXIMUM AVERAGE ANNUAL GROUND LEVEL CONCENTRATIONS
OF TCDD ISOMERS USING PTMAX AIR DISPERSION MODEL^a

<u>Pollutant(s)</u>	<u>Range (ng/m³)</u>
2,3,7,8-TCDD	up to 3.8×10^{-5}
Total TCDDs	up to 9.2×10^{-5}

TABLE 5-6

RANGE OF UPPER BOUNDS^a
OF TCDD CARCINOGENIC RISKS
DERIVED FROM VARIOUS EXTRAPOLATION MODELS

<u>Mathematical Model</u>	<u>Upper Bound of Cancer Risk</u>
Linearized Multi-stage	up to 8×10^{-6}
Probit	up to 15×10^{-6}
Logit	up to 15×10^{-6}
Weibull	up to 14×10^{-6}
Gamma Multi-hit	up to 19×10^{-6}

a - Upper bound of the 95% confidence interval for this bioassay.
(*Barnes, 1983*)

ASSUMPTIONS

1. The carcinogenic properties and reproductive effects of all TCDDs are the same as that of 2,3,7,8-TCDD.
2. The PTMAX air dispersion model adequately represents the transport of the emissions to ground level.
3. The composition of emission products found at ground level is identical to the composition (but not the concentration) found in the stack.
4. Seventy-five percent of the inhaled emission particles (to which the TCDDs are generally attached) are retained in the body.
5. All the TCDDs that are retained in the body are biologically available to the organism.
6. The population is exposed to the maximum annual average ground level concentration from the source for 24 hours a day throughout a 70 year lifetime.
7. Humans are of comparable sensitivity as the animals tested.

of TCDD emissions from five municipal waste combustors (See 5.3.1) in which EPA modeled a ground level maximum of up to $9.2 \times 10^{-14} \text{ g/m}^3$ ($9.2 \times 10^{-5} \text{ ng/m}^3$) for the MWC producing the highest output of TCDD. EPA concluded that, if this maximum value was not greatly exceeded, TCDD emissions from resource recovery facilities should not pose a concern to public health.

5.3.3 Canadian Ambient Air Quality Provisional Guideline for Chlorinated Dibenzodioxins and Dibenzofurans. In 1982, the Ontario Ministry of the Environment issued ambient air quality guidelines for dioxins and furans (Harding 1982). The guideline includes two key elements. The first is a guideline for an average annual ambient air concentration limit for 2,3,7,8-TCDD. The second is a guideline for mixtures of PCDDs and PCDFs. These guidelines are as follows:

- an annual average ambient air guideline for 2, 3, 7, 8-TCDD of 30 pg/m^3 ,
- an ambient air guideline for a mixture of chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans. This guideline should not exceed unity in the sum of the fractions for each group as shown below.

$$\frac{x}{30 \text{ pg/m}^3} + \frac{y}{30 \text{ pg/m}^3 \times 50} = 1$$

x = ambient concentration of all CDD's.

y = ambient concentration of all CDF's.

The above equation incorporates an additional safety factor by considering all the congeners in each group as being equal in toxicity to the most toxic congener of the group. The guideline (and the equation) assume that the PCDFs are, on the average, 50 times less toxic than PCDDs.

Harding (1982) suggests that a more realistic formula would correct for the less toxic congeners as follows:

$$\frac{X \text{ toxic}}{30 \text{ pg/m}^3} + \frac{X \text{ less-toxic}}{30 \text{ pg/m}^3 \times 100} + \frac{Y \text{ toxic}}{30 \text{ pg/m}^3 \times 50} + \frac{Y \text{ less-toxic}}{30 \text{ pg/m}^3 \times 50 \times 100} = 1$$

Subscript toxic = those congeners have 1 hydrogen atom in the molecule
and at least three chlorine atoms in the lateral ring
position

Subscript less-toxic = The remaining congeners

5.3.4 The Netherlands Dioxin Standard. In 1982, the Royal Institute of Public Health in the Netherlands issued an acceptable daily intake standard for 2,3,7,8-TCDD of 4×10^{-12} grams/kg-b.w/day (Heigden, 1982). This level utilizes the NOEL of 0.001 ug/kg/day (Kociba et. al., 1978) to calculate an ADI which, when divided by a safety factor of 250, constitutes the exposure standard. Although there is no ambient air standard in the Netherlands, applying the assumptions used by Canada (60 kg b.w., 20 m^3 daily ventilation rate and 100 percent respiratory absorption) yields an average annual value of $12 \times 10^{-12} \text{ g TCDD/m}^3$ as an ambient air standard.

5.3.5 New York State Department of Health Risk Assessment. After a transformer fire in an office building released PCDDs and PCDFs (the building was evacuated and shut down), criteria were developed to allow re-entry into the building (Kim et al, 1984). The guidelines were based upon a NOEL of 1 ng/kg-day divided by a safety factor of 500. This yielded an ADI for calculating reentry levels equal to 2pg/kg-day. Based on this ADI, an air guideline of 15 pg/m^3 was established for TCDD toxic equivalents for a 50kg office worker assuming a breathing volume of 10 m^3 for an 8 hour day, 250 day work year as shown below.

$$\frac{2 \text{ pg/kg-day} \times 50 \text{ kg}}{10 \text{ m}^3} \times \frac{365}{250} = 15 \text{ pg/m}^3 \text{ TCDD Toxic Equivalents}$$

In a similar fashion, guidelines for contamination of work surfaces were established, based on assumptions made regarding ingestion and dermal absorption pathways. These assumptions included:

1. Surface contact is assumed to result in the complete transfer of contaminants to the skin (as measured by a wipe test).
2. Total body surface area in square meters (S) can be estimated from a person's height in centimeters (H) and weight in kilograms (W). Data from the National Center for Health Statistics indicate that the height of a 50 kilogram female averages about 154 centimeters. [DuBois et al., 1916; Ganong, 1975; Guyton, 1976]

$$S = 0.007184 \times W^{0.425} \times H^{0.725} \quad S = 0.007184 \times 50^{0.425} \times 154^{0.725}$$

Total surface area is 1.46 m^2

3. The hands account for approximately 4.5% of the total surface area.

$$1.46 \text{ m}^2 \times .045 = 0.0657 \text{ m}^2$$

4. The contaminants from 5%, 10% or 25% of the surface area of the hands is assumed to be ingested every day.

$$\begin{aligned} 0.0657 \text{ m}^2 \times 0.05 &= 0.0033 \text{ m}^2 & 0.0657 \text{ m}^2 \times 0.10 &= 0.0066 \text{ m}^2 \\ 0.0657 \text{ m}^2 \times 0.25 &= 0.016 \text{ m}^2 \end{aligned}$$

5. The maximum exposed surface area for considering dermal absorption is the entire area of both arms. That surface area for a 50 kilogram female is 19% of the total body surface area, or 0.28 m^2 ($0.19 \times 1.46 \text{ m}^2$) [Diem et al., 1970]. Contact between skin and contaminated walls (or other surface) is assumed to occur for 10%, 25% or 50% of this surface area.

$$\begin{aligned} 0.10 \times 0.28 \text{ m}^2 &= 0.028 \text{ m}^2 & 0.25 \times 0.28 \text{ m}^2 &= 0.070 \text{ m}^2 & 0.50 \times \\ 0.28 \text{ m}^2 &= 0.14 \text{ m}^2 \end{aligned}$$

6. The amount of contamination absorbed by the skin is assumed to be 1% or 10% of the contaminant on the skin surface [Poiger et al., 1980].

7. The maximum and minimum guidelines among all possible guidelines were calculated as shown below.

a. Maximum guideline

Assumptions - ingest contamination from 5% of the hands' surface area (0.0033 m^2)

- absorb 1% of the contamination with 10% of the surface area of the arms contacting a contaminated surface (0.00028 m^2)

$$100 \text{ picograms} / (0.0033 \text{ m}^2 + 0.00028 \text{ m}^2) = 28 \text{ ng/m}^2$$

b. Minimum guideline

Assumptions - ingest contamination from 25% of the hands' surface area (0.016 m^2).

- absorb 10% of the contamination with 50% of the surface area of the arms contacting a contaminated surface (0.014 m^2).

$$100 \text{ picogram} / (0.016 \text{ m}^2 + 0.014 \text{ m}^2) = 3.3 \text{ ng/m}^2$$

5.4 Comparison of the Annual Average Ambient Air Concentrations of PCDDs and PCDFs at the Point of Maximum Impact with Standards and Criteria.

As the first criteria of risk, the average annual ambient air concentrations of PCDDs and PCDFs at the point of maximum impact were compared with existing standards and criteria. The purpose of this comparison was to determine if the predicted maximum annual average concentrations of PCDDs and PCDFs resulting from the operation of the BNYRRF exceed any existing standards or criteria at any point downwind of the facility.

As described in Section 4.2, the maximum ambient air concentrations of PCDDs and PCDFs are predicted to occur in Case 1, where we have assumed that all PCDDs and PCDFs are emitted in a gaseous state. Maximum average annual concentrations of PCDDs and PCDFs at ground level and elevated receptors used in the following comparisons are provided in Table 4-1.

5.4.1 Comparison with Canadian Standard. In 1982, the Ontario Ministry of the environment issued ambient air quality guidelines for complex mixtures of PCDDs and PCDFs using the ADI/NOEL approach as described in Section 5.2.1. This guideline stated that the following equation should not exceed 1.

$$\frac{x}{30\text{pg/m}^3} + \frac{y}{30\text{pg/m}^3 \times 50} = 1$$

x = Total PCDD concentration

y = Total PCDF concentration

Table 4-1 provides the predicted annual average PCDD and PCDF concentrations at ground level. Applying these numbers to the Ontario guidelines gives us:

$$\frac{0.23\text{pg/m}^3}{30\text{pg/m}^3} + \frac{1.99\text{pg/m}^3}{30\text{pg/m}^3 \times 50} = .009$$

The predicted worst-case downwind ambient concentration for PCDDs + PCDFs equals 0.9% of the standard. This standard is conservative in that all PCDD's are treated as being as toxic as 2, 3, 7, 8 TCDD and all PCDFs are treated as being 1/50 as toxic as 2, 3, 7, 8 TCDD.

5.4.2 Comparison with Netherlands Standard. The Netherlands has issued a standard for 2,3,7,8-TCDD based upon an ADI of 4×10^{-12} g/kg of b.w.-day. Applying assumptions used by Canada (60 kg/man, 20 m³ daily ventilation rate, a 100% particulate retention and 100% bioavailability) yields a maximum daily acceptable ambient air concentration of 12 pg/m³ of 2,3,7,8-TCDD.

The predicted maximum average annual concentration of 2,3,7,8-TCDD at ground and elevated receptors of 0.00168 pg/m^3 equals 0.014% of the Netherlands standard. Using a toxic equivalency factor of 59, the levels of TCDD toxic equivalents are still only 0.83% of the Netherlands ADI.

5.4.3 Comparison with NYSDEC Guideline. NYSDEC used the EPA's Risk Assessment of the Municipal Waste Combustors (MWCs) to establish a performance guideline for evaluating other combustion sources. As described in Section 5.3.1, EPA found a maximum annual average ambient air concentration at ground level equal to $9.2 \times 10^{-14} \text{ g/m}^3$ for all T_4 CDDs. EPA performed a risk assessment based on these concentrations and stated that the excess cancer risks (which ranged up to 19×10^{-6}) presented no significant risk to the public. On the basis of EPA's risk assessment, the maximum PCDD level found was then adopted by NYSDEC as a guidance level. Using data from Table 4-1, the maximum average TCDD concentrations predicted in the ambient air downwind of the BNYRRF at ground level and elevated receptors is 0.026 pg/m^3 which is equal to 28.2% of the NYSDEC guideline for total TCDDs.

5.4.4 NYSDOH Guideline. NYSDOH established air and exposure guidelines for reentry into a Binghamton, New York, office building that had been evacuated following an electrical transformer fire. For workers exposed for 250 days/year, 8 hour/day, the TCDD toxic equivalent concentration should not exceed 15 pg/m^3 . This concentration adjusted for 24 hour/day exposure for 365 days per year equals 3.4 pg/m^3 . Based upon our air dispersion model (Table 4-1) we predict an average annual 2,3,7,8-TCDD ambient air concentration at ground level equal to $.00168 \text{ pg/m}^3$ which is equal to a total TCDD toxic equivalent concentration of $.099 \text{ pg/m}^3$. Therefore, the predicted emissions from the BNYRRF are expected to result in an annual average ambient air concentration of 2,3,7,8-TCDD and TCDD toxic equivalents that is only 0.049% and 2.9% of the NYSDOH guideline, respectively.

5.5 Computation of a "Worst-Case" Upper Bound to the Level of Risk Associated with Emissions from the BNYRRF.

In the previous section, the maximum annual average PCDD and PCDF concentrations at ground level and elevated receptors were compared to the

existing standards and criteria. In this section, we calculated a range and upper-bound limit of risk for each of three potential pathways for PCDD and PCDF exposure: inhalation, ingestion, and dermal absorption.

An upper-bound limit of risk is a predicted upper limit or maximum risk, using worst-case assumptions, at the point of maximum exposure, for a period of a 70-year lifetime.

To calculate a range and upper-bound limit of risk, we have estimated a PCDD and PCDF daily intake for each of the three pathways using the dispersion and deposition models for dioxin emissions presented in Chapter 4, and data regarding the uptake and bioavailability of PCDDs and PCDFs from air, soil, dust, and street dirt. The PCDD daily intake was then compared with existing ADIs and the cancer dose/response data to determine if there are significant health impacts that might be associated with the predicted BNYRRF emissions.

5.5.1. General Approach. In order to lessen the inherent degree of uncertainty in the risk assessment process, the following sequence was followed.

1. The compounds considered were initially limited to 2,3,7,8-TCDD and HCDD. Although other isomers are present, these compounds are the only ones with enough toxicity and carcinogenicity data to apply to a risk assessment using standard procedures for estimating carcinogenic and other risks in human populations.
2. Risks associated with inhalation of the maximum annual ambient air concentrations of PCDDs and PCDFs, resulting from the predicted operations of the BNYRRF, were evaluated first. This pathway allows for the best estimate of risk with the least degree of uncertainty.
3. Data from air dispersion modeling (see Section 4.0) and assumptions regarding pulmonary uptake of particulates were used to calculate a maximum daily intake of PCDDs and PCDFs by the in-

halation pathway at ground-level and elevated receptors (DI_{inh}). The resulting number was then compared with ADIs and cancer dose/response extrapolations developed by regulatory agencies.

4. Since BNYRRF emissions constitute a mixture of PCDDs and PCDFs, the concept of toxic equivalency, as described in Section 5.2.3, may be an appropriate method for estimating the toxicity of these mixtures. Therefore, a toxic equivalency factor of 59 was applied to produce an estimate of the toxic equivalent daily intake for comparison with ADIs.
5. The daily intake through inhalation (DI_{inh}) was used in conjunction with three different cancer risk extrapolation models to generate an upper bound estimate of the projected excess cancer risk resulting from predicted BNYRRF emissions.
6. Although inhalation is an important route of exposure for emitted particulates, it has been suggested that ingestion of PCDD and PCDF containing particulates deposited on outdoor and indoor surfaces (i.e., on soil, dust and street dirt) might also be risk factors. The sensitivity of the daily intake rate through inhalation to the additional daily intake from ingestion was tested. There is considerably less data to model this pathway and predict steady state concentrations of PCDDs in soil and dust, and to accurately estimate the amount of soil and dust ingested each day. Therefore, the number of assumptions, and hence, the degree of uncertainty of these estimates is increased relative to the inhalation pathway. Due to this uncertainty, a number of conservative assumptions were used to establish an upper bound limit to risk for this pathway.
7. In order to make the assessment as thorough as possible, exposure through the dermal absorption pathway was examined. Again, information regarding the mechanism of dermal toxicity and absorption is limited and conservative assumptions were used to estimate risk.

5.5.2. General Assumptions

Several general assumptions are used throughout the assessment.

1. The air dispersion and particulate deposition modeling of the stack emissions from the chimney adequately represents the transport of the PCDD emissions to ground level.
2. The composition of emission products found at ground level is identical to the composition (but not the concentration) found in the stack.
3. The population is exposed to the maximum annual average ground level concentrations from the incinerator for 24 hours a day throughout a 70-year lifetime.
4. We have assumed conservatively, that there is no loss of PCDDs through volatilization or photodegradation.

5.5.3 Inhalation Exposure

5.5.3.1 Calculation of Daily Intake. In order to calculate an upper-bound estimate of the daily intake from inhalation, the average maximum annual ambient air concentration of 2,3,7,8-TCDD must be multiplied by the average amount of air exchanged per day, the particulate retention rate and the bioavailability of the inhaled material. Thus, the maximum daily intake of 2,3,7,8-TCDD through inhalation (DI_{inh}) in grams per day is calculated as shown below:

$$DI_{inh} \text{ (g/day)} = \text{TCDDs (g/m}^3\text{)} \times \text{ventilation rate (m}^3\text{/day)} \times \text{particulate retention (\%)} \times \text{bioavailability (\%)}.$$

In the absence of quantitative data, a conservative assumption has been applied, that indoor ambient air contaminant concentrations equal outdoor concentrations. In fact, as reviewed by Yocum, this is not true for contaminants of outdoor origin (Yocum, 1982). For contaminants attached to particulates, the long-term indoor versus outdoor concentration is reduced

by the scrubbing of outdoor air as it penetrates the building shell. The degree of reduction is in turn dependent on the season of the year, with higher indoor concentrations reported during warm weather, when windows are kept open. For contaminants such as lead or nonmethane hydrocarbons, the indoor concentration may equal only 50 - 66% of the outdoor concentration. Since the average person spends at least 1/3-1/2 of his or her life indoors, the assumption that the indoor/outdoor concentrations are equal may overestimate risk by at least 11-17%.

Reported air exchange volumes (averages for adult men and women combined) range from 13m^3 up to 20m^3 . For this assessment, the estimate used by the CDC of $15\text{m}^3/\text{day}$ will be used since this represents a reasonable estimate for a population that includes children in addition to working adults.

Not all particulate matter inhaled into the lungs is retained by the lungs. Thus, the amount of exposure depends on the particle size distribution. We used an EPA estimate that 75% of the inhaled particulates are retained (EPA 1981). This estimate is based upon studies done by the International Commission of Radiological Protection. It appears to be a slightly conservative estimate in that 50% of the particles by weight are of the size category (less than $2\mu\text{m}$) expected to settle deeply into the lungs (Lippman, 1979). The remaining 50% will be deposited in the upper respiratory tract and subsequently swallowed.

No data are available regarding the bioavailability of PCDDs and PCDFs in laboratory animals subjected to PCDD dosing through inhalation exposure. In the absence of any bioavailability data for the inhalation pathway, and in accordance with the EPA methodology used in its risk assessment of five MWC's, a conservative assumption of 100% bioavailability was used.

To derive an upper limit to DI_{inh} , we assumed a maximum annual average concentration of 2,3,7,8-TCDD for ground and elevated receptors equal to $0.00168 \text{ pg}/\text{m}^3$. This concentration was obtained from Table 4-1 using the Case 1 scenario where, for the purpose of modeling, it was assumed that all PCDD emissions leave the stack in a gaseous state.

To summarize, in order to determine an upper bound maximum daily intake of 2,3,7,8-TCDD from the inhalation pathway (DI_{inh}), the following assumptions were made:

- 75% of the inhaled particles are retained by the body
- 15 m³ of air are exchanged in one day
- 100% of the inhaled particles are bioavailable
- Maximum ambient air concentration of 2,3,7,8-TCDD equals 0.00168 pg/m³

$$DI_{inh} = 0.00168 \text{ pg/m}^3 \times 10^{-12} \text{ g/pg} \times 0.75 \times 15 \text{ m}^3/\text{day}$$

$$DI_{inh} = 1.9 \times 10^{-14} \text{ g/day for ground or elevated receptor}$$

For the Case 2 scenario, $DI_{inh} = 8.8 \times 10^{-15} \text{ g/day}$
 (assumes ambient air concentration of 2,3,7,8-TCDD = 0.000782 pg/m³)

5.5.3.2 Comparison of Daily Intake from Inhalation with Acceptable Daily Intake Levels (ADIs). Several regulatory agencies in this country and abroad have set 2,3,7,8-TCDD standards and criteria on the basis of an acceptable daily intake as presented in Table 5-1. These agencies felt that the ADI approach was a reasonable method for determining very safe dose levels. It also provides a large margin of safety for non-carcinogenic toxic effects.

The upper bound estimate of 2,3,7,8-TCDD intake through the inhalation pathway in comparison with these ADIs is presented in Table 5-7. In comparison to these ADIs, the impact of the BNYRRF emissions are negligible. For example, the maximum estimated intake of 2,3,7,8-TCDD through the inhalation pathway for a 70 kg man is only .017% of the most conservative published ADI, of 1.8 pg/kg-day.

As an added safety factor, we compared the daily intake with published ADIs using two other conservative assumptions. First, that all TCDDs (tetra chlorinated species) were as toxic as the 2,3,7,8-TCDD. Second, that the

TABLE 5-7

Upperbound Estimated Percentage of
Acceptable Daily Intake (ADI)
Attributable To Inhalation of PCDD
and PCDF Emissions from the BNYRRF
at Ground Level and Elevated Receptors

	Acceptable Daily Intake (ADI)			
	Canada 10 pg/kg-day	Netherlands 4pg/kg-day	NYSDOH 2pg/kg-day	CDC 1.8pg/kg-day
Upperbound Daily Intake- Inhalation Pathway				
2,3,7,8-TCDD ^(a) (2.7×10^{-4} pg/kg-day)	0.0027%	0.007%	0.014%	0.01%
TCDD ^(b) (4.2×10^{-3} pg/kg-day)	0.042%	0.11%	0.21%	0.23%
TCDD Toxic Equivalency ^(c) (1.6×10^{-2} pg/kg-day)	0.16%	0.40%	0.80%	0.89%

* Assumes 70 kg/person inhaling .00168 pg/m³ of 2,3,7,8-TCDD

$$(a) \text{ DI}_{\text{inh}} (\text{pg/kg-day}) = \frac{\text{DI}_{\text{inh}} (\text{g/day})}{70\text{kg}} = \frac{1.9 \times 10^{-2} \text{ pg/day}}{70} = 2.7 \times 10^{-4} \text{ g/day}$$

$$(b) \text{ DI}_{\text{inh}} (\text{TCDD}) = \text{DI}_{\text{inh}} (2,3,7,8\text{-TCDD} \times 15.5)$$

$$(c) \text{ DI}_{\text{inh}} (\text{Toxic Equivalents}) = \text{DI}_{\text{inh}} (2,3,7,8\text{-TCDD} \times 59)$$

toxicity of the complex mixture of PCDDs and PCDFs was 59 times that of 2,3,7,8-TCDD alone, using the toxic equivalency approach.

As can be seen in Table 5-7, even with these assumptions, the maximum daily intake of TCDD toxic equivalents through inhalation of gaseous or particulate emissions from the BNYRRF ranges from 0.16 to 0.89% of the various ADI's. These levels are well below very safe dose levels suggested by these regulatory agencies. Similar low levels are observed, using the assumption that all tetra CDDs are as toxic as 2,3,7,8-TCDD. The data indicates that risks associated with potential non-carcinogenic toxic effects due to inhalation of PCDD and PCDF emissions from the BNYRRF are not significant.

5.5.3.3 Comparison of Daily Intake From the Inhalation Pathway With Cancer Risk Estimates. A primary focus of concern regarding dioxin emissions from the BNYRRF has been the carcinogenicity risks. Extrapolated dose/response data necessary to estimate carcinogenicity risk is available from long-term animal feeding studies only for 2,3,7, 8-TCDD and a mixture of two HCDD isomers. Using the daily intake calculations for inhalation exposure, and three different risk extrapolation models, an estimate of the excess cancer risk resulting from the projected operations of the BNYRRF was calculated and is presented in Table 5-8. The data presented in this table provides the estimate of the increased cancer incidences per 1,000,000 people exposed (to the maximum concentrations) over a 70-year lifetime.

To calculate these risks, the daily intake (pg/day) for 2,3,7,8 TCDD and HCDDs in a 70 kg/person was compared to the dose (pg/day) required to produce an increase of 1 case of cancer per 1,000,000 people exposed to that dose over a 70 year lifetime.

For example, Table 5-8 indicates that the EPA dose/response extrapolation for 2,3,7,8-TCDD projects a 1×10^{-6} excess cancer risk if .0064 pg per kg of body weight is ingested each day over a 70-year period.

A 1×10^{-6} excess cancer risk means that the dose response extrapolation predicts one increased case of cancer for every one million (10^6) persons exposed to the .0064 pg/kg over a 70-year lifetime.

TABLE 5-8

UPPERBOUND ESTIMATED INCREASED CANCER RISK FOR
POPULATION OF ONE MILLION PEOPLE EXPOSED FOR A
70 YEAR PERIOD TO THE MAXIMUM DAILY INTAKE

Daily Intake	<u>Dose for 1×10^{-6} Excess Cancer Risk</u>		
	Kimbrough ^a	Kimbrough	EPA
	<u>(1.4 pg/kg-day)</u>	<u>(.028 pg/kg-day)</u>	<u>(.0064 pg/kg-day)</u>
	Upper Bound Excess Risk for 70Kg man		
1.9×10^{-2} pg/day (2,3,7,8-TCDD)	.0019	.010	.042
0.15 pg/day** (1,2,3,6,7,8 and 1,2,3,7,8,9-HCDD)	---	---	.013

** Dose for 10^{-6} excess risk HCDD (1,2,3,6,7,8 and 1,2,3,7,8,9) = 0.16 pg/kg-day.

Assumes only 20% of total HCDD isomers are 1,2,3,6,7,8 and 1,2,3,7,8,9-HCDD ($DI_{HCDD} = DI_{ing} (2,3,7,8-TCDD) \times 39.5 \times 0.2 = 0.13$ pg/day).

- a. Differences in Kimbrough dose/response estimates based upon upper and lower confidence limits to risk estimates for different lesion sites.

To quantify the excess cancer risk projected for the BNYRRF, we take a ratio of the predicted daily intake (dose) of 2,3,7,8-TCDD (DI_{inh}) to the dose predicted by a given dose/response extrapolation to cause an excess risk of 1×10^{-6} in a 70 kg person as follows:

$$\text{excess risk} = \frac{DI_{inh} \text{ (pg/day)} \div 70 \text{ (kg)} \times (1 \times 10^{-6} \text{ risk})}{(\text{dose for } 1 \times 10^{-6} \text{ risk in pg/kg-day})}$$

Using the EPA dose/response extrapolation for 2,3,7,8-TCDD cancer risk, and using $DI_{inh} = 1.9 \times 10^{-2}$ pg/day:

$$\text{excess risk} = \frac{1.9 \times 10^{-2} \text{ pg/day} \div 70 \text{ (kg)} \times (1 \times 10^{-6})}{(.0064 \text{ pg/kg-day})} = .042 \times 10^{-6}$$

Therefore, the EPA dose/response model predicts that the inhalation of 1.9×10^{-2} pg/day of 2,3,7,8-TCDD results in an upper limit to risk equal to less than 0.042 increased cancer cases for every one million people exposed.

For HCDD, only two isomers (1,2,3,6,7,8 and 1,2,3,7,8,9-HCDD) have been tested as a mixture. These compounds were shown to be carcinogenic in animal feeding studies. These two isomers make up only 20% of the total number of possible HCDD isomers. We assumed equal distribution of the various HCDD isomers in particulate emissions. Therefore, the daily intake for the carcinogenic isomers of HCDD was calculated by multiplying the total HCDD intake by 20%. Since $DI_{inh}(\text{HCDD}) = DI_{inh}(2,3,7,8\text{-TCDD}) \times 39\%$, $DI_{inh}(\text{HCDD})$ (1,2,3,6,7,8 and 1,2,3,7,8,9) equals $1.9 \times 10^{-2} \text{ pg/day} \times 39.5 \times 0.2 = 0.15 \text{ pg/day}$.

As demonstrated in Table 5-8, the increased cancer risks vary by several orders of magnitude depending upon the risk extrapolation model used. Using the most conservative model, the EPA risk model, and assuming that the excess risks from TCDD and HCDD are additive, the projected levels of exposure under worst case assumptions would not result in more than 0.06 new cases of cancer in a population of one million, exposed to the estimated maximum levels and assuming a maximum daily intake over a 70-year lifetime. In more common terminology, the excess cancer risk for a 70-year lifetime is less than 0.06×10^{-6} or 6 in 100 million. If the other dose extrapolations

are more representative, it can be seen that the cancer risk levels are substantially less by one to three orders of magnitude.

Note that the figures in Table 5-6 are not predictions of actual risk. Instead, they denote a level of risk that the actual risk is not likely to exceed, hence the term "upper bound". The actual risk should fall somewhere between zero and the estimated upper bound.

To summarize, the data indicate that the upper-bound excess cancer risks resulting from lifetime inhalation of the maximum annual average ambient air concentrations of 2,3,7,8-TCDD and HCDD, predicted downwind of the BNYRRF, are less than 0.06×10^{-6} . This risk is below levels that represent a significant public health risk.

5.5.3.4. Elevated Receptors As provided in Section 4-2, the air dispersion model used to predict ambient air concentrations of PCDDs and PCDFs predicts that elevated receptors will be exposed to the same average PCDD and PCDF concentrations predicted for ground level receptors. Accordingly, the risks at elevated receptors will be the same as discussed above in the previous section.

5.5.3.5. Summary of Risks Through Inhalation A maximum daily intake for 2,3,7,8-TCDD equal to 1.9×10^{-2} pg/day was predicted for the inhalation pathway. Using ratios of the various homologues, daily intakes for total TCDD, TCDD toxic equivalents, and HCDD were determined.

The level of risk was first estimated by comparing the predicted maximum average annual ambient air concentration of PCDDs and PCDFs with guidelines and standards used by other regulatory agencies.

Comparison of the total PCDD and PCDF concentrations at ground level with the Canadian Standard resulted in a concentration equal to 0.9% of the standard. Similar comparisons with the Netherlands and NYSDOH guidelines yielded .014% and .049% of the guidelines respectively for 2,3,7,8-TCDD, and 0.83% and 2.9% of the guidelines for TCDD toxic equivalents.

Comparison of maximum annual ground level and elevated receptor level TCDD concentrations with a NYSDEC guideline indicates that emissions from the BNYRRF facility will be within 28% of this guideline level.

Despite the application of several conservative assumptions, the daily intake of 2,3,7,8-TCDD through inhalation is predicted to be quite small (less than .017%) in comparison with ADIs promulgated by various regulatory agencies.

As an additional safety factor, the daily intake of TCDD toxic equivalents was determined. Using this toxic equivalency approach, the upper bound risk due to exposure to the mixture of PCDDs and PCDFs equals only 0.89% of the most conservative ADI for 2,3,7,8-TCDD.

An upper bound to carcinogenicity risk was determined using three different cancer dose/response extrapolations. The upper bound excess risk due to exposure to 2,3,7,8-TCDD and HCDD at the point of maximum exposure ranges from less than .0019 to less than 0.055×10^{-6} . This equals less than six cases per one hundred million people exposed to the maximum concentration over a 70 year lifetime.

5.5.4 Ingestion and Dermal Exposure.

5.5.4.1 Discussion. The standard practice for most regulatory agencies performing risk assessments for combustion sources is to consider inhalation of emission products as the only pathway of exposure.

Studies performed on other pollutants emitted from point source emissions, such as smelters, or from non point sources indicates that ingestion and dermal absorption of particulate emissions deposited on living area surfaces may also be exposure pathways (USEPA, 1977; USEPA, 1984c). However, typically these pathways are ignored since the data needed to characterize the environmental fate, transport, and biological uptake of toxic contaminants, in relation to ingestion and dermal exposure pathways, are not well documented.

Nonetheless, as an additional safety factor in our own risk assessment, we tested the sensitivity of the risks derived for the inhalation pathway to

the additive impacts of ingestion and dermal absorption of dioxin contaminated dust, dirt, and soil.

In Section 4, two emission scenarios were explored. In case 1, it was assumed that all dioxin emissions exit the baghouse in a gaseous state. Under this scenario, deposition of dioxin on streets, homes, parks, etc. is negligible.

In case 2, it was assumed that all dioxins entering the baghouse enter attached to particulates. Those particulates that escape through the baghouse, if heavy enough, will deposit on ground surfaces for potential uptake through ingestion or dermal pathways. However, under this scenario, the maximum annual average ambient air concentrations of PCDDs and PCDFs is decreased compared with case 1. Actual partitioning of dioxins between gaseous and particulate phases will most probably be somewhere between these two extremes presented as cases 1 and 2.

For the purpose of calculating a maximum daily intake of PCDD through maximum ingestion and dermal exposure, the case 2 scenario will be assumed. A daily intake was calculated for these two pathways where:

DI_{ing} = Daily intake of 2,3,7,8-TCDD through ingestion

DI_{derm} = Daily intake of 2,3,7,8-TCDD through dermal absorption.

Determining a daily TCDD intake rate through ingestion is more difficult than determining one for inhalation since the concentrations of PCDD on urban streets and in homes, and the clearing effect of wind, rain, and sunlight cannot be easily modeled. Further, the daily rate of ingestion of soil and dust and the bioavailability is not adequately established in the literature. As a result, in accordance with risk assessment practice, we have used a series of "worst case" assumptions. The daily intake levels calculated using the assumptions should be regarded as upper bound estimates. The actual daily intake is likely to be less than predicted.

5.5.4.2 Daily intake through the ingestion pathway. A daily intake of 2,3,7,8-TCDD through ingestion (DI_{ing}) was estimated in two ways. First,

we estimated a rate of soil ingestion in grams per day, TCDD concentration (weight basis) in soil or dirt, and a percentage bioavailability such that:

$$DI_{ing}(g/day) = [TCDD \text{ g/g-soil}] \times \text{Daily Ingestion (g/day)} \times \text{Bioavailability.}$$

Using a different, surface area approach, we also determined a concentration of TCDD in g/m^2 on home and street surfaces. Then, using an estimate of bioavailability and the surface contact area for hands, feet and other exposed areas, we calculated DI_{ing} as follows:

$$DI_{ing}(g/day) = [TCDD \text{ g/m}^2] \times \text{Surface Contact (m}^2/\text{day)} \times \text{Bioavailability}$$

The CDC, in its risk estimate, made an assumption that the average person ingests from 0.1 to 10 grams of soil a day, depending on the age group. Maximum ingestion rates occur at the $1\frac{1}{2}$ - $3\frac{1}{2}$ year old age group when mouthing behavior is prominent. Using the CDC data, a weighted average ingestion rate for a 70 year lifetime equals 0.41 g/day (Kimbrough, 1983).

The ingestion levels used by CDC seem quite high and therefore conservative when compared with other studies. For example, Duggan and Williams have summarized the literature on the amount of lead ingested through street dust (Duggan et al., 1977). In their opinion, a quantity of 50 ug of lead is ingested daily by children. Assuming, on the high side, an average lead concentration in urban environments of 1000 ppm, this would indicate an ingestion of 50 mg/day of soil and dirt per day.

Lepow et al., in an assessment of lead exposure in children caused by ingesting dirt and dust, estimated a rate of dirt ingestion equal to 100 mg/day (specifically 10mg of dirt ingested 10 times a day) (Lepow, 1974). In a recent Dutch study, the amount of lead on hands ranged from 4-12ng (Brunekreef, 1983). Assuming maximum lead concentrations of 500 ng/g (the levels were typically lower) and assuming the child ingested the entire contents absorbed on his hand on 10 separate occasions, the amount of ingested dirt would equal 240mg. Thus, to eat 10 grams of soil per day, as suggested by CDC, the child would have to place his hand in his mouth 410 times, a rate which seems improbable. Nevertheless, for calculating soil ingestion rates

a range of exposure levels was utilized assuming a daily ingestion rate of 100 mg to 410 mg/day.

Daily intake levels via the ingestion pathway were also calculated using a NYSDOH surface area approach. In their risk assessment of the Binghamton office fire, NYSDOH made the assumption that contaminants contained on 5-25% of the surface area of the hands were ingested. Based upon average hand surface areas for females, the material contained on 0.0033 m² - 0.016 m² of surface would be ingested each day.

The bioavailability of PCDD contaminated fly ash and soil via ingestion is not well documented. Data on gastrointestinal absorption are provided in Table 5-9. Studies of rats given TCDD in the diet reported 50 to 60 percent absorption. A mixture of TCDD in acetone and corn oil given to rats by gavage resulted in 86 percent absorption. A recent study reported by McConnell indicates high bioavailability in guinea pigs and rats fed dioxin contaminated soil from Times Beach (McConnell, 1984).

The CDC uses bioavailability estimates of 30% based on a personal communication from McConnell, who estimated 30-50% bioavailability for PCDD in soil, a level contradicted by his most recent publication (Kimbrough, 1983). Because of the lack of solid information, bioavailability was estimated to range from 30% to 80%.

It should be noted that dioxin is believed to bind more tightly to fly ash than to most soils. Frequently, very difficult extraction techniques are required to desorb the material from fly ash. Therefore, the bioavailability of dioxin adsorbed to fly ash is expected to be lower than for soil.

Feeding of fly ash containing PCDDs to rats over a 19-day period resulted in lower absorbed PCDD levels than for a similar PCDD concentration solvent extracted from fly ash in toluene (Van den Berg, 1983). For example, rats fed fly ash stored PCDDs and PCDFs in their livers at concentrations which were at least 3-5 times lower than rats fed with a comparable amount of a fly ash extract. For Penta-CDD, hexa-CDF, and hexa-CDD isomers, these concentrations were 10-20 times lower. This supports the argument that the bioavailability of fly ash is likely to be on the low side of the

TABLE 5-9

GASTROINTESTINAL ABSORPTION OF 2,3,7,8-TCDD

<u>Species</u>	<u>Vehicle</u>	<u>Dose (ug/kg) Schedule</u>	<u>Percent Absorption Mean $\pm$SD</u>	<u>Reference</u>
Guinea pig	NR	NR Single dose	50	Nolan et al., 1979
Rat	7 ppb in diet	0.5 ug/kg/day x 42 days	50-60	Fries and Marrow, 1975
Rat	20 ppb in diet	1.4 ug/kg/day x 42 days	50-60	Fries and Marrow, 1975
Rat	A:C 1:25	1.0 ug/kg Single dose	84 $\pm$ 11*	Rose et al., 1976
Rat	A:C 1:25	0.1 or 1.0 ug kg/day, 5 days/ week x 7 weeks	86 $\pm$ 12*	Rose et al., 1976
Rat	A:C	50.0 ug/kg, Single dose	70	Piper et al., 1973

NR = Not reported

A:C = Acetone:corn oil, v:v

* Mean $\pm$ standard deviation

range of numbers generated by feeding extracts of TCDD in acetone and corn oil, or in the diet, as presented in the Table 5-9.

To summarize, a determination of the daily intake due to ingestion was derived on the basis of several different assumptions concerning the patterns of exposure. These assumptions include:

- Ingestion of 100 mg of soil or dust per day and 30% bioavailability
- Ingestion of 410 mg of soil or dust and 30% bioavailability
- Ingestion of 100 mg of soil and 80% bioavailability
- Ingestion of 410 mg of soil and 80% bioavailability
- Contact with surfaces at up to 0.016 m²/day

Each of these assumptions was tested further by assuming three different sources of exposure - home dust, street dirt, and soil, using the data provided in Section 4.

The concentration of PCDDs in street dirt was determined by dividing the PCDD deposition rate by the average particulate deposition rate from non-dioxin sources. Table 4-4 shows the average annual deposition rate for 2,3,7,8-TCDD equal to .0065 ng/m²/year. At any point in time, this material is being diluted by 74 g/m²/year of particulates from non-dioxin sources. Therefore, for the purpose of this assessment, we predict a maximum 2,3,7,8-TCDD concentration to equal 8.8×10^{-14} gram per gram of street dirt (Table 4-6). This is a highly conservative estimate, since the dioxin containing fly ash will be diluted not only by other airborne particulate matter but also by lint, dirt, gravel, etc. The estimates are also particularly conservative in that no degradation, volatilization or physical clearing (e.g. runoff to storm sewers) of TCDD is assumed.

On a weight to weight basis, TCDD concentrations in home dust were assumed to be equal to the concentration in street dirt, an assumption which is used by CDC in its risk assessment and supported by some studies of lead contamination in indoor versus outdoor environments (Harrison, 1979).

The maximum concentration of TCDD's in soils was estimated by assuming a one centimeter mixing zone and estimating a build up over a 20 year period as provided in Table 4-5. Again, the estimate is clearly conservative, with no losses due to volatilization, degradation, or physical clearing.

As discussed in Chapter 4.0, PCDD levels in home dust and street dirt on a surface area basis were also used to estimate risk. The maximum accumulation on floors was estimated assuming indoor deposition at 25% of the outdoor rate, with a 30-day period of accumulation.

There is some evidence to suggest that a 30-day accumulation period is overly conservative. The data provided by Solomon *et al.*; if extrapolated, indicates that there is from 0.6 to 1g dust/m² in single family urban middle class homes (gas heated) in Champagne-Urbana Illinois. His data, if applied to the PCDD and total particulate deposition rates, would indicate that steady state conditions for dust buildup in homes would be reached in three to five days (Solomon, 1977).

For outdoor deposition the accumulation period in urban streets is unknown. The Swiss EPA in their assessment of dioxin emissions from incinerators, used an estimated half life equal to 14 days for rural environments (SFOEP, 1982). Consistent with this Swiss EPA assessment, we have assumed a 30 day period of accumulation as a reasonable accumulation period.

The estimated daily intake through the ingestion pathway calculated on a weight or surface area basis is presented in Tables 5-10 and 5-11.

The maximum estimated daily intake calculated by either method provides reasonably similar results. On a weight basis, the maximum estimated daily intake of 2,3,7,8-TCDD ranged from 2.5×10^{-16} g/day to 2.9×10^{-14} g/day. On a surface area basis, the daily intake ranged from 1.3×10^{-16} to 6.8×10^{-15} g/day.

5.5.4.3 Daily Intake From Dermal Adsorption. Estimating a daily intake due to dermal absorption requires a determination of the surface area or exposed skin, the frequency of contact between the exposed skin and

TABLE 5-10

ESTIMATED DAILY INTAKE OF 2,3,7,8-TCDD
THROUGH THE INGESTION PATHWAY
 (Weight Approach)

	<u>Source of Exposure</u>		<u>Soil*</u>
	<u>Home Dust</u>	<u>Street Dirt</u>	
Concentration of 2,3,7,8-TCDD	8.8×10^{-14} g/g	8.8×10^{-14} g/g	8.2×10^{-15} g/g
Mechanism	Daily Intake (g/day)		
100 mg/day - 30% Bioavail	2.6×10^{-15}	2.6×10^{-15}	2.5×10^{-16}
100 mg/day - 80% Bioavail	7.0×10^{-15}	7.0×10^{-15}	6.6×10^{-16}
410 mg/day - 30% Bioavail	1.1×10^{-14}	1.1×10^{-14}	1.0×10^{-15}
410 mg/day - 80% Bioavail	2.9×10^{-14}	2.9×10^{-14}	2.7×10^{-15}

* Assumes 20 year buildup in top centimeter of soil with no loss due to degradation, volatilization or runoff.

TABLE 5-11

ESTIMATED DAILY INTAKE OF 2,3,7,8-TCDD
THROUGH THE INGESTION PATHWAY
 (Surface Area Approach)

	<u>Source of Exposure</u>	
	<u>Home Dust</u>	<u>Street Dirt</u>
Concentration of 2,3,7,8 TCDD	$1.3 \times 10^{-13} \text{ g/m}^2$	$5.3 \times 10^{-13} \text{ g/m}^2$
Mechanism	Daily Intake (g/day)	
Contact with .0033 m ² /day - 30% Bioavail	1.3×10^{-16}	5.2×10^{-16}
Contact with 0.0033 m ² /day - 80% Bioavail	3.4×10^{-16}	1.4×10^{-15}
Contact with 0.016 m ² /day - 30% Bioavail	6.2×10^{-16}	2.5×10^{-15}
Contact with 0.016 m ² /day - 80% Bioavail	1.7×10^{-15}	6.8×10^{-15}

* Assumes buildup of dust or dirt over 30 day period.

contaminated surfaces, and the rates of absorption for PCDDs and PCDFs bound tightly to soil, dust, and fly ash. Information to calculate these data are also not well documented. Accordingly, a number of assumptions were used to provide a range and upper bound estimate for daily intake through the dermal pathway.

