FLORIDA POWER CORPORATION

SITE CERTIFICATION APPLICATION

POLK COUNTY SITE

AUGUST 1992

Florida Power CORPORATION

Volume 1

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SITE CERTIFICATION APPLICATION

FOR

FLORIDA POWER CORPORATION

POLK COUNTY SITE

Harold A. Frediani, Jr., P.E.
Florida No. 36394

Ebasco Services, Incorporated
Environmental Division
145 Technology Park
Norcross, Georgia 30092

Charles P. Gupton, P.E.
Florida No. 20902

Dames & Moore, Inc.
6400 Congress Avenue
Boca Raton, Florida 33487

Charles J. Schutty, P.E.
Florida No. 43646

Black & Veatch Engineers
11401 Lamar
Overland Park, Kansas 66211

APPLICANT INFORMATION

Applicant's Official Name Florida Power Corporation

Address P. O. Box 14042, St. Petersburg, FL 33733

Address of Official Headquarters Same

Business Entity (corporation, partnership, co-operative) Corporation

Names, owners, etc. Florida Progress Corporation

Name and Title of Chief Executive Officer Mr. A. J. Keesler Jr.
President and Chief Executive Officer

Name, Address, and Phone Number of Official Representative responsible for obtaining certification Ms. Kathleen L. Small
Florida Power Corporation
P. O. Box 14042, MAC H2G, St. Petersburg, FL 33733
(813) 866-5529

Site Location (county) Polk

Nearest Incorporated City Fort Meade

Latitude and Longitude Latitude 27° 47' 15"; Longitude 81° 52' 21"

UTM's Northerly 1,255,200

Easterly 541,600

Section, Township, Range S13, T31S, R24E

Location of any directly associated transmission facilities (counties) Polk, Hillsborough

Name Plate Generating Capacity 470 MW

Capacity of Proposed Additions and Ultimate Site Capacity (where applicable) 3,200 MW

Remarks: (Additional information that will help identify the applicant) Applicant is represented by: Mr. Gary Sams
Hopping Boyd Green & Sams
P. O. Box 6526, Tallahassee, FL 32314
(904) 222-7500

LIST OF ORGANIZATIONS THAT PARTICIPATED IN THE PREPARATION OF THE SCA

Florida Power Corporation
St. Petersburg, Florida
- Overall Management and Direction

Ebasco Environmental Division of Ebasco Services, Inc.
Stuart, Florida
- Overall Environmental Contractor

Black & Veatch
Kansas City, Missouri
- Engineering Contractor

Dames & Moore
Boca Raton, Florida
- Site Civil and Geotechnical Engineering
- Geohydrology

Hopping, Boyd, Green & Sams
Tallahassee, Florida
- Environmental Attorneys for FPC

Peterson, Myers, Craig, Crews, Brandon & Puterbaugh, P.A.
Winter Park and Lake Wales, Florida
- Attorneys Coordinating with Local Governments

Moore/Bowers
Tampa, Florida
- Subcontractor for Planning/Zoning, Human Resources, Land Use, Public Information, Socioeconomics and Linear Feature Review

KBN Engineering & Applied Sciences, Inc.
Gainesville, Florida

- Class I Area Air Quality Modeling

Orlando Laboratories, Inc.
Orlando, Florida

- Subcontractor for Water Quality Analyses

Kimley-Horn and Associates, Inc.
West Palm Beach, Florida

- Subcontractor for Traffic Analyses

VOLUME DIRECTORY i

TABLE OF CONTENTS v

LIST OF TABLES xxxiii

LIST OF FIGURES lviii

LIST OF ACRONYMS AND ABBREVIATIONS civ

PREFACE cix

VOLUME DIRECTORY

VOLUME 1

1.0 NEED FOR POWER AND THE PROPOSED FACILITIES
2.0 SITE AND VICINITY CHARACTERISTICS
2.1 SITE AND ASSOCIATE FACILITIES DELINEATION
2.2 SOCIOPOLITICAL ENVIRONMENT
2.3 BIOPHYSICAL ENVIRONMENT
- 2.3.1 Geohydrology
- 2.3.2 Subsurface Hydrology
- 2.3.3 Site Water Budget and Area Uses
- 2.3.4 Surficial Hydrology
- 2.3.5 Vegetation/Land Use
- 2.3.6 Ecology
- 2.3.7 Meteorology and Ambient Air Quality
- 2.3.8 Noise
- 2.3.9 Other Environmental Features