Some estimates of the exposure level due to direct contact can be made by considering the surface area of exposed skin. Based upon this consideration, the CDC has estimated direct contact on a weight basis by assuming contact with up to 0.55 grams of soil per day over a 70-year lifetime. (Kimbrough, 1983).

In its risk assessment of the Binghamton office fire, NYSDOH used a surface area approach and assumed a transfer of surface materials proportional to the surface area of the hands and arms of female workers. Contact between skin and surfaces was then estimated to occur over 10 percent, 25 percent, or 50 percent of this surface area. This estimate resulted in a range of exposures from $.028 \text{ m}^2$ to 0.14 m^2 each day (Kim, 1984).

The study by Poiger, et al., (1980), is the only study to provide data on the absorption of TCDD through the skin. Application of TCDD in methanol or TCDD in a soil/water paste resulted in TCDD accumulation in the liver amounting to 2 percent of the administered dose. Application in an activated carbon/ water paste completely eliminated absorption. Dermal application in polyethylene glycol resulted in 9.3 percent absorption compared with oral feeding of TCDD dissolved in ethanol. Since TCDD is expected to be bound tightly to fly ash, the amount of absorption from fly ash may be less than that for soil. As a conservative measure, we have assumed daily absorption rates of 1 percent and 10 percent.

To calculate a daily intake due to dermal absorption we tested the following models:

- contact with 0.55 grams of dust/dirt - 1 percent absorption
- contact with 0.55 grams of dust/dirt - 10 percent absorption
- contact with $.028 \text{ m}^2$ of surface area - 1 percent absorption

- contact with $.028 \text{ m}^2$ of surface area - 10 percent absorption
- contact with $.14 \text{ m}^2$ of surface area - 1 percent absorption
- contact with $.14 \text{ m}^2$ of surface area - 10 percent absorption

A daily intake through dermal absorption (DI_{derm}) was calculated as follows:

$$DI_{\text{derm}}(\text{g/day}) = [2,3,7,8\text{-TCDD}] \text{ g/g} \times 0.55 \text{ (weight approach)} \times \text{g/day} \times \% \text{ absorbed}$$

$$DI_{\text{derm}}(\text{g/day}) = [2,3,7,8\text{-TCDD}] \text{ g/m}^2 \times \text{Area m}^2/\text{day} \times \% \text{ absorbed}$$

or

$$DI_{\text{derm}}(\text{g/day}) = [2,3,7,8\text{-TCDD}] \text{ g/m}^2 = (\text{surface area approach}) \times \text{Contact Area m}^2/\text{day} \times \% \text{ absorbed}$$

The concentration of 2,3,7,8 TCDD in dust, dirt and soil used in the DI_{derm} calculation are the same as those described in Section 5.5.3.2.

The results of the daily intake calculation on a weight basis is presented in Table 5-12. The results using a surface area approach are provided in Table 5-13.

The calculation of a daily intake for dermal absorption using either a weight or surface area approach provides reasonably consistent results. Daily intake of 2,3,7,8-TCDD ranges from $4.5 \times 10^{-17} \text{ g/day}$ to $4.8 \times 10^{-15} \text{ g/day}$ using the weight approach, and from 3.6×10^{-17} to 6.7×10^{-15} using the surface area approach. Again, a high degree of conservatism has been applied. No losses of TCDD due to volatilization or degradation were considered. No physical clearing rates were considered in the weight approach estimate. Further, a significant rate of absorption was assumed (up to 10%), which for PCDDs bound to fly ash is believed to represent a significant overestimate for dermal absorption.

5.4.4.4 Impacts of Ingestion and Dermal Absorption Pathways on Risk Estimates. Several different models were tested in calculating a daily intake through inhalation, ingestion, and dermal absorption pathways. Using the range of 2,3,7,8-TCDD daily intake estimates provided in Tables 5-9 through 5-13, a minimum and maximum total daily intake in g/day was calculated as shown on Table 5-14 for each of the two emission scenarios (case

TABLE 5-12

DAILY INTAKE FROM DERMAL ABSORPTION
(weight approach)

	<u>Source of Exposure</u>		
	<u>Home Dust</u>	<u>Street Dirt</u>	<u>Soil</u>
Concentration of 2,3,7,8-TCDD	8.8×10^{-14} g/g	8.8×10^{-14} g/g	8.2×10^{-15} g/g
	Daily Intake (g/day)		
0.55 g of dust 1% Abs.	4.8×10^{-16}	4.8×10^{-16}	4.5×10^{-17}
0.55 g of dust 10% Abs	4.8×10^{-15}	4.8×10^{-15}	4.5×10^{-16}

TABLE 5-13

DAILY INTAKE FROM DERMAL ABSORPTION
(Surface Area Approach)

	<u>Source of Exposure</u>	
	<u>Home Dust</u>	<u>Street Dirt*</u>
Concentration of 2,3,7,8-TCDD	1.3×10^{-13} g/m ²	5.3×10^{-13} g/m ²
	Daily Intake (g/day)	
0.028 m ² of surface area 1% Abs	3.6×10^{-17}	1.5×10^{-16}
0.028 m ² of surface area 10% Abs	3.6×10^{-15}	1.5×10^{-15}
0.14 m ² of surface area 1% Abs	1.8×10^{-16}	7.4×10^{-16}
0.14 m ² of surface area 10% Abs	1.8×10^{-15}	7.4×10^{-15}

* PCDD concentrations in soils on a surface area basis are assumed to be identical with street dirt.

TABLE 5-14

CALCULATION OF A TOTAL DAILY INTAKE FOR INHALATION
INGESTION AND DERMAL ABSORPTION PATHWAY

Case 1 - PCDDs and PCDFs Enter Baghouse in Gaseous Phase.

$$DI = DI_{inh} + DI_{ing} + DI_{derm}$$

$$DI = 1.9 \times 10^{-14} + 0 + 0$$

$$DI = 1.9 \times 10^{-14} \text{ g/day}$$

Case 2 - PCDDs and PCDFs Enter Baghouse Attached to Particulates

$$DI = DI_{inh} + DI_{ing} + DI_{derm}$$

$$DI_{min} = 8.8 \times 10^{-15} + 1.3 \times 10^{-15} + 3.6 \times 10^{-17}$$

$$DI_{max} = 8.8 \times 10^{-15} + 2.9 \times 10^{-14} + 7.4 \times 10^{-15}$$

$$DI_{min} = 1.0 \times 10^{-14} \text{ g/day}$$

$$DI_{max} = 4.5 \times 10^{-14} \text{ g/day}$$

1 and 2) described in Section 4. Note that in case 2, DI_{inh} equals 8.8×10^{-15} g/day, $(0.000782 \text{ pg/m}^3 [(Table 4-2)] \times 0.75 \times 15 \text{ m}^3/\text{day})$.

Based on this analysis we predict that the maximum daily intake of 2,3,7,8-TCDD due to inhalation, ingestion, and dermal absorption of predicted emission products from the BNYRRF ranges from less than 1.9×10^{-14} g/day to 4.5×10^{-14} g/day.

The sensitivity of the risk estimates derived for the inhalation pathway to the additional risks that might be attributable to the ingestion and dermal pathways was tested. These latter two pathways were not considered initially due to the high degree of uncertainty in the estimates of ingestion, absorption, and bioavailability rates, and due to the difficulties in modeling PCDD concentrations in soil, dirt, and dust. To compensate for these uncertainties and provide a safety factor, a high degree of conservatism was applied to the model, and a number of "worst-case" assumptions were used to identify an upper bound, maximum limit to risk.

The data indicates that the predicted additional 2,3,7,8-TCDD intake from ingestion or dermal absorption of particulate emissions from the BNYRRF is negligible assuming that the minimum estimates for DI_{ing} and DI_{derm} are more representative of actual exposure (DI_{min}). Even using worst-case assumptions regarding the maximum rates of exposure (DI_{max}) through ingestion and dermal absorption, the total daily intake of 2,3,7,8-TCDD would increase by 2.4 times the amount from inhalation alone. Under this "worst-case" scenario, ingestion becomes the major pathway of exposure.

The general conclusions regarding the level of risk posed by the BNYRRF are not significantly altered if the maximum total daily intake of 2,3,7,8-TCDD increases 2.4 times to 4.5×10^{-14} g/day. This total daily intake of 2,3,7,8-TCDD equals only 0.036% of the most conservative ADI (1.8 pg/kg-day). Further, this total daily intake of 2,3,7,8-TCDD equals a toxic equivalent daily intake of 2.7×10^{-12} g/day (4.5×10^{-14} g/day $\times$ 59) which is only 2.1% of the most conservative ADI for a 70kg man.

The upper-bound carcinogenic risk estimates will also increase by a factor of 2.4 assuming the most conservative estimates for the ingestion and dermal absorption pathways. This would result in an upperbound increased cancer risk, for a population exposed to the maximum 2,3,7,8-TCDD and HCDD concentrations over a 70 year lifetime equal to less than 0.13×10^{-6} .

5.5.5 Additional Issues. It can be argued that the procedures used to predict the increased cancer risk associated only with 2,3,7,8-TCDD and HCDD exposure, underestimate the cancer risk of the complex mixture of PCDDs and PCDFs emitted from the BNYRRF. As stated previously, 2,3,7,8 TCDD represents only a small percentage of the total emissions projected for the BNYRRF.

It would be desirable to estimate the carcinogenic risk of this mixture for all other PCDD and PCDF isomers. However, dose/response data are lacking. Several regulatory agencies have used the concept of toxic equivalency to evaluate toxicities of complex mixtures and there is experimental evidence to support this approach in dealing with non-carcinogenic risk assessment procedures. However, there is no data regarding the applicability of this method to the assessment of the carcinogenicity of complex mixtures. In other words, it is not clearly established experimentally, that toxic equivalency correlates with carcinogenic equivalency.

Further, the regulatory agencies have taken conflicting positions regarding this issue. Neither EPA nor the CDC has tried to quantify the carcinogenicity risk of the complex mixture in any of their published risk assessments or publications on dioxins. However, EPA estimated increased cancer risk for 5 MWCs by making a conservative assumption that all TCDDs (Tetras) had the same carcinogenicity risk as 2,3,7,8-TCDD. Applying this assumption to the daily intake levels predicted downwind of the BNYRRF, we find that the maximum increased cancer risk for TCDD, for all three pathways would range to less than 1.3×10^{-6} depending upon the extrapolation model.

NYSDOH, in its risk assessment of the Binghamton office building fire, did use the TCDD toxic equivalent approach to estimate the increased cancer risk of the complex mixture of PCDDs and PCDFs present in soot. In this

particular example, the actual standards and guidelines set by NYSDOH did not consider the cancer risk issue, but instead were developed using an ADI NOEL approach. Working backwards, they used these standards, to determine an acceptable lifetime maximum daily intake and extrapolated the increased cancer risk at these daily intake levels. Using the most conservative extrapolated cancer dose/response model, the guidelines established by NYSDOH could result in an increased cancer risk of less than 6×10^{-6} for 2,3,7,8 TCDD exposure. This assumes exposures to the ADI level for 250 days per year over 70 years.

NYSDOH also presented data that the TCDD toxic equivalent increased cancer risk could be less than 200×10^{-6} . This cancer risk data of 200×10^{-6} is presented with no further evaluation or analysis other than to state some of the conservative factors used to develop the risk assessment.

The Ontario Ministry of Labour suggests that 2,3,7, 8-TCDD acts as a promoter, rather than an initiator of carcinogenicity. As such, there may be threshold no-effect levels that would mitigate cancer risk at very low dose levels. The Ontario Ministry of Labor has stated that for 2,3,7, 8-TCDD, the No-Observed Effect Level ADI approach can be used to determine a very safe dose for cancer risk. As discussed previously, we predict the maximum TCDD toxic equivalent daily intake to be significantly below (0.13%) this very safe dose level.

Assuming for the purposes of this assessment, that toxic equivalency equals carcinogenic equivalency, the risk due to the carcinogenic potential of the complex mixture of PCDD and PCDF would equal 59 times the risk due to the 2,3,7,8-TCDD. As stated previously, there is a great deal of uncertainty regarding the most appropriate model or procedure to use in estimating human equivalent dose/response for 2,3,7,8-TCDD. Given this inherent uncertainty, multiplication of the most conservative 2,3,7,8-TCDD dose/response extrapolation (EPA) by 59 times may not be appropriate and may significantly overestimate risk. However, in accordance with procedures used in risk assessment, this worst-case scenario has been examined.

The increased cancer risk due to the predicted concentration of 2,3,7,8-TCDD in BNYRRF emissions, for all three pathways of exposure was estimated to range from .005 to 0.10×10^{-6} assuming a maximum 2,3,7,8-TCDD daily intake equal to 4.5×10^{-14} g/day. Using the toxic equivalency method the increased cancer risk due to the complex mixture of PCDDs and PCDFs present in the emissions ranges from $0.26 \times 5.9 \times 10^{-6}$.

5.6 Summary and Conclusions

A risk assessment was performed to estimate the risks associated with predicted rates of PCDD and PCDF emissions from the BNYRRF. The assessment compared the predicted ambient air concentrations and estimated daily intake levels for PCDDs and PCDFs with 1) applicable standards and criteria and 2) concentrations of PCDDs and PCDFs known or suspected to cause a toxic effect.

Several safety factors were incorporated into our assessment to ensure conservatism. They include the following:

- Assessment of three potential pathways of exposure: inhalation of gaseous or particulate emissions, and ingestion or dermal absorption of particulates deposited on outdoor and indoor surfaces.
- Application of a toxic equivalency multiplier equal to 59. This number provides an estimate of the noncarcinogenic toxicity of the complex mixture of PCDDs and PCDFs compared with the concentration of 2,3,7,8-TCDD. This equivalency factor was also used to estimate carcinogenic equivalency as a worst case assumption although such an application is speculative.
- No losses of PCDDs were assumed through volatilization or degradation or through such actions as rainfall.
- Indoor ambient air quality was assumed to equal outdoor air quality.

- Risks were calculated based on continuous exposure over a 70-year lifetime at the point of maximum impact.
- The most conservative cancer risk extrapolation model was included to estimate an upper-bound limit to increased cancer risk.
- Conservative assumptions for bioavailability, and rates of ingestions and dermal contact were included to estimate worst-case daily intakes of PCDDs.

The results of our risk analysis are summarized below. Average ambient air concentrations were predicted for ground-level and elevated receptors using the Case 1 scenario that all PCDDs and PCDFs are emitted in the gaseous phase. The maximum average annual ambient air concentrations are predicted to be well below existing standards and guidelines typically less than 1 percent. Only the NYSDEC performance guideline for evaluating combustion sources is approached, but at only 28.2% of the guideline.

Risks associated with inhalation of PCDDs and PCDFs at the maximum average annual concentrations were determined by comparing a predicted maximum daily intake through inhalation (DI_{inh}) with ADIs and cancer dose/response extrapolations.

The maximum daily intake DI_{inh} of 2,3,7,8-TCDD, TCDD, and TCDD toxic equivalents are predicted to be well below (less than 1%) any ADI promulgated by any regulatory agency. These ADIs provide a margin of safety and they identify a very safe dose, below which risks are insignificant for non-carcinogenic toxic effects.

An upper-bound to carcinogenicity risk was also determined by comparing DI_{inh} with three different cancer dose/response extrapolations. The upper-bound excess risk due to exposure to 2,3,7,8-TCDD and HCDD, at the point of maximum impact, ranges from less than 0.0019 to less than 0.055×10^{-6} or less than five cases per 100 million people exposed to the maximum concentration over a 70-year lifetime.

The sensitivity of the risk estimates derived for the inhalation pathway, to the additional risks that might be attributable to the ingestion and dermal pathways was tested. These two pathways were not considered in the initial risk assessment of the inhalation pathway (section 5.5.3) due to the high degree of uncertainty in the estimates of ingestion, absorption, and bioavailability rates and due to the difficulties in modeling PCDD concentrations in soil, dirt and dust. A range of daily intake estimates was calculated (DI_{ing} and DI_{derm}).

The data indicate that the predicted additional 2,3,7,8-TCDD intake from ingestion or dermal absorption of particulate emissions from the BNYRRF is negligible assuming that the minimum estimates for DI_{ing} and DI_{derm} are more representative of actual exposure. Even using worst-case assumptions regarding the maximum rates of exposure, the total daily intake of 2,3,7,8-TCDD would increase by 2.4 times the amount from inhalation alone. Under this "worst-case" scenario, ingestion becomes the major pathway of exposure.

The general conclusions regarding the level of risk posed by the BNYRRF are not significantly altered if the maximum total daily intake of 2,3,7,8-TCDD increases 2.4 fold. This additional daily intake of 2,3,7,8-TCDD equals only 0.036% of the most conservative ADI (1.8 pg/kg-day) and a toxic equivalent daily intake which is only 2.1% of this ADI.

The upper-bound carcinogenic risk estimates will also increase by a factor of 2.4 assuming the most conservative estimates for the ingestion and dermal absorption pathways. This would result in an upperbound increased cancer risk for a population exposed to the maximum 2,3,7,8-TCDD and HCDD concentrations over a 70-year lifetime of less than 0.13×10^{-6} .

As an additional safety factor to our assessment, we examined the risks due to PCDD exposure through all three pathways assuming that carcinogenic equivalency equals toxic equivalency. Using the toxic equivalency method, the maximum increased cancer risk due to the complex mixture of PCDDs and PCDFs present in the emissions ranges from less than 0.24 to an upperbound limit less than 5.9×10^{-6} for all these pathways combined, again assuming a 70-year lifetime exposure, 24 hours a day, to the maximum concentrations.

CHAPTER 6.0

COMPARATIVE RISKS6.1 Introduction

In the previous section, the risks associated with predicted BNYRRF dioxin emissions were evaluated. These risks were judged to be low in relation to existing ambient air standards and guidelines and in relation to acceptable daily intake levels (ADIs). ADIs are developed as predicted very safe dose levels that should provide a margin of safety for risks due to non-carcinogenic toxic effects. These conclusions were judged to be valid for all three potential pathways of exposure to 2,3,7,8-TCDD, T₄CDD and TCDD toxic equivalents.

Judging the potential health significance of an excess cancer risk estimate predicted in a risk assessment is a much more difficult process. Due to the uncertainties involved in all phases of the process, there is no simple standardized format or methodology to evaluate significance. A given risk level for a project can be considered either acceptable or unacceptable, significant or insignificant depending upon such factors as:

- ° Whether the risks are voluntary or involuntary;
- ° Degrees of confidence (or uncertainty) in risk assessment assumptions;
- ° Comparisons with normal risks inherent in everyday activities;
- ° Public benefits derived from the project;

- ° Degree to which additional risk reduction can be effected through application of best available technology.

Ultimately, a determination of the acceptability of a given level of risk is a public policy decision in which the various costs and benefits are weighed.

To put the projected excess cancer risks for the BNYRRF in perspective, we will examine how these projected risks compare with:

- ° Risk evaluations for dioxin exposure performed by regulatory agencies;
- ° Current regulatory policy or practice regarding acceptable risk levels;
- ° Cancer rates for the general population;
- ° Normal risks inherent in everyday activities;
- ° Risks due to other common sources of TCDD.

6.2. Risk Evaluations for Dioxin Exposure Performed by Other Regulatory Agencies. Although there are no clear definitions of acceptable versus unacceptable levels for an increased risk of cancer, some guidance is available from other risk evaluations that have been performed for dioxin.

Harding, the author of the Ontario ambient air standard (1982), rejected the concept of applying a linear-non-threshold model for estimating cancer risks for TCDD. He concluded that "CDDs and CDFs exhibit the characteristics of non-genotoxic (i.e., does not alter genetic information) carcinogens and teratogens. As such, they would possess a threshold level of dosage.....". He went on to conclude that the NOEL/ADI approach is an

acceptable model for establishing standards where threshold effects exist. The Netherlands also have issued only an ADI based dioxin standard (Heigden, 1982). As described previously, the predicted maximum toxic equivalent daily intake as a result of potential BNYRRF emissions for the three exposure pathways combined is substantially less than any published ADI.

The USEPA estimated an upper bound increased risk of cancer due to inhalation of particulate emission from five municipal waste combustors (MWCs). The Agency used the maximum ground level concentration of TCDD derived from the PTMAX air dispersion model and assumed that all TCDDs are as toxic and carcinogenic as 2,3,7,8-TCDD. Using these assumptions, the estimated increased cancer risk ranged from 8 to 19×10^{-6} depending upon the dose/response extrapolation model that was used. Nonetheless, EPA concluded that, in the context of the worst-case assumptions used to calculate the increased risk, the risks to the public from the MWC emissions were minimal (USEPA, 1981). We predict an upper-bound to the increased cancer risk caused by predicted BNYRRF emissions of 2,3,7,8-TCDD or T₄CDD, assuming worst case conditions, for all three pathways (0.13×10^{-6}) to be almost an order of magnitude lower than the risk levels considered by EPA to have minimum impacts to public health. Even assuming, for the sake of risk assessment, that the carcinogenic risk of the complex mixture equals 59 times the risk due to 2,3,7,8-TCDD alone, the levels are lower than in EPA's assessment.

A sixth MWC studied by EPA had higher emission levels than in any of the five MWCs previously studied. Nonetheless, EPA's position regarding the public health impacts associated with these emissions remains unchanged;

however, operational and design changes were ordered on this facility to lower the PCDD emissions (USEPA, 1983).

The NYSDOH, in a risk assessment to establish guidelines for reentry to the Binghamton Office building, chose to use an ADI approach (Kim et al., 1984). They selected an ADI of 2 pg/kg-day to set guidance levels. At the same time, they presented data showing that the ADI for 2,3,7,8-TCDD would result in an upper-bound estimate of a lifetime increased cancer risk ranging from .01 to 6×10^{-6} , depending upon the risk extrapolation model. These risk levels are higher than those predicted for the BNYRRF. As noted by Kim, all of these estimates correspond to the lower 95% confidence limit in dose, providing an element of conservatism in these estimates.

In our opinion, after applying worst-case assumptions to all pathways of exposure, the predicted increased cancer risks resulting from predicted BNYRRF emissions are below the limits found by these agencies to require additional review and probable action to reduce risk.

6.3 Current Regulatory Policy or Practice Regarding Acceptable Risk Levels. Regulatory agencies in the U.S. have not established a uniform cancer risk level to distinguish acceptable from unacceptable risks. Nevertheless, there is a range of levels that guide the agencies in decision making.

For example, the USEPA has established surface water quality criteria for priority pollutants, including 2,3,7,8-TCDD. For suspected carcinogens in surface water, for which a zero concentration may not be attainable,

criteria for the protection of human health are established, that would limit the increased cancer risk over a lifetime to less than 10^{-5} to 10^{-7} . EPA's position is that while zero concentration is desirable, a risk level no greater than 10^{-5} is acceptable (USEPA, 1984).

Several USEPA health advisories for drinking water result in risks such as 10^{-4} (benzene), 3×10^{-4} (chlordane), and 6×10^{-6} (tetrachloroethylene) (Dowd, 1984).

The FDA has established a 25 ppt advisory level for 2,3,7,8-TCDD contaminated Great Lakes fish. Using various assumptions regarding the average concentrations of TCDD at the market place and the amount of fish consumed per day, etc., the advisory translates to an upper-limit cancer risk of 3×10^{-6} (FDA) to 3×10^{-5} (USEPA, 1984).

As recently summarized by Dowd in a review of the USEPA's regulatory policy regarding risk, "if a quantitative risk assessment is carried out with identifiable assumptions and is reasonably consistent with established modeling procedures, one can make broad comparisons among risks. In EPA's regulatory actions, values less than 10^{-6} generally have not been singled out for regulatory attention. Risks between 10^{-5} and 10^{-6} are often carefully reviewed but not often controlled. Risks between 10^{-5} and a few times 10^{-4} are cases for careful review and probably action, and risks above a few times 10^{-4} to 10^{-3} are likely to be viewed as major risks which require regulatory action to reduce them" (Dowd, 1984).

It should be noted that some disagree with the USEPA and believe that the Agency has allowed too high an increased cancer risk in its standard-setting policy, particularly where large populations are likely to be exposed. For example, NYSDOH will be proposing new drinking water regulations that will use the 10^{-6} risk level as the basis for setting standards. (NYSDOH 1984). The issue of acceptable risk levels continues to be an area of considerable controversy.

6.4 Risks from Non-Dioxin-Related Events

Most human activities and events involve some degree of inevitable risk. In order to put the risks posed by the BNYRRF in a measurable perspective, it may be helpful to understand how they compare to other risks. From Table 6-1, it is apparent that the likelihood of developing cancer from BNYRRF emissions is far exceeded by risks posed by such common activities as walking into a busy street, climbing a ladder, or having surgery under general anesthesia. Although some of these risks may be voluntary, understanding the degree of risk found in daily life activities may be helpful in making judgments about the relative predicted risks of the BNYRRF.

6.5 Comparison with Overall Cancer Rates

Recent statistical information from the National Cancer Institute indicates that the current cancer incidence rate (a direct estimate of the probability, or risk, of developing the disease) is 1 in 4 for males and slightly higher for females over a lifetime. These figures translate into a current overall lifetime cancer incidence rate of 250,000 cases per

TABLE 6-1
ESTIMATED LIFETIME RISK OF DEATH FOR PERSONS IN
NEW YORK STATE
 By Selected Events*

<u>1 in a Million or 10⁻⁶</u>	<u>1 in One Hundred Thousand or 10⁻⁵</u>	<u>1 in Ten Thousand or 10⁻⁴</u>
Diphtheria	Gas gangrene	Electrocution
Acute Polio	Hemophilia	Fall out of building
Rubella	Pedestrian hit by bicycle	Hit by falling object
(German measles)	Anesthesia complication	Firearm accident
Melanoma	of surgery	Excessive cold
Vitamin D deficiency	Lightning	Accidental poisoning
Rickets	Cataclysm (hurricane, flood, tornado, earth- quake, etc.)	with drug or medicine
Passenger on railroad hit by train	Bites and Stings (from venomous animals or insects)	Fall from ladder or scaffold
Passenger on a commercial air-craft		

* Estimate is based on the number of deaths in New York State recorded for each cause by the New York State Health Department, Office of Biostatistics, for the years 1974-1977. 1×10^{-6} risk represents events occurring from 0-5 times in that 4-year period; 1×10^{-5} risk represents events occurring from 6-50 times during the 4 years; and 1×10^{-4} risk represents events occurring 51-500 times during the 4 years. A four-year period for recording of events was selected because with the population of New York State (1977 estimate 17,924,000), just over 70 million person years of observation are accrued each 4 years; therefore, events occurring once every four years correlate with a risk of one in a million for a lifetime.

Source: Kim, N.K. and O. Stone (NYSDOH) Organic Chemicals and Drinking Water.

1,000,000 people. The New York State Department of Health lists cancer as the second highest cause of death in the state (1974-1977) and calculates the estimated lifetime risk of dying of cancer as 14 in 100 or 140,000 per 1,000,000. Even using levels derived from the conservative methods described in the last chapter, the potential risks posed by the BNYRRF constitute an insignificant incremental risk. Using the models described in Chapter 5, incremental cancer risks amount to less than 6 additional cases per 1,000,000 people, under all worst-case assumptions. This increased cancer rate projected for the BNYRRF is only 0.002% of the overall cancer incidence rate for a 70-year lifetime.

6.6 Other Sources of Dioxin

As analytical methods become more precise and minimum detection levels become lower, the ubiquitous nature of 2,3,7,8-TCDD is becoming more evident. It is also becoming obvious that this compound is present in a variety of common sources, many of which are totally unrelated to and maybe more significant than waste incineration.

Young, et al. (1983) describes an adipose tissue study undertaken by the Veterans Administration. The aim of the investigation was to determine if analysis of body fat could be used to determine earlier exposure to Agent Orange. Three groups of adult males were studied:

- 20 Vietnam veterans, 19 of who claimed health problems related to Agent Orange;
- 3 Air Force officers with known heavy and relatively recent exposure from herbicide disposal operations;

- 10 veterans with no service in Vietnam and no known exposure to herbicides.

The results, as related to levels of TCDD found, indicated that levels ranging from 3 to 99 ppt could be detected in human adipose tissue. These levels, however, did not correlate well with known exposure.

- Of the 20 Vietnam veterans:

- 7 had no detectable levels of TCDD (level of detection = 2-6 ppt)

- 2 had detectable material which could not be validated as TCDD

- 1 measured value was only questionably above the detection limit

- 5 had TCDD in amounts from 5-7 ppt

- 3 had TCDD in amounts from 9-13 ppt

- 1 had TCDD at 63 and 99 ppt

- 1 had TCDD at 23 and 35 ppt

- Of the 10 control (unexposed) veterans, four had TCDD detected at 6, 7, 7, and 14 ppt. Of the remainder, two had values low enough to be considered equivocal, and in three others, the detected material was not validated as TCDD. One control veteran showed no detectable levels.
- Of the three Air Force officers with known heavy exposure, one had no identified TCDD. The material measured in all three officers was never more than 3 ppt above the level of detection.

The interesting aspect of the above study is that levels of TCDD were found in the body fat of individuals with no known exposure to herbicides (i.e., the control group). Rappe (1984) cites studies by Ryan and Williams (1983) which report on the levels of 2,3,7,8,-TCDD in 23 autopsy samples of human adipose tissue from the Great Lakes area in Canada. Twenty-two of the

23 samples contained 2,3,7,8-TCDD at levels ranging from 4.1 to 130 ppt. The article goes on to state that additional preliminary data (Ryan, personal communication; Rappe and Nygren, personal communication) indicates background levels ranging from 1 to 600 ppt in the general population (Rappe, 1984).

A major source of exposure to PCDDs may be through dietary intake, primarily through fish. Several studies (Ryan et al., 1983; Cordle, 1981) indicate that a number of commercial and sport fish species contain 2,3,7,8-TCDD in levels ranging up to 38.5 ppt. Table 6-2 gives results of a study performed by Ryan et al.

Data from the New York State Department of Environmental Conservation revealed detectable levels of dioxin in all but one of 46 fish samples taken from Lake Ontario. Levels ranged from 2 to 162 ppt in small mouth bass; lake, rainbow, and brown trout; white sucker; brown bullhead; and coke and chinook salmon (NYSDEC, 1981). More recently, New York State DEC reported levels of up to 30 ppt TCDD and nearly twice that amount of TCDF in striped bass taken from the Hudson River. Their data is presented in Table 6-3 (NYSDEC, 1982).

2,3,7,8-TCDD has also been detected in other food sources. Health and Welfare Canada cites data which indicates that beef cattle, feeding on ranges sprayed with 2,4,5-T, can accumulate slightly more than 10 ppt in fat. Consumption of 250 grams of beef with 10 percent fat, with 10 ppt of 2,3,7,8-TCDD amounts to approximately 0.25 ng TCDD per meal or 0.004 ng/kg body weight for a 60 kg adult (Health and Welfare Canada, 1983). The livers

TABLE 6-2

2,3,7,8-TETRA-CDD LEVELS (PPT) IN 62 SAMPLES
OF GREAT LAKES FISH FROM LAKE ONTARIO

<u>Species</u>	<u>Number Analyzed</u>	<u>Number Positive for Tetra-CDD</u>	<u>Mean of Positives (ppt)</u>	<u>Range Positives (ppt)</u>
Rock Bass	6	0		
Sunfish	9	0		
Black Crappie	5	0		
White Perch	3	1		6.3
Yellow Perch	10	2	3.8	3.2-4.3
Brown Bullhead	7	2	6.0	3.4-8.6
White Sucker	5	2	3.0	2.0-4.0
Catfish	3	3	15.5	12.8-17.7
Eel	6	5	19.8	6.4-38.5
Smelt	8	6	20.0	11.3-32.9

Source: Ryan, et al., 1983

TABLE 6-3

AVERAGE CONTAMINANT LEVELS IN STRIPED BASS--1982
(2,3,7,8-TCDD AND 2,3,7,8-TCDF)
UNITS ARE PARTS PER TRILLION (PPT)

<u>Collection Location</u>	<u>2,3,7,8-TCDD, ppt</u>	<u>2,3,7,8-TCDF, ppt</u>
Poughkeepsie	28 (11)*	NA
Poughkeepsie	ND (9)	NA
Poughkeepsie	28 (3.6)	NA
Poughkeepsie	11 (2.8)	NA
Poughkeepsie	28.5**	NA
Montrose Point	30.5**	54 (7.0)
Montrose Point	13 (3.2)	54 (7.5)
Montrose Point	19.5**	NA
Montrose Point	7.5**	NA
Montrose Point	25 (15)	NA

NA - not analyzed

ND - not detected

* Values in parenthesis are detection limits

**Average of two samples

Source: New York State Department of Environmental Conservation, October 15, 1982.

of poultry raised on wood shavings containing pentachlorophenol show levels of H_6CDD up to 1.4 ppb. A person eating 250 grams of liver would have an intake of roughly 350 ng H_6CDD or 5.8 ng/kg b.w. for a 60 kg adult (Health and Welfare Canada, 1983).

Using this data, one can develop a risk assessment scenario similar to those generated in Chapter 5. Doing so helps to emphasize the conservative nature of the risk assessment process.

For example, we will utilize results of a New York State study in which approximately 25 percent of Lake Ontario fish sampled contained TCDD levels of 5 ppt. TCDD was not detected in the remaining 75 percent. Therefore, the average TCDD concentration for this fish population is 1.25 ppt (10^{-2} g). This is typically below detection limits. Let us assume, for the sake of this risk assessment, that the average concentration of 2,3,7,8-TCDD in fish equals only 0.5 ppt. We would not know if this were true or not since the concentration is below detection limits. Using the USEPA's estimate of 6.5 g/day for average daily fish consumption, this translates to 3.3×10^{-12} g/day of 2,3,7,8-TCDD. ($[0.5 \times 10^{-12}] \times 6.5$). Assuming 80 percent bioavailability, the consumption of 3.3×10^{-12} g/day of 2,3,7,8-TCDD corresponds to a predicted upper limit excess cancer risk of approximately 6×10^{-6} . If other PCDD and PCDF isomers are present, risks could be higher.

As shown above, using risk assessment, a worst-case argument could be made that New York State residents are potentially exposed to dietary levels of TCDD from fish in amounts equal to or greater than levels projected from the BNYRRF.

This argument serves to emphasize the point that worst-case assumptions do not necessarily provide a good indication of average, most probable, or most realistic conditions.

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APPENDIX A

Compilation of PCDF and PCDD Emission Data

APPENDIX A

COMPILATION OF PCDF AND PCDD EMISSION DATA
FROM PUBLISHED LITERATURE (ng/Nm³)

	<u>Chicago, Northwest</u> (a)	<u>Zurich- Josephstrasse</u> (b)	<u>Eskjo, Sweden</u> (c)	<u>Como, Italy</u> (d)
Tri-CDF	280	NR	NR	NR
Tetra-CDF	84	22.3	328	78
Penta-CDF	NR	27.3	54	83
Hexa-CDF	58	18.7	60	90
Hepta-CDF	7.0	12.4	28	99
Octa-CDF	0.6	8.2	12	63
Tri-CDD	12	NR	NR	NR
Tetra-CDD	5.9	4	ND-23	29
2,3,7,8 Tetra-CDD	0.38	0.16	ND-1.0	NR
Penta-CDD	NR	11	ND	46
Hexa-CDD	15	24.9	ND	76
Hepta-CDD	7.1	24.1	32	74
Octa-CDD	2.3	49.1	18	84
Sample Method				
condensibles	X	X	X	X
particulate	X	X	X	X
Combustion Temp.				
°C	650*	NR	700*	994*

NR - Not reported

ND - Not detected (no detection limit reported)

* Location of temperature sensor was not described in the literature.

Ref: (a) Redford et al. 1981, units converted from ng/dscm (13.1% H₂O)
 (b) Swiss EPA 1982 (c) Rappe et al. 1983 (d) Gizzi et al. 1982

APPENDIX A

COMPILATION OF PCDF AND PCDD EMISSION DATA
FROM PUBLISHED LITERATURE (ng/Nm³) (Continued)

	<u>Sweden</u> (e)	<u>Sweden</u> (e)	<u>Sweden</u> (e)	<u>Hampton, Virginia</u> (f)
Tri-CDF	NR	NR	NR	NR
Tetra-CDF	NR	NR	NR	2600
Penta-CDF	NR	NR	NR	1600
Hexa-CDF	NR	NR	NR	1800
Hepta-CDF	NR	NR	NR	2200
Octa-CDF	NR	NR	NR	170
Tri-CDD	NR	NR	NR	NR
Tetra-CDD	NR	NR	NR	380
2,3,7,8 Tetra-CDD	NR	NR	NR	NR
Penta-CDD	NR	NR	NR	530
Hexa-CDD	76	30	3	850
Hepta-CDD	603	23	10	2000
Octa-CDD	757	227	15	490
Sample Method				
condensibles	X	X	X	X
particulate	X	X	X	X
Combustion				
Temp. °C	400-600*	320-730*	680-1040*	550 ^(g)

NR - Not reported

* Location of temperature sensor was not described in the literature.

Ref: (e) Ahling and Lindskog 1982, units converted from ng/Nm³, dry at 10% CO₂.

(f) Tiernan et al. 1983

(g) Average temperature; furnace front 677°-732°C, rear 400°C.

APPENDIX A

COMPILATION OF PCDF AND PCDD EMISSION DATA
FROM PUBLISHED LITERATURE (ng/Nm³) (Continued)

	<u>Milan I</u> <u>Zema^(h)</u>	<u>Milan II</u> <u>Figino^(h)</u>	<u>Busto</u> <u>Arsizio^(h)</u>	<u>Desio^(h)</u>
Tri-CDF	NR	NR	NR	NR
Tetra-CDF	NR	NR	NR	NR
Penta-CDF	NR	NR	NR	NR
Hexa-CDF	NR	NR	NR	NR
Hepta-CDF	NR	NR	NR	NR
Octa-CDF	584	91	45	67
Tri-CDD	NR	NR	NR	NR
Tetra-CDD	22	NR	1.4	1.0
2,3,7,8 Tetra- CDD	2.4	NR	NR	NR
Penta - CDD	NR	NR	NR	NR
Hexa-CDD	NR	NR	NR	NR
Hepta-CDD	NR	NR	NR	NR
Octa-CDD	805	113	33	75
Sample Method				
condensibles	X	X	X	X
particulate	X	X	X	X
Combustion Temp.				
°C	NR	NR	NR	NR

NR - Not reported

ND - Not detected (no detection limit reported)

Ref: (h) Cavallaro et al. 1980

APPENDIX A

COMPILATION OF PCDF AND PCDD EMISSION DATA
FROM PUBLISHED LITERATURE (ng/Nm³) (Continued)

	<u>Italy</u> <u>1 (j)</u>	<u>Italy</u> <u>2 (j)</u>	<u>Italy</u> <u>3 (j)</u>
Tri-CDF	NR	NR	NR
Tetra-CDF	ND	184	432
Penta-CDF	NR	NR	NR
Hexa-CDF	NR	NR	NR
Hepta-CDF	NR	NR	NR
Octa-CDF	62	7,273	1,010
Tri-CDD	NR	NR	NR
Tetra-CDD	21	189	19
2,3,7,8 Tetra- CDD	NR	NR	NR
Penta-CDD	31	279	40
Hexa-CDD	190	38,635	6,549
Hepta-CDD	161	1,403	124
Octa-CDD	72	8,491	778
Sample Method			
condensibles	X	X	X
particulate	X	X	X
Combustion			
Temp. °C	NR	NR	NR

NR - Not reported

ND - Not detected (no detection limit reported)

Ref: (j) Cavallaro et al. 1982

APPENDIX A

COMPILATION OF PCDF AND PCDD EMISSION DATA
FROM PUBLISHED LITERATURE (ng/Nm³) (Continued)

	<u>Italy</u> <u>4 (j)</u>	<u>Italy</u> <u>5 (j)</u>	<u>Italy</u> <u>6 (j)</u>
Tri-CDF	NR	NR	NR
Tetra-CDF	1,818	380	27
Penta-CDF	NR	NR	NR
Hexa-CDF	NR	NR	NR
Hepta-CDD	NR	NR	NR
Octa-CDD	1,760	92	24
Tri-CDD	NR	NR	NR
Tetra-CDD	71	10	19
2,3,7,8 Tetra- CDD	NR	NR	NR
Penta-CDD	36	23	11
Hexa-CDD	1,391	524	480
Hepta-CDD	170	56	6
Octa-CDD	2,742	417	72
Sample Method			
condensibles	X	X	X
particulate	X	X	X
Combustion Temp.			
°C	NR	NR	NR

NR - Not reported

ND - Not detected (no detection limit reported)

Ref: (j) Cavallaro et al. 1982

APPENDIX A

COMPILATION OF PCDF AND PCDD EMISSION DATA
FROM PUBLISHED LITERATURE (ng/Nm³) (Continued)

Zaanstad,
Netherlands^(k)

Tri-CDF	NR
Tetra-CDF	182
Penta-CDF	311
Hexa-CDF	566
Hepta-CDF	295
Octa-CDF	65
Tri-CDD	NR
Tetra-CDD	72
2,3,7,8 Tetra- CDD	NR
Penta-CDD	313
Hexa-CDD	375
Hepta-CDD	313
Octa-CDD	221

Sample Method

gaseous

particulate

X

Combustion Temp.

°C

911*

NR - Not reported ND - Not detected (no detection limit reported)

* Location of temperature sensor was not described in the literature.

Ref: (k) Olie et al. 1982; average of tests where combustion temperatures were reported.

APPENDIX B

Example Calculations

APPENDIX B -- CALCULATIONS

BROOKLYN NAVY YARD AND RESOURCE RECOVERY FACILITYPREDICTED PCDD AND PCDF EMISSIONS
AND ASSOCIATED ENVIRONMENTAL IMPACTSPCDD and PCDF Concentrations in Flue Gas

Concentrations in BNYRRF flue gas were based upon tests of Chicago Northwest and Zurich-Josefstrasse facilities. Corrections were made for flue gas conditions projected for BNYRRF. The concentrations presented here assume: (1) gas phase PCDD and PCDF emission, or (2) particulate emission with electrostatic precipitators used for particulate control. Calculations in the following sections account for particulate emission of PCDD and PCDF with fabric filter particulate control.

	<u>BNYRRF</u>	<u>Chicago Northwest</u>	<u>Zurich-Josefstrasse</u>
CO ₂ % (dry)	10.5	9.5	10.9
H ₂ O %	13.63	13.1	14.7
Dry Gas Fraction	.8637	.869	.853
Standardized Temp.	0°C (N)	20°C (S)	0°C (N)

Chicago, N.W. data (CNW)

$$(\text{ng/Nm}^3) \text{ BNY} = (\text{ng/dry Sm}^3) \text{ CNW} \times (\% \text{ CO}_2) \text{ BNY} / (\% \text{ CO}_2) \text{ CNW} \times (\text{dry gas fraction}) \text{ BNY} \times (\text{abs. temp-S}) / (\text{abs. temp-N})$$

Example, Tri-CDF

$$\begin{aligned} 300 \text{ ng/dSm}^3 &\times 10.5/9.5 \times .8637 \times 293/273 \\ &= 307.4 \text{ ng/Nm}^3 \end{aligned}$$

Zurich-Josefstrasse data (Z-J)

$$\begin{aligned} (\text{ng/Nm}^3) \text{ BNY} &= (\text{ng/Nm}^3) \text{ Z-J} \times (\% \text{ CO}_2) \text{ BNY} / (\% \text{ CO}_2) \text{ Z-J} \\ &\times (\text{dry gas fraction}) \text{ BNY} / (\text{dry gas fraction}) \text{ Z-J} \end{aligned}$$

Example, Penta-CDF

$$\begin{aligned} 27.3 \text{ ng/Nm}^3 &\times 10.5/10.9 \times .8637/.853 \\ &= 26.6 \text{ ng/Nm}^3 \end{aligned}$$

PCDD and PCDF Mass Emission Rates

BNYRRF flue gas flow rate - 632,000 actual ft³/min at 420°F (489°K)

$$\text{actual ft}^3/\text{min} \times (\text{abs. temp.} - N) / (\text{abs. temp.}) \text{BNY} \times \text{m}^3/\text{ft}^3 \times \text{min}/\text{sec} \\ = \text{Nm}^3/\text{sec}$$

$$632,000 \times 273/489 \times 1/35.315 \times 1/60 = 166.5 \text{ Nm}^3/\text{sec}$$

$$\text{Nm}^3/\text{sec} \times \text{ng}/\text{Nm}^3 \times 10^{-3} \text{ ug}/\text{ng} = \text{ug}/\text{sec}$$

Example, Tri-CDF

$$166.5 \times 307.4 \times 10^{-3} = 51.18 \text{ ug}/\text{sec}$$

TABLE B-1

PREDICTED BNYRRF EMISSION RATES IF ELECTROSTATIC PRECIPITATORS
WERE USED, OR IF ALL PCDD AND PCDF EMISSIONS WERE GASEOUS

	<u>Reported Concentration</u>	<u>BNYRRF Concentration(3)</u>	<u>BNYRRF Mass Emission Rate (4)</u>
Tri-CDF	300(1)	307.4	51.18
Tetra-CDF	90(1)	92.2	15.35
Penta-CDF	27.3(2)	26.6	4.43
Hexa-CDF	7.5(1)	7.7	1.28
Hepta-CDF	62(1)	63.5	10.58
Octa-CDF	<u>0.60(1)</u>	<u>0.6</u>	<u>0.10</u>
TOTAL-CDF	--	498.0	82.92
Tri-CDD	13(1)	13.3	2.22
Tetra-CDD	6.3(1)	6.5	1.07
Penta-CDD	11.0(2)	10.7	1.79
Hexa-CDD	7.6(1)	7.8	1.30
Hepta-CDD	16(1)	16.4	2.73
Octa-CDD	<u>2.5(1)</u>	<u>2.6</u>	<u>0.43</u>
TOTAL-CDD	--	57.3	9.54
2,3,7,8-TCDD	0.41	0.42	0.07

(1) Chicago Northwest, ng/dSm³ at 20°C and 9.5% CO₂

(2) Zurich-Josefstrasse, ng/Nm³ at 0°C, 10.9% CO₂ (dry) and 14.7% H₂O

(3) ng/Nm³ at 0°C, 10.5% CO₂ (dry), and 13.63% H₂O

(4) ug/sec

Calculation of Particle Surface Area Distribution

These calculations assume electrostatic preprecipitators are used for particulate control at the proposed BNYRRF. The following section provides corrections for fabric filter outlet emissions. Particle size distribution data is taken from actual tests at the Braintree Municipal Incinerator, assuming aerodynamic spherical particles.

Specific surface area of spherical particle with radius, r . $S = 4\pi r^2$

Volume of spherical particle with radius, r . $V = 4/3 \pi r^3$.

Ratio of surface area to volume $S/V = 4\pi r^2 / (4/3 \pi r^3) = 3/r$.

Particle density is constant, and therefore the particle weight is proportional to volume. Consequently, the ratio of surface area to volume is proportional to the ratio of surface area to weight for a particle with a given radius. The ratio of surface area to volume (um^2/um^3) represents the relationship between surface area and weight ($\propto \text{um}^2/\text{g}$). Multiplying um^2/um^3 times the weight fraction of particles of a given size results in a number which represents the amount of surface area available on those particles. The fraction of total area on any size particle is this number divided by the sum of numbers for all particle sizes.

$\text{um}^2/\text{um}^3 \times \text{fraction of total weight for given particle size} = \text{relative proportion of available particle surface area for given particle size,}$
 $\propto \text{um}^2/\text{g}.$

Relative proportion of available particle surface area for given particle size divided by the sum of relative proportion of available particle surface area for all particle sizes = fraction of total surface area for given particle size.

Example, 15.0 μm particles, $r = 7.5 \mu\text{m}$, $S/A = 3/r = 3/7.5 = 0.400$

$S/A \times$ fraction of total weight comprised of 15 μm particles =
relative proportion of total surface area comprised of 15 μm particles.

$$0.400 \times .128 = 0.512 (\propto \mu\text{m}^2/\text{g})$$

sum of relative proportions of all particle sizes is 3.4423.

$$0.512/3.4423 = \text{fraction of total surface area comprised of 15 } \mu\text{m particles} = 0.0149 = 1.5\%$$

TABLE B-2
PARTICLE CHARACTERISTICS
IF ELECTROSTATIC PRECIPITATORS WERE USED

<u>Particle Diameter (μm)</u>	<u>Particle Radius (μm)</u>	<u>S/A ($\mu\text{m}^2/\mu\text{m}^3$)</u>	<u>Fraction of Total Weight</u>	<u>Relative Proportion of Total Surface Area ($\propto \mu\text{m}^2/\text{g}$)</u>	<u>Fraction of Total Surface Area</u>
15.0	7.5	0.400	0.128	0.0512	0.0149
12.5	6.25	0.480	0.105	0.0504	0.0146
8.1	4.05	0.741	0.104	0.0771	0.0224
5.5	2.75	1.091	0.073	0.0796	0.0231
3.6	1.8	1.667	0.103	0.1717	0.0499
2.0	1.0	3.000	0.105	0.3150	0.0915
1.1	0.55	5.455	0.082	0.4473	0.1290
0.7	0.4	7.500	0.076	0.5700	0.1656
LT 0.7	0.4	7.500	0.224	<u>1.6800</u>	0.4880
				3.4423	

LT - Less than

If an electrostatic precipitator would be used at the BNYRRF, the total particulate emission rate would be 7.94 g/sec. Average total PCDD concentration would be $(9.54 \text{ ug/sec}) / (7.94 \text{ g/sec}) = 1.202 \text{ ug/g}$ or 1,202 ng/g. Average total PCDF concentration would be $(82.92 \text{ ug/sec}) / (7.94 \text{ g/sec}) = 10.443 \text{ ug/g}$ or 10,443 ng/g. The concentrations of PCDD and PCDF as a function of particle size are calculated here, assuming that the concentrations are proportional to available particle surface area (Table B-2). This distribution will be used in the following section to calculate the effect on PCDD and PCDF emission rates of using a fabric filter.

$(\text{ug/sec}) \text{ total PCDD or PCDF} \times \text{fraction of total surface area for given particle size} = (\text{ug/sec}) \text{ PCDD or PCDF for given particle size}$

$(\text{g/sec}) \text{ total particulate} \times \text{fraction of total weight for given particle size} = (\text{g/sec}) \text{ particulate weight for given particle size}$

$(\text{ug/sec}) \text{ PCDD or PCDF for given particle size divided by } (\text{g/sec}) \text{ particulate weight for given particle size} \times 10^3 \text{ ng/ug} = (\text{ng/g}) \text{ PCDD or PCDF for given particle size}$

Example, 15.0 um particles

$9.54 \text{ ug/sec total PCDD} \times 0.015 = 0.1431 \text{ ug/sec PCDD on 15.0 um particles}$

82.92 ug/sec total PCDF x 0.015 = 1.2438 ug/sec PCDF on 15.0 um particles

7.94 g/sec x 0.128 = 1.0163 g/sec

$(0.1431 \text{ ug/sec PCDD}) / (1.0163 \text{ g/sec}) \times (10^3)$
= 141 ng/g PCDD for 15.0 um particles

$(1.2438 \text{ ug/sec PCDF}) / (1.0163 \text{ g/sec}) \times (10^3)$
= 1,224 ng/g PCDF for 15.0 um particles

TABLE B-3

CONCENTRATIONS OF PCDD AND PCDF AS A
FUNCTION OF PARTICLE SIZE

<u>Particle Diameter (um)</u>	<u>Fraction of Total Surface Area</u>	<u>Fraction of Total Weight</u>	<u>PCDD Concentration (ug/g)</u>	<u>PCDF Concentration (ug/g)</u>
15.0	0.015	0.128	141	1,224
12.5	0.015	0.105	172	1,492
8.1	0.022	0.104	254	2,209
5.5	0.023	0.073	379	3,291
3.6	0.050	0.103	583	5,070
2.0	0.092	0.105	1,053	9,150
1.1	0.129	0.082	1,890	16,429
0.7	0.166	0.076	2,624	22,812
LT 0.7	0.488	0.224	2,618	22,751

LT - Less than

Effect of Fabric Filter on PCDD and PCDF and Emissions

The outlet particle size distribution for a fabric filter differs from that of an electrostatic precipitator described in the previous section. As supplied by the vendor, particle size distribution is shown.

TABLE B-4
PARTICLE SIZE DISTRIBUTION
(FABRIC FILTER OUTLET)

<u>Particle Diameter (μm)</u>	<u>Percent Less Than by Weight</u>
10	64
8	58
6	54
4	48
2	39
1	23
0.8	17
0.6	11
0.4	5.6
0.2	1.7
0.1	1.1

This particle size distribution was plotted on log-log graph paper and the distribution was graphically determined for particle size ranges used in the previous section.

TABLE B-5

PARTICLE SIZE DISTRIBUTION
(FABRIC FILTER OUTLET)

<u>Particle Diameter (um)</u>	<u>Fraction of Total Weight</u>
15.0	0.24
12.5	0.11
8.1	0.07
5.5	0.05
3.6	0.07
2.0	0.07
1.1	0.14
0.7	0.10
LT 0.7	0.15

LT - Less than

Using total projected particulate emission rate for fabric filter outlet, fly ash emission rates for each particle size are calculated. The concentrations of PCDD and PCDF calculated in the previous section are then used to calculate PCDD and PCDF emission rates for each particle size.

(g/sec) total particulate x fraction of total weight for given particle size x (ng/g) PCDD or PCDF for given particle size = (ng/sec) PCDD or PCDF for given particle size

Example, 15.0 um particles

$$3.97 \text{ g/sec} \times 0.24 \times 141 = 134 \text{ ng/sec PCDD on 15.0 um particles}$$

$$3.97 \text{ g/sec} \times 0.24 \times 1,224 = 1,166 \text{ ng/sec PCDF on 15.0 um particles}$$

TABLE B-6

PCDD AND PCDF EMISSION RATES
IF FABRIC FILTER IS USED AND
ALL EMISSIONS ARE PARTICULATE

<u>Particle Diameter (um)</u>	<u>Fraction of Total Weight</u>	<u>PCDD Concentration (ng/g)</u>	<u>PCDD Emission Rate (ug/sec)</u>	<u>PCDF Concentration (ng/g)</u>	<u>Emission Rate (ug/sec)</u>
15.0	0.24	141	134	1,224	1,166
12.5	0.11	172	75	1,492	652
8.1	0.07	254	71	2,209	614
5.5	0.05	379	75	3,291	655
3.6	0.07	583	162	5,070	1,409
2.0	0.07	1,053	293	9,150	2,544
1.1	0.14	1,890	1,051	16,429	9,135
0.7	0.10	2,624	1,042	22,812	9,056
LT 0.7	0.15	2,618	<u>1,560</u>	22,751	<u>13,560</u>
			4,463		38,791

LT = Less Than

Distribution by weight of PCDD and PCDF among isomer groups with the same number of chlorine substitutions are assumed to be the same as shown in Table B-1.

TABLE B-7

PCDD AND PCDD EMISSION RATES BY ISOMER GROUP
IF FABRIC FILTER IS USED AND ALL
EMISSIONS ARE PARTICULATE

	<u>Fraction of Total Weight</u>	<u>Mass Emission Rate (ng/sec)</u>	<u>Concentration on Fly Ash (ng/g)</u>
Tri-CDF	0.6173	23,946	6,029
Tetra-CDF	0.1851	7,180	1,808
Penta-CDF	0.0534	2,071	521
Hexa-CDF	0.1275	4,946	1,245
Hepta-CDF	0.0155	610	151
Octa-CDF	0.0012	47	12
Total-CDF	<u>1.0000</u>	<u>38,791</u>	<u>9,766</u>
Tri-CDD	0.2321	1,036	261
Tetra-CDD	0.1135	507	127
Penta-CDD	0.1867	833	210
Hexa-CDD	0.2862	1,277	322
Hepta-CDD	0.1361	607	153
Octa-CDD	0.0454	203	51
Total-CDD	<u>1.0000</u>	<u>4,463</u>	<u>1,124</u>
2,3,7,8 TCDD	0.0073	0.0326	8

PCDD and PCDF Ambient Air Concentrations

Ambient Concentrations are calculated using the maximum normalized concentrations for ground-level and elevated receptors determined through the use of the MPTER dispersion model (0.024 ug/m^3 for a 1 g/sec emission rate).

$$(\text{ug/m}^3)/(\text{g/sec}) \times \text{g/sec} = \text{ug/m}^3$$

Example, Tri-CDF where emissions are assumed to be gaseous

$$\begin{aligned} &0.024 \times 51.18 \times 10^{-6} \text{ g/sec} \\ &= 1.2283 \times 10^{-6} \text{ ug/m}^3 = 1.2283 \text{ pg/m}^3 \end{aligned}$$

Example, Tri-CDF where emissions are assumed to be particulate

$$0.024 \times 23.95 \times 10^{-6} = 0.5747 \times 10^{-6} \text{ ug/m}^3 = 0.5747 \text{ pg/m}^3$$

TABLE B-8
MAXIMUM AMBIENT PCDF AND PCDD CONCENTRATIONS

	Concentration, pg/m ³ (assuming emissions are gaseous) Case 1	Concentration, pg/m ³ (assuming emissions are particulate) Case 2
Tri-CDF	1.2283	0.5747
Tetra-CDF	0.3684	0.1723
Penta-CDF	0.1063	0.0497
Hexa-CDF	0.2539	0.1187
Hepta-CDF	0.0307	0.0144
Octa-CDF	<u>0.0024</u>	<u>0.0011</u>
Total-CDF	1.9900	0.9309
Tri-CDD	0.0533	0.0249
Tetra-CDD	0.0257	0.0012
Penta-CDD	0.0430	0.0120
Hexa-CDD	0.0655	0.0306
Hepta-CDD	0.0312	0.0146
Octa-CDD	<u>0.0103</u>	<u>0.0049</u>
Total-CDD	0.2290	0.0882
2,3,7,8 TCDD	0.00168	0.000782

Settling Velocities and Reflection Coefficients

Reflection coefficients reflect the amount of particulate that reflects from the surface, i.e., the amount that does not settle. Reflection coefficients are a function of settling velocity.

$$V_s = \frac{d^2 g (P_p - P_g)}{18 u_g} \quad \text{Stokes settling velocity}$$

V_s - settling velocity (cm/sec)

d - particle diameter (cm)

g - Gravity acceleration (980.7 cm/sec²)

P_p - Particle density (1 g/cm³)

P_g - Air density (1.2×10^{-3} g/cm³)

u_g - Air viscosity (1.83×10^{-4} g/cm-sec)

Below particle sizes of one μm the settling velocities are adjusted for the Cunningham correction (slip flow).

$$C = 1 + (6.21 \times 10^{-4})(T)/(d)$$

C = Cunningham correction

T = Ambient temperature (285.8°K)

d = Particle diameter (μm)

Example, 10 um particles

$$V_s = \frac{(10 \times 10^{-4})^2 (980.7) (1 - 1.20 \times 10^{-3})}{18 (1.83 \times 10^{-4})}$$

$$V_s \quad 0.3 \text{ cm/sec} = 0.003 \text{ m/sec}$$

Example, 0.8 um particles

$$V_s = \frac{(0.8 \times 10^{-4})^2 (980.7) (1 - 1.20 \times 10^{-3})}{18 (1.83 \times 10^{-4})} \times [1 + (6.21 \times 10^{-4}) (285.8) / 0.8]$$

$$= 0.0035 \text{ cm/sec} = 0.000035 \text{ m/sec.}$$

Reflection coefficients are determined graphically using the curve supplied with the ISC model user's guide.

TABLE B-9

SETTLING VELOCITIES AND REFLECTION COEFFICIENTS

<u>Particle Diameter (μm)</u>	<u>Settling Velocity (m/sec)</u>	<u>Reflection Coefficient (dimensionless)</u>
10	0.003	0.85
8	0.002	0.90
6	0.001	0.95
4	0.0005	0.95
2	0.0001	1.0
1	0.000035	1.0
0.8	0.00002	1.0
0.6	0.00001	1.0
0.4	0.000007	1.0
0.2	0.000002	1.0
0.1	0.0000008	1.0
LT 0.1*	0.0000003	1.0

LT - Less than

* Estimated at 0.05

Similarly, settling velocities and reflection coefficients are calculated for the particle sizes used in the particulate emission analysis.

TABLE B-10
SETTLING VELOCITIES

<u>Particle Diameter (μm)</u>	<u>Settling Velocity (m/sec)</u>	<u>Reflection Coefficient (dimensionless)</u>
15.0	0.007	0.80
12.5	0.005	0.82
8.1	0.002	0.85
5.5	0.001	0.90
3.6	0.0004	0.95
2.0	0.0001	1.0
1.1	0.00004	1.0
0.7	0.00002	1.0
LT 0.7*	0.000004	1.0

LT - Less than

* Estimated at 0.35

Concentrations of PCDD and PCDF in Deposited Fly Ash

Concentrations of PCDD and PCDF in deposited fly ash are derived from the reflection coefficients in Table B-10 and the concentrations on fly ash as a function of particle size in Table B-3.

fraction of weight depositing for a given particle size = one minus reflection coefficient for a given particle size

Example, 15.0 um particles

$1 - 0.80 = 0.20$, fraction of all 15.0 um particles emitted that settle

(g/sec) total fly ash emitted x fraction of total weight emitted for a given particle size x fraction of weight depositing for a given particle size

= (g/sec) fly ash depositing for a given particle size

Example, 15.0 um particles

$3.97 \text{ g/sec} \times .24 \times .20 = 0.191 \text{ g/sec}$ 15.0 um particles depositing

(g/sec) total deposited = sum of g/sec depositing for all particle sizes = 0.346 g/sec

fraction of deposited particles for a given size range = g/sec depositing for a given particle size divided by the sum of g/sec depositing for all particle sizes.

Example 15.0 um particles

$(0.191 \text{ g/sec}) / (0.346 \text{ g/sec}) = 0.552$, fraction of all deposited fly
ash in 15.0 um size

TABLE B-11

FRACTION OF FLY ASH EMISSION THAT DEPOSITS

<u>Particle Diameter (μm)</u>	<u>Reflection Coefficient (dimensionless)</u>	<u>Fraction Depositing</u>	<u>Fraction of Fly Ash Emitted</u>	<u>Fly Ash Deposited (g/sec)</u>	<u>Fraction of Emission that Ultimately Deposits</u>
15.0	0.80	0.20	0.24	0.191	0.552
12.5	0.82	0.18	0.11	0.079	0.228
8.1	0.85	0.15	0.07	0.042	0.121
5.5	0.90	0.10	0.05	0.020	0.058
3.6	0.95	0.05	0.07	0.014	0.041
2.0	1.0	0	0.07	0	0
1.1	1.0	0	0.14	0	0
0.7	1.0	0	0.10	0	0
LT 0.7	1.0	0	0.15	0	0
				<u>0</u>	
				0.346	

LT - Less than

fraction of deposited fly ash in a given particle size $\times$ (ng/g) PCDD or PCDF for a given particle size = contribution of PCDD or PCDF in a given particle size

sum of contributions of PCDD or PCDF in a given particle size = ng/g PCDD or PCDF in deposited mixture

Example, 15.0 μ m particles

$$0.552 \times 141 \text{ ng/g PCDD} = 77.8 \text{ ng/g PCDD from } 15.0 \text{ } \mu\text{m particles}$$

$$0.552 \times 1,224 \text{ ng/g PCDF} = 675.7 \text{ ng/g PCDF from } 15.0 \text{ } \mu\text{ particles}$$

$$\text{sum of PCDD in all particle sizes} = 193.6 \text{ ng/g}$$

$$\text{sum of PCDF in all particle sizes} = 1682.0 \text{ ng/g}$$

TABLE B-12

PCDF AND PCDD CONCENTRATIONS IN DEPOSITED FLY ASH

<u>Particle Diameter (um)</u>	<u>Fraction of Deposited Fly Ash</u>	<u>PCDD Concentration (ng/g)</u>	<u>Contribution of PCDD in Deposited Fly Ash (ng/g)</u>	<u>PCDF Concentration (ng/g)</u>	<u>Contribution of PCDD in Deposited Fly Ash (ng/g)</u>
15.0	0.552	141	77.8	1,224	675.7
12.5	0.228	172	39.2	1,492	340.2
8.1	0.121	254	30.7	2,209	267.3
5.5	0.058	379	22.0	3,291	190.9
3.6	0.041	583	23.9	5,070	207.9
2.0	0	1,053	0	9,150	0
1.1	0	1,890	0	16,429	0
0.7	0	2,624	0	22,812	0
LT 0.7	0	2,618	0	22,751	0
			193.6		1682.0

LT - Less than

PCDF and PCDF Deposition Rates

Mass deposition rates of PCDD and PCDF are the concentrations in the fly ash mixture times the maximum fly ash deposition rate. From the ISC deposition model the maximum fly ash deposition rate is 0.004613 g/m² per year.

$$194 \text{ ng/g PCDD} \times 0.004613 \text{ g/m}^2 \text{ yr} = 0.8949 \text{ ng/m}^2 \text{ yr PCDD}$$

$$1,682 \text{ ng/g PCDF} \times 0.004613 \text{ g/m}^2 \text{ yr} = 7.7591 \text{ ng/m}^2 \text{ yr PCDF}$$

Distribution by weight of PCDD and PCDF among isomer groups with same number of chlorine substitutions are assumed to be the same as shown in Table B-1.

TABLE B-13
PCDD PCDF DEPOSITION RATES

	<u>Maximum Annual Deposition Rate (ng/m²-yr)</u>
Tri-CDF	4.790
Tetra-CDF	1.436
Penta-CDF	0.414
Hexa-CDF	0.990
Hepta-CDF	0.120
Octa-CDF	<u>0.009</u>
Total-CDF	7.759
Tri-CDD	0.208
Tetra-CDD	0.101
Penta-CDD	0.167
Hexa-CDD	0.256
Hepta-CDD	0.122
Octa-CDD	<u>0.041</u>
Total-CDD	0.895
2,3,7,8 TCDD	0.0065

PCDD and PCDF Concentrations in Soil

PCDD and PCDF depositing on soil are assumed to mix within the top centimeter of soil before or during exposure. Assuming 1.6 g/cm^3 for soil (100 lb/ft^3), concentrations are calculated using deposition rates in Table B-13.

$$\begin{aligned} & (\text{ng/m}^2\text{-yr}) \text{ PCDD or PCDF} / (1.6 \text{ g/cm}^3)(10,000 \text{ cm}^2/\text{m}^2)(1 \text{ cm}) = \\ & (\text{ng/g}) \text{ PCDD or PCDF in soil after one year} \end{aligned}$$

Example, Tri-CDF

$$(4.790)/(1.6)(10,000)(1) = 0.299 \times 10^{-3} \text{ ng/g} = 299 \text{ fg/g after one year}$$

TABLE B-14

PCDD AND PCDF CONCENTRATIONS IN SOIL

	<u>fg/g After One Year</u>
Tri-CDF	299
Tetra-CDF	90
Penta-CDF	26
Hexa-CDF	62
Hepta-CDF	8
Octa-CDF	<u>0.6</u>
Total-CDF	486
Tri-CDD	13
Tetra-CDD	6
Penta-CDD	10
Hexa-CDD	16
Hepta-CDD	8
Octa-CDD	<u>3</u>
Total-CDD	56
2,3,7,8 Tetra-CDD	0.41

PCDD and PCDF Concentrations in Depositing Dirt

Fly ash particles that deposit on hard surfaces, such as streets, automobile surfaces, painted wood, etc. are assumed to be diluted only by the airborne particulate that deposits along with the fly ash particles. Average total particulate deposition rates for Brooklyn ($74.4 \text{ g/m}^2\text{-yr}$) are used to calculate PCDD and PCDF concentrations in depositing dirt. Regardless of accumulation rates, the concentrations will remain the same.

$$\begin{aligned} & (\text{ng/m}^2\text{-yr}) \text{ PCDD or PCDF} / (\text{g/m}^2\text{-yr}) \text{ total particulate} = \\ & (\text{ng/g}) \text{ PCDD or PCDF in depositing dirt} \end{aligned}$$

Example, Tri-CDF

$$4,790/74.4 = 0.064 \text{ ng/g} = 64 \text{ pg/g}$$

TABLE B-15

PCDD AND PCDF CONCENTRATIONS IN DEPOSITING DIRT

	<u>pg/g</u>
Tri-CDF	64
Tetra-CDF	19
Penta-CDF	6
Hexa-CDF	13
Hepta-CDF	2
Octa-CDF	<u>0.1</u>
Total-CDF	104
Tri-CDD	3
Tetra-CDD	1
Penta-CDD	2
Hexa-CDD	3
Hepta-CDD	2
Octa-CDD	<u>0.6</u>
Total-CDD	12
2,3,7,8 TCDD	0.087

PCDD and PCDF Deposition on Indoor Surfaces

Assuming PCDD and PCDF deposition on indoor surfaces is proportional to outdoor deposition in the same ratio as ambient is the lead deposition, the overall indoor deposition rate is 25 percent of the overall outdoor deposition rate. The maximum accumulation time is assumed to be one month. The PCDD and PCDF accumulation is calculated using these assumptions.

$$\begin{aligned} & (\text{ng/m}^2\text{-yr}) \text{ PCDD or PCDF} \times 0.25 \times 1/12 \text{ yr/month} \times 1 \text{ month} = \\ & (\text{ng/m}^2) \text{ PCDD or PCDF maximum accumulation} \end{aligned}$$

Example, Tri-CDF

$$4,790 \times 0.24 \times 1/12 \times 1 = 0.100 \text{ ng/m}^2 = 100 \text{ pg/m}^2$$

TABLE B-16

MAXIMUM PCDD AND PCDF ACCUMULATION ON INDOOR SURFACES

	<u>pg/m²</u>
Tri-CDF	100
Tetra-CDF	30
Penta-CDF	9
Hexa-CDF	21
Hepta-CDF	2.5
Octa-CDF	<u>0.2</u>
Total-CDF	163
Tri-CDD	4
Tetra-CDD	2
Penta-CDD	3.5
Hexa-CDD	5
Hepta-CDD	2.5
Octa-CDD	<u>0.9</u>
Total-CDD	18
2,3,7,8 TCDD	0.135

APPENDIX C

Issues Related to Dioxin Emissions from BNYRRF

APPENDIX C

ISSUES RELATED TO DIOXIN EMISSIONS FROM
THE BROOKLYN NAVY YARD RESOURCE RECOVERY FACILITYIntroduction

This appendix discusses additional issues related to PCDF and PCDD emissions from the BNYRRF. Included is a discussion of additional methods that might be applicable to reduce PCDF and PCDD emissions and discussions of potential public health impacts associated with the fly ash residue produced during facility operations. Although these issues are not directly related to the emission assessment and risk analysis presented in previous chapters, they are important issues because they could ultimately affect plant design and operation and overall public exposure. Included will be a discussion of these related topics: (1) the segregation of polyvinyl chloride (PVC) from incoming solid waste, (2) operating controls, (3) emission controls, (4) residue in fly ash, (5) occupational exposures, and (6) disposal of fly ash. Since these topics are not directly involved in the risk analysis, they are not covered in as much detail as the information in Chapters 3, 4, and 5.

Potential Methods to Reduce PCDF and PCDD EmissionsSegregation of Polyvinyl Chloride

Pre-combustion separation is not considered a viable method to reduce PCDF and PCDD emissions, unless known precursors can be identified and removed with a degree of certainty (ASME 1981). PVC has never been shown to be a precursor of PCDF/PCDD, and the chlorine liberated by PVC combustion comprises only part of the total amount of chlorine in municipal solid waste. Therefore, at this time the removal of PVC from the incoming solid waste stream would not be expected to affect the PCDF and PCDD emissions from the stack.

Polyvinyl chloride (PVC) is a common plastic that is used extensively in construction materials in the United States. Uses include plastic pipe, indoor floor tile, wire insulation, and automobile interiors. PVC is a very durable material and is generally used in places where it will not be replaced frequently. Since PVC is primarily used for durable, and not consumable, products, it does not comprise a major portion of municipal solid waste. However, the fact that it is a commonly used material in the United States indicates that some of it will find its way into the municipal solid waste system. Studies on the amount of chlorine in municipal solid waste have shown that the total chlorine content is made up of contributions from textiles, rubber, leather, paper, and food, as well as plastics. The chlorine contribution from plastics has been found to be 35-50 percent of the total amount of chlorine. Therefore, removal of PVC will still leave a significant amount of chlorine in the waste, which would be available to form PCDF and PCDD compounds in the unlikely event of pyrolytic conditions in the municipal incinerator. Due to the many diverse sources of chlorine in waste, it is impractical to separate chlorine from the solid waste.

Prescreening of the waste to remove non-combustibles and plastics has been proposed at other facilities to enhance combustion and reduce PCDF and PCDD emissions further. Most plastics disposed in the U.S., however, are not chlorinated, but do have high heat contents; therefore, removal of the plastics may not enhance combustion or reduce PCDF and PCDD emissions. In addition, very great technical and safety problems would have to be overcome before this type of technology could be applied to the scale of the Brooklyn Navy Yard.

It has been reported that chlorine, whether organically bound or in the inorganic form, can react with phenol and creosol compounds that are formed when vegetable materials are pyrolyzed (Liberti et al. 1983). In these experiments pure vegetable extracts were pyrolyzed in the presence of organic and inorganic chlorine, yielding PCDFs and PCDDs in the ppm range. However, any source of chlorine, whether from PVC, other chlorocarbons, or inorganic chloride (salt) can transform products of incomplete combustion into PCDF and PCDD compounds. Therefore, in order to minimize PCDF and PCDD

emissions, the most important step is the optimization of combustion efficiency rather than the removal of chlorine from the waste. It is clear from reports of tests performed on a full-size Martin incinerator that, even when PVC was added to municipal refuse in amounts of 300 percent greater than what was normally found in urban municipal waste, there were no increases above normal levels of PCDF and PCDD emissions on fly ash (Karasek et al. 1983).

There is also some concern over PVC due to the fact that it has been reported that pyrolysis of this material under laboratory conditions can form chlorobenzenes (Ahling and Lindskog 1982), and that chlorobenzenes can convert to PCDDs and PCDFs in the ppm range during pyrolysis in sealed quartz ampules (Choudhry et al. 1982). However, combustion of PVC in the presence of an oxygen-rich flame at high temperatures and adequate residence time results in carbon dioxide, water, chlorine, and hydrogen chloride. This is true of all chlorinated hydrocarbon materials.

Operating Controls

It is abundantly clear that the quality of operations of a municipal incinerator can significantly affect the quantity of PCDF and PCDD emissions. The design of the equipment selected by the NYCDOS appears to have features that enhance complete and efficient combustion. These features include underfire and overfire air supply, secondary air injection at high velocity to provide effective turbulence, and auxiliary burners to maintain minimum design secondary combustion temperature (980°C). According to the test data examined, the design appears to be consistent with relatively low PCDF and PCDD emissions. Obviously, the system would have to be operated and maintained in good condition in order for these emissions to be at this level continuously. A detailed operating plan is necessary for consistent high-quality operations.

Combustion monitoring instrumentation to provide data on day-to-day operations is planned. Combustion-temperature sensors will be located at strategic places in the system, and indicators of combustion efficiency will be monitored at all times. The indicators of combustion efficiency will be

carbon dioxide or oxygen, and carbon monoxide. If carbon monoxide concentrations increase, then there are indications that PCDF and PCDD emissions will also increase. Decreasing oxygen concentrations are associated with starved-air conditions, which enhance PCDF and PCDD formation, while high oxygen concentrations indicate flame cooling and subsequent reduction of combustion efficiency, which is also likely to increase the PCDF and PCDD emissions. The goal is to operate with just enough oxygen to reduce carbon monoxide emissions without also reducing combustion temperature.

Even before start-up, the manner in which monitoring will be used to control operations should be carefully defined. The systems must be designed to sound an alarm when the indicators are out of the acceptable range. Even more important, when the alarm sounds the operators must be fully trained and prepared to respond to the problem.

Another potential problem is the maintenance of charging, combustion, and air-supply systems. It is imperative that preventive maintenance be performed regularly and whenever necessary. Deferred maintenance could result in frequent upset conditions.

Emission Controls

Emission controls can be separated into process controls and after-process collection/removal/destruction equipment. Process controls are inherent to the charging, combustion, and air supply systems. These controls are designed to optimize combustion efficiency and minimize emission of combustible materials, including PCDF and PCDD compounds. A modern, sophisticated combustion control system will be utilized at the Brooklyn Navy Yard Facility, including auxilliary burners to ensure the maintenance of minimum combustion temperatures, and continuous monitoring devices to permit combustion conditions to remain in specified ranges. Furthermore, the operators will be trained sufficiently in the use of the system so that combustion efficiency will be maximized and emissions will be minimized.

After-process control systems include particulate collection devices, which remove fly ash from the gas stream, resulting in low concentrations of suspended and settleable particulate matter. There is evidence that a large portion of PCDF and PCDD materials adsorb onto particulate matter while in the gas flues. There is a relationship between particle surface area and PCDF/PCDD concentration resulting from condensation on the particle surfaces. Small particles have a greater surface area to weight ratio; therefore, there is an inverse relationship between particle size and concentration by weight of PCDF/PCDD compounds on the particles. This results in higher concentrations on smaller particles. For this reason, a particulate control device which has a high collection efficiency for smaller particles will be more effective in controlling PCDF and PCDD emissions. Fabric filters are significantly more efficient in collecting smaller particles than electrostatic precipitators; therefore, fabric filters are a better choice for minimizing emissions than electrostatic precipitators.

Since some PCDF and PCDD materials may be condensible when the flue gas enters the pollution control system, any temperature reduction within the pollution control system may cause condensation of these materials onto particle surfaces. The greatest portion of particle surface area is found in the ultra-fine particle size range. Therefore, a temperature reduction followed by collection of ultra-fine particles will result in the most efficient removal of PCDF and PCDD materials from the gas stream. Furthermore, a dry scrubbing system, operating at reduced temperatures and using a neutralizing agent, can absorb acid gases and enhance vapor condensation (Teller and Lauber 1983). This equipment, followed by a fabric filter particulate collector, can effect removal of HCl, SO₂, PCDD, PCDF, and ultra-fine particulates.

Teller and Lauber (1983) speculate that a reduction of temperature from 220°C to 120°C may reduce vapor-phase concentration of TCDD in incinerator emissions by 97-98 percent. Since the condensation will tend to occur mostly on the smallest particles, these researchers report that subsequent filtration devices, which are capable of 97-99 percent removal of particles to the 0.3 micron range, may effectively remove TCDD materials from the gas-stream. These data are based on the assumption that the equilibrium gas

phase TCDD concentration is equivalent to the concentrations observed in six Italian incinerators (Cavallaro et al. 1983). This may not be an appropriate comparison to the BNYRRF, since there are no design and operations data for the Italian incinerators. Also, there is very little confidence in the test method used for quantifying the particulate and gaseous fractions. However, the Teller and Lauber analysis clearly shows that gas-temperature reduction, dry scrubbing, and fabric filtration may have a significant effect on PCDF and PCDD emissions. In fact, the California Air Resources Board has enacted regulations requiring acid gas control and fabric filtration on new municipal incinerators, and the New Jersey Department of Environmental Protection requires new municipal incinerators to have acid gas control as well as particulate emission control.

The type of particulate control selected for the BNYRRF is fabric filtration, which is a relatively new technology for incinerators. It can be designed to collect greater than 99.5 percent of the overall particulate matter, and is very efficient on the very small particles. Fabric filters have been installed in recent years on power plants, but only very recently have they been installed on municipal incinerators. The recent installations have primarily been overseas, in Europe and Japan. The alternate control technology is electrostatic precipitation, which has been used effectively on municipal incinerators for many years.

The advantages and disadvantages of electrostatic precipitators and fabric filters are presented in Table C-1 (Skizim 1982). Although fabric filters are very efficient on ultra-fine particles and are relatively insensitive to changes in inlet flow and dust loadings, they are expensive to operate, especially if used in conjunction with a dry scrubber, which would require the use of a specialty chemical. (These costs would also apply, however, to any scrubber used in connection with an electrostatic precipitator.) In addition, the fabric must be selected and handled properly. If conditions exceed the design temperature range, blinding or fabric degradation can occur. Electrostatic precipitators, although less efficient on ultra-fine particles, are reliable and inexpensive to operate and maintain. These units have been used successfully on municipal incinerators for many years, and they may also be used in conjunction with dry scrubbers for acid gas control.

The dry scrubber technology has been used with fabric filtration on municipal incinerators only very recently. Some PCDF/PCDD analyses have been performed on an installation in Japan; at this time, however, the data are not available. Therefore, the extent to which this technology will reduce emissions from those predicted in Section 3.6, if at all, is not known. Given the extremely low exposures and risks determined by this report, the recommendation for using an untested combination dry scrubber/filter fabric technology for further reductions is not warranted.

Potential Impacts of Fly Ash Residue

Residue in Fly Ash

Approximately 25 percent of the weight of solid waste input will be removed from the site as bottom ash and fly ash residue. This material will be quenched with water immediately upon removal from the incinerator so as to facilitate handling and to reduce fugitive emissions. Most of the residue will be in the form of bottom ash, and approximately 12 percent will be fly ash from the particulate collection devices. The test data indicate that negligible concentrations of PCDF and PCDD materials are found in bottom ash of municipal incinerators, while concentrations on fly ash range from negligible to greater than several thousand ng/g. A compilation of concentrations of PCDF and PCDD materials on fly ash collected in electrostatic precipitators of municipal incinerators is shown in Table C-2.

The low data-set from the Lustenhouwer data compares with the Martin plant data (Karasek et al. 1983). The representative analyses of 25 plants (Lustenhouwer et al. 1980) shows medium concentrations from 18 ng/g (octa-CDF) to 361 ng/g (hexa-CDF), while the average of nine Dutch incinerators (Olie et al. 1982) is also within this order of magnitude. The low data set from the Lustenhouwer et al. (1980) reference compares well with the Martin plant (Karasek et al. 1983). This ranges from 5 ng/g for tetra-CDD to 266 ng/g for octa-CDD. The Chicago, Northwest incinerator test data (Redford et al. 1980), shows that PCDF and PCDD compounds were not detected at a detection limit of 0.5 ng/g. Approximately 93 tons of fly ash per day would be generated by the Brooklyn Navy Yard facility at full capacity,

TABLE C-1

COMPARISON OF ELECTROSTATIC PRECIPITATORS
AND FABRIC FILTERS

	<u>Electrostatic Precipitators</u>	<u>Fabric Filters</u>
Advantages:	High overall efficiency High turn-down ratio Low pressure drop High reliability Low maintenance Extensive operating experience	High efficiency in sub-micron particle size range Insensitive to fluctuations in inlet flow and particulate loading Compatible with dry scrubbing technology (acid gas control without wet scrubber problems)
Disadvantages:	Sensitivity to changes in dust and gas loads and characteristics Loss of efficiency in the sub-micron range	If operating with a dry scrubber, reduced gas temperature may restrict plume rise and pollutant dispersion * High operating costs Limited operating experience

* This would also be true of the case where an electrostatic precipitator is used with a dry scrubber, although it is more common to use dry scrubbers with fabric filters. Furthermore, as in the case with the BNYRRF, the fabric filter can be operated without a dry scrubber with no reduction in temperature from the case where an electrostatic precipitator is used.

Ref: (Skizim 1982)

based upon the difference between the controlled and uncontrolled emission rates cited in the PDEIS. For use in this analysis, the low concentrations of analyses representing 25 plants (Lustenhouwer et al. 1980) is used to calculate the annual PCDF and PCDD mass rates in collected fly ash; these rates are also shown in Table C-2.

Occupational Exposures

The degree to which workers at the BNYRRF are exposed to levels of PCDDs and PCDFs in the flyash will depend on several factors:

- the concentration of these materials in the fly ash
- the manner in which fugitive dust emissions are controlled, and
- the degree of respiratory and dermal protection provided.

Based upon an examination of available data, we estimated that the TCDD concentration of the fly ash would be as high as those found by Lustenhouwer et al. (1980) in the range for incinerators (55 ng/g-TCDD). This, in turn, would equal 0.3 ng/g of 2,3,7,8-TCDD (Assumes 2,3,7,8-TCDD is 6 percent of TCDD).

A concentration of 0.3 ng/g (ppb) of 2,3,7,8-TCDD is slightly lower than the 1 ppb concentration used by CDC as a guideline for determining the need to remove dioxin contaminated soils from residential areas. While dioxin binds more tenaciously to fly ash than soil, suggesting that it may be less bioavailable, there may or may not be a need to limit occupational exposure to fly ash dust emissions.

As indicated in Chapter 3, levels of PCDDs and PCDFs in flyash vary considerably. During the startup phase of the BNYRRF, it is recommended that fly ash samples be analyzed to determine actual levels of these compounds. This information should then be utilized to develop a safety plan that identifies the need for and type of respiratory and/or dermal protection, and appropriate procedures for dust suppression and handling of fly ash material. The occupational and safety risks, if any, should be controlled through sound management procedures.

TABLE C-2
RESIDUE IN FLY ASH

	Concentration in Fly Ash ^(b) (ng/g)	Concentration in Fly Ash ^(a) (ng/g)			Concentration in Fly Ash ^(c) (ng/g)	Annual BNY Projected Mass Rate (kg/yr)
		Low	Med.	High		
Tri-CDF	NA	NA	NA	NA	--	--
Tetra-CDF	170	13	111	233	--	0.4
Penta-CDF	NA	42	196	510	--	1.3
Hexa-CDF	315	109	361	870	--	4.1
Hepta-CDF	NA	89	177	407	--	3.4
Octa-CDF	48	20	18	26	--	0.8
Tri-CDD	NA	NA	NA	NA	--	--
Tetra-CDD	126	5	54	110	ND	0.2
Penta-CDD	NA	31	182	488	8	1.2
Hexa-CDD	443	80	326	1200	28	3.0
Hepta-CDD	NA	190	288	902	75	7.2
Octa-CDD	389	266	106	110	180	10.1

LT - Less than

NA - Not analyzed

- (a) Lustenhouwer et al. 1980; representing 80 analyses at 25 plants.
 (b) Olie et al 1982; average of nine Dutch incinerators.
 (c) Karasek et al. 1983; average of three analyses at a French Martin plant.

Disposal of Fly Ash

Landfill disposal of the BNYRRF fly ash is not anticipated to present a problem from an environmental standpoint assuming adequate cover, proper operating controls (particularly dust control), and effective occupational safety measures for landfill workers. These measures, combined with PCDF's and PCDD's tendencies to bind to fly ash, should ameliorate any adverse impacts to landfill personnel, air, ground and surface waters. As reported in Esposito, (1980) TCDD has never been detected in groundwater. Further, since NYC residents obtain drinking water from upstate reservoirs, there would be no pathway of exposure via groundwater migration. Due to the tenacious binding of PCDD to fly ash, as well as the relative insolubility of PCDD, migration to surface water would be unlikely to occur.

Summary

In evaluating the impacts and risks of PCDF and PCDD emissions from the BNYRRF, it was necessary to evaluate whether any options were available to reduce atmospheric emissions further than those projected. In addition, it was necessary to evaluate the design and identify possible problems and risks that are related to the PCDF and PCDD emissions.

The design of the BNYRRF is state-of-the-art with additional controls that are not used in other resource recovery facilities in the U.S. The use of auxiliary burners on a resource recovery plant to maintain secondary combustion temperature is an application of an existing tested technology in a new way to assure minimum emissions. The use of a fabric filter to remove fly ash from the flue gas stream is a relatively new technology for resource recovery in the U.S., although these have been installed recently in other countries. Given that these units have only recently been installed on resource recovery plants, performance will have to be monitored closely in order to assure that emissions are as low as projected, and that reliability is of a high degree.