3.0 THE PLANT AND DIRECTLY ASSOCIATED FACILITIES
3.1 BACKGROUND
3.2 SITE LAYOUT
3.3 FUEL AND FUEL HANDLING CHARACTERISTICS
3.4 AIR EMISSIONS AND CONTROLS
3.5 PROJECT WATER USE
- 3.5.1 Heat Dissipation System
- 3.5.2 Domestic/Sanitary Wastewater
- 3.5.3 Potable Water Systems
- 3.5.4 Process Water Systems

3.6 CHEMICAL AND BIOCIDE WASTE
3.7 SOLID AND HAZARDOUS WASTES AND BY-PRODUCTS
3.8 ON-SITE DRAINAGE SYSTEM
3.9 MATERIALS HANDLING
3.10 AQUIFER STORAGE AND RECOVERY

VOLUME DIRECTORY

VOLUME 2

4.0 ENVIRONMENTAL EFFECTS OF SITE PREPARATION, AND PLANT AND ASSOCIATED FACILITIES
4.1 LAND IMPACT
4.2 IMPACT ON SURFACE WATER BODIES AND USES
4.3 GROUNDWATER IMPACTS
4.4 ECOLOGICAL IMPACTS
4.5 AIR IMPACT
4.6 IMPACT ON HUMAN POPULATIONS
4.7 IMPACT ON LANDMARKS AND SENSITIVE AREAS
4.8 IMPACT ON ARCHAEOLOGICAL AND HISTORIC SITES
4.9 SPECIAL FEATURES
4.10 BENEFITS FROM CONSTRUCTION
4.11 VARIANCES
5.0 EFFECTS OF PLANT OPERATION
5.1 EFFECTS OF THE OPERATION OF THE HEAT DISSIPATION SYSTEM
5.2 EFFECTS OF CHEMICAL AND BIOCIDE DISCHARGES
5.3 IMPACTS ON WATER SUPPLIES
5.4 SOLID/HAZARDOUS WASTE DISPOSAL IMPACTS
5.5 SANITARY AND OTHER WASTE DISCHARGES
5.6 AIR QUALITY IMPACTS
5.7 NOISE
5.8 CHANGES IN NONAQUATIC SPECIES POPULATION
5.9 OTHER PLANT OPERATION EFFECTS
5.10 ARCHAEOLOGICAL SITES
5.11 RESOURCES COMMITTED
5.12 VARIANCES
6.0 TRANSMISSION LINE AND OTHER LINEAR FACILITIES
6.1 TRANSMISSION LINE
6.2 GAS PIPELINE
6.3 OTHER LINEAR FACILITIES

VOLUME DIRECTORY

VOLUME 2 (Continued)

7.0 ECONOMIC AND SOCIAL EFFECTS OF PROJECT CONSTRUCTION AND OPERATION
7.1 SOCIOECONOMIC BENEFITS
7.2 SOCIOECONOMIC COSTS
7.3 REFERENCES
8.0 SITE AND DESIGN ALTERNATIVES
9.0 COORDINATION

VOLUME 3

10.0 APPENDICES
10.1 FEDERAL PERMIT APPLICATIONS OR APPROVALS
- 10.1.1 316 Demonstrations
- 10.1.2 NPDES Application/Permit
- 10.1.3 Hazardous Waste Management Application/Permit
- 10.1.4 Section 10 or 404 Application/Permit
- 10.1.5 Prevention of Significant Deterioration Permit Application
- 10.1.6 Coastal Zone Management Certifications
- 10.1.7 FAA Notice of Proposed Construction of Alteration