After careful consideration of alternate designs, the only method that may achieve even lower emissions than those projected is the application of the dry scrubber/fabric filter combination for air pollution control. This technology, although available, has not been widely used or tested. However, claims have been made for significant PCDF and PCDD collection through gas quenching, pollutant condensation, and subsequent collection of solid particulates. Until this technology can be demonstrated to be effective without creating significant problems, such as moisture condensation in the fabric filter and reduced atmospheric dispersion through inhibited plume buoyancy of a cooler gas, it is not recommended to install this technology at this time. However, studies of this technology are ongoing and the reliability and performance may be shown to be effective in the future.

Occupational exposure to fly ash may have to be controlled through sound management practices and through implementation of a safety plan. The specific safety requirements should be determined after fly ash samples from the BNYRRF are analyzed.

Recommendations

The previous chapters provide an analysis of impacts from predicted BNYRRF emissions. Because of public concern regarding potential risks, actual rather than predicted impacts should be assessed through a sampling program.

In order to avoid future controversy, the feasibility and need for completing a background testing program of soils, sediments and dust samples collected prior to the startup of the BNYRRF, should be determined. Since there may be multiple (non-resource recovery facility) sources of dioxin emissions in the urban environment, background studies may be necessary to correlate future impacts after startup on the facility. Background data will also help determine the statistical significance of any sampling data collected after startup. It should be noted that much more information concerning background levels of dioxin should be available as a result of USEPS's Dioxin Strategy and other research programs.

Upon startup and reaching the steady-state charging capacity, it is recommended that stack emission tests for each group of PCDF and PCDD isomers be performed. Three test runs at each of three operating conditions, such as maximum, minimum, and an intermediate load, should be performed to obtain an emission profile on at least one unit. The other units can be tested at only the condition which results in the highest emissions. Unless specific emission problems are observed, these tests should be followed up after one and three years of operation to ensure that equipment and/or operating problems are identified if they occur. These tests should be performed on each unit at the condition initially identified with the highest emissions.

Additional monitoring should be performed of on-site meteorological conditions so that updated dispersion and deposition analyses can be performed. If ambient air and/or soil sampling is performed, the meteorological monitoring is absolutely necessary to correlate sampling data with source data. However, ambient sampling is not recommended at this time due to the difficulty of accurately making this correlation, plus the short sampling period, the expense of analysis, and the difficulty of excluding interference from other sources, such as apartment house incinerators.

Furthermore, it is recommended to analyze fabric filter collection dust for 2,3,7,8 TCDD. If the concentration exceeds the CDC guidance level of one ng/g, which was developed for action in assessing ambient soil concentrations, then a health and safety plan for worker protection should be developed. This analysis should be performed as soon after startup as possible and quarterly thereafter. Should the dust analysis reveal levels at or above the 1 ng/g level, occupational health and safety program should incorporate both dermal and respiratory protection as well as medical monitoring, if indicated. Emphasis should also be placed on dust suppression measures.

APPENDIX D

Comments of Peer Review Panel Members on this Report

APPENDIX D

Overall, the panel, with the possible exception of Dr. Goldfarb, generally supported the methodology, approach, and conclusions of this document. Based upon the expert panel's comments on the Draft Report, several minor editorial and technical changes and recommendations were incorporated into the Final Report. However, several substantive issues and areas of disagreement, which could not be addressed adequately in the final document were identified by the various panelists. Our response to these issues is provided below.

Drs. Chalmers, Goldfarb and Harbison suggested that the report should address the issue of the potential risks from the NYCDOS's long-term plan to construct eight resource recovery facilities in the city. We agree that the incremental risks from the multiple facilities should be evaluated. Our risk assessment procedures can be scaled up and directly applied to estimate the level of risk for the multiple facilities.

Drs. Thibodeaux and Goldfarb both brought up the issue that PCDD-containing fly ash deposition rates might be greater than estimated using the ISC model, due to terrain effects.

With the approach used to estimate PCDD concentrations in dust and dirt, localized changes in deposition rates due to terrain effects should have little impact on overall PCDD exposure through ingestion or dermal pathways. In our analysis, concentrations of PCDD in dust and dirt were determined by dividing the PCDD deposition rate by the deposition rate of total particulates found in the ambient air over Brooklyn. Therefore, if the deposition rate of PCDD increases or decreases due to terrain effects, there should also be a proportional increase or decrease in the total particulate deposition rate, causing relatively constant concentrations of PCDD in deposited particulates.

Another related comment by Dr. Goldfarb indicated that particle agglomeration and particle growth could significantly affect deposition rates. While we agree that the potential exists for particle agglomeration and growth, we have not found any data that suggests how much, if at all, these phenomena may occur on a resource recovery plant. Therefore, since a model for these effects is not available, we do not see any reason to change from the USEPA-approved model utilized in our analysis.

Mr. Velzy suggests that perhaps PCDD/PCDF emissions are not preferentially adsorbed onto small particles. This view is not generally held by the researchers whose papers and articles have been reviewed. Only one additional specific set of data was mentioned by Mr. Velzy in his letter. Changes have been made in the final report which address this additional data; however, the conclusion of the report has not been changed. That is, we feel that the PCDF/PCDD emissions are preferentially adsorbed onto the smaller particles. The data mentioned by Mr. Velzy are from the Hempstead refuse-derived-fuel (RDF) plant, which has been shut down in recent years because of operational difficulties. We do not believe that emission data from this facility is comparable to the efficient mass-burn plants described in the literature and currently operating successfully without emission problems. In summary, we feel that the data adequately supports the assumption that PCDD/PCDF emissions are concentrated on the small particles. The report discusses the reasoning behind this assumption.

Mr. Velzy states that, since PCDDs and PCDFs may not be preferentially adsorbed onto small particles, a fabric filter may not have a significant advantage over a high efficiency electrostatic precipitator. Fabric filters are much more efficient at removing very fine particles than electrostatic precipitators, and therefore, they would have a significant advantage at removing PCDDs and PCDFs, if these trace organics were associated with the very fine particles. As described above, the available data support the view that PCDD and PCDF emissions are in fact adsorbed in higher concentrations on the smaller particles. However, in our report we addressed two emission scenarios. The first case was the situation where the PCDDs and PCDFs were in gaseous form, in which case neither type of particulate control device would have an advantage. The second scenario was the situation

where all the PCDDs and PCDFs were preferentially adsorbed onto the small particles. This provides a range of effects which cover the uncertainties over the amount adsorbed on particulate. We feel that this assessment covers the range of possibilities from no advantage of the control equipment to a very reasonable advantage based upon careful examinations of data published in the literature.

In summary, although we cannot definitively conclude that a fabric filter will have an advantage over an electrostatic precipitator (since the PCDDs and PCDFs may be in gaseous form), we believe that the higher collection efficiency of the fabric filter will cause a beneficial effect if the PCDDs and PCDFs are adsorbed onto particulates.

Mr. Velzy comments that particle size data from the Braintree Municipal Incinerator may not be suitable for use in this analysis because the unit is less efficient at collecting particles than a unit designed today. However, the only use for the Braintree data in our report is to provide a distribution of particle size in order to determine the concentration of PCDDs and PCDFs as a function of particle sizes emitted from a fabric filter. While we agree that a modern electrostatic precipitator would shift the average emitted particle size to one that is lower than used in the report, a significant portion of these same smaller particles would be trapped in a fabric filter. The smaller particles, which carry a relatively high proportion of the adsorbed PCDDs and PCDFs, would be collected at a higher rate than that estimated in the report. Using the Braintree data to develop the case of the increase in effective particle collection of a fabric filter over an electrostatic precipitator actually results in a higher PCDF/PCDD emission rate than would the use of a particle size distribution from a modern electrostatic precipitator. Therefore, from this aspect our data is conservative. Changes have been made in the report that explain and support the use of the Braintree data for this purpose.

Both Drs. Goldfarb and Hutzinger addressed comments on the removal of polyvinyl chloride (PVC) from the waste prior to combustion. The comments generally suggest that the removal of chlorine (specifically chlorine present in PVC) will reduce chlorine available to combine with other combustion

products, thus reducing PCDD and PCDF emissions. Dr. Hutzinger, however, admitted that the removal of PVC from the waste stream is not easily accomplished in a conventional incinerator. In fact, there are no studies where PVC has been successfully removed from the waste stream of a conventional incinerator in order to test the effects on PCDD/PCDF emissions. The Karasek data cited in our report shows no increase in PCDD emissions when 300 percent more than normal PVC was added to the waste of a French incinerator. Dr. Goldfarb contends that excess chlorine was available from the already high concentration of PVC commonly found in French solid waste, and therefore the added PVC did not make any difference. However, the point we are trying to emphasize is that more PVC does not necessarily make more PCDD, unless other variables (such as poor combustion) predominate. Therefore, while removal of PVC may limit the maximum PCDD emissions under abnormally severe upset conditions, it will not affect emissions under normal day-to-day operations.

It is true that the removal of PVC from the waste stream would reduce emissions of acid gases. However, as of this writing, there are no data that indicate that PVC removal would affect PCDD/PCDF emissions. The California Air Resources Board (CARB), in their draft report on air pollution from resource recovery facilities, recommended that plastics removal be instituted to reduce acid gas and trace chlorinated organic emissions. However, CARB stated in a subsequent version of the report that a clear relationship between chlorine in solid waste and emissions of chlorinated organic materials does not exist and that reductions in chlorinated organic emissions should be primarily affected by good combustion practices. Therefore, given the huge problems associated with attempting to remove PVC from a waste stream of the magnitude of the BNYRRF and the lack of definitive data on the effects of removal on emissions, we still feel that PVC removal is not warranted.

Dr. Hutzinger stated that only measurements of PCDDs and PCDFs in the emissions would satisfactorily determine the effect of combustion conditions on emissions of these contaminants. While we agree on this issue, and have recommended periodic emission testing to assess emission rates, we feel that the day-to-day monitoring and control of combustion parameters (including

carbon monoxide) together with a detailed operating plan and effective operator training, will raise the quality of operations and minimize emissions.

Dr. Goldfarb is critical of the many references to the conservatism of the risk assessment and cites examples where he feels it is inappropriate to use such terminology. We strongly disagree with Dr. Goldfarb on this issue. To ensure a margin of safety in our assessment, we have gone far beyond the traditional approach to risk assessment used by regulatory agencies for evaluating point source emissions. The majority of the panel members concurred that the assumptions utilized were highly conservative in nature. Furthermore, they agreed with the technical approach and methodology used in the risk assessment. Within the content of the standard operating practice for risk assessment our assumptions or range of estimates, except in two instances, include conservative rather than average or most probable case assumptions. These include an assessment of all three pathways of exposure rather than just the inhalation pathway, a multiplicative factor to estimate the carcinogenicity of the complex mixture of PCDD/PCDFs (twice as great as that used by Commoner *et al.*), conservative estimates for ingestion rates, dermal exposure and bioavailability, no losses due to volatilization or photo-degradation. In these instances conservative assumptions were used because data regarding the most probable assumptions were lacking.

There are two instances where the most conservative estimates were not used. In the first instance data were available to estimate a most probable case assumption. In this example, Dr. Goldfarb mentioned that the use of PCDD and PCDF emission data from one incinerator, supplemented by data from one other incinerator, was not a sufficient basis for a conservative exposure assessment. Actually, the emission data from a large number of incinerators was examined. Unfortunately, most data was lacking in: (a) appropriate testing methodology, (b) description of combustion conditions and/or incinerator, or (c) similarity of design and/or operation. The data selected was the most appropriate from all aspects. Although we certainly would rather have more data points from which to make a prediction, we feel that the data selected is the closest representation of the BYNRRF available. We also feel that the design of the facility will provide for at

least as effective control of PCDD and PCDF emissions as predicted by this assessment report.

In the second instance, we used what we believe to be the most conservative assumption regarding the carcinogenic risk of 2,3,7,8-TCDD. We also used a conservative assumption that the complex mixture of PCDDs/PCDFs was 59 times as carcinogenic as 2,3,7,8-TCDD despite the fact that this assumption is highly speculative. However, Dr. Goldfarb suggests that the risk estimate used by Dr. Commoner et al., is even more conservative based upon the alleged promoter effects of TCDD. The validity of using Dr. Commoner's approach to estimating carcinogenic risk is an issue that will not be resolved in this report. Dr. Commoner's approach, which should be analyzed critically through peer review, is currently not an accepted method used by any regulatory authority in determining excess carcinogenic risk. Further, Dr. Commoner's approach ignores the issue of whether there are any threshold effects for promoters. Drs. Harbison, Heath, Hutzinger and Upton, all of whom also commented on the risk assessment procedure, supported the risk assessment methodology used in the report.

In the absence of supporting data to show that trace concentrations of promoters in the environment increase overall cancer incidence rates at the same rate as in laboratory studies, and prior to peer review, Dr. Commoner's approach must be regarded as speculative, outside of accepted practice, and therefore inappropriate for use in our risk assessment.

Dr. Goldfarb also stated that he felt the BNYRRF design was deficient in that it does not include a dry scrubber for acid gas and PCDF/PCDD emission control. This is the single method not included in the BNYRRF design that may reduce PCDD/PCDF emissions even more than those currently predicted. Nonetheless, we do not feel that any change in the report regarding the effectiveness of dry scrubbers is warranted. Our report does state that dry scrubbing may reduce PCDD/PCDF emissions; however, the technology described in the literature is expensive, and as of this writing, there are no test results available that describe the effectiveness of this technology for PCDD/PCDF removal. As Dr. Goldfarb states, however, test results should be available soon. It must be stressed that the predicted BNYRRF emissions

and risks are already quite low with the current design, and any decrease in emissions and risks must be compared to the cost of the additional control. Obviously, if a significant risk was associated with the design without dry scrubbers, and dry scrubbers could significantly reduce those risks, then adding this equipment would be essential. Given the expected emissions, we recommend that developments in dry scrubber technology be monitored, but that adding this technology at this time is not warranted on the basis of available information.

Drs. Chalmers and Heath have raised the issue of the lack of long-term health data indicating adverse effects of TCDD exposure. Dr. Chalmers correctly points out that recent information on follow-up of factory workers exposed to this material, and data from Love Canal residents does not indicate the presence of adverse teratogenic and carcinogenic effects. Dr. Heath also indicates that data relating exposure to phenoxy herbicides to the development of soft tissue sarcomas, while suggestive of a link, are not conclusive. While we were aware of the Love Canal data, we chose not to cite it in the document. The large number of compounds present at Love Canal, and the lack of information relating to route and level of exposure, make it difficult to interpret this data as it relates to dioxin risks. As regards the soft tissue sarcoma data, we would agree with Dr. Heath's contention that they are mainly suggestive, as is much of the data regarding human health effects of TCDD. Following the conservative approach generally used in risk assessment, however, we have chosen to presume a possible adverse effect in the absence of data clearly indicating otherwise.

Dr. Goldfarb raises the issue of the half-life of 2,3,7,8-TCDD and states that the lower estimates may result from inaccurate sampling and analytical techniques. This criticism is not relevant, however; because of the contradictory data regarding half-life, we took the most conservative approach i.e., assuming that no degradation occurred over time. It should be noted that the half-life of 2,3,7,8-TCDD, regardless of its length, will reduce exposure, possibly substantially, and therefore, by not assuming any half-life at all, our risk assessment assumption for this issue could not be more conservative.



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*Thomas C. Chalmers, M.D.
Distinguished Service Professor
Clinical Trials Unit*

August 7, 1984

Dr. David Lipsky
Group Manager
Public Health and Chemistry
Fred C. Hart Associates, Inc.
530 Fifth Avenue
New York, NY 10036

Dear Dr. Lipsky:

I am glad to give you the following comments on the report entitled, "Assessment of Potential Public Health Impacts Associated with Predicted Emissions of Polychlorinated Dibenzo-Dioxins and Polychlorinated Dibenzo-furans from the Brooklyn Navy Yard Resource Recovery Facility." To place my contribution in its proper perspective, you should appreciate that I have limited abilities as an expert in the field. I am a clinical epidemiologist, another translation for which is the study of the application of the scientific method to preventive and therapeutic medicine. I am not an environmental toxicologist, although I have learned something about the field from associations with the Division of Environmental Health of the Mount Sinai's Department of Community Medicine, and have served during the last year on a special committee set up to advise the Commissioner of Health about the safety of inhabitants who might move back into the Love Canal area. There are some analogies between the present New York city situation and those deliberations.

First, I want to commend all of you for what I consider to be a superb document. You have included vast amounts of quantitative material with very skillful dissertations on its applicability to the problem at hand. Aside from its obvious usefulness in assisting arrival at a rational conclusion with regard to the proposed waste proposal, it will also serve as a lasting source document of great interest to scholars in the field.

I have only a few minor omissions to point out. I don't believe that you give enough space and emphasis to the examples of long time human exposure to TCDD (Dioxin). I believe that there are now data on long-term follow-up of factory workers to show that the toxicity in humans from doses far in excess of those expected to be encountered in the city is minimal, although the numbers may be small. The data on exposure of residents of the Love Canal are also impressively benign. You can obtain these from Dr. Robert Huffaker of the Department of Public Health in Albany. In essence they reveal that at the time of maximal exposure to hundreds of different chemicals including dioxin, the only creditable health effects were a diminution in birth size and some very vague symptoms which could have been related to worry as much as exposure. The doses to which some people living in the immediate vicinity of the Love Canal were exposed is very much greater than the life-long exposure expected to result from the incinerators. Although the answer will not be forthcoming about long-term oncogenic effects, there is certainly no evidence as yet of any life-threatening effects.

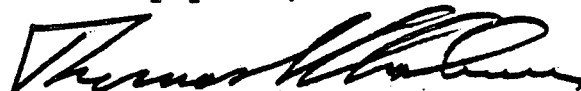
In the section on relative risks, I believe some data could be given on the effects of smoking. I recognize that this is for the large part voluntary, but on the other hand there are some recent data on passive exposure to cigarette smoke which I suspect reveal a hazard greater than that calculated from the incinerators.

I also have missed some discussion of the relative potential health hazards of not having the incinerators and continuing to dispose of wastes by burning in less safe apparatuses, by burying as at the Love Canal, or by dumping out to sea which we all recognize could eventually be a real health hazard for the whole world.

Finally, I am a little bothered by the fact that the report talks about one incinerator only at the Brooklyn Navy Yard and yet the newspapers mention the fact that five or six are planned for the New York area. Should not the effects of these be considered?

In summary, it is a job well done and the people can be assured that the possible increase in risk from the Brooklyn Navy Yard facility is so minimal that the city should proceed forthwith to tackle this very difficult problem by starting construction.

Sincerely yours,



Thomas C. Chalmers,
Distinguished Service Professor

DOUGLAS M. COSTLE

COMMENTS

on the July 1984 Draft Report:

Assessment of Potential Public Health Impacts

...from the Brooklyn Navy Yard Resource Recovery Facility

prepared by Fred C. Hart Associates, Inc.

These comments address the July 1984 Draft Report on the Assessment of Potential Public Health Impacts Associated with Predicted Emissions of Polychlorinated Dibenzo-Dioxins and Polychlorinated Dibenzo-furans from the Brooklyn Navy Yard Resource Recovery Facility from the viewpoint of public policy decision-making involving risk assessments.

A central question in judging a technology -- whether a manufacturing process, a resource recovery facility, landfilling (conventional or chemically-stabilized), a high-temperature incinerator, etc. -- is not whether it is risk-free, but rather whether the degree of risk presented is acceptable. As our knowledge of analytical chemistry grows, we can detect chemical substances at ever lower concentrations: measurements in parts-per-billion are as routinely possible today as were measurements in parts-per-million a decade ago; measurements in parts-per-trillion may soon be commonplace. In some cases the substances we are now finding are "new" -- i.e., they are synthetic compounds that have only been introduced in the past half-century. In other cases, we are discovering naturally-occurring substances that we either never knew existed, or whose presence in certain places or in certain concentrations was unsuspected at previous limits of detection. Increasingly, therefore, we find (potentially) hazardous chemicals, often in trace amounts, in products or processes related to our society's technologically-dependent living patterns.

The degree of risk deemed acceptable becomes, therefore, ultimately a societal judgment, expressed through our political and social institutions. Our best scientists and their most careful studies can only describe for us the potential nature and outcomes of such risks. Their information and judgment(s) become one more tool -- often a critical one -- in determining how to manage such risks. Sound risk assessments precede sound risk management.

From this perspective, two questions arise in evaluating a risk assessment document: (1) how well has it defined/described the potential risk(s), and (2) how well has it identified underlying assumptions so that we may judge their validity?

The following comments on individual chapters accordingly address these issues of descriptiveness and identification of assumptions from a policy evaluation standpoint rather than from that of a scientific or engineering review.

The Executive Summary, in addition to serving -- quite adequately -- its traditional role of consolidating the report's major findings, is unusually accessible to an interested lay reader who wants a quick overview and explanation of lengthier, more technical materials. Reports like this too rarely bother to explain what "congeners," "isomers," "promoters," or "initiators" are, or the basic chemical structure that differentiates compounds. Here this basic information is succinctly incorporated, giving the non-science-trained reader a framework for the findings and comparisons. The Summary is clear and readable; the assumptions (cf. pp. 13-14) are defined well enough to give a useful context for evaluating the subsequent description of the study results.

In Chapter 1, the explanation of the use of extrapolation in risk assessments is helpful; the identification of safety factors (p.1-6) is particularly good, not only in the description of the conservatism implied but (from the viewpoint of public health concerns) in the selection of the set of factors.

Chapter 2's discussion of the technical aspects (chemical structure and properties, dioxin formation and half-life, pathways, etc.) is useful. Again, the explicit statements of basic facts and findings (cf. pp. 2-1,2, 2-12, and the summary on p. 2-18) are very helpful, as are the explanations of problems with human toxicology studies (p. 2-19) and acute lethality results (p. 2-21). The sections on human health effects are less definitive -- in large part, it seems to me, because the data are less definitive and more subject to varying interpretations. The summary section (pp. 2-38,39) may well be as conclusive as it is possible to be without over- or under-stating the various study results; these paragraphs are therefore likely to be less satisfactory for a reader looking for open-or-shut findings, but they are within the field of potential results generally described by a careful risk assessment. Risk assessments, after all, provide information, not answers.

Chapter 3 on dioxin incineration emissions is, again, useful for the reader attempting to learn about the generation and control of these pollutants through the combustion process. Particularly worth mentioning is the discussion of several theories of dioxin formation and the variations in combustion parameters and products. These descriptions suggest the range of considerations necessary in determining effective controls, from source/generation through process/condition controls to pollutant collection devices. Other panel members will undoubtedly comment in technical detail on the specific design, emission rates, and control feasibility for the facility as presently proposed/designed. From a non-engineer-

ing point of view, I find that these sections provide a good general explanation of the project and the technical engineering issues of concern in this report.

Like the data in preceding chapters, the exposure assessments in Chapter 4 are calculated conservatively, in that all three of the likeliest pathways -- inhalation, ingestion, and dermal exposure -- are evaluated and their (potential) contributions allowed for. Here again, the assumptions -- which are necessarily theoretical and numerous -- are appropriately identified, along with some indication of their conservative application.

Chapter 5, the risk assessment itself, is of course the centerpiece of the report. The content and method of development described on p. 5-1 is straightforward and adequate; it provides two, rather than a single, useful risk estimates. The discussion of the limits of the risk assessment process on pp. 5-2 and 3 is very important, including the caveat that the (appropriate, I believe) consistent application of the most conservative assumptions typically results in a higher-than-likely prediction of actual risk. Such potentially over-large estimates of possible hazard are too often misunderstood as indications of unacceptable risk, or even -- sometimes wrongly -- promoted as sole determinants of acceptability. The closing sentence of the section on p. 5-3 describes the proper context for evaluating the numerical values derived from the risk assessment process: "These results of a risk assessment are then used for risk management purposes, to judge whether the upper bound of risk levels are acceptable in comparison to any proposed benefits."

The description of ADIs, NOELs and extrapolation techniques provide good background for the key explanation (cf. pp. 5-8ff.) of the different ways that public health agencies have interpreted data on carcinogenicity and the derivation of the toxic equivalency numbers used in the report. All of this discussion is prelude to the explanation of current standards and guidelines (pp. 5-16 to 5-25). These guideline summaries contain succinct identifications of assumptions and limitations (cf., e.g., pp. 5-18 and 5-21). More critical are the report's own adopted limitations set out on pp. 5-25 through 5-27. These latter assumptions seem reasonable and well within accepted criteria for these types of calculations; if anything, they probably err on the side of conservatism -- the bias most protective of public health. Accordingly, the estimates of exposures (intake through the previously described pathways [inhalation, etc.]) in the following pages are also likely to be conservative -- i.e., high. Lastly, the summary of this section (pp. 5-51 to 5-53) presents a clear and readable distillation of the somewhat complex (for lay readers) calculations in the latter half of the chapter.

While the first three sections of Chapter 6 are essentially a reprise of parts of Chapter 5, they are particularly valuable as a succinct statement of the judgment factors (assumptions) and some of the relevant studies/methodologies used to derive the numerical values that are the end result of this risk assessment process, especially for the lay reader who desires an overview and summary of these materials.

The Dowd summary quoted on p. 6-5 encapsules in a single paragraph the general numerical risk assessment parameters that are used to trigger review or regulatory action in federal Environmental Protection Agency programs. As noted, these levels vary somewhat among programs (e.g., drinking water, air). The variations depend on many factors, including Congressional mandates specified in program legislation -- for example, just one statute (the Clean Air Act) requires an "adequate margin of safety" in establishing one kind of standard (§. 108) and an "ample margin of safety" for establishing another kind (§. 112). Such legislative instructions, along with other variables such as the adequacy of data bases and the limits of measuring/modeling abilities, obviously result in variations in calculated numerical values, for which the Dowd summary furnishes a good sense of comparative practices. Because EPA's statutory charges to protect public health encourage the Agency to adopt assumptions weighted toward conservatism, the Agency's general risk "trigger numbers" outlined here are often criticized as overly stringent. On the other hand, other health-protective regulatory bodies (NYSDOH is cited) consider EPA's levels too lenient, especially for target populations, and opt for more stringent criteria. As the report quite accurately observes, "The issue of acceptable risk levels continues to be an area of considerable controversy" (p. 6-6).

Lastly, two other sections of Chapter 6 deserve to be called to the reader's attention, namely, the paragraph on non-dioxin-related risks (p. 6-6) and the following brief section on overall cancer rates, especially pp. 6-6 through 6-8. While not traditionally a part of a classic scientific risk assessment, the table on estimated death risks for New York State residents (p. 6-7) can give a reader some sense of perspective for evaluating the acceptability of the risks estimated to be presented by this proposed resource recovery facility.

The preceding comments may appear less critical of this draft risk assessment than might be considered appropriate from a reviewer who has explicitly been asked to critique it. Please note, however, that my remarks in praise of the report -- for its readability and general informativeness -- do not so much reflect an endorsement of its scientific or technical thoroughness or accuracy: I defer to other reviewers on these subjects. Rather, I have evaluated the draft as it meets criteria evolved from my experience as a policy- and decision-maker. In this capacity, what I look for in a risk assessment is a well set

out evaluation -- using clear, understandable language and concepts -- of what the problem is, what ranges of risk it presents, and the data and assumptions used to quantify the numerical risk values.

This draft report basically satisfies these criteria. Based on the understanding it provides of the degree of risk associated with the proposed facility -- well within current accepted public health protection parameters -- a decision-maker can proceed to the next step of judging the possibility and desirability of managing the risks presented. And interested readers simultaneously have in the report a basis for forming their own opinions of the acceptability of these risks.

8/27/84

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Comments on "Assessment of Potential Public Health Impacts Associated with Predicted Emissions of Polychlorinated Dibenzo-dioxins and Polychlorinated Dibenzo-furans from the Brooklyn Navy Yard Resource Recovery Facility"

by Theodore D. Goldfarb

General Remarks

As pointed out repeatedly in the Fred C. Hart Associates' report, the task of assessing the potential health impact of PCDD and PCDF emissions from the proposed BNYRRF is a complex endeavor requiring the use of many assumptions and estimates. Despite the numerous recent studies on a wide variety of dioxin exposure problems, including many that have focused on incinerator emissions, key questions remain unanswered. Insufficient data exists to permit a precise prediction of either the expected dioxin and dibenzofuran emissions or the public health consequences of an assumed level of emissions.

The principal conclusion of the report is that the likely PCDD and PCDF emission levels constitute a health threat that is too low to warrant additional review or action to further reduce the risks. This conclusion appears to be at odds with some of the recommendations in recent generic studies such as the Canadian "Report of the Ministers' Expert Advisory Committee on Dioxins" and the California Air Resources Board study of "Air-Pollution Control at Resource Recovery Facilities." The Canadian study identifies municipal and industrial incineration as the largest source of environmental dioxin contamination and recommends a comprehensive program to minimize such emissions. The California Study suggests the use of dry scrubbers in addition to the baghouse filters as a method of further reducing toxic organic effluents. In addition another recent assessment of the risks

of dioxin and dibenzofuran emissions from proposed New York City Incinerators, by B. Commoner, K. Shapiro and T. Webster, predicts a considerably greater cancer promotion threat than the Hart study, and recommends remedial action.

The data used in the Hart study, does not differ appreciably from that used in other technical assessments of the PCDD and PCDF emission hazard. The presentation of the facts available in the literature is generally thorough and complete. A commendable effort is made to estimate public exposure resulting from ingestion of accumulated dust fallout as well as the usual calculation of estimated inhalation exposure. What distinguishes this and those other studies which have concluded that the PCDD/PCDF risk is minimal from those that consider it a serious potential health threat are the assumptions and value judgements used in arriving at the conclusions.

After carefully reviewing the present study it is my conclusion that the BNYRRF presents a significantly greater potential health threat to the public as a result of PCDF/PCDD emissions than is claimed in the report. In view of the fact that this is only the first of eight such facilities planned for New York City and that other sources of airborne dioxins and dibenzofurans such as hospital incinerators, industrial furnaces and existing solid waste incinerators will continue to operate, I believe that every effort must be made to reduce such emissions to an absolute minimum. If the City decides to proceed with the building of resource recovery plants, after reviewing other means of disposing of its municipal waste, it should incorporate the best available control technology to limit airborne effluents and it should find sites for these plants that will result in less public exposure than the Brooklyn Navy Yard. The recent decision by the Department of Sanitation to specify the use of air bags, rather than the less effective electrostatic precipitators to control particulate emission is a step in the right

direction. The air bags should be coupled with a dry scrubbing system. This will have the dual advantage of drastically reducing the hazardous acid emissions, presently ignored by the Department of Sanitation, as well as providing the potential for significant further reduction in toxic organic emissions including PCDD and PCDF. In a recent technical report Dr. W. Shaub, of the National Bureau of standards, has provided theoretical support for the proposal that PCDD and PCDF can be contained by an appropriately engineered scrubbing system. I urge the City of New York to fund the experimental research studies recommended by Dr. Shaub which could provide the data needed to adjust the scrubbing conditions to provide maximum containment of the toxic effluents. The City should also urge the State to promptly promulgate emission standards for resource recovery plants, or it should have its own Departments of Environmental Protection and Public Health promulgate such standards. Without such standards there is no guarantee that the plant will be operated properly even if the laudable recommendations in the Hart report for the inclusion of technology to permit continuous monitoring of key operating conditions is accepted by the Department of Sanitation.

My principal criticisms of the assumptions and methods used in the Hart study are as follows:

- The data used in estimating the projected levels of PCDD/PCDF emissions from the BNYRRF is from a single set of measurements on one similar facility in Chicago augmented by data from another such plant in Switzerland. It is acknowledged that data of other incinerators, including those designed for resource recovery, indicate emission levels that are tens to thousands of times higher. Not enough is known about the way PCDD and PCDF are formed in incinerators to justify rejection of these data on the grounds that the conditions may have been different than in the Martin type furnace planned for

the BNYRRF. This choice of a low set of emission values affects every other phase of the risk calculation and seriously undermines the credibility of the results.

• The report repeatedly refers to the "conservatism" of the assumptions and methods used and suggests that the actual hazard potential is likely to be much less than what is ^{ur}ported to be a "worst case" scenario. In fact many of the references to conservatism are either completely inappropriate or involve only a small likely overestimate of the hazard. Considering the fact that several of the assumptions and methods may underestimate the potential risk by orders of magnitude (see the preceding criticism and those that follow) it is hardly credible to refer to the overall procedure as a "worst case" scenario. Examples of assertions of conservatism with which I disagree are:

(1) The use of a multiplicative factor to estimate the carcinogenic and other toxic effects of all PCDD/PCDF ^{isomers} ~~compounds~~ based on data for 2, 3, 7, 8-TCDD. The failure of other assessments to include this factor is a serious error. The inclusion of a reasonable factor is not "conservative" nor is it a "worst case" assumption.

(2) The claim that the most conservative cancer risk assessment is included. The recent report by Commoner et al. uses an apparently rational scientific method of estimating cancer risk for promoters like TCDD that leads to considerably higher values than the methods used in the ~~Hart~~ report.

(3) The use of 24 hour, 70 year exposure at the point of maximum impact. The dispersion model predicts levels of airborne effluents that are close to the maximum level extending over a large fraction of the heavily populated metropolitan area. Thus this assumption is only slightly conservative.

• The model used to estimate the fallout of particulate matter laden with PCDD/PCDF fails to account for agglomeration of small particles with larger ones or to take account of the effect of building structures and elevated terrain in promoting fallout. It is asserted without justification that this is likely to result in only a small error. In fact the small particles that are assumed to remain suspended carry greater than 98% of the projected PCDD/PCDF emissions. If only a small fraction of these suspended particles are incorporated into the larger, often moist particles that regularly precipitate out of New York City air or if they deposit as a result of repeated impact with elevated structures or the walls of enclosures the result will be an increase in the estimated deposition of dioxins and dibenzofurans that could increase the exposure from ingestion and dermal exposure many-fold. Since the upperbound estimate makes the ingestion mechanism the principle route of exposure the result is an additional serious potential underestimate of risk.

The criticisms detailed above, and those listed below in the section on Specific Comments are not intended to imply that those who prepared the ~~Hart~~^{or} report were lacking in competence or are guilty of a willful attempt to underestimate the risks. In a situation where many assumptions and estimates must be made it is inevitable that the subtle pressures that operate on any client consultant will result in choices that favor the outcome desired by the contractor of the consultant's services. In this case the contractor, the Department of Sanitation, was a very visible presence, reviewing and commenting on the consultant's efforts on an ongoing basis. It is therefore to be expected that, given the uncertainties involved, the consultant's conclusion and the conclusion contained in the Preliminary Draft Environmental Impact Statement (also prepared under contract to the Sanitation

is
 Department) that the PCDD/PCDF emissions from the BNYRRF will result in
 "acceptable" health risks. If the City desired a more independent assessment
 of the potential risks it would have been wiser to ask an agency with less of
 a vested interest such as the New York State Department of Health, to oversee
 the study.

It is only reasonable to expect independent environmental scientists
 and the general public to make value judgements that differ from those of a
 City Agency charged with doing a particular job within budgetary constraints.
 In this case the Sanitation Department is also contending with vendors of
 resource recovery equipment who have a large vested interest in resisting
 attempts to increase the cost of their products by requiring additional safety
 features. My own judgement is that the added cost of additional PCDD/PCDF
 controls and of acid gas control is clearly justified by the potential (though
 necessarily speculative due to ~~our~~ limitations of available scientific data)
 health threats posed by these effluents.

Specific Comments

<u>Section</u>	<u>Page</u>	<u>Comments</u>
1.4	1-6	Several criticisms of the list of "conservative assumptions" are included under General Comments above. The remaining "conservative" safety factors do not appear to include any assumptions that would unrealistically overestimate likely risk. The assumptions of equal indoor and outdoor pollutant levels and of no PCDD losses due to volatilization or degradation should result in less than a doubling of risk estimates.

- 1.4 1-7 As indicated above, it is incorrect to assert that the calculations represent an "upper limit" to risk.
- 2.1.3 2-6 Although it is true that recent papers by Somers and Douglas, Hasselriis, Lauber and others indicate a correlation between poor combustion efficiency and high PCDD/PCDF levels when examining data from specific facilities, attempts by Niessen and others to develop specific relationships between particular operating parameters and emission levels that apply to all facilities shows that the information currently available is inadequate for this purpose.
- 2.3.1 2-12 The literature does contain estimates of the environmental 1/2-life of 2,3,7,8-TCDD ranging from 0.5 to 12 years, but the earlier, lower estimates have been criticized as resulting from inaccurate sampling and analysis techniques.
- 2.3.1 2-20 The statement that a linear non-threshold model is believed to overestimate risks for cancer promoters is by no means universally accepted. Commoner, Shapiro and Webster have developed an alternative analysis that results in a larger risk value than the usual linear model based on the assumption that dioxins are cancer promoters and that the ratio of increased cancer incidence to background incidence should be proportional to promoter exposure.
- 3.2.2 3-2 Recent results from Canada strongly support the theory that at least a major fraction of PCDD/PCDF is formed

by a de novo mechanism. Mass balance analysis has shown that in the case of two specific facilities in Ontario more PCDD/PCDF is emitted than was initially present in the waste input.

3.2.2

3-5

The negative results of the addition of PVC to the waste input of a resource recovery facility in France by Karasek does not necessarily indicate that removal of chlorinated plastics would have little or no effect on PCDD/PCDF emissions. France has one of the highest percentages of chlorinated plastics in the waste stream. If there was already excess chlorine present adding another source would probably not have much effect. Experiments should be performed on a variety of waste streams to determine the effectiveness of PVC removal with regard to controlling chlorinated organic effluents. PVC removal would also reduce the HCl gas emission problem.

3.3

3-13

The existence of instruments to measure combustion process parameters, in the absence of standards that specify minimal operating conditions and an effective system for independent monitoring of the operations, does not assure that efficient combustion will be maintained.

3.3

3-14,15

As indicated in the General Comments section I consider the rationale offered to ignore the much higher PCDD and PCDF emission levels from other

incinerators to be a very serious defect in the analysis. Even if, as has not been adequately proven, Martin Units are intrinsically capable of producing lower emission rates, it is by no means certain, based on industry experience, that the plant will be continually operated at optimum conditions.

3.4 3-16 I would like to see an economic and technical analysis that shows that the goal of effective resource recovery corresponds to the "optimization of combustion efficiency" in a manner that minimizes PCDD/PCDF emissions.

4.3 4-8 As noted in the General Comments Section I consider the failure of the ISC model to account for particle agglomeration and the impact of elevated terrain or buildings to be a serious potential source of error.

4.4 4-16 Comparison of PCDD/PCDF with lead levels indoors and outdoors may be misleading. Much of the outdoor lead comes from automobile exhausts and settles rapidly on roadways. This is clearly different from a gaseous or microparticulate stack emission.

5.3.1 5-17 While it is true that the present EPA appears to consider cancer risk levels as high as 4.6×10^{-5} to be "minimal", previous EPA officials did not always share this view. The EPA has also failed to publicly announce that it considered 46 potential extra cancer deaths per million people to be minimal. If they did so it is highly unlikely the public would accept that

assessment.

App. C

C-4

The assumption that if the furnace supplier operates the unit, problems are likely to be minimal is contrary to the experience of those who are familiar with the operation of the Hempstead RRF which involved a similar arrangement.

C

C-7

The assertion that dry scrubbing must be done with an expensive "specialty chemical" is not necessarily true. There is evidence that the recycling of fly ash as a dry scrubbing material might be effective. Also the characterization of the dry scrubber/filter fabric combination as untested" is not accurate. By the time the City's first recourse recovery facility is completed there should be considerable experience with such systems in Japan and California.



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August 8, 1984

Dr. David Lipsky
Fred C. Hart Associates, Inc.
530 Fifth Avenue
New York, New York 10036

Dear Dr. Lipsky:

I have reviewed the Report entitled "Assessment of Potential Public Health Impact Associated with Predicted Emissions of Polychlorinated Dibenzo-Dioxins and Dibenzo-Furans from the Brooklyn Navy Yard Resource Recovery Facility". I have the following comments concerning this report.

The toxicity data for Polychlorinated Dibenzo-Dioxins (PCDDs) and Polychlorinated Dibenzo-Furans (PCDFs) are adequately reviewed and accurately assessed. This information has been used to assess the risk associated with predicted emissions of PCDDs and PCDFs from the Brooklyn Navy Yard Resource Recovery Facility (BNYRRF). I agree that the risk associated with the predicted emissions of PCDDs and PCDFs from the BNYRRF are small and well below the risk generally considered acceptable by the United States Environmental Protection Agency for these compounds. I have evaluated all aspects of the assessment of risk for predicted emissions of PCDDs and PCDFs from the BNYRRF and I concur with the modeling and support the conclusion that the BNYRRF can be built with negligible risk to the surrounding community public health. The predicted emissions are conservatively estimated and likely to be overestimated. Therefore, the risk associated with the prediction is also likely to be overestimated. Using a very conservative assessment, there is still a negligible risk associated with the operation of the BNYRRF.

I support the construction and operation of the BNYRRF and have determined it does not increase the risk of the surrounding community to adverse health effects.

Sincerely,

Raymond D. Harbison

Raymond D. Harbison, Ph.D.
Professor and Director of
Interdisciplinary Toxicology

REPORT

Comments on the 'Fred C. Hart Draft Report'
concerning a proposal to operate a Martin-
type incinerator at the Brooklyn Navy Yard.

CONTENTS

Page

1	I. INTRODUCTION.
2	II. FRED C. HART REPORT
5	III. COMMENTS ON THE HART REPORT
7	IV. THE COMMONER REPORT
11	-V. RECOMMENDATIONS

Appendix

NOTES ON FRED C. HART AND COMMONER REPORTS.

FRED C. HART ORIGINAL WITH MARGINAL ANNOTATIONS.

I. INTRODUCTION

It is proposed to build and operate a Martin-type incinerator to burn municipal solid waste at the Brooklyn Navy Yard. This has aroused public concern illustrated by the circulation of a report prepared by Dr. Barry Commoner and associates (called here "Commoner Report"). The main issues raised in the Commoner Report are that the hazards of incineration have been under-estimated for two reasons. First, seven more incinerators are to be built which will lead to greater flue emissions; and second the hazards associated with dioxin release to the atmosphere have been under-estimated in various ways.

The purpose of this report is to review the 'Fred C. Hart' report, to assess the Commoner Report and to make any suggestions arising therefrom.

II. THE FRED C. HART REPORT

Section 2. The report goes through the relevant properties of dioxins. 957°C would be required for 99.99% destruction of 2,3,7,8-TCDD in an incinerator with a dwell time of 2 seconds; the BNY incinerator has a design combustion temperature of 980°C. The dioxin literature is reviewed accurately and conservatively. An important point is that dioxins disperse through the top foot of soils high in organic matter and down to at least three feet in sandy soils. This will effectively reduce the concentration entering houses as dust.

While the report states that the toxic mechanism is not known it would be useful to discuss Poland's hypothesis and data in more detail since they show little effect of low dioxin levels, and highly non-linear switch-like behavior in receptor binding and enzyme induction, leading to over-estimation when linear extrapolation is used.

Section 3. Dioxins and dibenzofurans can reach the incinerator effluent both by de novo syntheses and from their presence already in MSW: Thus, the most important variables in incinerator operation are waste and incinerator type. For this reason it makes good sense to compare the proposed incinerator with that in Chicago and it is reasonable to base risk estimates on effluent measurements

from Chicago NW; which has a similar design and combustion temperature. The discussion of ash particle size and dioxin and dibenzofuran condensation onto ash is thorough and accurate.

Section 4. In this section data are given for particle settling rates and the accumulation of dust indoors. Only 7% of particles actually settle, and these are the largest, while about 10-25% of the outside concentration of another toxin, lead, is found indoors. Thus, it would be very effective to remove more large particles from the stack effluent.

Section 5. This section contains risk assessments and shows that, using the toxic equivalent approach of the Swiss EPA, which is conservative, an excess cancer risk of 0.4×10^{-6} can be calculated. This is far below EPA risk assessments which were considered to show minimal public health risks and which ranged from $8-19 \times 10^{-6}$.

In this section the calculations, in which contributions from various sources are added, are given. Up until page 5-44 the text is reasonably clear. Numbers are missing at the bottom of that page and on page 5-48. The discussion here shows signs of hurry and is hard to understand; it is not clear where the new risks (p. 5-49) ranging from 2×10^{-8} to 47×10^{-6} come from; similar figures on p. 5-50 are not

explained.

Section 6. Risks from other hazards are given for comparison and do, indeed, show the relatively insignificant risk due to a new incinerator.

III. Comments on the Hart Report

The report is reasonably clear and well argued. The weakest sections are around pages 5-47 to 5-50, where relatively high risk estimates are not adequately explained or dismissed. This section is too hurried and has several omissions.

The primary data on the carcinogenicity of dioxins are not, to me, compelling. The results look more like plain sampling error since the number of significant results is well within 10% of the total number of results in the Kociba et al. study. While one might not get far with this argument, since everyone believes they are carcinogenic, it does give one confidence that risk estimates are high, almost certainly by one or two orders of magnitude. Since many other factors have been treated conservatively I therefore agree that the incinerator presents no hazard as it is proposed. However, since it appears that there will be 8 incinerators (see Commoner report) it would also be conservative to consider my recommendations in order to reduce dioxin and fly ash in the effluent. The report should include a discussion of the extra incinerators if they are indeed to be built.

In section 5 it would be appropriate to have a short graphical summary of the results. The section is quite long and confusing.

IV. THE COMMONER REPORT

In general in the Commoner Report accurate data are used but manipulated inaccurately. The main points made, in order, are:

1. There will have to be eight incinerators, burning a total of 21,850 tons/day of MSW.

2. Since it is projected that the first will be in operation by 1989 (i.e. five years after construction starts) a further three will have been begun before experience has been gained from operation of the first.

3. The only significant environmental hazard, with no generally accepted standards, will be the release of dioxins and dibenzofurans from the incinerators.

4. A risk assessment must be made using known emission rates from incinerators already operating.

5. Since the carcinogenicity of only one dioxin, 2,3,7,8-TCDD, is known, toxic equivalents must be calculated for the other groups of dioxins and dibenzofurans.

6. Most of the dioxins and dibenzofurans condense onto fly ash; its dispersal can be modelled. For eight incinerators the maximum deposition of fly ash will be increased by a factor of 3.14.

7. Calculation of the total uptake of dioxins and dibenzofurans by humans must take into account the higher

concentrations at higher levels - e.g. in high rises - and the accumulation of dust in houses which are imperfectly cleaned.

8. Since 2,3,7,8-TCDD is probably a promoter its effect (and the effects of the other compounds) will be a multiplicative one. The factor can be derived from the Kociba et-al data for rat liver tumors. Applying it to the other data the excess cancer risk, in the worst case, turns out to be 421 cases/year for greater New York.

9. Thus the risk of building and operating incinerators may not be acceptable.

The flaws in the Commoner Report are as follows, keyed to its page numbers.

1. (9-10) The best model for the BNY incinerator is a Martin-type incinerator in Chicago, called Chicago, NW. Not only is this the same type as the proposed incinerators, but it burns similar waste. Thus it is highly significant that it releases dioxins and dibenzofurans at the lowest measured rate for incinerators for which adequate data are known.

2. (11-12) The toxic equivalents are calculated in terms of efficiency in inducing aryl hydrocarbon hydroxylases; yet this is not known to correlate with carcinogenicity.

3. (14-20) Commoner believes there are no data allowing calculation of the deposition of toxins in houses, and that dust enters with perfect efficacy. There are data (cited in the Hart report) and dust "scrubbed" as it enters, removing some particles. Commoner concludes that exposure indoors is the same as outdoors, but this is known not to be true, a reduction of up to 75% being realistic. In addition he does not subtract the dust accumulating indoors from the total accumulation outdoors. Both errors lead to over-estimates, which have a multiplicative effect in his risk assessment.

4. (22-27) Commoner's most egregious error is to use a single set of data points from the Kociba et. al. study of rats to get a 'factor' whereby the promoting effect of the carcinogens can be calculated. This factor is $16\%/ \ln g$ toxic equivalent/kg/day. Taken over-all the Kociba et. al. data do not show a significant increase in tumor incidence, since some sites show more and some fewer tumors in experimentals than controls, and fewer than 10% of the results show significant differences from the controls. Nonetheless, if the carcinogenicity of 2,3,7,8-TCDD is accepted it is an obvious distortion to use a single ratio, one liver tumor in a control group of female rats and eleven in an experimental group to calculate a factor for risk assessment. From the

data given the ratio could easily have approached one, leading to a very small risk. Indeed, Poland (1982) shows clear thresholds for 2,3,7,8-TCDD binding and enzyme induction, so that linear extrapolation, as done by Commoner, is inconsistent with the promotion effect Commoner assumes.

Thus, the Commoner report errs in several ways. If the Chicago NW incinerator were used as the model the excess risk found, even retaining the other erroneous assumptions and allowing eight incinerators would be about 1×10^{-6} .

V. RECOMMENDATIONS

The objections raised in the Commoner Report do not appear to be valid and are adequately covered by Fred C. Hart. However, there are several issues crucial to the safe running of one or more urban incinerators, even though U.S. experience to date has been good and does not justify widespread concern. It is vital to:

1. Remove particulates efficiently.
2. Maintain an adequate combustion temperature and dwell time.
3. Monitor particulate emission.

Therefore, it is recommended that the Hart report be modified as suggested and that it would be prudent to:

1. Insert a second stage of electrostatic precipitation to reduce small particulates (below 1.0 μ diameter). This may require extra fan horsepower.
2. Maintain combustion temperature at furnace throat as close to design temperature (980°C) as possible.
3. Monitor particulate emission using back-scattering from a laser of appropriate wave-length.



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RECEIVED AUG 11 1984
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August 8, 1984

Dr. David Lipsky
Fred C. Hart Associates, Inc.
530 Fifth Avenue
New York, New York 10036

Dear Dr. Lipsky:

Attached are some of the errors or omissions I noted in the draft report entitled "Assessment of Potential Public Health Impacts Associated with Predicted Emissions of PCDDs and PCDFs from the Brooklyn Navy Yard Resource Recovery Facility". I have not yet finished and will provide the remaining comments by the end of this week.

Sincerely,

Raymond D. Harbison, Ph.D.
Professor and Director,
Division of Interdisciplinary
Toxicology

RDH/rec

2-10: 2.2.1-line 3: "As a result dioxins will tend to bind to fatty tissue". Dioxins don't bind to fatty tissue, but are stored or absorbed in fatty tissue. Change bind to concentrate. Bind sounds like a chemical reaction which is not reversible and could be confused with receptor binding.

Kooke, R. et al. 1981 reference is not styled correctly. Too many spaces between lines.

2-11: 2.2.2-line 5-6: Shaub and Tsang (1983) is listed as 1981 in references.

2-12: line 3 - Crosby and Wong, 1977 is 1976 in references.

2-12: 2.3.1-line 2-3: Young 1983 is 1981 in references.

2-12: 2.3.1-line 6: Freeman and Schroy 1984 is Freeman in references

2-13: Empirical formula for 2,3,78-TCDD is not correct.

2-14: line 5: Crosby and Wong 1977 is 1976 in references.

2-14: line 11 and 13: Nestrick et al 1980 is 1981 in references.

2-15: 2.3.3-line 12-13: Matsumura and Ward 1976 is not in reference section.

2-15: 2.3.3-line 15 and line 27: Matsumura et al 1983 is listed as 1981 in the references.

Table 2-4: Crosby et al 1973 is not listed among the references for Chapter 2.

Crosby and Wong 1977 is 1976 in the references for Chapter 2.

Bertoni 1978 is not listed in the references to Chapter 2.

2-17: 2.3.4-line 1 and 17: Thibodeaux 1984 is 1983 in the references.

2-17:2.3.4 last paragraph, line 2: Crosby and Wong, 1977 is 1976 in the references.

2-18: second paragraph, line 3 and 4: Hutter and Philippi, 1982 is 1980 in references.

2-18: second paragraph, line 8: Camoni et al., 1982 is 1980 in the references.

2-19: 2.4.1, third paragraph, line 6: NAS, 1977 reference is not contained in bibliography.

2-20: line 3: Piper et al., 1973 is not contained in bibliography.

2-20: line 4: Fries and Marrow, 1975 is not cited in the bibliography and Rose et al., 1976 and Nolan et al., 1979 are not cited in the bibliography.

2-20: paragraph 4:

Line 2 and 3: Pitot et al., 1980 is not cited in the bibliography.

Line 5 and 6: Kouri et al., 1978 is not cited in the bibliography.

Line 6 and 7: NTP, 1980b and Berry et al., 1978 and 1979 are not cited in the bibliography.

2-21: 2.4.2-line 6-8: This sentence is not clear and should be revised.

2-21:2.4.2- Second bullet, line 3-4: The thymus involutes but what body tissues. There may be wasting or atrophy of body tissues. The terms wasting or atrophy better describe the effects seen for other tissues.

2-21:2.4.2- Third bullet, lines 1-3: The terms dose and dosage are not usually used synonymously with exposure. For example the interval between dosage and death ranged up to 45 days. This would be better style if it read the interval between exposure and death ranged up to 45 days.

Table 2-5: Loomis, Essentials of Toxicology is not cited among references.

Table 2-6:

Third column: Vertibrates is misspelled.

Fourth column: Should be minimum observed dosage.

Fifth column: Should be minimum observed dosage.

Sixth column: Should be minimum observed dosage

Legend: Superscript a: What is acute sensitivity to PCDDs? Should this be acute toxicity? Are all dosages for all toxicities administered by the same route? If not, should be noted.

Table 2-7: LD50s are usually referred to as Medial Lethal Dosages.

2-25: line 17: Toth et al., 1978 is not cited among references.

2-27: line 14: Oliver (1975) is not cited among the references.

2-27: last paragraph, line 2: Holmstedt (1980) is not cited among the references.

2-30: line 8: Wipf and Schmidt, 1983 is not cited among the references.

2-30: 2nd paragraph - last line: Beale, 1977 is not cited among the references.

2-30, fourth paragraph, line 3: 10:10 mixture should be 1:1.

Table 2-10: Poland et al., 1971 is not cited among the references.

Walker and Martin, 1979 is not cited among the references.

Column 3, line 5-6: Should read elevated triglyceride levels, omit and.

Ott et al., 1980 is Ott, 1980 in references. There is no et al.

Column 3, line 14: plaoma should be plasma.

2-32:2.4.4, line 2: Toth, 1979 is noted as Toth et al., in references. Which is correct.

2-33: line 1: .1 ug 2,3,7,8-TCDD kg/b.w.-day should be .1 ug 2,3,7,8-TCDD/kg b.w./day.

Line 4: Squire, 1980 is not cited in the reference section.

2-33: second paragraph, line 3: .071 ug/kg/b.w.-day should be .071 ug/kg b.w./day.

second paragraph, line 9-10: 0.1 ug/kg/b.w. as opposed to 0.7 ug/kg/b.w. should be 0.1 ug/kg b.w. as opposed to .07 ug/kg b.w.

2-33: Human Epidemiology, line 6: Hardell (1977) is not cited in the reference list.

2-33: Human Epidemiology, line 14: Smith et al., 1983 is not cited in the reference list.

Table 2-11: Dose level: T₄ has not been previously used or described.

Table 2-11: Superscript legend e is not used in the table.

2-35: line 4-5: Sarma and Jacobs (1982) is listed as 1981 in the references. Also on line 4 Jacoks should be Jacobs.

2-35: line 7 and 8: Bishop and Jones, 1982 and Olsson and Brandt, 1982 are not cited in the references.

2-35: line 8 and 9: Hardell, 1979 is not cited in the references.

2-35: line 9 and 10: Thiess and Frentzel-Beyme, 1977 is not cited in the references.



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RECEIVED AUG 5 1984

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August 2, 1984

David Lipsky, Ph.D.
Group Manager
Public Health and Chemistry
Fred C. Hart Associates, Inc.
530 Fifth Avenue
New York, NY 10036

Dear Dr. Lipsky:

I have reviewed the finalized version of the report which you sent on July 18, regarding assessment of health impacts of dioxin-furan emissions anticipated from the planned Brooklyn Navy Yard Resource Recovery Facility. My comments on the report are given below and are arranged, as you request, in both general and specific categories.

A. General Comments. The report seems to me to be an exceptionally complete and thorough analysis of a most complex public health/toxicologic/engineering issue. It reviews the issues of dioxin/furan properties and emissions, as well as exposure and risk assessment, in their logical sequence and with a realistic appreciation of the strengths and weaknesses of our current knowledge concerning these areas. In particular, the report clearly explains the step-wise assumptions which must be made in such cancer risk assessments. The cumulative conservative effect of these assumptions is especially well conveyed.

I can provide specific evaluations only for the public health/toxicology aspects of the report. In these areas, it appears to me that the report provides an accurate and complete review of pertinent scientific literature and that the conclusions reached concerning risk levels, based on that scientific review, are justified and valid.

B. Specific Comments. The Chapter concerned with dioxin/furan properties clearly appreciates the variability in toxicologic response observed among different laboratory animal species exposed to these organic compounds and the attendant difficulties in extrapolating such findings to the human situation. The review of human data is complete and detailed. Despite the low-dose carcinogenicity and teratogenicity of dioxin in laboratory animals, direct evidence of such effects in humans is lacking. In particular, recent suggestions that dioxin exposures may lead to sarcoma production in humans remain unresolved. Animal data are currently perceived as suggesting that dioxin plays a promoting rather than an initiating role in carcinogenicity.

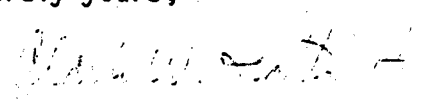
Chapter 3 on dioxin/furan emissions deals with the engineering and chemistry aspects of incinerator technology. Although I cannot judge the details of this chapter, it appears to be a thorough review and assessment. Principal points are the requirement for particular temperature, time, turbulence, and oxygen mixture parameters in effective dioxin/furan combustion, and the need to assess emissions in terms of both gases and particulates when emission control is predicated on a fabric filter.

Exposure assessment (Chapter 4) depends on computerized meteorologic predictions of air concentrations and particle deposition in the New York area. These predictions are obviously critical to subsequent health risk assessments. They inevitably require a series of assumptions concerning eventual dioxin/furan concentrations at the end of dispersion pathways in air, soil, dirt, and dust. The consistently conservative nature of these assumptions is clearly explained. Unfortunately we have no way of knowing in a quantitative sense how great an impact these and other assumptions have on the eventual risk assessment.

The fifth Chapter deals with health risk assessment based on data and assumptions discussed in the preceding chapters. The assessment process involves several further conservative assumptions, each of which is as clearly explained, I think, as the subject's complexity allows. These include some allowance for toxic equivalency estimates, statistical models for cancer risk extrapolation, assumptions regarding maximal or "worst case" lifetime exposure scenarios, and assumptions concerning degree of toxin absorption into human tissue. The resulting estimates of toxic equivalent intakes are then compared with existing regulatory standards and are translated in conservative fashion into cancer risk estimates. These estimates range widely (from about 5 to about 600 excess cancer cases per 100 million population over a 70 year lifetime), depending on particular sets of exposure/extrapolation assumptions.

In the sixth Chapter, these risk assessments are discussed in relation to other aspects of risk-taking and of competing cancer risks and dioxin sources. Such comparisons are unavoidably qualitative, and yet they represent an important consideration when public health policy is at issue and when it is realized that some level of risk is necessary. The particular comparisons presented in this concluding chapter seem to me to be appropriate to the waste incineration issue and to provide some useful perspectives.

Sincerely yours,


Clark W. Heath, Jr., MD
Professor of Community Health

COMMENTS

On Draft Report: Assessment of Potential Public Health Impacts Associated with Predicted Emissions of Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans from the Brooklyn Navy Yard Resource Recovery Facility by

Fred C. HART ASSOCIATES INC.

GENERAL COMMENTS

This document is one of the best and complete summaries and literature reviews on various aspects of PCDD/PCDF I have seen in the last years. There are no major errors in the sections on Dioxin chemistry, fate, destruction and emissions. As far as the actual risk assessment is concerned, it is important to note that a conservative approach is taken throughout the document ("to err on the side of public health"). Where information is absent or conflicting the most conservative assumptions ("worst case") are made. For instance in the case of photodegradation of airborne PCDD/PCDF no reaction (degradation) is assumed although photoreaction of vapour phase PCDD/PCDF is likely to occur, but no quantitative data in real-life situations exist. In summary, the section on risk assessment is done extremely carefully and an attempt is made to include all imaginable scientific factors from modelling and distribution to stability, bioavailability and toxic effects. The various model calculations and large amounts of numbers, however, convey a sense of certainty and security which does not exist. Whilst it is important to stress that the conclusions are in the very conservative range and that no one else could have done any better, glaring gaps in our knowledge (e.g. carcinogenicity of most isomers/congeners) do not allow presentation of precise numbers.

SPECIFIC COMMENTS

Page 3, last paragr.

Congeners differ by the number of attached chlorine atoms. Isomers have the same number of chlorine atoms but vary in their position of attachment. Tetrachloro-Dioxins is better than

"tetrachlorinated". The number of attached chlorines vary from one to eight (even if only tetra- or tri- to octa are usually considered). The abbreviations TCDD (and TCDF) and HCDD (HCDF) should be made more specific to T₃CDD (for tri) T₄CDD (for tetra), H₆CDD (for hexa) and H₇CDD (for hepta).

Only groups of PCDDs and PCDFs with the same number of chlorine atoms can be called isomers.

Page 4, 1st paragr.

The herbicide 2,4,5-T is not a chlorophenol but a product de-
rived from 2,4, 5-trichlorophenol.

Middle of page.

Insert high between and, and binding, for clarity, thus: low water solubility and high binding affinity....

Page 5, line 4.

Change sentence to: The acute toxicity of different polychloro-dibenzo-p-dioxins varies widely....(problem with use of the term isomer).

Last line of 2nd paragr.

Passage in parentheses perhaps better: (and some related chlorinated hydrocarbons), since several groups of chlorinated hydrocarbons such as the solvents are not known to produce chloracne.

Page 8, 2nd paragr.

The problem of volatile (gaseous) PCDD/PCDF is not addressed.

Page 1-5, 2nd paragr.

1st sentence incomplete.

Page 2-1, line 8 of text.

Use the term herbicide rather than pesticide.

Line 14.

"PCDD and PCDF have also been detected in emissions from combustion sources, primarily municipal and chemical waste incinerators". Municipal incinerators are likely major sources of these compounds.

4th line from bottom.

The congener class of TCDD has 22 isomers. Table 2-1 lists all possible chlorodibenzo-p-dioxins.

Table 2-2 is a list of abbreviations for various chlorodibenzo-p-dioxins (avoid the use of "homologue" which is reserved for series of compounds differing by methyl groups).

Page 2-4.

Exchange homologue for congener in title.

Page 2-6.

First three points: Exchange homologue for congener.

Page 2-8. 1st paragr., last sentence.

Recent results make it likely that more PCDD/PCDF are in the vapor phase than previously assumed.

3rd paragr.

3rd sentence is redundant.

Page 2-9, 2nd last sentence of paragr. 2.

Other samples showed no detectable level of TCDD and only 14 ppt OCDD.

Page 2-10, 3rd paragr.

Under real environmental conditions photochemical formation of PCDD is unlikely.

Last paragr....Dioxins will be found in fatty tissue.(not bind)

Delete "isomer" after PCDF.

Solubility in organic solvents does not necessarily increase with higher chlorine content of the PCDD molecule.

Page 2-11, 1st paragr.

Rather than bind strongly use ...adsorbed onto...

3rd paragr.

Except for the last sentence, this paragraph does not give usable information based on data.

Last paragr., 1st line. delete "harsh".

Page 2-12, first lines.

"Dioxin also will undergo photoreductive dechlorination...".
This is the general mechanism for photoreaction.

4th point from bottom of page.

Why is temperature the driving force for the transport of TCDD into the soil column?

3rd point from bottom.

For what climatic conditions do these statements apply?

Page 2-13.

It should be realized that most data shown in table 2-3 give little information for predicting environmental behavior.

Page 2-14, 1st paragr.

Volatilization of PCDD/PCDF from fly ash may be quite different to volatilization from superficially-contaminated soil.

Table 2-4.

Photodegradation data for only 2,3,7,8-TCDD are given (no other PCDD or PCDF, which would be relevant to mixtures as they occur in incineration effluents).

Page 2-3.

The sentence about the de novo formation theory does not accurately convey the statements of Choudhry et al. It should read ...such as a variety of organic compounds and inorganic chloride ions.

Page 3-7, 2nd paragr.

This does not make sense. Most information (including combustion kinetics) originate from laboratory studies, data are then reported in the literature, and retrieved by literature searches.

Last paragr. delete: (i.e. does not burn easily).

Page 3-15.

Section 3.4 is not really about "Rates of Dioxin Emission from Incinerators".

Page 3-31.

Much of the relationship between temperature and destruction efficiency can only indicate trends and certainly cannot be quantitatively transferred from one incinerator to another.

Page 3-32, 1st paragr.

Where are the data to support the statement: ... a significant portion, if not all, PCDF and PCDD emission from incinerators are adsorbed onto fly ash."

Page 4-4, last full paragr.

Frequently in the document reference is made to volatile vs adsorbed PCDD/PCDF; since lower temperatures undoubtedly would favour adsorption, reduction of gas temperature in the bag-house section should increase retention of PCDD/PCDF.

Page 5-2, middle of page.

I don't think it is justifiable to use information on the bio-availability of PCDD adsorbed (not absorbed) to soils to extra-

polate to fly ash - the binding mechanism and thus availability may be vastly different.

Page 5-18.

I cannot possibly agree with your assumption that carcinogenic and reproductive effects of all TCDD are the same as that of 2,3,7,8-TCDD on the one hand and that you neglect all other PCDD/PCDF on the other. Whilst the overall effect of these shortcomings may indeed cancel each other it is not an elegant procedure considering all the care you have taken in the other steps.

Page 5-31. 5.5.3.3, line 6.

.... a mixture of two HCDD isomers.

Page 5-33, line 14.

Only two isomers....have been tested as a mixture and these compounds were shown to be carcinogenic (to my knowledge no other HCDD have been tested).

Page 5-38/39.

Table 5-9 does not list data on gastrointestinal absorption of PCDD/PCDF from fly-ash. Data by van den Berg et al. (1983) suggest that uptake/retention from fly ash to be much lower than the 50% up mentioned in the Table.

Page 5-50.

The Ontario Ministry of Labour suggests that 2,3,7,8-TCDD acts as a promotor. This, presumably, is based on some data which should be cited.

Page 5-51.

Several safety factors were incorporated into the assessment to ensure conservatism. There is no quantitative measure of conservatism at each step. It would be more transparent if average assessment parameters were chosen and then one conservative but visible safety factor applied.

Appendix C-2, 2nd paragr.

... removal of the plastics may not enhance combustion or re-
duce PCDF and PCDD emissions.

Appendix C-3, top.

The most efficient way of reducing PCDD/PCDF formation may indeed be removal of chlorine; this, however, is not easily attained in a conventional waste combustor.

Center page.

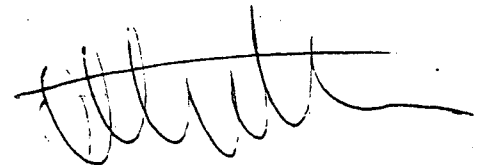
A cautionary "PVC itself is a significant precursor" may be in order.

OPERATING CONTROLS

Whilst there is no doubt that the Martin system is a modern, efficient system, there is no comparative, quantitative and scientifically sound data available to indicate that this incinerator will emit, in principle, less PCDD/PCDF than another design run under optimal conditions. Eventually, only a constant monitoring program can ascertain low emissions. This monitoring will have to be for PCDD/PCDF.

Since to date no correlation of low PCDD/PCDF emission with operating parameters have been consistently found, except that higher PCDD/PCDF levels can be expected at low operating temperatures, PCDD/PCDF will have to be monitored and not a surrogate parameter.

Bayreuth, August 2, 1984



O. Hutzinger

RECEIVED AUG 10 1984

1441 Oak Manor Drive
Fayetteville, AR 72701
August 6, 1984

Dr. David Lipsky
Fred C. Hart Associates, Inc.
530 Fifth Avenue
New York, NY 10036

Dear Dr. Lipsky:

I have reviewed the final version of the dioxin report entitled, "Assessment of Potential Public Health Impacts Associated with Predicted Emissions of PCDDs and PCDFs from the BNYRRF." This letter constitutes my written comments, both general and specific.

1. General characterization of the overall report.

My general impression of the thoroughness and completeness of the report is very good. The peer review panel assembled by FCH was complete in the sense of the range of expertise represented. There was not much overlap of expertise, but all areas were covered. My function was in the area of environmental fate. I have been on review panels involving dioxins in which there were several individuals with similar expertise. Nevertheless, the document in this regard is very thorough and up-to-date.

The general body of knowledge on environmental fate of dioxins has been consolidated into several key documents. Several years ago the information was scattered and large panels were needed to provide assurance that all aspects were covered. These large panels are not necessary now due to the availability of extensive review documents on dioxins.

New reports of laboratory studies, field studies, models, studies, etc., were presented at each of the meetings held at FCH on Feb. 28 and April 29. These have been incorporated into the report so that it is complete to this moment in time.

The report is well written and presents a faithful reflection of the original manuscripts of experimental and research findings. Again, my comments are with respect to the environmental fate aspects that involve major portions of Chapters 2, 3, and 4. Those particular sections were 2.1, 2.2, 2.3, 3.1, 3.2, 3.4, 3.5, 3.6, 3.7, 3.8, 4.1, 4.2, 4.3, 4.4, and 4.5.

August 6, 1984
Page Two

The flow of information in the report proceeds in a very logical order. The building of facts from properties of dioxins to emissions to exposure to risk is very ordered and compartmentalized. This has assured a high degree of completeness. This format provides an easy route from fact to assumption to conclusion.

From the point of view of environmental fate the assumptions adopted to arrive at concentration levels, both for dioxins in (all) gaseous and (all) particulate form, are very conservative in my estimation.

2. Detailed comments on specific aspects.

Page 2-13, Table 2-3. The vapor pressures reported here are apparently much too high. Recently measured values (Freeman and Schroy, 1984) suggest 10^{-9} mm Hg as more reasonable at 25°C. If this data is correct, then under ambient conditions most of 2,3,7,8-TCDD will be associated with the particulates. If the data in Table 2-3 is in fact correct, then the converse may be true; a significant fraction of 2,3,7,8-TCDD is in the vapor phase.

Page 2-15, Line 5. I am not sure this is correct interpretation of the photolytic degradation data I am aware of. It is my understanding that a surface, like silica, must be present and the sorbed species undergoes degradation on this surface in the presence of sunlight.

Page 3-23, Paragraph 2, Line 1. "This suggests that PCDF and PCDD compounds . . ." may be better wording. There has been no vapor/solid sorptions studies with 2,3,7,8-TCDD or related compounds to indicate fact.

Page 4-6, Section 4.3, Deposition Model. It is my opinion that the deposition model prediction is one of the weak aspects of the exposure analysis. The authors state on page 4-8 that, "The model is not equipped to handle terrain features or elevated receptors when calculating deposition, and the model is not able to account for any physical transformations or change in particle size occurring in the atmosphere. Therefore, some inaccuracies may be introduced due to flow obstruction by buildings, and by particle changes. However, the inaccuracies are expected to be minor."

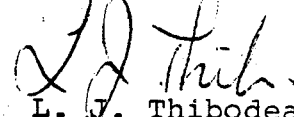
I think it is likely that the deposition rates are higher than the model (ISC w/ reflection) predicts. Reflection coefficients do not account for the reduction in turbulence caused

August 6, 1984
Page Three

by buildings. In effect, buildings act as a screen to slow the wind, and as a consequence more fines drop out. Wind screens, made of thin slats, are a common device used to cause controlled snow deposition. The present state-of-the-art deposition models do not account for this factor; however, the many conservative assumptions in the particle exposure model should more than compensate for this underestimation of the deposition rate.

Page 4-18, Line 8 from bottom. It is an extremely conservative assumption to neglect transformations, volatilization, chemical degradation, biological degradation, resuspension and reentrainment.

Sincerely,

A handwritten signature in dark ink, appearing to read 'L. J. Thibodeaux', written in a cursive style.

L. J. Thibodeaux



RECEIVED AUG 8 1984

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Institute of Environmental Medicine

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ANTHONY J. LANZA RESEARCH LABORATORIES AT UNIVERSITY VALLEY

LONG MEADOW ROAD, STERLING FOREST, TUXEDO, N.Y. 10987

MAIL AND TELEPHONE ADDRESS: 550 FIRST AVENUE, NEW YORK, N.Y. 10016

August 3, 1984

David Lipsky, Ph.D.
Group Manager
Public Health and Chemistry
Fred C. Hart Associates, Inc.
530 Fifth Avenue
New York, New York 10036

Dear Dr. Lipsky:

In response to your letter of July 18th, I have reviewed the July 1984 Draft Report entitled "Assessment of Potential Public Health Impacts Associated with Predicted Emissions of Polychlorinated Dibenzo-Dioxins and Polychlorinated Dibenzo-furans from the Brooklyn Navy Yard Resource Recovery Facility", and I am submitting my comments below, as requested.

General Evaluation

In general, I consider the report to be well-written, careful, thorough, accurate, and consistent with the current state of the art in toxicological risk assessment. I endorse its methodology, assumptions, and conclusions as scientifically appropriate in our present state of knowledge.

Specific Comments

- Page 5, 3rd paragraph, line 5: the word "contradictory" should be replaced by "inconclusive".
- Page 12, 3rd paragraph, line 3-5: this sentence seems to be incomplete.
- Page 15, 3rd paragraph, line 4: I would suggest deletion of "very safe" since the term is ambiguous.
- Page 15, 4th paragraph: It would be instructive to estimate the number of years the BNYRR could be expected to operate before inducing a case of cancer; e.g., if the maximally exposed population numbered 1000 persons, the risk estimate implies that thousands of years would elapse before a case of cancer attributable to the BNYRR would occur in this population.
- Page 17, penultimate line: I would suggest deleting the word "many" and rewording to read "...generally found by..."
- Page 2-20, 3rd paragraph, line 2: I would suggest deleting "in one of two ways" and replace with "through initiation or promotion of tumor formation".
- Page 2-20, 3rd paragraph, line 6: I would suggest inserting "some" before "initiators" and "at high doses, however," after "capable".

- Page 2-20, 4th paragraph, 1st sentence: I would suggest rewording to read, "Although 2,3,7,8-TCDD is carcinogenic to animals, it is not clear whether it can act both as an initiator and as a promoter of carcinogenesis".
- Page 2-35, 2nd paragraph, line 1: I would suggest inserting "possibly" before "associated".
- Page 2-35, 2nd paragraph, lines 2-3: "Hodgkin's" is misspelled.
- Page 2-36, 2nd paragraph, last line: I would suggest deleting "enough".
- Page 2-39, 2nd paragraph, line 5: I would suggest inserting "in humans" after "sarcomas".
- Page 5-1, lines 6-7: I would suggest rewording to read "the relationship between the two levels indicates the magnitude of risk...".
- Page 5-1, last line: I would suggest replacing "criterion" with "indication".
- Page 5-3, 2nd paragraph, last sentence: I would suggest rewording to read, "A conservative assumption is one that increases the estimated hazard to public health".
- Page 5-4, 5th line: I would suggest replacing "carcinogenesis" with "carcinogens".
- Page 5-5, 3rd paragraph, line 2: I would suggest deleting "excess".
- Page 5-28, 3rd paragraph, line 5: "International Commission of Radiological Protection" is the name of the organization.
- Page 5-31, 2nd paragraph, line 4: I would suggest replacing "very" with "acceptably".
- Page 5-52, 4th paragraph, line 4: I would suggest deleting "very safe" since the term is ambiguous.

I hope that my comments will be helpful to you. If there is anything I can do to be of further assistance, please don't hesitate to call on me.

Sincerely,



Arthur C. Upton, M.D.
Professor and Chairman

~~Velzy~~
ASSOCIATES

RECEIVED AUG 14 1984

August 13, 1984

Charles R Velzy Associates, Inc.
Consulting Engineers
355 Main Street
Armonk, New York 10504
Telephone: 914/273-9840

Dr. David Lipsky, Group Manager
Public Health and Chemistry
Fred C. Hart Associates, Inc.
530 Fifth Avenue
New York, New York 10036

Dear Dr. Lipsky:

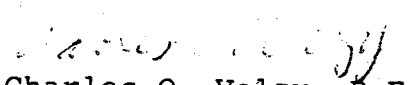
Enclosed please find my comments on the draft report on health risks from PCDD/PCDF emissions from the Brooklyn Navy Yard proposed RR facility.

I have also enclosed copies of the following pages from the draft report on which I have noted typos, unclear or incomplete sentences, and/or have indicated recommended wording changes or additions to improve accuracy or preciseness of expression:

Pages 12 and 13 in the Executive Summary
Pages 1-6, 1-9, 2-38, 3-15, 3-16, 3-33, 5-24 and
5-41 in the main body of the report
Pages B-1, B-2 and B-4 in Appendix B.

I trust you will find these suggestions helpful. Thank you for the opportunity to participate in this project. Would you please send me a copy of the final, complete report. Thank you.

Very truly yours,


Charles O. Velzy, P.E.
President

COV/maf
encl.

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Richmond, Virginia 23288
Telephone: 804/288-6061
York, Pennsylvania 17401
Telephone: 717/846-4614

COMMENTS ON
DRAFT REPORT ON "ASSESSMENT OF POTENTIAL PUBLIC
HEALTH IMPACTS ASSOCIATED WITH PREDICTED EMISSIONS
OF PCDD/PCDF FROM THE BROOKLYN NAVY YARD RR FACILITY"

I agree with the overall conclusion of this Report that a modern, carefully designed and operated energy from solid waste plant does not represent a significant risk to public health by reason of potential discharges of PCDD/PCDF. This confirms earlier study conclusions reached by ASME and EPA. However, I have problems with some of the detailed explanations offered for equipment selection and predicting performance.

Thus, on pages 2-8, 3-23, 3-24, and 3-31 (at least), it is indicated that PCDD/PCDF tend to concentrate on small particles since small particles have a greater surface area than larger particles for the same given mass. On pg. 3-24, it is pointed out that Karasek has generated some data which is contrary to this theory. However, it is indicated that this is the only contrary data and it is dismissed as being anomalous.

I think this conclusion is drawn too hastily and may not be correct. Karasek is not the only investigator to find PCDD/PCDF concentrations higher on larger particles. Tiernan, et al, in an article published in 1982, cited in your references for Chapter 3, shows TCDD concentrations 2 to 3 times greater on 10 μ m to 3 μ m particles than on 1 μ m and smaller particles. More recent, as yet unpublished, test results seem to confirm these results. A possible explanation for these results may be contained in the comments referenced to Barnes, 1983, in the first complete paragraph on page 2-11 of your Report.

The implication of this, in my judgment, is that a bag house may not have a significant advantage over a high efficiency electrostatic precipitator from the standpoint of control of PCDD/PCDF emissions. More important considerations, when striving for maximum control of emissions of these compounds, is the split between particulate sorbed material versus that in gaseous or vapor form at stack conditions, and conditions (most important perhaps, temperatures) that result in adsorption and desorption of these compounds on particulates at stack conditions. As correctly noted in the Report, we have literally no definitive information with which to make predictions in these two areas.

In summary on this point, I agree with the decision to use a bag house on the Brooklyn Navy Yard plant in order to maximize smaller particulate removal through filtration of stack gases. However, the numerical projections of removal of PCDD/PCDF may be inaccurate due to uncertainties as to the form of these compounds at stack conditions. In any case, there does not seem to be a significant health risk.

In the last paragraph on page 3-11, the Report apparently attempts to describe a sampling methodology that was generally in use prior to promulgation of EPA Method 5. These earlier methods frequently obtained a sample of particulates by drawing a sample of flue or

stack gases out of the duct and filtering the sample immediately at stack temperature using an in-stack filter. Current European methodology for particulate sampling closely parallels these methods.

However, I do not believe the conclusion drawn at the end of the paragraph can be supported. Tiernan has not collected, in any manner whatsoever, the samples that he has analyzed in his laboratory. Further, none of the general references that I have reviewed in this field give any indication as to the sampling method that was used in the investigation. EPA test reports do describe sampling methodology which is as described at the top of page 3-12, Modified EPA Method 5. This absence of definitive information on sampling methodology used in these investigations, or absence of general prior agreement on a single standard method of test, is a problem in the field today.

Similarly, the last two sentences on page 3-12 of the Report represent a tremendous understatement. Combustion conditions during testing for PCDD/PCDF are usually not described at all, or are completely and/or inaccurately characterized. Only this year, 1984, have we begun to see some work to relate combustion conditions to trace organic emissions. This information should allow us to refine our estimates of emissions and achieve more cost effective control in the future.

I believe the statement in the second line of the first paragraph on page 3-13 is not accurate. Benfenati, et al, were unable to show any correlation between combustion conditions and PCDD/PCDF emissions, except for a general loose correlation between minimum combustion temperature and PCDD/PCDF emissions. The last sentence in this same paragraph would be more accurate if it read as follows: "Slow operator response to temperature excursions and poor control of the air/fuel mixture may potentially result in significant increases in PCDF and PCDD emissions."

Finally, I believe the use of the particle size data from the tests on the Braintree Incinerator to predict size distribution for particulate emissions from modern electrostatic precipitators is flawed. The Braintree plant, when designed many years ago, incorporated a precipitator with a particulate removal efficiency of about 90%. During the tests that produced the particle size distribution data cited, the precipitator was reportedly only operating at approximately 74% efficiency. When operating at such a low removal efficiency, the emissions must include a much larger fraction of large sized particles than would be found in a unit considered for a facility such as the Brooklyn Navy Yard plant. Precipitators at such a plant would have a removal efficiency in excess of 99%. Such a unit should essentially totally remove material larger than 2 μ m in size.

Again, the above comments are offered from the standpoint of improving the accuracy of the Draft Report in certain specific areas. I don't feel that any of these points change the basic conclusion of the Report that a modern, carefully designed and operated energy from solid waste plant does not represent a significant risk to public health by reason of potential discharges of PCDD/PCDF.

C.4 Risk Assessment

A risk assessment was performed to estimate the risks associated with predicted maximum PCDD and PCDF concentrations in ambient air, soil, dust and dirt downwind of the BNYRRF. The assessment compared the predicted ambient air concentrations and estimated daily intake levels for PCDDs and PCDFs with: (1) applicable standards and criteria; and (2) concentrations of PCDDs and PCDFs known or suspected to cause a toxic effect.

In reviewing the findings of our risk assessment it is important to keep in mind the methodological limitations of the risk assessment process.

First, a risk assessment, while based upon scientific considerations, often requires the application of sound technical and scientific judgement or assumptions. The use of assumptions rather than scientific experimental fate, transport, and bioavailability of contaminants such as PCDDs and PCDFs.

Second, a risk assessment frequently requires extrapolation from high-dose animal feeding studies to estimate risk to humans at the extremely low dosages or concentrations of contaminants found in the environment. Data are not available to determine the actual shape of a dose/response curve (i.e., the level of risk), or the best method to extrapolate risk. Accordingly, there is a great range of uncertainty regarding actual risk (at very small concentrations) for a given contaminant.

M.
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some

In the absence of sufficient data or knowledge about the degree of exposure, intake, and bioavailability of contaminants, the typical risk assessment uses the most reasonable assumptions possible. Typically, "worst-case" scenarios or conservative assumptions are used in the assessment process. A conservative assumption is one which increases the likelihood that a substance will represent a hazard to public health.

However, the use of a number of "worst-case" or conservative assumptions carries the danger that the estimate of risk can become vastly overstated and therefore unrealistic. Risk assessments relying upon "worst-case" scenarios must be evaluated critically regarding the degree of realism in the model used to estimate risk.

Several conservative assumptions were incorporated into our assessment. They include the following:

- Use of worst-case assumptions for three potential pathways of exposure: inhalation of gaseous or particulate emissions, and ingestion or dermal absorption of particulates deposited on outdoor and indoor surfaces. Typically, risk assessments of point-source emissions assess risks only for the inhalation pathway.
- Application of a toxic equivalency multiplier equal to 59. This number provides an estimate of the non-carcinogenic toxicity of the complex mixture of PCDDs and PCDFs compared with the concentration of 2,3,7,8-TCDD. This equivalency factor was also used to estimate carcinogenic equivalency as a worst-case assumption although such an application is speculative.

1 sec
L-6
P3

In the absence of sufficient data or knowledge about such issues as the degree of exposure, intake, fate and bioavailability of contaminants, the typical risk assessment uses the most reasonable assumptions possible, erring on the side of public health. Typically, "worst-case" scenarios or conservative assumptions are used in the assessment process to provide an added safety factor. A conservative assumption is one which increases the likelihood that a substance represents a hazard to public health.

To provide an element of conservatism, the following safety factors were incorporated into our risk assessment:

- ° Risks were calculated based on maximum 24 hours a day exposure, over a 70 year lifetime at the point of maximum impact.
- ° Assessment of three potential pathways of exposure: Inhalation of gaseous or particulate emissions, and ingestion or dermal absorption of particulates deposited on outdoor and indoor surfaces.
- ° Application of a toxic equivalency multiplier equal to 61. This number provides an estimate of the non-carcinogenic toxicity of the complex mixture of PCDDs and PCDFs compared with the concentration of 2,3,7,8-TCDD. This equivalency factor was also used to estimate carcinogenic equivalency as a worst-case assumption although such an application is speculative.
- ° No losses of PCDDs were assumed through volatilization or degradation or losses from such actions as rainfall.
- ° Indoor ambient air quality was assumed to equal outdoor air quality.
- ° The most conservative cancer risk extrapolation model was included to estimate an upper bound limit to increased cancer risk.
- ° Conservative assumptions for bioavailability, and rates of ingestions and dermal contact were included to estimate worst-case daily intakes of PCDDs.

However, the use of a number of "worst-case" or conservative assumptions carries the danger that the estimate or risk can become vastly overstated and therefore unrealistic. Risk assessments relying upon "worst-case" scenarios must be critically evaluated with regard to the degree of realism in the model used to estimate risk.

Arthur Upton, M.D.--Professor and Chairman, Department of Environmental Medicine, New York University School of Medicine. Former Director, National Cancer Institute.

Charles Velzy^R, P.E.--President, Charles Velzy^{Inc.} and Associates, Extensive experience in design and operation of solid waste incineration facilities and air pollution control technologies.

The panel met to review and comment on the proposed scope and approach of this report on February 28, and reconvened on April 29 to review the first draft. The written comments of the panelists on the final version of this report appear as Appendix D.

specific dioxin congeners. However, although TCDD is an extremely potent enzyme inducer in cell cultures, there is no demonstrated correlation between enzyme induction and cytotoxicity. This observation implies that despite the observed correlation in animal models, there may be no direct connection between enzyme induction and the degree of toxicity of 2,3,7,8-TCDD.

Vitamin A Depletion. Many of the toxic effects of 2,3,7,8-TCDD resemble the effects of Vitamin A (retinol) deficiency. These include epithelial lesions, keratosis and immunosuppressive effects. It has been demonstrated that the administration of a single oral dose of 2,3,7,8-TCDD produces a dose-related increase in the hepatic (liver) storage of Vitamin A in rats (Thunberg et al. 1979, 1980). These results suggest that an induced Vitamin A deficiency may be responsible for some of the toxic effects produced by 2,3,7,8-TCDD.

Lipid Peroxidation. Sweeney and Jones (1983) have suggested increased lipid peroxidation as a possible mechanism of 2,3,7,8-TCDD toxicity. Based on limited data, it appears that iron deficiency inhibits in vitro lipid peroxidation and reduces the hepatotoxic effects of 2,3,7,8-TCDD. Also lipofuscin pigments, by-products of lipid peroxidation, are increased in the heart muscle of rats treated with 2,3,7,8-TCDD. Thirdly, administration of an antioxidant to mice provided some protection from porphyria induced by 2,3,7,8-TCDD. More recent studies (Stohs et al., 1983) indicate that 2,3,7,8-TCDD may accelerate lipid peroxidation in Sprague-Dawley rats.