10.2 ZONING DESCRIPTIONS
10.3 LAND USE PLAN DESCRIPTION

VOLUME 4

10.4 EXISTING STATE PERMITS OR APPLICATIONS
- 10.5.1 Visual Analysis
- 10.5.2 Cultural Resources and Sovereignty and Submerged Lands
- 10.5.3 Subsurface Investigations

VOLUME DIRECTORY

VOLUME 5

10.5.4 Surface Water
10.5.5 Ecology

VOLUME 6

10.5.6 Meteorology/Air Quality
10.5.7 Noise
10.5.8 Aquifer Characteristics Program
10.5.9 Groundwater Supply Model
10.5.10 Construction Dewatering Impact Model
10.6 SUMMARY AIR QUALITY ANALYSIS
10.7 PSC ORDER ON NEED
10.8 TRANSPORTATION ANALYSIS
10.9 RECLAMATION INFORMATION
10.10 ELECTRIC AND MAGNETIC FIELD DETERMINATIONS
10.11 BENEFICIAL USE OF TREATED SEWAGE EFFLUENT

TABLE OF CONTENTS

Section/Title			Page
1.1	NEED SUMMARY		1.1-1
1.2	PSC ORDER ON NEED		1.2-1
1.3	POLK COUNTY SITE SELECTION PROCESS		1.3-1
1.4	TECHNOLOGY SELECTION		1.4-1
	1.4.1	Generation Alternatives	1.4-1
	1.4.2	Combined Cycle Design	1.4-2
1.5	POLK COUNTY SITE STRATEGIC ASSESSMENT		1.5-1
	1.5.1	Schedule Flexibility	1.5-1
	1.5.2	Fuel Flexibility	1.5-1
	1.5.3	Clean Air Act Requirements	1.5-1
2.0	SITE AND VICINITY CHARACTERISTICS		2.0-1
2.1	SITE AND ASSOCIATED FACILITIES DELINEATION		2.1-1
	2.1.1	Description of the Site and Surrounding Area	2.1-1
	2.1.2	Establishment of the Baseline Condition	2.1-2
	2.1.3	Proposed Site Delineation	2.1-5
	2.1.4	References	2.1-5
2.2	SOCIOPOLITICAL ENVIRONMENT		2.2-1
	2.2.1	Governmental Jurisdictions	2.2-1
	2.2.2	Zoning and Land Use Plans	2.2-3
	2.2.3	Demography and Ongoing Land Use	2.2-3

TABLE OF CONTENTS (Continued)

Section/Title		Page
2.2.4	Easements, Title, Agency Works	2.2-6
2.2.5	Regional Scenic, Cultural and Natural Landmarks	2.2-6
2.2.6	Archeological and Historic Sites	2.2-6
2.2.7	Socioeconomics and Public Services	2.2-6
2.2.7.1	Socioeconomics	2.2-6
2.2.7.2	Public Services	2.2-12
2.2.8	References	2.2-22
2.3	BIOPHYSICAL ENVIRONMENT	2.3.0-1
2.3.1	Geohydrology	2.3.1-1
2.3.1.1	General Geology	2.3.1-3
2.3.1.2	Detailed Site Lithologic Description	2.3.1-5
2.3.1.3	Geologic Maps	2.3.1-15
2.3.1.4	Bearing Strength	2.3.1-15
2.3.1.5	References	2.3.1-20
2.3.2	Subsurface Hydrology	2.3.2-1
2.3.2.1	Subsurface Hydrological Data For Site Area	2.3.2-1
2.3.2.2	Karst Hydrogeology	2.3.2-6
2.3.2.3	References	2.3.2-19
2.3.3	Site Water Budget and Area Uses	2.3.3-1
2.3.3.1	Site Water Budget	2.3.3-1
2.3.3.2	Area Uses	2.3.3-3
2.3.3.3	References	2.3.3-4