2.4.8 Summary. Relatively little is known regarding the effects of PCDDs and PCDFs on humans. Animal studies, which are limited primarily to 2,3,7,8-TCDD, indicate that this compound shows considerable variation in toxicity and varying effects among species, as well as a delay between the administration of this material and the manifestation of a toxic effect.

As regards humans, most information is derived from cases of accidental exposure to mixtures containing PCDDs. Assessing the effects of these uncontrolled exposures and relating effects solely to exposure to PCDDs is difficult. The symptoms observed in these incidents include skin conditions; hair loss and excess hair growth; nervous disorders; respiratory

during testing by the USEPA. The owners of the Hampton plant have been requested by USEPA to revise their operating conditions in order to reduce the PCDF and PCDD emissions, and the facility is due to be re-tested. Clearly, the emissions from this incinerator are not representative of normal emissions ^{generally acceptable operating conditions} under operations. However, this facility was sampled for both particulate and gaseous forms of PCDFs and PCDDs, and the data reflects total emissions. The two plants in Milan, Italy, are resource recovery steam plants with Volund combustion systems. The Eskjo, Sweden, plant is a refuse-fired fluidized-bed boiler operating at 700°C and two seconds gas retention time. Both gaseous and condensible forms of PCDFs and PCDDs were measured at these Italian plants and at the Sweden plant. The Zaanstad, Netherlands plant is a simple refractory-lined furnace. The effluent was sampled and analyzed for solid PCDD and PCDF forms only. Of these systems the Chicago Northwest facility and the Zurich-Josefstrasse facility are the closest in design and operation to the BNYYRF. In addition, these facilities were sampled using methodology which includes gaseous and solid forms of PCDFs and PCDDs. Of note, the emissions from these facilities are among the lowest of all those tested. The highest values were obtained from incinerators about which absolutely no information was presented ^{regarding furnace combustion conditions during testing}.

3.4 Rates of Dioxin Emission from Incinerators

From Section 3.2 it is clear that a complex set of circumstances influence the rate of PCDF and PCDD materials in incinerator effluents. The results of the laboratory studies indicate that the primary method of achieving minimum emissions is a maximization of combustion efficiency. That is, with combustion temperatures of about 900°C, the air/fuel mixture must be just slightly oxygen-rich, the mixture must be homogeneous (no stratification), and the gas residence time at the average combustion temperature must be at least one second. These conditions are not extreme; they are attainable with fully developed and tested technology. This is demonstrated by the emission data obtained from the Chicago Northwest facility (Redford et al., 1981) and the Zurich-Josefstrasse facility (SFOEP, 1982).

The system central to these facilities, the Martin stoker-grate, has been developed over many years with the goal of ~~effective resource recovery~~ ^{promoting optimum}. ~~That is, these systems were designed to obtain the highest energy output, and therefore the "optimization of combustion efficiency" was the goal of the design.~~

In contrast, many other incinerators were designed with the primary goal of reducing waste volume. It is cheaper and easier to design and build an incinerator that effectively reduces waste volume without providing a high combustion efficiency. These facilities do not have the high-velocity secondary air nozzles to provide air/fuel mixing, or the larger dimensions to provide long gas residence times, or the sophisticated control systems necessary to keep conditions from exceeding their desired ranges. Two relatively simple incinerators without resource recovery are the Como, Italy and the Zaanstad, Netherlands facility. Emissions from these plants are one to two orders of magnitude greater than the Chicago, Northwest facility.

However, a resource recovery design in itself does not assure that PCDF and PCDD emissions will be minimal. Three systems that were designed for resource recovery emitted relatively high PCDF and PCDD emissions. These are the two plants in Milan, Italy (Cavallaro et al. 1980) with Volund steam generation systems and the Hampton, Virginia refuse-fired steam boiler (Tiernan et al. 1983). Emissions from these systems are two to three orders of magnitude higher than the Chicago, Northwest facility emissions. Six Italian plants were tested but the types of incinerators were not described. These ranged several orders of magnitude from moderate to very high levels (Cavallaro et al. 1982). unclear
?

The extreme range of emissions shown in these studies demonstrates that the factors influencing PCDF and PCDD emissions are complex. Although design can play a significant role in the magnitude of emissions, it is not probable that design alone can assure low emissions. The most probable cause of the wide range of emissions is fluctuations in operating conditions from plant to plant and from day to day. This shows that the most important

3.8 Summary

In summary, PCDF and PCDD emissions in incinerator effluents can originate from a number of sources and/or chemical reactions, such as being a part of raw refuse, being formed from precursors, and being formed from degradation products of materials commonly found in solid waste.

Whatever the cause of formation or occurrence, the combustion conditions necessary for destruction include a minimum of one to two seconds of gas residence time at a minimum combustion temperature of 900-1,000°C, very turbulent conditions in the high-temperature zone, and an air/fuel mixture with a slight excess of oxygen.

The incinerator design selected for the BNYRRF appears to fulfill the requirements for efficient combustion and maximum destruction of PCDFs and PCDDs. Furthermore, the use of auxiliary burners will assure that the minimum combustion temperature is consistently maintained. In addition, a more efficient fly ash pollution control device than is generally used on incinerators has been selected. Since at least some of the PCDF and PCDD materials will be adsorbed on particulate, less of these materials will be emitted and the exposure to the public will be less than if the less efficient electrostatic precipitator had been selected. However, the exact portion of PCDFs and PCDDs in the environment which can be attributed to any single source or process is impossible to determine.

Emission test data from a number of incinerators has demonstrated a wide range of PCDF and PCDD emissions spanning several orders of magnitude. High levels of emissions have been observed from several types of incinerators, indicating that operational factors have as much or more effect on PCDF and PCDD emissions than incinerator design. However, the lowest emissions were observed from incinerators with the same basic design as the BNYRRF. This is an encouraging point and may mean that effective operation and maintenance is easier on these units. The BNYRRF has also been designed with additional control features not found on the incinerators tested with even the lowest emissions.

The predicted maximum average annual concentration of 2,3,7,8-TCDD at ground and elevated receptors of 0.00168 pg/m^3 equals 0.014% of the Netherlands standard. Using a toxic equivalency factor of 59, the levels of TCDD toxic equivalents are still only 0.83% of the Netherlands ADI.

5.4.3 Comparison with NYSDEC Guideline. NYSDEC used the EPA's Risk Assessment of the Municipal Waste Combustors (MWCs) to establish a performance guideline for evaluating other combustion sources. As described in Section 5.3.1, EPA found a maximum annual average ambient air concentration at ground level equal to $9.2 \times 10^{-14} \text{ g/m}^3$ for all TCDDs . EPA performed a risk assessment based on these concentrations and stated that the excess cancer risks (which ranged up to 19×10^{-6}) presented no significant risk to the public. On the basis of EPA's risk assessment, the maximum PCDD level found was then adopted by NYSDEC as a guidance level. Using data from Table 4-1, the maximum average TCDD concentrations predicted in the ambient air downwind of the BNYRRF at ground level and elevated receptors is 0.026 pg/m^3 which is equal to 28.2% of the NYSDEC guideline for total TCDDs.

5.4.4 NYSDOH Guideline. NYSDOH established air and exposure guidelines for reentry into a Binghamton, New York, office building that had been evacuated following an electrical transformer fire. For workers exposed for 250 days/year, 8 hour/day, the TCDD toxic equivalent concentration should not exceed 15 pg/m^3 . This concentration adjusted for 24 hour/day exposure for 365 days per year equals 3.4 pg/m^3 . Based upon our air dispersion model (Table 4-1) we predict an average annual 2,3,7,8-TCDD ambient air concentration at ground level equal to 0.00168 pg/m^3 which is equal to a total TCDD toxic equivalent concentration of 0.099 pg/m^3 . Therefore, the predicted emissions from the BNYRRF are expected to result in an annual average ambient air concentration of 2,3,7,8-TCDD and TCDD toxic equivalents that is only 0.049% and 2.9% of the NYSDOH guideline, respectively.

5.5 Computation of a "Worst-Case" Upper Bound to the Level of Risk Associated with Emissions from the BNYRRF.

In the previous section, the maximum annual average PCDD and PCDF concentrations at ground level and elevated receptors were compared to the

As discussed in Chapter 4.0, PCDD levels in home dust and street dirt on a surface area basis were also used to estimate risk. The maximum accumulation on floors was estimated assuming indoor deposition at 25% of the outdoor rate, with a 30-day period of accumulation.

There is some evidence to suggest that a 30-day accumulation period is overly conservative. The data provided by Solomon et al.; if extrapolated, indicates that there is from 0.6 to 1g dust/m² in single family urban middle class homes (gas heated) in Champagne-Urbana Illinois. His data, if applied to the PCDD and total particulate deposition rates, would indicate that steady state conditions for dust buildup in homes would be reached in three to five days (Solomon, 1977).

For outdoor deposition the accumulation period in ~~an~~ urban streets is unknown. The Swiss EPA in their assessment of dioxin emissions from incinerators, used an estimated half life equal to 14 days for rural environments (SFOEP, 1982). Consistent with this Swiss EPA assessment, we have assumed a 30 day period of accumulation as a reasonable accumulation period.

The estimated daily intake through the ingestion pathway calculated on a weight or surface area basis is presented in Tables 5-10 and 5-11.

The maximum estimated daily intake calculated by either method provides reasonably similar results. On a weight basis, the maximum estimated daily intake of 2,3,7,8-TCDD ranged from 2.5×10^{-16} g/day to 2.9×10^{-14} g/day. On a surface area basis, the daily intake ranged from 1.3×10^{-16} to 6.8×10^{-15} g/day.

5.5.4.3 Daily Intake From Dermal Adsorption. Estimating a daily intake due to dermal absorption requires a determination of the surface area or exposed skin, the frequency of contact between the exposed skin and contaminated surfaces, and the rates of absorption for PCDDs and PCDFs bound tightly to soil, dust, and fly ash. Information to calculate these data are also not well documented. Accordingly, a number of assumptions were used to provide a range and upper bound estimate for daily intake through the dermal pathway.

APPENDIX B -- CALCULATIONS

BROOKLYN NAVY YARD AND RESOURCE RECOVERY FACILITYPREDICTED PCDD AND PCDF EMISSIONS
AND ASSOCIATED ENVIRONMENTAL IMPACTSPCDD and PCDF Concentrations in Flue Gas

Concentrations in BNYRRF flue gas were based upon tests of Chicago Northwest and Zurich-Josefstrasse facilities. Corrections were made for flue gas conditions projected for BNYRRF. The concentrations presented here assume: (1) gas phase PCDD and PCDF emission, or (2) particulate emission with electrostatic precipitators used for particulate control. Calculations in the following sections account for particulate emission of PCDD and PCDF with fabric filter particulate control.

	<u>BNYRRF</u>	<u>Chicago Northwest</u>	<u>Zurich-Josefstrasse</u>
CO ₂ % (dry)	10.5	9.5	9.3
H ₂ O %	13.63	13.1	14.7
Dry Gas Fraction	.8637	.869	.853
Standardized Temp.	0°C (N)	20°C (S)	0°C (N)

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see following
pg.

Chicago, N.W. data (CNW)

$$(\text{ng/Nm}^3) \text{ BNY} = (\text{ng/dry Sm}^3) \text{ CNW} \times (\% \text{ CO}_2) \text{ BNY} / (\% \text{ CO}_2) \text{ CNW} \times (\text{dry gas fraction}) \text{ BNY} \times (\text{abs. temp-S}) / (\text{abs. temp-N})$$

Example, Tri-CDF

$$300 \text{ ng/dSm}^3 \times 10.5/9.5 \times .8637 \times 293/273 \\ = 307.4 \text{ ng/Nm}^3$$

Zurich-Josefstrasse data (Z-J)

$$(\text{ng/Nm}^3) \text{ BNY} = (\text{ng/Nm}^3) \text{ Z-J} \times (\% \text{ CO}_2) \text{ BNY} / (\% \text{ CO}_2) \text{ Z-J} \\ \times (\text{dry gas fraction}) \text{ BNY} / (\text{dry gas fraction}) \text{ Z-J}$$

Example, Penta-CDF

$$27.3 \text{ ng/Nm}^3 \times 10.5/10.9 \times .8637/.853 \\ = 26.6 \text{ ng/Nm}^3$$

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see previous pg

TABLE B-1

PREDICTED BNYRRF EMISSION RATES IF ELECTROSTATIC PRECIPITATORS
WERE USED, OR IF ALL PCDD AND PCDF EMISSIONS WERE GASEOUS

	<u>Reported Concentration</u>	<u>BNYRRF Concentration(3)</u>	<u>BNYRRF Mass Emission Rate (4)</u>
Tri-CDF	300(1)	307.4	51.18
Tetra-CDF	90(1)	92.2	15.35
Penta-CDF	27.3(2)	26.6	4.43
Hexa-CDF	7.5(1)	7.7	1.28
Hepta-CDF	62(1)	63.5	10.58
Octa-CDF	<u>0.60(1)</u>	<u>0.6</u>	<u>0.10</u>
TOTAL-CDF	--	498.0	82.92
Tri-CDD	13(1)	13.3	2.22
Tetra-CDD	6.3(1)	6.5	1.07
Penta-CDD	11.0(2)	10.7	1.79
Hexa-CDD	7.6(1)	7.8	1.30
Hepta-CDD	16(1)	16.4	2.73
Octa-CDD	<u>2.5(1)</u>	<u>2.6</u>	<u>0.43</u>
TOTAL-CDD	--	57.3	9.54
2,3,7,8-TCDD	0.41	0.42	0.07

(1) Chicago Northwest, ng/dSm³ at 20°C and 9.5% CO₂

(2) Zurich-Josefstrasse, ng/Nm³ at 0°C, 10.9% CO₂ (dry) and 14.7% H₂O

(3) ng/Nm³ at 0°C, 10.5% CO₂ (dry), and 13.63% H₂O

(4) ug/sec

? see pgs B14BZ

APPENDIX E

Curriculum Vitaes of Peer Review Panel Members

Curriculum Vitae

Thomas C. Chalmers, M.D.

Born Forrest Hills, New York
December 8, 1917

Business Address Mount Sinai Medical Center
One Gustave L. Levy Place
New York, New York 10029
(212) 650-8254

Education & Training

Yale College	1936-39
Columbia College of Physicians and Surgeons	M.D. 1943
Medical Intern, Presbyterian Hospital, New York City	1943-44
Research Fellow, Department of Medicine, New York University Malaria Research Unit, Goldwater Memorial Hospital, NYC	1944-45
Assistant Resident & Resident, 2nd and 4th Medical Services (Harvard), Boston City Hospital, Boston	1945-47
Research Fellow, Harvard Medical School and Thorndike Memorial Laboratory, Boston City Hospital, Boston	1946-47

Licensure

Licensed to practice medicine	
New York State License No. 42374	Date Issued: May 12, 1944

Academic Appointments

1947-1961	Harvard Medical School	Assistant in Medicine Instructor Clinical Associate Assistant Clinical Professor of Medicine
1961-1968	Tufts University School of Medicine	Professor of Medicine
1962-1975	Harvard Medical School	Lecturer in Medicine
1970-1973	George Washington University School of Medicine	Professor of Medicine
1973-1983	Mount Sinai School of Medicine of the City University of N.Y.	Dean and President Professor of Medicine
1983-	Mount Sinai School of Medicine of the City University of N.Y.	President Emeritus, Dean Emeritus and Distinguished Service Professor

HOSPITAL AND RELATED APPOINTMENTS

Boston City Hospital, 2nd and 4th Medical Services, (Harvard) and
Thorndike Memorial Laboratory, Boston

1947-1948 Out-patient Physician
1949-1953 Assistant Visiting Physician
1955-1968 Associate Visiting Physician

Mount Auburn Hospital, Cambridge

1947-1953 Junior Physician
1955-1968 Associate Visiting Physician

New England Center Hospital, Boston

1961-1968 Associate Staff

Faulkner Hospital, Boston

1955-1968 Consultant in Medicine

Lemuel Shattuck Hospital, Boston

1955-1968 Chief of Medical Services

Director of Hepatitis Study, Commission in Liver Disease, Armed Forces

1951-1953 Epidemiological Board

Veteran's Administration Central Office, Washington, D.C.

1968-1970 Assistant Chief Medical Director for
Research and Education

National Institute of Health

1970-1973 Associate Director for Clinical Care &
Director of the Clinical Center

Mount Sinai Medical Center, New York City

1973-1983 President

MILITARY SERVICE - United States Army Reserve, Walter Reed Army Hospital
Washington, D.C.

1953-1955 Captain

COMMITTEES AND BOARDS

Federal Advisory Committees

National Heart and Lung Institute

1961-1965 Training Committee
1964-1969 Heart Special Projects Committee (Chairman, 1968-69)
1968 Diet-Heart Review Panel

National Cancer Institute

1965-1966 Cancer Chemotherapy Collaborative Program Review
Committee (Richardson Committee)

Health Resources Administration (HEW)

1974- National Center for Health Statistics (Consultant)

Food and Drug Administration

1970-1974 Consultant to the Bureau of Drugs
1973-1975 Drug Experience Advisory Committee
1975-1976 Review Panel on New Drug Regulations (Chairman)

Veterans Administration

1971-1974 Cooperative Studies Evaluation Committee (Chairman, 1972-74)
1974-1975 Medical School Assistance Review Committee
1976- Center for Ulcer Research and Education, Los Angeles
Advisory Board Member

Department of Defense

1965-1973 Surgeon General's Advisory Committee on General Medicine,
Subcommittee on the Liver
1970-1972 United States Army Medical Research and Development Command,
Consultant to the Commander

Clinical Trial Policy Advisory Boards and Data Monitoring Committees

1966-1975 National Heart and Lung Institute, Coronary Drug Project
1966-1968 Special Review Panel
1966-1975 Data and Safety Monitoring Committee
1971- National Heart and Lung Institute, Safety Monitoring
Committee, Type II Hyperlipidemia Coronary Intervention Study
1968-1972 National Heart and Lung Institute, Urokinase-Streptokinase
Pulmonary Embolism Trials Policy Board
1971-1973 Boston Collaborative Drug Surveillance Program,
Myocardial Infarction Study Advisory Board
1971-1978 National Institute of Arthritis, Metabolism and Digestive
Diseases, National Cooperative Crohn's Disease Study
Advisory Board (Chairman)
1972-1975 National Heart and Lung Institute, Hyper-immune Gamma
Globulin Trials Policy Board
1972-1977 University Group Diabetes Program, Policy Advisory Board
(Chairman)
1978- National Institute of Arthritis, Metabolism and Digestive
Diseases, Member of Policy Advisory Committee of the
National Cooperative Gallstone Study
1974- Persantine-Aspirin Re-Infarction Study Policy Board (Chairman)
1975- Program on the Surgical Control of the Hyperlipidemias,
Data Monitoring Committee (Chairman-1978)
1976- VA-NHLBI Cooperative Study of Mild Hypertension,
Advisory Committee on Trial Design

National Academy of Sciences - National Research Council Committees

1965-1969 Committee on Epidemiology and Veterans Follow-up Studies
1974-1977 " " " " " "
1970-1972 Ad hoc Committee on Hepatitis-Associated Antigen Tests
Ad hoc Committee on Hepatitis-Associated Antigen Carrier
Guidelines
1972-1973 Division of Medical Sciences, Member-at-large
1974 Visiting Committee, Drug Review Board

MISCELLANEOUS COMMITTEES AND BOARDS

1963-1967	American Gastroenterological Association, Committee on Research
1964-1967	American Public Health Association, Committee on New Drugs
1966-1970	Pharmaceutical Manufacturers Association Foundation Advisory Committee to the Faculty Development Awards in Clinical Pharmacology Program (Chairman, 1968-1970)
1966-1968	Pharmaceutical Manufacturers Association Foundation Scientific Advisory Committee
1970-1976	American Board of Internal Medicine, Subspeciality Board on Gastroenterology
1974-1976	American Gastroenterological Association, Committee on Publications and Communications
1974-	National Disease and Therapeutic Index, Advisory Committee of Physicians and Educators
1975-	Board of Overseers of Harvard College, Visiting Committee on Statistics
1975-	The Public Health Research Institute of the City of New York, Inc., Board of Directors
1977-1979	National Commission on Digestive Diseases, Chairman of the Subcommittee on Clinical Trials
1978-1982	Institute of Medicine (Natl. Acad. of Sci.) Membership Committee
1978-1979	Advisory Panel on Coronary Disease (Council on Sci. Affairs of the AMA)
1981-	International Physicians for the Prevention of Nuclear War
1982-	Physicians for Social Responsibility
1982-	Technical Board of the Milbank Memorial Fund
1983-	Chairman, of Trustees, Dartmouth-Hitcock Med. Center

PROFESSIONAL MEMBERSHIPS

American Association for the Study of Liver Disease (President, 1959)
American Board of Internal Medicine, 1950 and Recertification, 1974
American Clinical and Climatological Association
American College of Gastroenterology (Honorary Fellow, 1975)
American College of Physicians
American Federation for Clinical Research
American Public Health Association
American Society for Clinical Investigation
Associated Medical Schools of New York (Vice President, 1974-1975;
President, 1976-1977)
Association of American Medical Colleges
Association of American Physicians
Biometric Society
International Association for the Study of the Liver (Councilor for
North America, 1970-1974)
Medical Society of the County of New York
Medical Society of the State of New York
National Academy of Science, Institute of Medicine
New York Academy of Medicine (Fellow)

PROFESSIONAL MEMBERSHIPS (cont'd.)

Practitioners Society of New York
Society for Epidemiological Research
Society for Experimental Biology and Medicine
National Library of Medicine, Board of Regents (1978-1979)
AOA (1979)
Ethics Advisory Board-Special Consultant, 1980 (NIH) Department of
Health and Human Services

AWARDS

Julius Friedenwald Medal for Outstanding Achievement in
Gastroenterology 1982
Paul Lazarfeld Award for Research 1982 given by the Evaluation
Research Society

BIOGRAPHICAL SKETCH

Give the following information for key professional personnel listed on page 2, beginning with the Principal Investigator/Program Director. Photocopy this page for each person.

NAME	TITLE	BIRTHDATE (Mo., Day, Yr.)	
Thomas C. Chalmers , M.D.		12/8/17	
EDUCATION (Begin with baccalaureate or other initial professional education and include postdoctoral training)			
INSTITUTION AND LOCATION	DEGREE (circle highest degree)	YEAR CONFERRED	FIELD OF STUDY
Yale College		1936-39	
Columbia College of Physicians & Surgeons	M.D.	1943	Medicine
Intern, Presbyterian Hospital, NYC		1943-44	Medicine
Resident, Boston City Hospital		1945-47	Medical
Harvard Medical Services			

RESEARCH AND/OR PROFESSIONAL EXPERIENCE: Concluding with present position, list in chronological order previous employment, experience, and honors. Include present membership on any Federal Government Public Advisory Committee. List, in chronological order, the titles and complete references to all publications during the past three years and to representative earlier publications pertinent to this application. DO NOT EXCEED TWO PAGES.

ACADEMIC APPOINTMENTS

1947-61 Harvard Medical School, Assistant Clinical Professor of Medicine
 1961-68 Tufts university Medical School, Professor of Medicine
 1962-75 Harvard Medical School, Lecturer in Medicine
 1970-73 George Washington University School of Medicine, Professor of Medicine
 1973-83 Mount Sinai School of Medicine of the City University of New York
 Dean and President
 1983 - Mount Sinai School of Medicine of the City University of New York,
 Professor
 1983-84 Visiting Professor, Dept. Health Policy & Management, Harvard School of
 Public Health, Director, Clinical Trials Unit.

ADMINISTRATIVE POSTS

1955-68 Lemuel Shattuck Hospital, Chief of Medicine
 1968-70 Assoc. Chief, Medical Director for Res. & Ed., Veterans Administration
 1970-73 Assoc. Director for Clinical Research and Director, Clinical Center, NIH
 1973-83 President, Mount Sinai Medical Center

CLINICAL TRIAL EXPERIENCE

Data and Safety Monitoring Committees
 1966-75 NHLBI: Coronary Drug Project
 1971-76 NHLBI: Type II Hyperlipidemia coronary intervention study
 1975 Program on surgical control of hyperlipidemias (chairman)

POLICY ADVISORY BOARDS

1968-72 NHLBI: Urokinase-Streptokinase Pulmonary embolism trials
 1971-73 Boston collaborative drug surveillance program - myocardial infarction study
 1971-78 NIAMDD: National Cooperative Crohn's Disease Study (Chairman)
 1972-75 NHLBI: Hyperimmune Gamma Globulin trials
 1972-82 NIAMDD: University Group Diabetes Program (Chairman)
 1978-82 NIAMDD: National Cooperative Gallstone Study
 1974 Persantine Aspirin reinfarction studies (Chairman)

Presentation and Pertinent Publications

1. Chalmers, T.C., Eckhardt, R.D., Reynolds, W.E., Reifenshtein, R.W., Deane, N., Smith, C.W., Cigarroa, J.G., and Davidson, C.S. The treatment of acute infections hepatitis. Controlled studies of the effects of diet, rest, and physical reconditioning on the acute course of disease and on the incidence of relapses and residual abnormalities. *J Clin Invest* 34:1163-1234, 1955.
2. Plough, I.C., Iber, F.L., Shipman, M.E., and Chalmers, T.C. The effects of supplementary calories on nitrogen storage at high intakes of protein in patients with chronic liver disease. *Am J Clin Nutr* 4:224-230, 1956.
3. Chalmers, T.C., Iber, F.L., and Uzman, L.L. Hepatolenticular (Wilson's Disease) as a form of idiopathic cirrhosis. *N. Engl J Med* 256; 235-242, 1957.
4. Iber, F.L., Rosen, H., Levenson, S.M. and Chalmers, T.C. The plasma amino acids in patients with liver failure. *J Lab Clin Med* 50:417-425, 1957.
5. Moore, E.W., Mitchell, M.L., and Chalmers, T.C. Variability in absorption of insulin I-131 in normal and diabetic subjects after subcutaneous and intramuscular injection. *J Clin Invest* 38:1222-1227, 1959.
6. Mashford, M.L., Mahon, W.A., and Chalmers, T.C. Studies of the cardiovascular system in the hypotension of liver failure. *N Engl J Med* 267:1071-1074, 1962.
7. Moore, E.W., Strohmeyer, G.W., and Chalmers, T.C. Distribution of ammonia across the blood-cerebrospinal fluid barrier in patients with hepatic failure. *Am J Med* 35:350-362, 1963.
8. Greenberg, M.S., Strohmeyer, G.W., Hine, G.J., Keene, W.R., Curtis, G. and Chalmers. Studies in iron absorption III. Body radioactivity measurements of patients with liver disease. *Gastroenterology* 46:651-661, 1964.
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10. Linscheer, W.G., Patterson, J.F., Moore, E.W., Clermpong, R.J., Robins, S.J., and Chalmers, T.C. Medium and long chain fat absorption in patients with cirrhosis. *J Clin Invest* 45:1317-1325, 1966.
11. Vlahcevic, Z.R., Adham, N.F., Chalmers, T.C., Clermont, R.J., Moore, E.W., Jick, H., Curtis, G.W., and Morrison, R.S. Intravenous therapy of massive ascites in patients with cirrhosis: I. Short term comparison with diuretic treatment. *Gastroenterology* 53:211-219, 1967.
12. Resnick, R.H., Chalmers, T.C., Ishihara, A.M., Garceau, A.J., Callow, A.D., Schimmel, E.M., O'Hara, E.T., and the Boston Inter Hospital Liver Group. A controlled study of the prophylactic portacaval shunt. *Ann Intern Med* 70:675-688, 1969.
13. Epstein, M., Berk, D.P., Hollenberg, N.K., Adams, D.F., Chalmers, T.C., Abrams, H.L., and Merrill, J.P. Renal failure in the patient with cirrhosis. *Am J Med* 49:175-185.
14. Chalmers, T.C., Block, J.B., and Lee, S. Controlled studies in clinical cancer research. *N Engl J Med* 287:75-78, 1972.
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17. Chalmers, Thomas C., Smith Harry, Jr., Blackburn, Bradley et al. A Method for Assessing the Quality of a Randomized Control Trial. 2(1) 31-49, 1981.
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19. Sacks, H., Chalmers, T.C. and Smith, H. Jr. Randomized versus Historical Controls for Clinical Trials. AJM: Vol. 72, Feb. 1982 p. 233-240.
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Born: Long Beach, California

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EDUCATION:

Harvard University, Cambridge,
Massachusetts, B.A.

University of Chicago Law School,
Chicago, Illinois, J.D.

PROFESSIONAL:

Counsel to the Law Firm of Wald,
Harkrader & Ross, Washington, D.C.

Counsel to the Law Firm of Updike,
Kelly & Spellacy, P.C.,
Hartford, Connecticut

Adjunct Lecturer, John F. Kennedy
School of Government, Harvard
University, Cambridge, Massachusetts

BOARDS:

Member, Board of Directors and
Chairman of the Executive Committee
of the Environmental Testing and
Certification Corporation, Edison,
New Jersey

February 1981
- August 1981

Visiting Scholar, Harvard School of
Public Health, Cambridge, Massachusetts

1977 - 1981

Administrator, United States Environmental
Protection Agency, Washington, D.C.

Chairman, United States Regulatory
Council (1978-1981)

Chairman, United States Radiation Policy
Council (1980-1981)

President's Representative to NATO's
Committee on the Challenges of
Modern Society (CCMS)

United States Chairman of the US-USSR
Joint Committee on Cooperation in the
Field of Environmental Protection

United States Co-Chairman of the
United States/Peoples Republic of China,
Environmental Protection Protocol (1980-1981)

1975 - 1976	Assistant Director, Natural Resources and Commerce Division, Congressional Budget Office, Washington, D.C.
1973 - 1975	Commissioner, Department of Environmental Protection, State of Connecticut
1972 - 1973	Deputy Commissioner, Department of Environmental Protection, State of Connecticut
1971	Fellow, Woodrow Wilson International Center for Scholars, Smithsonian Institution, Washington, D.C.
1969 - 1970	Senior Staff Associate, Environmental and Natural Resources, President's Advisory Council on Executive Organization, Washington, D.C.
1968 - 1969	Senior Associate, Marshall Kaplan, Gans and Kahn, San Francisco, California (Urban policy planning firm)
1967	Associate, Kelso, Cotton, Seligman and Ray, San Francisco, California
1965 - 1967	Attorney, Economic Development Administration, U.S. Department of Commerce, Washington, D.C.
1964 - 1965	Trial Attorney, Civil Rights Division, U.S. Department of Justice, Washington, D. C.

PROFESSIONAL
AFFILIATIONS:

Member of Bars of State of California
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Precis of Curriculum Vitae

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Education: Ph.D.: University of California, Berkeley, 1959. (Phys. Chemistry)
A.B.: Cornell University, 1956 (With honors in chemistry)

Awards: State University of New York Chancellor's Award for Excellence in Teaching 1979

Texaco Fellowship in Chemistry 1958, 1959

Honorary Societies: Phi Beta Kappa, Sigma Xi.

Employment: Associate Professor of Chemistry, State University of New York at Stony Brook, 1967-present. Assistant Professor, 1959-1967. Consultant to Energy Systems Research Group, (a-nonprofit research and consulting firm) on energy demand and environmental effects of various energy producing technologies. Legal consultant on chemical and fire safety hazards and product liability. Visiting Professor, Center for the Biology of Natural Systems, Queens College, 1981-82.

Teaching Experience: Director of Department of Energy sponsored Faculty Development Program for High School Teachers (1980).

Developed a course on environmental effects of chemical technology about one-third of which is focused on energy-related technologies including nuclear power, fossil fuels and solar energy.

Participating teacher in Federated Learning Communities program on technology, values and society.

Has taught a course on materials and methods in the teaching of chemistry and physics.

Has taught freshmen seminars on science and social values and on the role of the contemporary American university.

Has also taught a wide variety of undergraduate and graduate lecture and laboratory courses in the fields of spectroscopy, physical chemistry and general chemistry.

Research: Has performed research funded by the National Science Foundation, Air Force Office of Scientific Research and the Research Foundation of the State University of New York on vibrational spectroscopy, flash photolysis, photochemistry, and energy technologies. Co-leader of delegation invited to study scientific planning in the Peoples Republic of China during the summer of 1978. Present research is on the environmental effects of various energy-related technologies and agricultural practices.

Publications: Has published over twenty research papers in refereed scientific journals in the fields of vibrational spectroscopy, chemical kinetics and photochemistry. Has authored several articles in newspapers and popular journals on energy technologies and on scientific planning in China.

Coauthor of a textbook, A Search for Order in the Physical Universe, W.H. Freeman, San Francisco (1974). Russian translation published in Moscow (1977). Presently editing a text on controversial environmental issues for Dushkin Publishing Group.

Public Service: Frequent lecturer and participant in forums at local colleges, civic and community organizations and television and radio shows on energy demand, alternate energy, environmental effects of energy strategies, and science and social values. Guest lecturer on energy development in China at 1979 National Conference of the U.S. China Peoples' Friendship Association, Detroit, Michigan. Member of advisory committee on Solid Waste Disposal for the Town of Hempstead, N.Y.

Organizational Affiliations: American Chemical Society, American Association for the Advancement of Science, Science for the People, Port Jefferson Safe Energy Group, Member of Board of Directors of the Shoreham Opponents Coalition, and Member of Board of Directors of the Safe Energy Resource Center.

Dioxin Experience

Dr. Raymond D. Harbison is Professor and Director of the Interdisciplinary Toxicology Program at the University of Arkansas for Medical Sciences and the National Center for Toxicological Research. He conducts basic research on the toxicological effects of dioxins and has reviewed many health and safety and environmental matters concerned with dioxin contamination. Dr. Harbison has recently completed a study which identified some of the metabolites of dioxin using animal models. He serves as a member of the National Institute of Occupational Safety and Health advisory group. In this capacity he has reviewed many proposals for the study of the effects of dioxins on workers as well as studies to investigate the efficacy of protective equipment against dioxin penetration. Dr. Harbison also serves as a consultant to the U.S. Environmental Protection Agency. During the past 5 years he has reviewed site safety plans and safety procedures for management of dioxin contamination at hazardous waste sites and when incidentally found at hazardous material spills. He served on the Health and Safety Advisory Committee which recommended the safety procedures to be used while investigating the Times Beach dioxin contamination. He also assessed the risk associated with the dioxin contamination at Verona, Missouri (Denny Farm Site). Further he has directed the medical monitoring program for field personnel investigating hazardous waste sites contaminated with dioxin. He has also written reviews on the subject area of the general toxicity of chlorinated biphenyls and dioxin contaminants. Dr. Harbison has written more than 100 scientific papers and has an international reputation in the field of toxicology.

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Curriculum Vitae

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 Decatur, Georgia 30030

Family: Spouse: Janet
 Children: Thomas
 Andrew
 Mary

Education

A.B., Oberlin College, Oberlin, Ohio, 1954

M.D., Johns Hopkins University School of Medicine, Baltimore, Maryland, 1958

Professional Training

Intern and resident in internal medicine, Boston City Hospital, II and IV Medical Services (Harvard), Boston, Massachusetts, 1958-1960

Epidemic Intelligence Service (EIS) Officer, U.S. Public Health Service, Communicable Disease Center, Atlanta, Georgia, 1960-1962

Resident in internal medicine, Boston City Hospital, II and IV Medical Services (Harvard), Boston Massachusetts, 1962-1963

Research Fellow, Tufts Hematology Laboratory, Boston City Hospital, Boston, Massachusetts, 1963-1965

Career Positions

Chief, Leukemia Section, Epidemiology Program, Center for Disease Control (CDC), Atlanta, Georgia, 1965-1972

Deputy Chief, Viral Diseases Branch, Epidemiology Program, CDC, 1968-1972

Chief, Cancer and Birth Defects Branch, Epidemiology Program, CDC, 1972-1975

Director, Chronic Diseases Division, Bureau of Epidemiology, CDC, 1975-1980

Director, Chronic Diseases Division, Center for Environmental Health, Centers for Disease Control, 1980-1982

Program Development Officer, Office of the Director, Centers for Disease Control, 1982 -

Academic Appointments

Assistant in Medicine, Harvard Medical School, Boston, Massachusetts,
1962-1963

Clinical Associate, Tufts University School of Medicine, Boston,
Massachusetts, 1963-1965

Clinical Instructor in Medicine, Emory University School of Medicine,
Atlanta, Georgia, 1965-1971

Clinical Assistant Professor of Medicine, Emory University School of
Medicine, 1971-

Clinical Assistant Professor of Preventive Medicine, Emory University School
of Medicine, 1971-1980

Clinical Associate Professor, Community Health, Emory University School
of Medicine, 1981-

Visiting Professor, University of Minnesota, School of Public Health,
Summer, 1981, 1982

Professional Organizations

American Association for the Advancement of Science
American Federation for Clinical Research
American Medical Association
American Public Health Association
National Scientific Research Society of America
Society for Epidemiologic Research
American Epidemiological Association
International Epidemiological Association

Boards

Georgia State Board of Medical Examiners
Qualifications completed, American Board of Internal Medicine
Fellow, American College of Epidemiology, 1981

Awards

PHS Meritorious Service Medal, HEW, May 19, 1978
HEW Certificate of Appreciation, March 15, 1979
PHS Certificate of Appreciation, 1979
CDC Medal of Excellence, 1979

Committees, Work Groups, and Consultations

Consultant, World Health Organization (WHO), Work Group on alpha chain
disease, 1975
Contributing author: "Alpha-chain Disease and Related Small-Intestinal
Lymphoma: a Memorandum," Bull WHO 54:615-624, 1976

Consultant, WHO, Epidemiology of alpha chain disease, Iran and Algeria,
October 1976

Committees, Work Groups and, Consultations (continued)

Member, Second Task Force for Research Planning in Environmental Health, 1976

Author: Environmental health surveillance (background document for the Task Force)

Member, Epidemiology Work Group, Breast Cancer Task Force, National Cancer Institute, 1976-1978

Chairperson, Subcommittee on Polybrominated Biphenyls, Committee to Coordinate Environmental and Related Programs within the Public Health Service (CCERP), U.S. Public Health Service (USPHS), 1976-1978

Member, Task Force on Environmental Cancer and Heart and Lung Disease, 1978

Chairperson, Work Group on Science, Interagency Taskforce on the Health Effects of Ionizing Radiation, 1978-1979

Principal author: Report of the Work Group on Science, Interagency Task Force on the Health Effects of Ionizing Radiation. U.S. Department of Health, Education, and Welfare, June 1979, Washington, D.C., 132 p

Member, Interagency Radiation Research Committee (IRRC) (U. S. Government), 1979 -

Chairperson: IRRC study group to evaluate research proposals to study delayed health effects of fall-out radiation in Utah/Nevada/Arizona (1980).

Chairperson, Subcommittee on the Use of Long-term Registries for Health Followup of Populations Exposed to Toxic Hazards, CCERP, USPHS, 1981

Member, Steering Committee, Conference on Guidelines for Studies of Human Populations Exposed to Mutagenic and Reproductive Hazards, 1981

Chairperson, USPHS panel to advise the Environmental Protection Agency concerning health implications of environmental toxicologic testing at Love Canal, 1981 - 1982

Consultant, WHO, concerning epidemic in Spain of "toxic allergic syndrome" associated with cooking oil use, 1981, 1983

Experience in Teaching Epidemiology

Responsibility for teaching principles of chronic disease and analytic epidemiology in the annual Epidemic Intelligence Service course, CDC, 1972- (includes preparation of CDC syllabus entitled "Principles of Analytic Epidemiology" and several teaching exercises for class participation)

Prepared and taught a 3-week course in environmental epidemiology, University of Minnesota, summer 1981, 1982

Periodic lectures and class exercises, Emory University School of Medicine, 1965-

PUBICATIONS

1. Galton MM, Menges RW, Shotts EB Jr, Nahmias AF, Heath CW Jr: Lepto-spirosis: epidemiology, clinical manifestations in man and animals and methods in laboratory diagnosis. Public Health Service Publications, No. 951, 70 p, U.S. Government Printing Office, Washington, 1962.
2. Doege TC, Heath CW Jr, Sherman IL: Diphtheria in the United States, 1959-1960. Pediatrics 1962; 30:194-205.
3. Heath CW Jr, Zusman J: An outbreak of diphtheria among skid-row men. New Engl J Med 1962; 267:809-12.
4. Doege TC, Levy PS, Heath CW Jr: A diphtheria epidemic related to community immunization levels and the health problems of migrant workers. Public Health Reports 1963; 78:151-60.
5. Heath CW Jr, Hasterlik RJ: Leukemia among children in a suburban community. Am J Med 1963; 34:796-812.
6. Heath CW Jr, Zusman J, Sherman IL: Tetanus in the United States, 1950-1960. Am J Public Health 1964; 54:769-79.
7. Heath CW Jr, Manning MD, Zelkowitz L: Case clusters in the occurrence of leukemia and congenital malformations. Lancet 1964; 2:136-7.
8. Heath CW Jr, Moloney WC: Familial leukemia. Five cases of acute leukemia in three generations. New Engl J Med 1965; 272:882-7.
9. Fine RN, Wang MYFW, Heath CW Jr: Nuclear projections of neutrophils in the 13-15 trisomy syndrome. Pediatrics 1965; 35:712-4.
10. Heath CW Jr, Alexander AD, Galton MM: Leptospirosis in the United States. Analysis of 483 cases in man, 1949-1961. New Engl J Med 1965; 273:857-64, 915-22.
11. Heath CW Jr, Moloney WC: The Philadelphia chromosome in an unusual case of myeloproliferative disease. Blood 1965; 26:471-8.
12. Heath CW Jr, Moloney WC: Cytogenetic observations in a case of erythremic myelosis. Cancer 1965; 18:1495-504.
13. Heath CW Jr: Cytogenetic observations in vitamin B12 and folate deficiency. Blood 1966; 27:800-15.
14. Heath CW Jr: Epidemic leukaemia in man: community patterns of leukaemia occurrence. Proc XIth Cong of the Int Soc Haem, 1966, Sydney, pp 194-6.
15. Heath CW Jr: The significance of leukemia clusters. Hospital Practice 1968; 3:64-70.

16. Heath CW Jr: Formal discussion: epidemiology of acute leukemia and Burkitt's tumor. *Cancer Res* 1967; 27 (Part 1):2439-40.
17. Heath CW Jr, Bennett JM, Whang-Peng J, Berry EW, Wiernik PH: Cytogenetic findings in erythroleukemia. *Blood* 1969; 32:453-67.
18. Ebbin AJ, Heath CW Jr, Moldow RE, Lee J: Down's syndrome and leukemia in a family. *J Pediat* 1968; 73:917-20.
19. Falek A, Heath CW Jr, Ebbin AJ, McLean WR: Unilateral limb and skin deformities with congenital heart disease in two siblings: a lethal syndrome. *J Pediat* 1968; 73:910-3.
20. McPhedran P, Heath CW Jr, Lee J: Patterns of familial leukemia: ten cases of leukemia in two interrelated families. *Cancer* 1969; 24:403-7.
21. McPhedran P, Heath CW Jr: Multiple cases of leukemia associated with one house. *J Am Med Assoc* 1969; 209:2021-5.
22. Chen ATL, Ebbin AJ, Schimpeler S, Heath CW Jr, Falek A: Birth weight and mortality in Down's syndrome infants. *Soc Biol* 1969; 16:290-1.
23. McPhedran P, Heath CW Jr: Acute leukemia occurring during chronic lymphocytic leukemia. *Blood* 1970; 35:7-11.
24. McPhedran P, Heath CW Jr, Garcia JS: Racial variations in leukemia incidence among the elderly. *J Nat Cancer Inst* 1970; 45:25-8.
25. Heath CW Jr: Human leukemia: genetic and environmental clusters. *Bibl Haemat* 1970; 36:649-53.
26. Heath CW Jr, Alexander AD: Leptospirosis. In Volume II, Brennenman's Textbook of Pediatrics. Hagerstown, Harper and Row, 1970, pp 2-5.
27. Kyle RA, Herber L, Evatt BL, Heath CW Jr: Multiple myeloma: a community cluster. *J Am Med Assoc* 1970; 213:1339-41.
28. Potolsky AI, Heath CW Jr, Buckley CE III, Rowlands DT Jr: Lymphoreticular malignancies and immunologic abnormalities in a sibship. *Am J Med* 1971; 50:42-8.
29. Heath CW Jr: Epidemiologic implications of feline leukemia virus. *J Am Vet Med Assoc* 1971; 158:1119-22.
30. Evatt BL, Dowdle WR, Johnson M Jr, Heath CW Jr: Epidemic mycoplasma pneumonia. *New Engl J Med* 1971; 285:374-8.
31. Kyle RA, Heath CW Jr, Carbone P: Multiple myeloma in spouses. *Arch Intern Med* 1971; 127:944-6.

32. Heath CW Jr, Brodsky AL, Potolsky AI: Infectious mononucleosis in a general population. *Am J Epidemiol* 1972; 95:46-52.
33. McPhedran P, Heath CW Jr, Garcia J: Multiple myeloma incidence in metropolitan Atlanta, Georgia: racial and seasonal variations. *Blood* 1972; 39:866-73.
34. Brodsky AL, Heath CW Jr: Infectious mononucleosis: epidemiologic patterns at United States colleges and universities. *Am J Epidemiol* 1972; 96:87-93.
35. Heath CW Jr: Epidemiology of Hodgkin's disease (editorial). *Ann Intern Med* 1972; 77:313-4.
36. Heath CW Jr: Cancer as a sequel to therapy (editorial). *New Engl J Med* 287:1146-7.
37. Larsen RJ, Holmes CL, Heath CW Jr: A statistical test for measuring unimodal clustering. A description of the test and of its application to cases of acute leukemia in metropolitan Atlanta, Georgia. *Biometrics* 1973; 29:301-9.
38. Evatt BL, Chase GA, Heath CW Jr: Time-space clustering among cases of acute leukemia in two Georgia counties. *Blood* 1973; 41:265-72.
39. Heath CW Jr, Evatt BL: Observations concerning the time-space distribution of childhood acute leukemia in DeKalb County, Georgia. *Trace Substances in Environmental Health VI*, 1973; pp 23-7.
40. Heath CW Jr: Sick pets and human leukemia (editorial). *Ann Intern Med* 1973; 78:605.
41. Falletta JM, Fernbach DJ, Singer DB, South MA, Landing BH, Heath CW Jr, Shore NA, Barrett FF: A fatal X-linked recessive reticuloendothelial syndrome with hyperglobulinemia. *J Pediat* 1973; 83:549-56.
42. Heath CW Jr: Current epidemiologic evidence regarding known or suspected oncogenic viruses in relation to human cancer. In Hellman A, Oxman MN, Pollack R (eds): *Biohazards in Biological Research*. Cold Spring Harbor Laboratory, 1973, pp 205-8.
43. Brown TM Jr, Heath CW Jr: Time-space clustering among cases of Burkitt's tumor. *Cancer Res* 1974; 34:1216-8.
44. Falk H, Creech JL Jr, Heath CW Jr, Johnson MN, Key MM: Hepatic disease among workers at a vinyl chloride polymerization plant. *J Am Med Assoc* 1974; 230:59-63.
45. Randolph VI, Heath CW Jr: Influenza during pregnancy in relation to subsequent childhood leukemia and lymphoma. *Am J Epidemiol* 1974; 100:399-409.

46. Heath CW Jr, Falk H, Creech JL Jr: Characteristics of cases of angiosarcoma of the liver among vinyl chloride workers in the United States. *Ann NY Acad Sci* 1975; 246:231-6.
47. Heath CW Jr, Flynt JW Jr, Oakley GP Jr, Falek A: The role of birth defect surveillance in control of fetal environmental hazards. *Postgrad Med J (Suppl 2)* 1975; 51:69-77.
48. Heath CW Jr: Epidemiology of leukemia. In Schottenfeld D (ed): *Cancer Epidemiology and Prevention: Current Concepts*. Springfield, CC Thomas, 1975, pp 318-50.
49. Heath CW Jr, Caldwell GG, Feorino PC: Viruses and other microbes. In Fraumeni JF Jr (ed): *Persons at High Risk of Cancer. An Approach to Cancer Etiology and Control*. New York, Academic Press, 1975, pp 241-64.
50. Heath CW Jr: Hereditary factors in leukemia and lymphoma. In Lynch HT (ed): *Cancer Genetics*. Springfield, CC Thomas, 1976, pp 233-48.
51. Caldwell GG, Heath CW Jr: Case clustering in cancer. *Southern Med J*, 1976; 69:1598-602.
52. Brown TM Jr, Heath CW Jr, Lang RM, Lee SK, Whalley BW: Nasopharyngeal cancer in Bermuda. *Cancer* 1976; 37:1464-8.
53. Heath CW Jr: Epidemiologic implications of animal leukemia virus models for the human situation. *Cancer Res* 1976; 36:589-90.
54. Levine PH, Connelly R, Heath CW Jr, Caldwell GG, Terasaki PI, Mickey MR, Fabrizio P: An evaluation of antibody titers to the Epstein-Barr as a test for susceptibility to cancer. *Proc 3rd Int Symp on Detection and Prevention of Cancer*, New York, 1976, pp 1525-37.
55. Heath CW Jr: Carcinogens of industrial origin: occupational and non-occupational risks. In Nieburg HE (ed): *Proceedings of the Third International Symposium on Detection and Prevention of Cancer*. New York, Marcel Dekker, 1977.
56. Heath CW Jr, Dumont CR, Gamble J, Waxweiler RJ: Chromosomal damage in men occupationally exposed to vinyl chloride monomer and other chemicals. *Environ Res* 1977; 14:68-72.
57. Zack MM Jr, Heath CW Jr, Andrews MD, Grivas SA Jr, Christine BW: High school contact among persons with leukemia and lymphoma. *J Natl Cancer Inst* 1977; 59:1343-9.
58. Carter CD, Brown TM Jr, Herbert JT, Heath CW Jr: Cancer incidence following infectious mononucleosis. *Am J Epidemiol* 1977; 105:30-6.
59. Heath CW Jr: Industrial toxins and the community. Introductory comments. 37th Annual AMA Congress on Occupational Health, 1977.

60. Harrington JM, Blot WJ, Hoover RN, Housworth WJ, Heath CW Jr, Fraumeni JF Jr: Lung cancer in coastal Georgia: a death certificate analysis of occupation: brief communication. *J Natl Cancer Inst* 1978; 60:295-8.
61. Heath CW Jr: Environmental pollutants and the epidemiology of cancer. *Environ Health Perspect* 1978; 27:7-10.
62. Blot WJ, Harrington JM, Toledo A, Hoover R, Heath CW Jr, Fraumeni JF Jr: Lung cancer after employment in shipyards during World War II. *New Engl J Med* 1978; 299:620-4.
63. Landrigan PJ, Wilcox KR Jr, Silva J Jr, Humphrey HEB, Kauffman C, Heath CW Jr: Cohort study of Michigan residents exposed to polybrominated biphenyls: epidemiologic and immunologic findings. *Ann NY Acad Sci* 1979; 320:284-94.
64. Silva J, Kauffman CA, Simon DG, Landrigan PJ, Humphrey HEB, Heath CW Jr, Wilcox KR Jr, Van Arnborg G, Kaslow RA, Ringel A, Hoff K: Lymphocyte function in humans exposed to polybrominated biphenyls. *J Reticuloend Soc* 1979; 26:341-7.
65. Caldwell GG, Kelley DB, Heath CW Jr: Leukemia among participants in military maneuvers at a nuclear bomb test (Smoky). A preliminary report. *J Am Med Assoc* 1980; 244:1575-8.
66. Zack MM Jr, Heath CW Jr: Epidemiology and the 1980 census (editorial). *Ann Int Med* 1980; 92:562-3.
67. Zack M, Cannon S, Loyd D, Heath CW Jr, Falletta JM, Jones B, Housworth J, Crowley S: Cancer in children of parents exposed to hydrocarbon-related industries and occupations. *Am J Epidemiol* 1980; 111:329-36.
68. Landrigan PJ, Kreiss K, Xintaras C, Feldman RG, Heath CW Jr: Clinical epidemiology of occupational neurotoxic disease. *Neuro Behav Toxicol* 1980; 2:43-8.
69. Heath CW Jr, Caldwell GG: Animal malignancies and their relation to public health. In Steele JH and Beran GW (eds): *Handbook of Zoonoses, Vol II: The Viral Zoonoses*. Boca Raton, CRC Press, 1981, pp 439-49.
70. Falk H, Herbert JT, Edmonds L, Heath CW Jr, Thomas LB, Popper H: Review of four cases of childhood hepatic angiosarcoma. Elevated environmental arsenic exposure in one case. *Cancer*, 1981; 47:382-91.
71. Heath CW Jr: The leukemias. In Schottenfeld D, Fraumeni J Jr (eds): *Cancer Epidemiology and Prevention*. Philadelphia, WB Saunders, 1982, pp 728-38.

72. Kimbrough RD, Taylor PR, Zack MM, Heath CW Jr: Studies of human populations exposed to environmental chemicals. Considerations of Love Canal. In Assessment of Multichemical Contamination: Proceedings of an International Workshop (Milan, Italy, April 1981). Washington, National Academic Press, 1982, pp 289-306.
73. Caldwell GG, Heath CW Jr: Surveillance of infectious mononucleosis cases by use of existing data from state laboratories. Public Health Rep 1982; 97:579-82.
74. Heath CW Jr: Epidemiology of dump exposures. In Finberg L, Miller RW (eds): Chemical and Radiation Hazards to Children. Report of the Eighty Fourth Ross Conference on Pediatric Research. Columbus, Ross Laboratories, 1982, pp 10-6.
75. Heath CW Jr: Carcinogenic effects of chemical and physical agents. Human observations. In Dardanoni L, Miller RW (eds): Plans for Clinical and Epidemiologic Follow-up after Area-wide Chemical Contamination. Proceedings of an International Workshop, Washington, DC, March 17-19, 1980. Washington, National Academy Press, 1982, pp 195-203.
76. Heath CW Jr: Epidemiology of gastrointestinal lymphomas. In Correa P, Haenszel W (eds): Epidemiology of Cancer of the Digestive Tract. Martinus Nijhoff, 1982, pp 148-59.
77. Heath CW Jr: Leukemogenesis and low-dose exposure to radiation and chemical agents. In Yohn DS, Blakeslee JR (eds): Advances in Comparative Leukemia Research 1981. New York, Elsevier, 1982, pp 23-9.
78. Heath CW Jr: Field epidemiologic studies of populations exposed to waste dumps. Envir Health Perspect, in press.
79. Heath CW Jr: Pollution. McGraw Hill Year Book of Science and Technology, in press.
80. Heath CW Jr: Occupational and environmental diseases. Funk and Wagnalls New Encyclopedia, in press.
81. Heath CW Jr, Evatt BL: Haematopoietic diseases. In Holland W, Detels R, Knox G (eds): Textbook of Public Health. Oxford, Oxford University Press, in press

Abstracts, Letters, Presentations

1. Heath CW Jr, Manning MD: Leukemia outbreaks? Lancet 1964; 1:1394.
2. Heath CW Jr, Moloney WC: Familial leukemia: five cases of myelocytic leukemia in three generations. Xth Cong of Int Soc Hemat, 1964.
3. Heath CW Jr: Cytogenetic observations in pernicious anemia and folic acid deficiency. Clin Res 1965; 13:275.
4. Wang MYFW, Heath CW Jr, Desforages JF: Galactose-1-phosphate uridyl transferase in chronic myelogenous leukemia. Clin Res 1965; 13:341.
5. Heath CW Jr: Cytogenetic findings in the blast phase of chronic granulocytic leukemia. Meeting of the Commissioned Officer's Association, USPHS, 1967.
6. Heath CW Jr. Book review (Racial and geographical factors in tumour incidence) New Engl J Med 1968; 278:568-9.
7. Potolsky AI, Heath CW Jr: Familial leukemia and lymphoma. 96th Annual Meeting of the APHA, 1968. Also in Clin Res 1969; 17:33.
8. McPhedran P, Heath CW Jr: Patterns of familial leukemia. Clin Res 1969; 17:335.
9. Potolsky AI, Heath CW Jr, Buckley CE III, Rowlands DT Jr: Immunologic studies in familial leukemia. Clin Res 1969; 17:338.
10. Heath CW Jr, Falek A: Surveillance of birth defects in metropolitan Atlanta, Georgia. 3rd International Conference on Congenital Malformations, 1969.
11. Falletta JM, Fernbach DJ, Singer DB, Shore NA, Landing B, Heath CW Jr: An X-linked recessive "malignant" reticuloendotheliosis. Soc for Ped Res, 1970.
12. McPhedran P, Heath CW Jr: Incidence of multiple myeloma: racial and seasonal variations. Am Soc of Hemat, 1970.
13. Oakley GP Jr, Ebbin AJ, Flynt JW Jr, Schimpeler S, Falek A, Heath CW Jr: Incidence of Down's syndrome (mongolism) in Atlanta, 1960-69. Teratology Society, 1971.
14. Falek A, Flynt JW Jr, Heath CW Jr, Freeman M, Schwartz J: Comparison of congenital malformations between white and black newborns in Atlanta, Georgia. Int Cong of Human Genetics, 1971.
15. Flynt JW Jr, Heath CW Jr: Surveillance of congenital malformations: problems and perspective. Am Public Health Assoc, 1971.

16. Heath CW Jr, Rosenstock JG, Lobdell G: An epidemic of Hodgkin's disease? Lancet 1971; 2:426-7.
17. Heath CW Jr: Clusters of leukemia and Hodgkin's disease. New Engl J Med 1971; 285:1146-7.
18. Heath CW Jr, Rosenstock JG, O'Connor DM, Goldenson RH: Time-space clusters in childhood leukemia and lymphoma. XIV Int Cong of Haemat, 1972.
19. Heath CW Jr, Everett JR II, Stewart JR, Daines J, Daines PH: Clustering in Hodgkin's disease. Lancet 1973; 1:669-70.
20. Falk H, Heath CW Jr, Fernbach DJ, Falletta JM: Incidence of childhood leukemia. Lancet 1973; 2:862.
21. Falk H, Heath CW Jr, Carter CD, Wagoner JK, Warweiler RJ, Stringer WT: Mortality among vinyl-chloride workers. Lancet 1974; 2:784.
22. Stoopler MB, Caldwell GG, Housworth WJ, Heath CW Jr: Sibship size and Hodgkin's disease. New Engl J Med 1975; 292:1025.
23. Morse DL, Harrington JM, Heath CW Jr: Laetrile, apricot pits and cyanide poisoning. New Engl J Med 1976; 295:1264.
24. Zack M, Heath CW Jr, Isbister JL, Van Amberg G: Re "a cluster of Hodgkin's disease in a small community." Am J Epidemiol 1979; 109:621-2.
25. Heath CW Jr: Epidemiologic studies at Love Canal. Am Public Health Assoc, Detroit, 1980.
26. Heath CW Jr: Applying epidemiology to public health. Presented at Symposium Honoring Alexander D. Langmuir, University of Texas School of Public Health, 1982.
27. Heath CW Jr: The Spanish toxic syndrome. Am Epidemiol Soc, 1982.

CURRICULUM VITAE

Otto Hutzinger

Address: work

Chair of Ecological Chemistry
and Geochemistry
University of Bayreuth
Postfach 3008
D-8580 Bayreuth
Germany

home

Friedenstraße 10
D-8580 Bayreuth
Germany

14-3-1933 born in Vienna, Austria

1947-1952 Polytechnic for Chemical Industry and Trade
(Vienna Austria)

1952-1958 EBEWE Drug Co., Austria

1958 Emigration to Canada

1963 M.Sc. (Chemistry) University of Saskatchewan

1965 Ph.D. (Chemistry) Univ. of Saskatchewan

1965 Canadian Citizen

1965-1967 NIH-postdoctoral fellow in Biochemistry, Dept. of
Plant Pathology, Univ. of California, Davis

1967-1974 Scientist, National Research Council of Canada,
Halifax

1973-1974 Sabbatical leave, Technical University of Munich,
Institute of Ecological Chemistry

1974-1983 Professor and Director, Laboratory of Environmental
and Toxicological Chemistry, University of Amsterdam

Since 1983 Professor, Chair of Ecological Chemistry and Geo-
chemistry, University of Bayreuth, Germany.

Otto Hutzinger: Activities related to polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF).

Since 1971 research on PCDD and PCDF

1977 first report on PCDD and PCDF in incinerator effluents resulting from work in my Amsterdam laboratory

1979 250.000 hfl grant from Dutch Ministry of the Environment to work on PCDD and PCDF in incinerator effluents

1980 expert witness on PCDD during 2,4,5-T cancellation hearings in Washington

Since 1980 on Organizing Committee for "International Symposium on Chlorinated Dioxins and Related Compounds". 1980 Rome (chairman and editor of proceedings), 1981 Washington, 1982 Salzburg (chairman and editor of proceedings), 1984 Ottawa, 1985 Bayreuth.

1981 Panel on PCDD, National Research Council of Canada (external advisor)

1982 Health and Welfare Canada / Environment Canada Advisory Committee on Dioxins (external advisor)

June 1983 Expert Group, Ministry of the Environment Rheinland Pfalz on PCDD-containing waste dump Biebelshausen

July 1983 Peer Review workshop on Dioxin Documents for the US-EPA (panel member)

Summer 1983 Advisor to industrial client on PCDD and PCDF formation in wood burning operation

Since July 1983 Ontario Scientific Advisory Committee on
Dioxins and Furans (Committee Member)

Sept. 1983 Conference on Health Effects of PCB (invited
paper on thermal formation of PCDF and PCDD)

Dec. 1983 Dioxins in the Environment, Michigan State
University (invited speaker)

Feb. 1984 400.000 DM grant from the German EPA, on
formation of PCDD and PCDF in industrial
processes

RÉSUMÉ

LOUIS JOSEPH THIBODEAUX
Professor of Chemical Engineering
University of Arkansas
Fayetteville, AR 72701
Phone (501) 575-4951

PERSONAL DATA

Date of birth: November 13, 1939
Place of birth: Church Point, Louisiana
Home address: 1441 Oak Manor Dr., Fayetteville, AR
Home phone: (501) 521-3837
Wife: Elwana Joyce Lasiter
Place of birth: Wewoka, Oklahoma
Children: Jason Scott born Aug. 8, 1961
Michelle Renee born April 21, 1964
Hobbies: sailing, history, travel, hunting, country music
Social Security No.: [REDACTED]

EDUCATION

Ph.D., Chemical Engineering, Louisiana State University, 1968
M.S., Chemical Engineering, Louisiana State University, 1966
B.S., Petroleum-Chemical Engineering, Louisiana State University, 1962
(five-year course equivalent to separate degrees in each discipline).

PROFESSIONAL EXPERIENCE

Academic

Professor of Chemical Engineering, University of Arkansas; July 1977 to present
Visiting Professor of Chemical Engineering, University of Exeter, Exeter, England; January to June 1983
Associate Professor of Chemical Engineering, University of Arkansas; July 1972 to July 1977
Visiting Professor of Chemical Engineering, Oregon State University; August 1974 to January 1975
Assistant Professor, Chemical Engineering, University of Arkansas; January 1968 to July 1972
Assistant Professor, Civil Engineering (Environmental), University of Arkansas; Summer 1969, 1971
Research Assistant, National Council for Air and Stream Improvement, Division Engineering Research; Louisiana State University, Baton Rouge; June 1965 to February 1968
Research Assistant, Institute of Saline Studies, Division Engineering Research Louisiana State University, Baton Rouge; September 1964 to June 1965.

Consulting and Expert Witnessing

Great Lakes Chemical, El Dorado, AR, 1983
U.S. Corps of Engineers, Tacoma, WA, 1983
Ethyl Corporation, Baton Rouge, LA, 1983
Ethyl, Exxon, Dow, Petroprocessor vs USEPA, Baton Rouge, LA, 1983
Arkansas Department Pollution Control and Ecology, USEPA vs Vertac
Chemical, Little Rock, AR, 1979-1980
Exxon Research and Engineering Company, Florham Park, NJ, 1979
ESCOM Laboratory, Fayetteville, Arkansas, 1979
McClelland Consulting Engineers, Fayetteville, Arkansas, 1979
Monsanto Chemical Company, El Dorado, Arkansas, 1976
Zero Mountain, Johnson, Arkansas, 1972
Northwest Arkansas Regional Planning Commission, Springdale, Arkansas,
1971-72
Daisy/Heddon, Rogers, Arkansas, 1971
National Rejectors, Industries, Hot Springs, Arkansas, 1971
Georgia Kraft Company, Rome Georgia, 1968-70

Full-time and Summer

International Paper Company, Natchez, MI; Summer, 1970
Georgia Kraft Company (Mead Corporation), Rome GA; Summer 1968 and 1969
National Council Air and Stream Improvement, Baton Rouge, LA; Summers
1965, 1966, and 1967
U.S. Rubber Company, Scotts Bluff, LA; Summer 1964
E. I. duPont de Nemours and Company; Aiken, S.C.; June 1962 to February
1964

Organizations Memberships

American Institute of Chemical Engineers
Technical Session Chair: Philadelphia, 1984;
Washington, D.C., 1983; Tulsa, OK, 1974
Environmental Division Officer
Second Vice Chair, 1984
Treasurer, 1982 and 1983
Secretary, 1982
American Chemical Society
Technical Session Chair: Miami, 1985, San Francisco, 1976
American Water Resources Association
Meeting Program Chair (Ark. Section), 1972-1975
President (Ark. Section), 1975
American Association Advancement of Science
American Association University Professors
Air Pollution Control Association
American Society Engineering Education
Society of Environmental Toxicology and Chemistry

Registrations

Arkansas No. 4114
Louisiana No. 11762

TEACHING AND EDUCATION EXPERIENCE

Undergraduate Courses (last 5 years)

- Chemical Processes and Kinetics
- Mass Transfer Principles
- Mass Transfer Applications

Graduate Courses (last 5 years)

- Advanced Mathematics for Chemical Engineers
- Transport Phenomena (Mass)
- Advanced Reactor Design
- Environmental Chemical Engineering (Chemodynamics)

Graduate Research Advisor

- Thesis advisor to 28 Masters Degree students
- Dissertation advisor to 4 Ph.D. Degree students

Continuing Education

- 4 Environmental Chemical Engineering courses (1969, 1971, 1979, 1981)
- 13 Chemodynamics short courses (1981, 1982, 1983)
- 6 under AIChE sponsorship
- 7 under University Missouri-Columbia sponsorship

Committees and University Service

- University Committees and Related Activities
 - Student Relations Committee-member
 - Hazardous Waste Committee-member
 - UA Chapter EXi-president
 - UA Chapter EXi-White paper to President of UA on Research-co-author
 - ORSP/EXi Research Proposal-Writing Seminar/Workshop-March 14-15, 1977 co-chairman
 - University Research Council-member
 - Graduate Council-member

College of Engineering Committees

- Service Course Committee
- Tenure Committee
- Computer Use (ad hoc)
- Graduate curriculum committee
- Engineering Math (ad hoc)

Department of Chemical Engineering

- Department Directions in Research (ad hoc)
- Graduate Studies-co-chairman

CONTRIBUTIONS TO TECHNICAL LITERATURE

Doctoral Dissertation

"Ion-Exchange Resin Diffusion Coefficient and Resin Phase Ion Diffusivities", Jesse Coates, Advisor, Louisiana State University, Baton Rouge, 1968.

Book

CHEMODYNAMICS - Environmental Movement of Chemicals in Air, Water, and Soil, John Wiley, New York, (1979), 501 p.

Book Chapters

Thibodeaux, L. J., Chapter entitled: Chemodynamics, in the Handbook of Environmental Chemistry, Vol 2C, O. Hutzinger, Editor, Springer-Verlag, Berlin, WG (1984?)

Thibodeaux, L. J., and H. D. Scott, Chapter 4, Air/Soil Exchange Coefficients, in Environmental Exposure from Chemicals, W. Brock Neely and G. E. Blau, Editors, CRC Press, Inc., Boca Raton, FL (1984?)

Thibodeaux, L. J., C. Springer and S. Chatrathi, Chapter 17, Simulation Study of the Volatilization of Polychlorinated Biphenyls from Landfill Disposal Sites, in Environmental and Solid Waste, C.W. Francis and S.I. Auerbach, Editors, Butterworth Publishers, Woburn, MA (1983).

Thibodeaux, L. J., Chapter 5, Offsite Transport of 2,3,7,8-Tetrachlorodibenzo-p-dioxin from a Production Disposal Facility, in Chlorinated Dioxins and Dibenzofurans in the Total Environment, G. Choudhary, L. H. Keith and C. Rappe, Editors, Butterworth Publishers, Woburn, MA (1983).

Thibodeaux, L. J., L. K. Chang, D. J. Lewis, "Dissolution Rates of Organic Contaminants Located at the Sediment Interface of Rivers Streams, and Tidal Zones," Chapter 16 in Contaminants and Sediments, Vol. 1, R. A. Baker, Ed., Ann Arbor Science, Michigan, (1980).

Journal Articles

Thibodeaux, L. J., D. G. Parker and H. Heck, "A Flux Measurement Technique of Volatile Chemical Emissions from Surface Impoundments," Environmental Progress (accepted 11/17/83).

Hwang, S., and L. J. Thibodeaux, "Measuring Volatile Chemical Emission Rates from Large Waste Disposal Facilities," Environmental Progress, Vol. 2, No. 2, May 1983, p. 81.

Thibodeaux, L. J., and B. Becker, "Chemical Transport Rates Near the Sediment in Wastewater Impoundments," Environmental Progress, Vol. 1, No. 4, Nov. 1982, p. 296.

Thibodeaux, L. J., and P. S. Christy, "Spill of Soluble, High Density, Immiscible Chemicals In Rivers," Environmental Progress Vol. 1, No. 2, May, 1982, p. 12.

Thibodeaux, L. J., and S. Hwang, "A Model for Volatile Chemical Emissions to Air from Landfarming of Oily Waste," Environmental Progress Vol. 1, No. 1, Feb. 1982, p. 42.

Thibodeaux, L. J., C. Springer and L. M. Riley, "Models of Mechanisms for the Vapor Phase Emission of Hazardous oChemicals from Landfills," Journal Hazardous Materials, 7(1982) 63-74.

Thibodeaux, L. J., "Estimating the Air Emissions of Chemicals from Landfills," Jo. Haz. Materials, 4 (1981) 235-244.

Thibodeaux, L. J., "Fluid Dynamic Observations on a Packed Crossflow Cascade at High Loadings," Ind. Eng. Chem. Process Des. Dev., (1980) Vol. 19, 33-40.

Thibodeaux, L. J., K. Pittaway, "Measurements of the Oxygen Desorption Rate in a Single Stage Crossflow Packed Tower," Ind. Eng. Chem. Process Res. Dev., (1980), Vol. 19, p. 40-46.

Thibodeaux, L. J., J. D. Millican, "Quantity and Relative Desorption Rates of Air-Strippable Organics in Industrial Wastewater," Env. Sci. Tech., Vol. 11, No. 9, (September 1977), p. 879.

Thibodeaux, L. J., "Mechanisms and Idealized Dissolution Modes for High Density ($\rho > 1$), Immiscible Chemicals Spilled in Flowing Water," AIChE Jr., Vol. 23, Nov 4, (July 1977), p. 544-553.

Thibodeaux, L. J., D. R. Daner, A. Kimura, J. D. Millican and R. J. Parikh, "Mass Transfer Units in Single and Multiple Stage Packed Bed, Cross-Flow Devices," Ind. Eng. Chem. Process Design and Development, Vol. 16, No. 3, (1977), p. 325.

Thibodeaux, L. J., and C. K. Chen, "A Fickian Analysis of Lake Sediment Upsurge," Water Resources Bulletin, Vol. 12, No. 2, April 1976.

Thibodeaux, L. J., "Semi-Infinite Solid Model for Prediction of Temperature in Deep Reservoirs and Lakes," Water Resources Bulletin, Vol. 11, No. 3, June 1975.

Thibodeaux, L. J., R. E. Estridge, B. G. Turner and R. L. Smathers, "Treatment of Selected Kraft Mill Waste in Cooling Towers," TAPPI, 54, 1, p. 53 (1971).

Thibodeaux, L. J., "Continuous Corsscurrent Mass Transfer in Towers," Chemical Engineering, Vol. 75, No. 12, June 1969, pp. 165-170.

Thibodeaux, L. J., W. C. McGlasson and H. F. Berger, "Potential Uses of Activated Carbon for Wastewater Renovation," TAPPI, 49, No. 12, pp. 521-526 (1966).

Thibodeaux, L. J., P. W. Murrill, "Comparing Packed and Plate Columns," Chemical Engineering, July 18, 1966.

Proceedings

Thibodeaux, L. J., C. Springer, and G. Hildebrand, "Air Emissions of Volatile Organic Chemicals From Landfills-A Pilot-Scale Study," 10th Annual Research Symposium, USEPA, Ft. Mitchell, KY, April 2-5, 1984.

Springer, C., L. J. Thibodeaux, P. D. Lunney and R. S. Parker, "Secondary Emissions from Hazardous Waste Disposal Lagoons: Field Measurements," 9th Annual Research Symposium, USEPA, Ft. Mitchell, KY, May 2-4, 1983.

Thibodeaux, L. J., C. Springer, P. Lunney, S. C. James and T. T. Shen, "Air Emissions Monitoring of Hazardous Waste Sites," Proceedings National Conference on Management of Uncontrolled Hazardous Waste Sites, Hazardous Materials Control Research Institute, Silver Spring, Maryland, 1982, p. 70-75.

Thibodeaux, L. J., and N. J. Carter, "Coliform Emissions from Air/Water contractors: A Preliminary Attempt to Establish Maximum Concentrations," AICHE Symp. Series 137, Vol. 70, 1974.

Thibodeaux, L. J., B. Kirsch and D. T. Mitchell, "Methodology of a Regional Industrial Waste-water Audit," presented at 28th Annual Purdue Industrial Waste Conference, West Lafayette, IN, May 1-3, 1973.

Thibodeaux, L. J., R. B. Estridge and B. G. Turner, "Simultaneous Stripping, Biochemical Oxidation and Cooling of Kraft Mill Wastewater," AICHE Symposium Series--Forest Products and the Environment, No. 133, Vol. 69, 1973.

Thibodeaux, L. J., "Measurement of the Relative Volatilization Rates of the Water-Miscible Fractions in an Aqueous Effluent," AICHE Symposium Series (WATER-1971) 68, 124, p. 169 (1972).

Thibodeaux, L. J., D. R. Smith and H. R. Berger, "Water Renovation Possibilities in the Pulp and Paper Industry," Chemical Engineering Progress Symposium Series 90 (AICHE), Vol. 64, 1968, pp. 178-186.

Reports and Bulletins

Thibodeaux, L. J., and D. Wolf, "Impact of High Chemical Contaminant Concentrations on Terrestrial and Aquatic Ecosystems: A State-of-the-Art Review," USEPA, Athens Environmental Research Lab., Athens, GA (1983).

Thibodeaux, L. J., C. Springer and P. D. Lunney, "Emission of Hazardous Chemicals from Surface Impoundments to Air," USEPA, Municipal Environmental Research Laboratory, June 1983 (in review).

Thibodeaux, L. J., D. G. Parker, and H. Heck, "Measurement of Volatile Chemical Emissions from Wastewater Basins," Final Report, U.S. Environmental Protection Agency, IREL, Cincinnati, OH, January, 1982, 79p.

Thibodeaux, L. J., "Spill of Soluble, High-Density, Immiscible Chemicals in Water," DOT/RSPA/DPB-50/78/25, U.S. Department of Transportation, Office of University Research, Washington, DC, (1978).

Thibodeaux, L. J., "The Quantity of High Volatile Constituents in Industrial Wastewater," Final Technical Letter Report for National Science Foundation, NSF-ENG 74-17316, Washington, D.C., July 1977, 6p.

Thibodeaux, L. J., "An Aqueous Environmental Simulation Model for Mid-South Lakes and Reservoirs," Water Resources Research Center Pub. No. 41, University of Arkansas, Fayetteville, Arkansas (1976).

Thibodeaux, L. J., "A Test Method of Volatile Component Stripping of Wastewater," Report EPA-660/2-74-044, U.S. Environmental Protection Agency, Washington, DC, (1974).

Thibodeaux, L. J., "Industrial Wastewater Survey-Northwest Arkansas Water Quality Management Study," Report No. NWARPC/UA-1, Northwest Arkansas Reg. Plan. Comm. Springdale, AR (1972).

Thibodeaux, L. J., C. Springer, T. Hedden and P. Lunney, "Chemical Volatilization Mechanisms from Surface Impoundments in the Absence of Wind," Proceedings of 8th Annual Research Symposium, U.S. Env. Protection Agency, Cincinnati, OH, (March 8-10, 1982).

Thibodeaux, L. J., "Transport of Pesticides and Related Chemicals Across Air-Water Interfaces" U.S.-USSR Symposium - Forecasting Behavior of Pesticides in the Environment, (accepted for publication U.S. EPA Lab, Athens, GA and to be published simultaneously in USSR), (October, 1981).

Thibodeaux, L. J., D. G. Parker, H. Heck. and R. Dickerson, "Quantifying Organic Emission Rate from Surface Impoundments with Micrometeorological and Concentrations Profile Measurements," Paper No. 127e, AIChE microfiche preprint in the Engineering Societies Library, United Engineering Center, 345 East 47th Street, New York, New Orleans Ann. Mtg., (Nov, 8-12, 1981).

Thibodeaux, L. J., R. Merrill and D. Wolbach, "Pentachlorophenol and Naphthalene Emissions to Air During Thermal Evaporation of Wastewater," Paper No. 1196 AIChE microfiche preprint in the Engineering Societies Library, United Engineering Center, 345 East 47th Street, New York, New Orleans Ann. Mtg. (Nov. 8-12, 1981).

Springer, C. S., and L. J. Thibodeaux, "Mechanisms and Models for Predicting the Desorption of Volatile Chemicals from Wastewater," Proceedings 7th Annual Symposium, U.S. Env. Protection Agency, MERL, Cincinnati, OH, (March 1981), p. 85-90.

Thibodeaux, L. J., D. Moncada, "Performance Comparison of A Crossflow Cascade and A Conventional Countercurrent Operation in Packed Towers," Paper 21st AIChE microfiche preprint in the Engineering Societies Library, United Engineering Center, 345 East 47th Street, New York, Chicago Ann. Mtg., (Nov. 16-20, 1980).

Thibodeaux, L. J., P. S. Christy, "The Spill of Sinker Chemicals - Laboratory Simulations," Proceedings of the 1980 Conference on Control of Hazardous Materials Spills, (May 13-15, 1980), Louisville, KY p. 369-374.

Thibodeaux, L. J., D. G. Parker, "Emission of Volatile Chemicals from Wastewater Plants," Special Report, National Council Air Stream Improvement, for Proceedings 1979 So. Regional Mtg., (June 6, 7, 1979), New Orleans, LA.

Thibodeaux, L. J., L. K. Chang, J. K. Harris, D. J. Lewis and M. W. Mourot, "Laboratory Results on the Spill of Soluble, High Density Chemicals on Water," Proceedings 4th Joint Conference on Sensing Environmental Pollutants, Washington, D.C. (1978), p. 511-514.

Thibodeaux, L. J., and D. G. Parker, "Desorption Limits of Selected Gases and Liquids from Aerated Basins," AIChE Symp. Series 156, Vol. 72, 1976.

Thibodeaux, L. J., "Air-Stripping of Organics from Wastewater: A Compendium," AIChE Proceedings of 2nd National Conference on Complete Water Reuse, May 5-8, 1975, Chicago, IL, p. 358.

Thibodeaux, L. J., "Preliminary Report on National Rejectors Industrial Wastewater Treatment Facilities and Practites," National Rejectors Inc., Hot Springs, Arkansas (August 1971).

Thibodeaux, L. J., "Natchez Mill Wastewater Improvement Studies," Final Report, International Paper Company, Natchez, Mississippi (September 1970).

Thibodeaux, L. J., and R. L. Wright, "Deionization of Paper Industry Wastewater by Ion Exchange," Special Report, Nat. Council Air Stream Imp., 103 Park Ave., New York, New York (May 1970).

Thibodeaux, L. J., and H. F. Berger, "Laboratory and Pilot Plant Studies on Water Reclamation," Tech. Bul. No. 203, Nat. Council Air Stream Imp., 103 Park Ave., New York, NY (July 1967).

Thibodeaux, L. J., "Improvement Study of Scotts Bluff Plant Effluent," Final Report, Naugatuck Chemical Co., Baton Rouge, LA, (August 1964).

TECHNICAL PRESENTATIONS

Thibodeaux, L. J., "Physical and Chemical Methods of Kraft Mill Wastewater Treatment," Seminar given to Department of Bio-Environmental Engineering, University of Florida, Gainesville, FL, August 1967.

Thibodeaux, L. J., "Water Pollution Prevention and Treatment," Interdisciplinary Toxicology Seminar, University of Arkansas Animal Science Center, Fayetteville, Arkansas, June 1969.

Thibodeaux, L. J., "Use of Chemical Engineering Design Procedures in Wastewater Treatment," Georgia WPCA Annual Conference, Savannah, Georgia, Sept. 20-23, 1970.

Thibodeaux, L. J., R. B. Estridge and B. G. Turner, "Measurement of the Relative Volatilization Rates of the Water-Miscible Fractions in an Aqueous Effluent," 69th National AIChE Meeting, Cincinnati, OH, May 16-19, 1971.

Thibodeaux, L. J., R. B. Estridge and B. G. Turner, "Simultaneous Biochemical Oxidation, Stripping and Cooling of Kraft Mill Wastewater," 73rd National AIChE Meeting, Minneapolis, MN, August 1972.

Thibodeaux, L. J., "Review of Biotreating Processes for Wastewaters," 26th Annual Meeting, Bartlesville Section AIChE, Bartlesville, OK, March 25, 1972.

Thibodeaux, L. J., and N. J. Carter, "Coliform Emissions from Air/Water-Contactors: A Preliminary Attempt to Establish Maximum Concentrations," AIChE Meeting, New York, NY, Fall 1972.

Thibodeaux, L. J., B. Kirsch, and D. Mitchell, "Methodology of a Regional Wastewater Audit," 28th Annual Purdue Industrial Waste Conference, West Lafayette, Indiana, May 1-3, 1973.

Thibodeaux, L. J., and D. G. Parker, "Desorption Limits of Selected Industrial Gases and Liquids from Aerated Basins," 76th National AIChE Meeting, Tulsa, OK, March 10-13, 1974.

Thibodeaux, L. J., and J. R. Jones, "A Test Method for Volatile Component Stripping of Wastewater," National AIChE Meeting, Salt Lake City, UT, Fall 1974.

Thibodeaux, L. J., "Air-Stripping of Organics from Wastewater-A Compendium," 2nd National Conference on Water Reuse, Chicago, IL, May 5-8, 1975.

Thibodeaux, L. J., "Interphase Transport in the Natural Environment," AIChE Mid-Michigan Section, Midland Michigan, February 18, 1976.

Thibodeaux, L. J., and J. D. Millican, "Quantity and Relative Desorption Rates of the Air-Strippable Organics in Industrial Wastewater," ACS 172nd Meeting, San Francisco, California, August 29-September 3, 1976.

Spill of Sinker Chemicals in Flowing Water, March 12, 1977, Oklahoma Amer. Inst. Chemical Engr., Bartlesville, OK.

Mechanisms and Idealized Dissolution Modes for High Density ($p > 1$), Immiscible Chemicals Spilled in Flowing Water, March 23, 1977, 83rd National AIChE, Houston, TX.

Laboratory Results on the Spill of Soluble, High Density Chemicals in Water, Nov. 6-11, 1977, 4th Joint Conf. Sensing Environmental Pollution, New Orleans, TN.

Laboratory Observations of the Spill of Heavy Liquids ($p > 1$) in Water Dec. 5-7, 1977, 33rd S.W. Amer. Chem. Soc., Little Rock, AR.

Fluid Dynamics of a Packed, Crossflow Cascade at High Loadings, February 26-March 1, 1978, 84th National AIChE, Atlanta, GA.

Fluid Dynamics and Oxygen Desorption Rates in a Crossflow Packed Column, March 22, 1978, Arkansas Section AIChE, Little Rock, AR.

Spill of Soluble, High Density Immiscible Chemicals on Water, June 6, 1978, Department of Transportation, U.S. Coast Guard, Washington, DC.

Measurement of the Oxygen Desorption Rate in a Single Stage Crossflow Packed Tower, September 10-15, 1978, Amer. Chem. Soc., Miami, FL.

Dissolution Rates of Organic Contaminants Located at the Sediment Interface Rivers, Streams, and Tidal Zones, April 6-13, 1979, Amer. Chem. Soc., Honolulu, HI.

Review of Crossflow Mass-Transfer, May 10, 1979, Norton Chemical Co., Cleveland, OH.

Dissolution Processes in an Unstratified Lake, May 14-15, 1979, Amer. Water Resources Association, Arkadelphia, AR.

Thibodeaux, L. J., and C. Springer, "Air Emission Monitoring of Hazardous Wastes Sites" at National Conference on Management of Uncontrolled Hazardous Wastes Sites, Washington, D.C. (Nov., 1982).

Thibodeaux, L. J., "Chemodynamics at Environmental Interfaces-the Mass Transport Aspects," Monsanto Company Technical Community, St. Louis, MO, Nov. 8, 1982.

Thibodeaux, L. J., "Chemicals in the Environmental," University de Santiago, Santiago de Compostela, Spain, April 19, 1983.

Thibodeaux, L. J., "Hazardous Chemicals in the Environment: Mass Transfer Aspects," University of Exeter, Exeter, England, April 29, 1983.

Thibodeaux, L. J., "Chemical Engineering Research in Hazardous Waste," 7th Anniversary Symp. Arkansas Chemical Industry, Little Rock, AR, Oct. 27-28, 1983.

SPONSORED RESEARCH PROJECTS

Title: Northwest Arkansas Water Quality Management Study-Industrial Wastewater Survey

Agency: U.S. EPA

Period of Support: 1970-72

Total Dollars: \$30,000

Title: A Test Method of Volatile Component Stripping of Wastewater — in Cooling Towers

Agency: U.S. EPA

Period of Support: 1972-73

Annual Dollars: \$38,538

Total Dollars: \$38,538

Title: The Quantity of Highly Volatile Constituents in Industrial Wastewaters

Agency: National Science Foundation

Period of Support: 1975-76

Annual Dollars: \$24,185

Total Dollars: \$24,185

Title: An Aqueous Environmental Simulation Model for Mid-South Lakes and Reservoirs

Agency: U.S. Dept. Interior

Period of Support: 1973-76

Annual Dollars: \$7,079

Total Dollars: \$21,237

Title: Spill of Soluble High Density, Immiscible Chemicals on Water

Agency: USCG, DOT

Period of Support and Annual Dollars: 1977 - \$48,520

1978 - \$46,654, 1979 - \$10,642

Total Dollars: \$105,816

Title: Measurement of Volatile Chemical Emissions from Wastewater Basins
Agency: U.S. EPA
Period of Support: 1977, 1978, 1979 (Extension)
Total Dollars: \$127,782

Title: Emission of Hazardous Chemicals from Surface and Near Surface
Impoundments into Air
Agency: U.S. EPA
Period of Support and Annual Dollars: 1980-81 \$156,872
1981-82 \$148,457, 1982-83 \$154,238
Total Dollars: \$459,567

Title: Impact of High Chemical Contaminant Concentrations on
Terrestrial and Aquatic Ecosystems: A State-of-the Art Review"
Agency: U.S. EPA
Period of Support and Annual Dollars: 1982-83 \$16,381
Total Dollars: \$16,381

Title: Investigation of Volatile Organic Chemical Emission Control
Methods from Hazardous Waste Disposal Operations
Agency: U.S. EPA
Period of Support: 1983-1985
Total Dollars: \$262,888

AWARDS, HONORS

1974 Awarded off-campus-duty-assignment to Oregon State University
1977-78 Elected President Sigma Xi, UA Chapter
1979-80 Dr. Yoshishi Hayashi, Visiting Professor, Kanazawa, Japan to UA
research on crossflow mass transfer
1982 College of Engineering, Outstanding Research in Chemical Engineering
(\$1000)
1982 University of Arkansas Alumni Award, Outstanding Researcher and
Teacher (\$1000)
1982 Halliburton Company Award for Excellence in Research
1983 Awarded off-campus-duty-assignment to University of Exeter, Exeter,
England
1983 Dr. Hans Schecker, Visiting Professor, University of Dartmund, W.
Germany, to UA, study environmental chemical engineering research
activities

ADVISORY COMMITTEES, PANELS, DELEGATIONS

State of Arkansas Hazardous Waste Technical Advisory Committee, member
appointed by W. Clinton, Governor (Dec. 1979 to Dec. 1981)

AICHe, ad hoc committee, National Academy of Sciences/EPA Study on
Disposal of Hazardous Industrial Waste-member of funds solicitation com-
mittee (March-October, 1980).