TABLE OF CONTENTS (Continued)

Section/Title		Page
2.3.4	Surficial Hydrology	2.3.4-1
2.3.4.1	Hydrologic Characterization	2.3.4-1
2.3.4.2	Measurement Programs	2.3.4-9
2.3.4.3	References	2.3.4-10
2.3.5	Vegetation/Land Use	2.3.5-1
2.3.5.1	Baseline Conditions	2.3.5-1
2.3.5.2	Existing Conditions	2.3.5-8
2.3.5.3	References	2.3.5-9
2.3.6	Ecology	2.3.6-1
2.3.6.1	Species - Environmental Relationships	2.3.6-2
2.3.6.2	Pre-existing Stresses	2.3.6-33
2.3.6.3	Measurement Program	2.3.6-35
2.3.6.4	References	2.3.6-49
2.3.7	Meteorology and Ambient Air Quality	2.3.7-1
2.3.7.1	Meteorology	2.3.7-1
2.3.7.2	Ambient Air Quality	2.3.7-5
2.3.7.3	Ambient Monitoring Program Description	2.3.7-7
2.3.7.4	References	2.3.7-9
2.3.8	Noise	2.3.8-1
2.3.8.1	Introduction	2.3.8-1
2.3.8.2	Study Area Description	2.3.8-1
2.3.8.3	Noise Standards or Guidelines	2.3.8-2
2.3.8.4	Noise Monitoring Methodology	2.3.8-2

TABLE OF CONTENTS (Continued)

Section/Title			Page
	2.3.8.5	Data Analysis	2.3.8-3
	2.3.8.6	Survey Results	2.3.8-4
	2.3.8.7	Summary	2.3.8-7
	2.3.8.8	References	2.3.8-7
2.3.9		Other Environmental Features	2.3.9-1
	2.3.9.1	References	2.3.9-1
3.0		THE PLANT AND DIRECTLY ASSOCIATED FACILITIES	3.0-1
3.1		BACKGROUND	3.1-1
3.2		SITE LAYOUT	3.2-1
3.2.1		Plant Island	3.2-1
3.2.2		Balance of Site	3.2-2
3.3		FUEL AND FUEL HANDLING CHARACTERISTICS	3.3-1
3.3.1		Natural Gas	3.3-1
3.3.2		Fuel Oil	3.3-1
3.3.3		Coal	3.3-2
3.3.4		Groundwater Protection/Runoff Collection and Treatment	3.3-3
3.3.5		Alternative Fuels	3.3-4
3.4		AIR EMISSIONS AND CONTROLS	3.4-1
3.4.1		Air Emission Types and Sources	3.4-1
	3.4.1.1	Sources	3.4-1

TABLE OF CONTENTS (Continued)

Section/Title			Page
	3.4.1.2	Emissions	3.4-3
	3.4.1.3	Emissions Inventory	3.4-3
3.4.2		Air Emission Controls	3.4-3
3.4.3		Best Available Control Technology (BACT)	3.4-4
	3.4.3.1	Introduction	3.4-4
	3.4.3.2	Requirements and Assumptions	3.4-5
	3.4.3.3	Nitrogen Oxides	3.4-6
	3.4.3.4	Sulfur Dioxide	3.4-19
	3.4.3.5	Sulfuric Acid Mist	3.4-26
	3.4.3.6	Carbon Monoxide and Volatile Organic Compounds	3.4-27
	3.4.3.7	Particulate Matter (PM_{10}) Emissions	3.4-30
	3.4.3.8	Trace Pollutant Emissions	3.4-33
	3.4.3.9	Summary	3.4-36
3.4.4		Design Data for Control Equipment	3.4-36
3.4.5		Design Philosophy	3.4-37
3.4.6		References	3.4-37
3.5		PROJECT WATER USE	3.5.0-1
3.5.1		Heat Dissipation System	3.5.1-1
	3.5.1.1	System Design	3.5.1-1
	3.5.1.2	Source of Cooling Water	3.5.1-35
	3.5.1.3	Dilution System	3.5.1-36