U.S. Environmental Protection Agency, Environmental Research Laboratory,
Athens, GA - reviewer for Technology Development Applications Branch,
Pesticide Exposure Assessment Technology, February 19, 1983.

Panel discussion member: Major Technical Issues Relating to the Land Disposal of Hazardous Waste, Arlington, VA, May 18-22, 1981.

Delegation member: USA-USSR Symposium: "Prediction of Pesticide Behavior in the Environment," Yerevan, Armenia SSR, Oct. 18-31, 1981.

Member, workshop: Determining the Field Applicability of Environmental Assessment Methods, U.S.EPA, Washington, DC, March 15-19, 1982.

Member, EPA Level I and II Exposure Assessment Workshop, Washington, DC, April 6-7, 1982 and Atlanta, GA, April 27-29, 1982.

Member Scientific Advisory Committee of Hazardous Waste Research Center, Louisiana State University, Baton Rouge, LA, 1982-83.

Peer Review Panel: Dioxin Documents to Assess the Health Risk in Air and Water Media, U.S. EPA, Cincinnati, OH, July 27-29, 1983.

Emission of Volatile Organic Carbon and Reduced Sulfur Compounds from Wastewater Treatment Plants, June 6-7, 1979, National Council Air Stream Improvement So. Reg. Mtg., New Orleans, LA.

Sediment/Chemical Dissolution Processes in an Unstratified Lake, Sept. 17, 1979, UA ChE, Fayetteville, AR.

Measurement of Volatile Chemical Emissions from Wastewater Basins Oct. 29-30, 1979, U.S. Environmental Protection Agency, Industrial Research Environmental Lab., Cincinnati, OH.

Estimating the Air Emissions of Chemicals from Hazardous Waste Landfills, November 25-29, 1979, Annual Mtg. AIChE, San Francisco, CA.

A Review of Crossflow Mass-Transfer, February 29, 1980, Department of Chemical Engineering, University-Missouri, Rolla, MO.

The Spill of Sinker Chemicals-Laboratory Simulations, May 13-15, 1980 Hazardous Spills Conference, Louisville, KY.

An Aerodynamic - Hydrodynamic Interaction Model of the Bottom Water Mass-Transfer Coefficient in Lakes and Similar Waterbodies, Aug. 24-29, 1980, Amer. Chem. Soc., Las Vegas, NV.

Chemodynamics - What we know and what we don't know, Sept. 22, 1980 UA ChE, Fayetteville, AR.

Spill of Soluble, High Density Immiscible Chemicals on Water, Oct. 2, 1980, Department of Transportation, U.S. Coast Guard, Washington, D.C.

Performance Comparison of A Crossflow Cascade and a Conventional Countercurrent Operation in Packed Towers, Nov. 16-20, 1980, Annual Mtg., AIChE, Chicago, IL (delivered by D. Moncada).

Quantifying Organic Emission Rates from Surface Impoundments with Micrometeorological and Concentration Profile Measurements, Jan. 7, 1981, U.S. Environmental Protection Agency, RTP, Durham, NC.

Chemodynamics - What we know and what we don't know, March 5, 1981 Dept. of Chemical Engineering, OK State University, Stillwater, OK.

Models of Mechanisms for Hazardous Chemical Emissions from Landfills, March 29-April 3, 1981, Amer. Chem. Soc., Atlanta, GA.

Chemodynamics - What we know and what we don't know, April 29, 1981, Rensselaer Poly. Institute, Troy, NY

Chemodynamics - What we know and what we don't know, May 19, 1982, Dow Chemical, Freeport, TX

Chemodynamics - What we know and what we don't know, June 10, 1981, Department of Chemical Engineering, Tech. High School, Zurich, Switzerland.

Gas-Side Mass-Transfer Coefficient and Interfacial Phenomena of Flat-Bladed Surface Agitators, Oct. 4-9, 1981, Second World Congress Chem. Engr. Montreal Canada (delivered by James Reinhardt).

Gas Crossflow Distillation in Packed Towers, Oct. 4-9, 1981, Second World Congress Chem. Engr., Montreal, Canada (delivered by Bruce Eldridge).

Transport of Pesticides and Related Chemicals Across Air-Water Interfaces, Oct. 17-31, 1981 US-USSR Symposium on Transport of Pesticides in the Environment, Yerevan, Armenia SSR.

Spill of Soluble, High Density, Immiscible Chemicals in Rivers, Nov. 8-11, 1981, Ann. Mtg. AIChE, New Orleans (delivered by Pattie S. Christy).

Pentachlorophenol and Naphthalene Emissions to Air During Thermal Evaporation of Wastewater, Nov. 8-11, 1981, Ann. Mtg. AIChE, New Orleans, LA.

A Model for Volatile Chemical Emissions to Air from Landfarming of Oily Waste, Nov. 8-11, 1981, Ann. Mtg. AIChE, New Orleans, LA.

Quantifying Organic Emission Rate from Surface Impoundment with Micro-meteorological and Concentration Profile Measurements, Nov. 8-11, 1981, Ann. Mtg., AIChE, New Orleans, LA.

A Simulation Study of the Volatilization of Polychlorinated Biphenyls from Landfill Disposal Sites, October 4-8, 1981, 4th Annual Oak Ridge National Laboratory Life Sciences Symposium on Environment and Solid Waste, Oak Ridge, TN (deliered by C. Springer).

Mechanisms and Models for Predicting the Desorption of Volatile Chemicals from Wastewater, 7th Annual Research Symposium, U.S. Envir. Protection Agency, March 16-18, 1981, Philadelphia, PA (delivered by C. Springer).

Chemical Volatilization Mechanisms from Surface Impoundments in the Absence of Wind, March 8-10, 1982, 8th Annual Research Symposium U.S. Environmental Protection Agency, Cincinnati, OH.

Measurement of Volatile Chemical Emissions from Aerated Stabilization Basins, National Conference on Environmental Engineering, Env. Engr. Div. ASCE, Atlanta, GA, July 1981 (presented by H. Heck).

Thibodeaux, L. J., and C. Springer, presented "Identification of Volatilization Mechanisms" at EPA Research Symposium in Cincinnati, OH, (Feb., 1982)

Thibodeaux, L. J., "Off-site Transport of 2,3,7,8-Tetrachlorodibenzo-p-dioxin from a Production Disposal Facility" was presented at the American Chemical Society Meeting at Kansas City, (Sept. 1982).

CURRICULUM VITAE

Name: Arthur Canfield Upton

Date & Place of Birth: February 27, 1923, Ann Arbor, Michigan

Marital Status: Married, March 1, 1946, to Elizabeth Perry

Children: Rebecca, Melissa, Bradley

Military Record: Army U.S., 1943-1946
Capt. USAF Reserve, 1955-1970

Education: B.A., University of Michigan, 1944
M.D., University of Michigan, 1946

Positions Held:

1947- -- Intern, University Hospital, Ann Arbor, Michigan
1948-1950 -- Resident in Pathology, University of Michigan
1950-1951 -- Instructor in Pathology, University of Michigan
1951-1954 -- Pathologist, Biology Division, Oak Ridge National
Laboratory
1954-1969 -- Chief, Pathology-Physiology Section, Biology Division,
Oak Ridge National Laboratory
1969-1977 -- Professor of Pathology, State University of New York at
Stony Brook
1969-1970 -- Chairman, Department of Pathology, State University of
New York at Stony Brook
1970-1975 -- Dean, School of Basic Health Sciences, State University
of New York at Stony Brook
1969-1977 -- Associate Pathologist, Medical Department, Brookhaven
National Laboratory
1977-1979 -- Director, National Cancer Institute
1980- -- Director, Institute of Environmental Medicine, New York
University
1980- -- Professor and Chairman, Department of Environmental
Medicine, New York University, School of Medicine

Honors and Awards:

Alpha Omega Alpha
Phi Beta Kappa
Ciba Foundation Lecturer, 1959
E. W. Lawrence Award, 1965
Peruvian Oncology Society, 1967
Failla Lecturer, Radiation Research Society, 1977
Comfort Crookshank Award for Cancer Research, 1978
Japanese Cancer Association, 1979
Institute of Medicine, National Academy of Sciences, 1979
Claude M. Fuess Award, 1980
IBM-Princess Takamatsu Cancer Research Foundation, Lecturer, 1981

Membership in National Scientific Societies:

American Association for Advancement of Science
American Association for Cancer Research
American Association of Pathologists and Bacteriologists
American College of Toxicology
American Society for Experimental Pathology
Collegium Ramazzini
Gerontological Society
Harvey Society
International Academy of Pathology
New York Pathological Society
Permanent Commission and International Association on Occupational Health
Peruvian Society of Oncology, Honorary Member
Radiation Research Society
Scientific Research Society of America (RESA)
Society for Experimental Biology and Medicine
Society for Risk Analysis

Offices Held in National Scientific Societies:

American Association for Cancer Research:

Board of Directors, 1961-1964
Vice-President, 1962-1963
President, 1963-1964

Representative to USA National Academy of Sciences-National Research
Council: 1967-1969

Representative to USA National Committee on the International Union
Against Cancer: 1972-1975

American Society for Experimental Pathology:

Councilor, 1965
Vice-President, 1966-1967
President, 1967-1968

Radiation Research Society:

Councilor, Medicine, 1963-1964
Vice-President, 1964-1965
President, 1965-1966

International Association for Radiation Research:

Vice-President, 1979-1983
President, 1983-

Editorial Boards:

Cancer Research, 1960-1964
Radiation Research, 1961-1964
Laboratory Investigation, 1961-1975
Nuclear Medicine, Excerpta Medica, 1964-1977
International Journal of Cancer, International Union Against Cancer,
1965-1974
Proceedings of the Society for Experimental Biology and Medicine,
1965-1968
Cancer, 1977-
Forum on Medicine, 1978-1982
American Journal of Industrial Medicine, Associate Editor, 1980-
Gerontology and Geriatrics Education, 1980-
American Society of Preventive Oncology, Publications Committee, 1980-
Risk Analysis, 1980-
SciQuest, 1981-1982
Environmental Research, 1981-

Committees:

National Academy of Sciences-National Research Council, Subcommittee
on Long-Term Effects of Ionizing Radiation from External Sources,
1957-1960
American Cancer Society, Advisory Committee on Research on Etiology of
Cancer, 1958-1961
U.S. Air Force, Life Sciences Working Group, 1958-1960
National Committee on Radiological Protection, Subcommittee on
Relative Biological Effectiveness (M-4), 1958-1962
International Commission on Radiological Protection, Committee on
Radiation Biology, 1960-1962
International Commission on Radiological Protection, Subcommittee on
Relative Biological Effectiveness, 1960-1962
U.S. Public Health Service, National Advisory Committee on Radiation,
1961-1965
National Academy of Sciences-National Research Council, Ad Hoc
Advisory Committee on Radiation Pathology, Chairman, 1962-1964
National Academy of Sciences-National Research Council, Committee on
Pathology, 1962-1972
International Cancer Research Commission on the International Union
Against Cancer, Expert Panel on Carcinogenicity, 1963
International Commission on Radiological Protection, Committee I, The
Committee on Radiation Effects, 1963-, Vice-Chairman, 1965-1973;
Chairman, 1973-1978
International Commission on Radiological Protection, Committee I, Task
Group on the Biological Effects of High Energy Radiations,
Chairman, 1963-1965
Executive Office of the President, Office of Science and Technology,
NIH Study Committee Panel on Pathology, 1964
National Academy of Sciences-National Research Council, Advisory
Committee to Federal Radiation Council, Chairman, 1964-1966;
1968-1971

National Council for Radiation Protection and Measurements, 1965-1977;
1980-

International Commission on Radiological Protection, Task Group on the
Radiosensitivity of Different Tissues in Relation to Radiation
Protection, 1966-1968

Federal Aviation Administration, Standing Committee for Radiation
Biology Aspects of the SST, 1967-1970

National Cancer Institute, Ad Hoc Discussion Group on Recruitment and
Training in Chemical Carcinogenesis, Chairman, 1967-1968

American Cancer Society, Tennessee Division, Board of Directors,
1967-1969

National Academy of Sciences-National Research Council, Division of
Medical Sciences, 1967-1972; Executive Committee, 1968-1972

National Academy of Sciences-National Research Council, NASA Life
Sciences Review Program Committee, 1970

National Cancer Institute, Cancer Research Training Committee,
1970-1971

Smithsonian Institution, Interdisciplinary Communications Program,
Carcinogenesis Core Group, 1970-1973

Steering Committee of Los Alamos Meson Physics Facilities,
Subcommittee on Whole Animal Radiation Biology and Pathology,
1971-1977

National Academy of Sciences-National Research Council, Advisory
Committee on the Biological Effects of Ionizing Radiation,
1971-1977

National Academy of Sciences-National Research Council, Committee on
the Biological Effects on Ionizing Radiation, Subcommittee on
Somatic Effects, Chairman, 1971-1977

National Academy of Sciences-National Research Council, Committee on
Pathology, Subcommittee on Environmental Pathology, Chairman,
1971-1972

Argonne Universities Association Review Committee, Biological and
Medical Research Division, Argonne National Laboratory, 1971-1973

Argonne National Laboratory, Advisory Committee for the Center on
Human Radiobiology, 1972-1977

Federation of American Societies for Experimental Biology, Life
Sciences, Research Office, Advisory Committee, 1972-1977;
Chairman, 1974-1977

National Cancer Institute, Carcinogenesis Advisory Panel, 1972-1973

National Cancer Institute, Division of Cancer Biology and Diagnosis,
Board of Scientific Counsellors, 1973-1977

International Commission on Radiological Protection, Main Commission,
1973-1978; Committee, 1979-

Scientific Advisory Group, U.S.-Japan Cooperative Cancer Research
Program, 1974-1977

National Center for Toxicological Research, Scientific Advisory Board
1974-1977

U.S.-Japan Radiation Effects Research Foundation, Scientific Council,
1975-1977; 1980-

World Health Organization, International Agency for Research on
Cancer, Scientific Council, 1975-1977; Governing Council,
1977-1979

Environmental Protection Agency, Administrator's Pesticide Policy
Advisory Committee, 1975-1977

International Commission for Protection Against Environmental Mutagens
 and Carcinogens, 1978-1979; 1980-
 General Motors Cancer Research Foundation, Awards Assembly, 1978-1981
 Institute of Medicine, National Academy of Sciences, 1979-
 March of Dimes, Advisory Committee on Reproductive Hazards in the
 Workplace, 1980-1982
 National Academy of Sciences-National Research Council, Advisory
 Committee on the Radiation Effects Research Foundation, Chairman,
 1980-
 Oak Ridge National Laboratory, Biology Division Advisory Committee,
 1980-
 Northwestern University Cancer Center, External Advisory Committee on
 Commonwealth Edison Study, 1980-
 Brookhaven National Laboratory, Medical Department Visiting Committee,
 1980-
 GTE Laboratories, Technical Advisory Council, Steering Committee,
 1980-1982
 Department of Energy, Ad Hoc Advisory Board on Melanoma, 1980-1981
 Governor's Committee on Love Canal, State of New York, 1980
 National Academy of Sciences-National Research Council, Assembly of
 Life Sciences, 1980-1983
 National Academy of Sciences-National Research Council, Commission on
 Life Sciences, 1983-
 National Academy of Sciences-National Research Council, Committee on
 Priority Mechanisms, Chairman, 1980-1983
 Exxon Corporation, Medical Department, Science Advisory Board,
 Chairman, 1980-
 National Academy of Sciences-National Research Council, Assembly of
 Life Sciences, Panel on Hiroshima/Nagasaki Occupation Forces,
 1980-1981
 Johns Hopkins University, Nuclear Shipyard Workers Study, Technical
 Advisory Panel, Chairman, 1980-
 New York State Department of Health, Health Research Council, 1981;
 Chairman, 1982-
 American Health Foundation, Scientific Advisory Board, 1981-
 American Association for Cancer Research, Public Issues Committee,
 Chairman, 1981-
 The Permanent Commission and International Association on Occupational
 Health, Committee on Occupational Carcinogenesis, 1981-
 Robert Wood Johnson Foundation, National Hospice Study, National
 Advisory Committee, 1981-
 Three Mile Island Unit 2 Safety Advisory Board, 1981-1982
 Harvard University, School of Public Health Overseers' Committee, 1981-
 National Academy of Sciences-National Research Council, Steering
 Committee on Identification of Toxic and Potentially Toxic Chemicals
 for Consideration by the National Toxicology Program, 1981-
 Labor Policy Institute Advisory Board, 1982-
 Associated Universities, Inc., Council for Research Planning in Biological
 Sciences, Board of Directors, 1982-
 World Resources Institute, Board of Directors, 1982-
 Third Task Force for Research Planning in Environmental Health Sciences,
 National Institute of Environmental Health Sciences, Chairman,
 1983-

BIBLIOGRAPHY

Arthur C. Upton, M.D.

1. Upton, A.C. and Zarafonitis, C.J.D.: Histologic Findings in Rats Subjected to Prolonged Administration of Para-Aminobenzoic Acid. Proceedings of the Society for Experimental Biology and Medicine 75:450-452, 1950.
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3. Upton, A.C., and Coon, W.W.: Effects of Cortisone and Adrenocorticotrophic Hormone on Wound Healing in Normal and Scorbatic Guinea Pigs. Proceedings of the Society for Experimental Biology and Medicine 77:153-156, 1951.
4. Coon, W.W., and Upton, A.C.: Histochemical Studies of Wound Healing in Scurvy: Effects of Adrenocorticotrophic Hormone (ACTH) and Cortisone. In: Surgical Forum. W. H Saunders, Philadelphia, 1951, pp. 493-499.
5. Upton, A.C.: Histochemical Investigation of the Mesenchymal Lesions in Whipple's Disease. American Journal of Clinical Pathology 22:755-764, 1952.
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9. Upton, A.C. and Gude, W.D.: Changes of Dermal Connective Tissue After Total-Body Irradiation. Federation Proceedings 12:405, 1953.
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11. Furth, J. and Upton, A.C.: Vertebrate Radiobiology: Histopathology and Carcinogenesis. Annual Review of Nuclear Science 3:303-338, 1953.

12. Upton, A.C. and Furth, J.: Induction of Pituitary Tumors by Means of Ionizing Irradiation. Proceedings of the Society for Experimental Biology and Medicine 84:255-257, 1953.
13. Furth, J., Gadsen, E.L., and Upton, A.C.: ACTH Secreting Transplantable Pituitary Tumors. Proceedings of the Society for Experimental Biology and Medicine 84:253-254, 1953.
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17. Upton, A.C. and Gude, W.D.: Physiologic and Histochemical Changes in Connective Tissue of Rat Induced by Total Body Irradiation. A.M.A. Archives of Pathology 58:258-264, 1954.
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45. Schwartz, E.E., Upton, A.C., and Congdon, C.C.: A Fatal Reaction Caused by Implantation of Adult Parental Spleen Tissue in Irradiated F₁ Mice. Proceedings of the Society for Experimental Biology and Medicine 96:797-800, 1957.
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CHARLES O. VELZY, P.E.
President

VELZY
Associates

SUMMARY

Mr. Velzy has over twenty-five years of experience in the design and operation of solid waste processing facilities. He has developed nationally recognized expertise in the fields of recovery of energy from solid waste and air pollution control. Based on his extensive design and field operation experience, he has authored numerous papers on the present status of solid waste management practices; co-authored with his father, Charles R. Velzy, the section on "Incineration" in Marks' Standard Handbook for Mechanical Engineers; and has served as an instructor in Resource Recovery and Incinerator Technology.

EXPERIENCE

Mr. Velzy, as Project Engineer for the mechanical design of the energy-from-waste plant in the Town of Hempstead, New York, developed the mass and heat balances; the furnace combustion chamber and boiler arrangements; and all mechanical design for the two 300 ton-per-day mass-burning, steam-producing units at the plant. Steam is produced for electrical power generation from the burning of as-received municipal solid waste.

Under his direction, engineering design modifications were made to two 300 ton-per-day, energy-from-waste units at the Merrick, New York, disposal plant; in addition to three 150 ton-per-day mass-burning units at Huntington, New York; and the Waterbury, Connecticut, facility which included co-disposal of solid waste and sludge, upgrading of air pollution control equipment, water treatment facilities, and air pollution control technology advice.

Mr. Velzy heads the Technical Advisory and Review Committee of the Firm, which oversees all Velzy solid waste management projects. Recent technical reviews include the Dutchess County, New York, Solid Waste Management Plan for a 400 ton-per-day, energy-from-waste pyrolysis facility; the Power Authority of the State of New York (PASNY) feasibility study for utilization of steam generated from municipal solid waste at the Indian Point-3 Nuclear Plant; and energy-from-waste feasibility studies for Richmond, Virginia, Franklin County, Massachusetts, and the Hampton, Virginia, Peninsula Planning Commission, in addition to the New York City Brooklyn Navy Yard Resource Recovery Facility. He also directed the overall technical review and preparation of a formal report for use in the bond prospectus for the Multi-Town project, Suffolk County, New York.

Mr. Velzy also has extensive experience in development and design of wastewater and industrial waste treatment facilities.

EDUCATION

B.S. - Mechanical Engineering, University of Illinois, 1953
B.S. - Civil Engineering, University of Illinois, 1960
M.S. - Sanitary Engineering, University of Illinois, 1959

CHARLES O. VELZY, P.E.
President

REGISTRATION

Professional Engineer: NY, MD, MA, PA, OH, IN, IL, DE, WI,
VA, FL, NC, CT

HONORS

Diplomate - American Academy of Environmental Engineers
Fellow - American Society of Mechanical Engineers
1980 - Engineer of Year, N.Y.S. Society of Prof. Engineers,
Westchester Chapter

AFFILIATIONS

AWWA, ASME, ASCE, WPCF, NSPE, NWWA, APWA, AWRA, APCA, ASTM

APPENDIX F

Qualifications and Experience of Fred C. Hart Associates

QUALIFICATIONS

Fred C. Hart Associates, Inc. (FCHA) has developed specific expertise in the assessment of risks related to dioxin and has assigned a multidisciplinary team of professionals to this study. The firm's experience encompasses studies of dioxin contamination at field sites including the early investigative work at Verona, Missouri (in 1981) and other locations in Puerto Rico and Connecticut; selection by EPA to develop dioxin analytical protocols down to 30 parts per quadrillion at our high hazard laboratory and contaminant facility in Las Vegas; one of the nation's largest risk assessment practices for hazardous materials including risk assessments for insurance companies, industry, and USEPA; and broad experience in combustion chemistry and the measurement and control of hazardous air emissions from waste disposal facilities. Specifically:

- ° The study team includes chemical engineers, public health specialists, chemists, and biologists with expertise in the risks associated with hazardous waste in the environment. For example, Dr. David Lipsky, the principal investigator, has recently completed a dioxin sampling study in Puerto Rico and has delivered expert testimony on the health significance of dioxin levels.
- ° FCHA operates two U.S. Environmental Protection Agency High Hazard Laboratories, which are the only laboratories of their kind in the U.S. FCHA staff regularly process all high hazard dioxin samples collected throughout the U.S. by the USEPA. FCHA staff also develop nationally used protocols for handling high concentrations of hazardous chemicals. For example, our staff has developed performance evaluation standards for dioxin samples in three matrices: water, clay, and fish tissue. The lab will be developing standards for additional matrices in the future.
- ° FCHA has conducted extensive field studies and designed remedial engineering solutions for a major Connecticut Superfund site, at which dioxin was one of the waste materials of concern.
- ° FCHA performed early field sampling and analyses at the New Jersey and Missouri dioxin sites under contract to USEPA.

- FCHA is currently performing field sampling analyses at suspect dioxin sites for local government and industry.

Fred C. Hart Associates specific dioxin work is backed up by a broad scientific base of expertise in dealing with hazardous waste management, risk assessment and public health:

- FCHA has a long history of investigations at hazardous waste disposal and treatment facilities. The firm has worked for nearly all of the major hazardous waste treatment companies and has represented local government as well.
- FCHA has conducted risk assessments for applicants for environmental impairment liability (EIL) insurance coverage. Our firm has relationships with a number of insurance companies including American Insurance Group, Aetna, and Hartford.
- For Aetna Life and Casualty, FCHA developed an environmental audit manual for use by field engineering personnel to inspect facilities of prospective clients who are attempting to obtain EIL insurance. The manual provided guidance in conducting environmental audits and risk assessments.
- FCHA conducted a similar effort for St. Paul Insurance Company where we provided training for company personnel in site evaluations and risk assessments for closure and post-closure insurance for hazardous waste management facilities.
- FCHA has conducted a variety of studies that address the technical feasibility and environmental impact of resource recovery facilities including over a dozen such studies for the U.S. Environmental Protection Agency.

The principal investigators for this project included:

Dr. David Lipsky, manager of the Public Health Group at Fred C. Hart Associates. He served as the Field Investigation Team Leader (FITL) for the Region II Field Investigation Team (FIT) and has six years' experience in assessing the impact of chemical contaminants on human health and the environment. Dr. Lipsky supervised a multidisciplinary team of 23 engineers and scientists, who performed extensive site investigations in the New York, New Jersey area.

Dr. Lipsky supervised the investigations of over 204 hazardous waste sites, including 40 sites designated as top priority under Superfund. The investigation activities included air, water, soil, sediment, and biota monitoring and collection programs, hydrogeologic and geophysical studies, risk assessments and engineering studies in support of remedial action plans.

Dr. Lipsky promoted and supervised the use of state-of-the-art techniques for measuring the impacts of toxic emissions on biota and ambient air quality. He has supervised air pollution studies near sanitary landfills to measure and assess air impacts at the parts per billion level. Dr. Lipsky also acted as the Senior Public Health Specialist for the Region II FIT, assessing and interpreting all data with regard to public health and environmental impacts.

Dr. Lipsky holds a Ph.D. in Biochemistry from the State University of New York at Stony Brook.

Karl Boldt, a Senior Air Quality Engineer with Fred C. Hart Associates, has over 13 years of experience in air quality emission assessments and impact analyses from new and existing stationary emission sources. He has designed and implemented continuous emission test programs on fossil fuel power plants, a cogeneration plant, and a cement kiln burning hazardous waste as fuel. He also developed air quality assessments of hazardous waste treatment, storage and disposal facilities including incinerators, landfills, tanks, and a solid waste resource recovery plant. Several projects included air quality impact analyses using USEPA manual and computer modeling techniques.

Mr. Boldt received a B.S. degree in Mechanical Engineering from the University of Rhode Island. He is a member of the American Society of Mechanical Engineers and the Air Pollution Control Association.

Mary Manto is a public health specialist and Assistant Project Manager for Fred C. Hart Associates. Her background is in toxicology, epidemiology, and safety planning. Since joining Fred C. Hart Associates, Ms. Manto's work has been mainly focused on the hazardous waste area. In the last five years she has participated in a variety of waste-related efforts including an assessment of the health risks posed by the development of a former hazardous waste site as a recreation area, and participation in a nationwide assessment of hazardous waste sites for Environmental Protection Agency Headquarters. Under this contract, Ms. Manto was responsible for health assessments concerning sites located in different areas of the country. These assessments involved preliminary epidemiological survey designs, health interviews, and toxicological research.

Ms. Manto holds an M.P.H. degree in environmental health from Columbia University.

Renee R. Bobal is an Assistant Project Manager and Chemist. Her responsibilities with the firm's New York office include conducting risk assessments and environmental impact analyses for government and private industry. She has developed an extensive management plan for the handling, storage, use, and disposal of hazardous materials for a multi-project industrial operation. She has managed a politically sensitive project concerning potential contamination of groundwater, soil, and air, which included risk assessment of past facility operations, developing and coordinating an environmental monitoring program, and assisting in the development of engineering controls for a proposed facility to alleviate potential impacts.

Ms. Bobal received her Bachelor and Master of Science degrees from Rutgers University.

GARY SMITH TESTIMONY ON BEHALF OF WILLIAM RUCKELHAUS

NEW JERSEY DEPARTMENT
OF ENVIRONMENTAL PROTECTION
DIVISION OF WASTE MANAGEMENT

RE: Public Hearing to Solicit :
and Receive Comment on the : TRANSCRIPT OF
Tentative Approval of Plans : PROCEEDINGS
Submitted by the Applicant: :
:
The American Ref-Fuel Company :
of Essex County. :

Essex County Community College
University Avenue
Newark, New Jersey
Monday, December 17, 1984
2:00 p.m.

B E F O R E :

ALBERT MONTAGUE,
Deputy Assistant Director, Engineering,
Permits and Licensing of the Division
of Waste Management

WILLIAM O'SULLIVAN,
CHIEF, Engineering and Technology of the
Division of Environmental Quality

BARBARA GREER,
Assistant Director, Office of Regulatory
Services, Department of Environmental
Protection

DR. MARWAN SADAT,
Director of Division of Waste Management
of the DEP

EDWARD POST,
Chief, Industrial Permits Section,
Division of Water Resources

Reported by:
HELEN DOHOGNE, C.S.R.

(CONTINUED)

DR. RICHARD DIME,
Research Scientist, Bureau of
Environmental Evaluation and Risk
Assessment, Hazardous Site Mitigation
Administration

DR. JOSEPH SPATOLA,
Director, Essex County Office of
Environmental Health

MR. ROBERT GOLDEN,
Karch and Associates,
Washington, D.C.

WILBERT O'CONNELL,
Battelle Memorial Institute

ROBERT ENGDAHL,
Battelle Memorial Institute

1 opinion must make every effort to educate the
2 American public and, in this case, New Jersey public,
3 to the assets of resource recovery.

4 The safety, economy and ability to ensure
5 a safe environment for our children and their
6 children to follow makes it a mandate and our
7 responsibility.

8 Resource recovery is today's path and
9 tomorrow's path.

10 Yet it's something that's taken for
11 granted as old hat all over Europe. I'm here today
12 to support this technology that's so desperately
13 needed by not only our sister county, Essex County,
14 but Union County, Bergen County and all of the other
15 counties and throughout our entire state and I speak
16 on behalf the permit. Thank you.

17 DR. SADAT: Thank you very much. Mr.
18 Gary Smith will represent the United States
19 Environmental Protection Agency and will give a
20 statement for Administrator Ruckelshaus.

21 MR. SMITH: Thank you, Dr. Sadat. The
22 first thing I need to do is put my glasses on.

23 My name is Gary Smith. I am with the
24 Solid Waste Branch of Region Two of the United
25 States Environmental Protection Agency. And I am

1 here today to deliver a statement from our
2 administrator, Mr. William Ruckelshaus.

3 It is a pleasure to appear today to
4 provide comments from the U.S. Environmental
5 Protection Agency on the preconstruction permits for
6 the Essex County Resource Recovery facility.

7 One of the most intransigent problems of
8 any modern society, particularly one as prosperous
9 as our own, is what to do with the discards of our
10 prosperity.

11 This nation has a first class solid waste
12 problem, both in terms of hazardous materials and
13 the more mundane things each of us throws away every
14 day, municipal trash. It is not confined to this
15 county, to Essex County.

16 America's municipal waste stream is
17 expanding at a rate of approximately four percent
18 annually. Our trash is expensive to collect and
19 it's getting more so.

20 It's difficult to segregate in any
21 orderly fashion and some would say it's impossible
22 to dispose of, at least conveniently.

23 Most cities are running out of places to
24 dump it.

25 Our existing landfill capacity is

1 dwindling. And our citizens are increasingly
2 reluctant to allow new disposal sites to be located
3 anywhere near them.

4 Nothing seems to mobilize a community
5 faster than the rumor that a new landfill is being
6 planned nearby. At EPA, we refer to this as the
7 NIMBY syndrome, people understand that wastes must
8 be disposed of somewhere but not in my backyard.

9 It is this public opposition to the
10 siting of new waste disposal facilities, based
11 frequently upon fear as much as fact, that presents
12 many cities and counties with the prospects of grid-
13 lock in the management of the thousands of tons of
14 municipal wastes generated every day.

15 The public is justified in being fearful
16 of unsound waste management practices. We have
17 experience in dealing with the consequences of past
18 mismanagement in our Superfund Program, and I can
19 assure you that this is a very difficult problem to
20 manage due to the complexity of these sites, in
21 combination with the pitched emotions associated
22 with environmental contamination.

23 During the past fifteen years, we have
24 learned a great deal about our environment and the
25 need to keep it clean and safer. Since the start of

1 EPA in 1970, our mission was simple: Protect our
2 air and water resources from the materials we were
3 haphazardly dumping into them.

4 As we succeeded in cleaning up these most
5 obvious media, we discovered a new link in the
6 environmental chain. Our lands and subsurface water
7 supplies were at risk due to the disposal of
8 increasing quantities of sludges, residues and other
9 emissions generated during our environmental
10 protection efforts.

11 Today, we know better. We are aware of
12 the potential hazards associated with land disposal
13 of wastes, both toxic and municipal. While
14 landfilling continues to be the management technique
15 of choice in many places, due largely to economic
16 considerations, the tables are slowly turning.

17 I am confident that we will see dramatic
18 changes in the years ahead, and we will move away
19 from land disposal.

20 I submit that a variety of approaches
21 must be explored as alternatives to landfilling.
22 These innovative techniques will cost more, but,
23 after all, we are an industrial nation. We benefit
24 from the production of highly sophisticated consumer
25 products.

1 Our standard of living is such that we
2 can afford to manage our wastes in a manner that is
3 as environmentally sound as possible. One of the
4 most promissing ways for managing the mountains of
5 municipal waste generated daily in this nation is
6 resource recovery. There is something inherently
7 sensible in utilizing all of our resources to the
8 fullest extent possible, whether they be virgin
9 materials or recycleable wastes.

10 America has a reputation of being a
11 disposable society -- conspicuously wasteful. This
12 is an ironic circumstance for a nation also known
13 for its productive efficiency and belief in the
14 profit motive.

15 Management of waste is truly one of the
16 leading challenges of our modern society. We know
17 the old ways -- dumping wastes in and on the land --
18 don't work.

19 I am hopeful that resource recovery
20 presents us with an opportunity to deal with wastes
21 in a positive and responsible way.

22 Our challenges are many in resource
23 recovery. We must overcome the inertia which
24 resists all change. We must educate the public to
25 the positive attributes of resource recovery and we

1 must make these projects succeed through careful
2 design and skillful operation. I think we can meet
3 these challenges.

4 We at EPA believe that resource recovery
5 presents the best available management option for
6 dealing with the ever increasing volume of municipal
7 solid waste. Through resource recovery, we cannot
8 only reduce the size of the waste stream, we can
9 also recover valuable energy and materials which
10 otherwise would be lost.

11 Well designed and operated facilities
12 that generate energy represent the state of the art
13 in waste management. They are technically,
14 environmentally, and economically sound alternatives
15 to what we already know is a fundamentally shortsighted
16 and unsound practice -- land disposal.

17 Bear in mind that this management option,
18 like all other, is not free of risk. But the risks
19 are manageable.

20 Today, more than fifty resource recovery
21 systems are in place and operating throughout the
22 United States; more than 20 others are on the way.

23 I am convinced that this is the way to go.
24 These facilities enlarge our pooling of waste
25 management options. If they meet our expectations,

1 they will help to sway other communities that
2 resource recovery may be for them as well.

3 If so, the message is coming none too
4 soon. The mountain of waste is getting higher every
5 day. Thank you.

6 DR. SADAT: Thank you, Mr. Smith.

7 Now, do we have any other public
8 officials in the audience? We've taken public
9 officials first. I believe I have a Mayor Leopold
10 from Livingston. I guess he'll be coming later.

11 I have a letter which I am going to read
12 into the record and it is a letter from Mr. Gerald
13 A. Calabrese who is a Freeholder Director in Bergen
14 County. It is addressed to Dr. Marwan Sadat,
15 Director of Waste Management, New Jersey Department
16 of Environmental Protection, 32 East Hanover Street,
17 CN027, Trenton, New Jersey, 08625. Reference
18 December 17, 1984 Public Hearing - Essex County
19 Resource Recovery Facility.

20 "Dear Dr. Sadat:

21 "Because of the importance of the
22 resource recovery subject, for the well-being of the
23 residents of New Jersey, I requested the following
24 statement be read at the public hearing and
25 incorporated into the official hearing record.

ARCHAEOLOGICAL SITES

RECEIVED

AUG 11 1983

HAZEN & SAWYER, P.C.
Hollywood, Fla.



Attachment 8
Page 1 of 2

FLORIDA DEPARTMENT OF STATE

George Firestone
Secretary of State

DIVISION OF ARCHIVES,
HISTORY AND RECORDS MANAGEMENT
The Capitol, Tallahassee, Florida 32301
(904) 488-1480

July 22, 1983

In Reply Refer to:

Louis D. Tesar
Historic Preservationist
(904) 487-2333

Mr. Rhodes Robinson, Vice President
Coastal Zone Resources, Inc.
1001 U.S. Highway 1, Suite 305
Jupiter, Florida 33458

RE: Your Letter of June 28, 1983
Cultural Resource Assessment Request
Proposed Development of Two Resource Recovery Facilities and
Associated Landfills, Broward County, Florida

Dear Mr. Robinson:

In accordance with the procedures contained in 36 C.F.R., Part 800 ("Procedures for the Protection of Historic and Cultural Properties"), we have reviewed the above referenced project for possible impact to archaeological and historical sites or properties listed, or eligible for listing, in the National Register of Historic Places. The authorities for these procedures are the National Historic Preservation Act of 1966 (Public Law 89-665) as amended by P.L. 91-243, P.L. 93-54, P.L. 94-422, P.L. 94-458 and P.L. 96-515, and Presidential Executive Order 11593 ("Protection and Enhancement of the Cultural Environment").

A review of the Florida Master Site File indicates that no archaeological or historical sites are recorded for the project area. Furthermore, because of the location of the project, it is considered highly unlikely that any significant, unrecorded sites exist in the vicinity. Therefore, it is the opinion of this office that the proposed project will have no effect on any sites listed, or eligible for listing, in the National Register of Historic Places, or otherwise of national, state or local significance.

Mr. Rhodes Robinson
July 8, 1983
Page Two

If you have any questions concerning our comments, please do not hesitate to contact us.

Your interest and cooperation in helping to protect Florida's archaeological and historical resources are appreciated.

Sincerely,

George W. Percy
State Historic
Preservation Officer

GWP:Teb

CZR, INCORPORATED
Coastal Zone Resources

1001 US HIGHWAY 1
SUITE 305
JUPITER, FL 33458
305/747-7455

June 28, 1983

→ July 6, arrived

Mr. George W. Percy
Deputy State Historic Preservation Officer
Division of Archives History and
Records Management
Florida Department of State
Tallahassee, FL 32301

Dear Mr. Percy:

CZR is working for Hazen and Sawyer, P.C., and Broward County in the development of two resource recovery facilities and associated landfills. Locator maps of the two areas are enclosed. I would appreciate your department's review of both sites for any known historic or archaeological resources. I would also appreciate any data relative to probability of resource occurrence and need to conduct an archaeological survey in both areas.

Should you have any questions, please feel free to call me at your convenience.

Sincerely yours,



Rhodes Robinson
Vice President

RR/jt

Attachments

no sites, no site likely A-95 no number project

POWER OF ATTORNEY

BROWN, WOOD, IVEY, MITCHELL & PETTY

ONE WORLD TRADE CENTER, NEW YORK, N.Y. 10048

212-839-5300

TELEX: 127324

CABLE ADDRESS: BROWOODLAW

TELECOPIER: 212-839-5599

555 CALIFORNIA STREET
SAN FRANCISCO, CA. 94104
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TELECOPIER: 415-397-4621

ONE FARRAGUY SQUARE SOUTH
WASHINGTON, D.C. 20006
TELEPHONE: 202-383-7400
TELECOPIER: 202-383-7409

March 18, 1985

Mr. Ron Mills
Malcolm Pirnie, Inc.
2 Corporate Park Drive
Box 751
White Plains, New York 10602

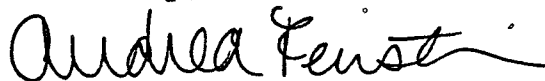
Re: Broward County, Florida
Resource Recovery Project

Dear Mr. Mills:

Enclosed please find the Power of Attorney appointments on behalf of North Broward County Resource Recovery Project, Inc. and South Broward County Resource Recovery Project, Inc. Thomas Henderson requested that I send these forms to you.

If I can be of further assistance, please contact me (212-839-5398).

Sincerely,



Andrea Feirstein

AF:ms
Enclosure

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS, That

NORTH BROWARD COUNTY RESOURCE RECOVERY PROJECT, INC., a corporation organized and existing under the laws of Florida (hereinafter the "Corporation"), has irrevocably constituted and appointed, and by these presents does irrevocably constitute and appoint Thomas Henderson its true and lawful Attorney-in-Fact, with full power of substitution, with respect to all matters arising in connection with the development, acquisition, construction and operation of the proposed resource recovery facilities, financed by the issuance by Broward County, Florida of its Resource Recovery Revenue Bonds, Series 1984A, 1984B and 1984C. Without in any way limiting the generality of the foregoing, the power and authority of the said Attorney-in-Fact and of any substitute Attorney-in-Fact appointed hereunder, shall include the power and authority to make application for, execute and deliver on behalf of the Corporation any and all regulatory forms, permits and licenses as may be required by federal, state and local statutes, ordinances and/or administrative regulations, and any and all other agreements, contracts, consents and documents in connection with the Corporation's acting as aforesaid which the said Attorney-in-Fact or any such substitute Attorney-in-Fact may deem advisable. The Corporation hereby ratifies and confirms all that the said Attorney-in-Fact or any such substitute Attorney-in-Fact may do by virtue hereof.

IN WITNESS WHEREOF, the Corporation has caused these presents to be executed in its name a member of its Board of Directors this 18th day of March, 1985.

NORTH BROWARD COUNTY RESOURCE
RECOVERY PROJECT, INC.

By



James B. May

A member of the Board of Directors

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS, That

SOUTH BROWARD COUNTY RESOURCE RECOVERY PROJECT, INC., a corporation organized and existing under the laws of Florida (hereinafter the "Corporation"), has irrevocably constituted and appointed, and by these presents does irrevocably constitute and appoint Thomas Henderson its true and lawful Attorney-in-Fact, with full power of substitution, with respect to all matters arising in connection with the development, acquisition, construction and operation of the proposed resource recovery facilities, financed by the issuance by Broward County, Florida of its Resource Recovery Revenue Bonds, Series 1984A, Series 1984B and Series 1984C. Without in any way limiting the generality of the foregoing, the power and authority of the said Attorney-in-Fact and of any substitute Attorney-in-Fact appointed hereunder, shall include the power and authority to make application for, execute and deliver on behalf of the Corporation any and all regulatory forms, permits and licenses as may be required by federal, state and local statutes, ordinances and/or administrative regulations, and any and all other agreements, contracts, consents and documents in connection with the Corporation's acting as aforesaid which the said Attorney-in-Fact or any such substitute Attorney-in-Fact may deem advisable. The Corporation hereby ratifies and confirms all that the said Attorney-in-Fact or any such substitute Attorney-in-Fact may do by virtue hereof.

IN WITNESS WHEREOF, the Corporation has caused these presents to be executed in its name by a member of its Board of Directors this 18th day of March, 1985.

SOUTH BROWARD COUNTY RESOURCE
RECOVERY PROJECT, INC.

By

Andrea K. Feirstein

Andrea K. Feirstein

A member of the Board of Directors