TABLE OF CONTENTS (Continued)

Section/Title		Page
3.5.1.4	Blowdown, Screened Organisms, and Trash Disposal	3.5.1-36
3.5.1.5	Injection Wells	3.5.1-37
3.5.1.6	References	3.5.1-37
3.5.2	Domestic/Sanitary Wastewater	3.5.2-1
3.5.3	Potable Water Systems	3.5.3-1
3.5.4	Process Water Systems	3.5.4-1
3.6	CHEMICAL AND BIOCIDE WASTE	3.6-1
3.6.1	Introduction	3.6-1
3.6.2	Ultimate Development	3.6-2
3.6.2.1	Cooling Pond Circulating Water Treatment and Other Biocide Treatment	3.6-2
3.6.2.2	Well Water Treatment Wastes	3.6-3
3.6.2.3	Process Water Treatment	3.6-3
3.6.2.4	Sanitary Waste Treatment	3.6-5
3.6.2.5	Steam Cycle Water Treatment	3.6-5
3.6.2.6	Makeup Water Demineralization and Condensate Polishing Wastes	3.6-5
3.6.2.7	Chemical Cleaning Wastes	3.6-6
3.6.2.8	Miscellaneous Chemical Drains	3.6-7
3.6.2.9	Neutralization Basin	3.6-8
3.6.2.10	Oil Spill Prevention	3.6-8
3.6.2.11	Material Storage Area Runoff	3.6-9
3.6.2.12	Active Solid Waste Area Runoff	3.6-9
3.7	SOLID AND HAZARDOUS WASTES AND BY-PRODUCTS	3.7-1

TABLE OF CONTENTS (Continued)

Section/Title		Page
3.7.1	Solid Wastes	3.7-1
3.7.1.1	Quantities and Types	3.7-1
3.7.1.2	Methods of Treatment, Handling, Interim Storage and Off-Site Disposal	3.7-4
3.7.1.3	On-Site Disposal	3.7-5
3.7.2	Hazardous Wastes	3.7-29
3.7.2.1	Coal Gasification Units	3.7-29
3.7.2.2	Pulverized Coal Units	3.7-29
3.7.2.3	Other Hazardous Wastes	3.7-29
3.7.2.4	On-Site Disposal and Storage	3.7-30
3.8	ON-SITE DRAINAGE SYSTEM	3.8-1
3.8.1	Design Parameters	3.8-1
3.8.2	Construction Phase Runoff	3.8-2
3.8.3	Operational Phase Storm Water Runoff	3.8-3
3.8.4	Parcel Descriptions	3.8-3
3.9	MATERIALS HANDLING	3.9-1
3.9.1	Site Facilities	3.9-1
3.9.2	Operational Materials	3.9-3
3.10	AQUIFER STORAGE AND RECOVERY	3.10-1
4.0	ENVIRONMENTAL EFFECTS OF SITE PREPARATION, AND PLANT AND ASSOCIATED FACILITIES CONSTRUCTION	4.0-1
4.1	LAND IMPACT	4.1-1

TABLE OF CONTENTS (Continued)

Section/Title		Page
4.1.1	General Construction Impacts	4.1-1
4.1.1.1	Plant Island Area	4.1-1
4.1.1.2	Cooling Pond Area	4.1-2
4.1.1.3	Solid Waste Disposal Area	4.1-4
4.1.1.4	Brine Pond Area	4.1-4
4.1.1.5	Buffer Area	4.1-5
4.1.1.6	Triangle Lakes Area	4.1-6
4.1.2	Roads	4.1-6
4.1.3	Flood Zones	4.1-6
4.1.4	Topography and Soils	4.1-6
4.1.5	References	4.1-7
4.2	IMPACT ON SURFACE WATER BODIES AND USES	4.2-1
4.2.1	Impact Assessment	4.2-1
4.2.1.1	Off-Site Water Bodies	4.2-1
4.2.1.2	On-Site Water Bodies	4.2-2
4.2.2	Monitoring Programs	4.2-3
4.3	GROUNDWATER IMPACTS	4.3-1
4.3.1	Construction Dewatering Impact Assessment	4.3-1
4.3.1.1	Introduction	4.3-1
4.3.1.2	Site Considerations	4.3-2
4.3.1.3	Dewatering Considerations	4.3-3
4.3.1.4	Method of Analysis	4.3-4

TABLE OF CONTENTS (Continued)

Section/Title			Page
4.3.2		Dewatering Monitoring Program	4.3-6
	4.3.2.1	Introduction	4.3-6
	4.3.2.2	Purpose	4.3-6
	4.3.2.3	Hydrogeologic and Water Quality Background	4.3-7
	4.3.2.4	Areas of Potential Impact	4.3-7
	4.3.2.5	Proposed Groundwater Monitoring Plan	4.3-7
4.3.3		References	4.3-10
4.4		ECOLOGICAL IMPACTS	4.4-1
4.4.1		Impact Assessment	4.4-1
	4.4.1.1	Site Construction	4.4-1
	4.4.1.2	Environmental Management and Protection Plans for Construction	4.4-2
	4.4.1.3	Aquatic Ecology	4.4-4
	4.4.1.4	Vegetation Communities	4.4-5
	4.4.1.5	Enhancement Plan	4.4-6
	4.4.1.6	Threatened and Endangered Animal Species	4.4-10
	4.4.1.7	Threatened and Endangered Plant Species	4.4-11
4.4.2		Monitoring Programs	4.4-12
4.5		AIR IMPACT	4.5-1
4.5.1		Air Quality Impacts	4.5-1
	4.5.1.1	Fugitive Dust	4.5-1
	4.5.1.2	Other Air Pollutant Emissions	4.5-1

TABLE OF CONTENTS (Continued)

Section/Title		Page
4.5.2	Air Quality Control Methods	4.5-2
4.5.3	Ambient Air Quality Monitoring Program	4.5-3
4.6	IMPACT ON HUMAN POPULATIONS	4.6-1
4.6.1	Construction Traffic Impacts	4.6-1
4.6.1.1	Study Area	4.6-2
4.6.1.2	Year 2002 Non-Project Traffic	4.6-4
4.6.1.3	Year 2010 Non-Project Traffic	4.6-5
4.6.1.4	Plant Construction Traffic	4.6-7
4.6.1.5	2002 Roadway Capacity Analysis	4.6-9
4.6.1.6	2002 Intersection Capacity Analysis	4.6-10
4.6.1.7	2010 Roadway Capacity Analysis	4.6-10
4.6.1.8	2010 Intersection Capacity Analysis	4.6-11
4.6.1.9	Recommendations	4.6-11
4.6.2	Socioeconomic Impacts	4.6-13
4.6.3	Construction Noise Impacts	4.6-14
4.6.4	References	4.6-16
4.7	IMPACT ON LANDMARKS AND SENSITIVE AREAS	4.7-1
4.8	IMPACT ON ARCHAEOLOGICAL AND HISTORIC SITES	4.8-1
4.9	SPECIAL FEATURES	4.9-1
4.10	BENEFITS FROM CONSTRUCTION	4.10-1
4.11	VARIANCES	4.11-1

TABLE OF CONTENTS (Continued)

Section/Title			Page
5.1	EFFECTS OF THE OPERATION OF THE HEAT DISSIPATION SYSTEM		5.1-1
5.1.1	Temperature Effect on Receiving Body of Water		5.1-1
5.1.2	Effects on Aquatic Life		5.1-1
5.1.3	Biological Effects of Modified Circulation		5.1-1
5.1.4	Effects of Offstream Cooling		5.1-3
	5.1.4.1	Fog	5.1-3
	5.1.4.2	Blowdown and Drift	5.1-3
5.1.5	Measurement Program		5.1-3
5.2	EFFECTS OF CHEMICAL AND BIOCIDE DISCHARGES		5.2-1
5.2.1	Industrial Wastewater Discharges		5.2-1
5.2.2	Cooling Tower Blowdown		5.2-1
5.2.3	Measurement Program		5.2-1
5.3	IMPACTS ON WATER SUPPLIES		5.3-1
5.3.1	Surface Water		5.3-1
	5.3.1.1	Peace River	5.3-2
	5.3.1.2	Tributaries	5.3-3
5.3.2	Ground Water		5.3-4

TABLE OF CONTENTS (Continued)

Section/Title		Page
5.3.2.1	Impacts of Groundwater Withdrawals for Supplemental Make-Up Water to the Cooling Pond	5.3-5
5.3.2.2	Cooling Pond and Brine Pond Seepage	5.3-13
5.3.2.3	Impacts of On-Site Solid Waste Disposal	5.3-20
5.3.3	Drinking Water	5.3-23
5.3.3.1	Impacts of Withdrawal from a Drinking Water Source	5.3-24
5.3.3.2	Impacts of Discharge to a Drinking Water Source	5.3-24
5.3.3.3	Water Reuse and Recycling	5.3-24
5.3.4	Leachate and Runoff	5.3-24
5.3.4.1	Material Handling Areas	5.3-24
5.3.4.2	Solid Waste Disposal Areas	5.3-25
5.3.5	Measurement Program	5.3-25
5.3.6	References	5.3-25
5.4	SOLID/HAZARDOUS WASTE DISPOSAL IMPACTS	5.4-1
5.4.1	Solid Waste	5.4-1
5.4.2	Hazardous Waste	5.4-2
5.5	SANITARY AND OTHER WASTE DISCHARGES	5.5-1
5.6	AIR QUALITY IMPACTS	5.6-1
5.6.1	Impact Assessment	5.6-1

TABLE OF CONTENTS (Continued)

Section/Title			Page
	5.6.1.1	Introduction	5.6-1
	5.6.1.2	Air Quality Regulatory Requirements Applicability	5.6-2
	5.6.1.3	Modelling Approach	5.6-4
	5.6.1.4	Meteorological Data	5.6-5
	5.6.1.5	Proposed Source Emissions/Stack Parameters	5.6-5
	5.6.1.6	Existing Source Emission Inventories	5.6-8
	5.6.1.7	Receptor Locations	5.6-11
	5.6.1.8	Background Concentrations	5.6-13
	5.6.1.9	Air Quality Modelling Results	5.6-14
	5.6.1.10	Supplementary PSD Class I Area Analyses	5.6-19
	5.6.1.11	Additional Impacts Analysis	5.6-27
5.6.2		Monitoring Programs	5.6-47
	5.6.2.1	Preconstruction Ambient Air Quality Monitoring	5.6-47
	5.6.2.2	Continuous Emissions Monitoring	5.6-48
5.6.3		References	5.6-51
5.7		NOISE	5.7-1
5.7.1		Receptors and Barriers	5.7-1
5.7.2		Noise Sources	5.7-2
5.7.3		Noise Modeling Results	5.7-2
5.7.4		Impact Assessment	5.7-3
5.7.5		References	5.7-4
5.8		CHANGES IN NONAQUATIC SPECIES POPULATION	5.8-1
5.8.1		Impacts	5.8-1
5.8.2		Monitoring	5.8-2

TABLE OF CONTENTS (Continued)

Section/Title			Page
5.9	OTHER PLANT OPERATION EFFECTS		5.9-1
5.9.1	Highway Traffic		5.9-1
	5.9.1.1	Study Area	5.9-2
	5.9.1.2	Year 2008 Non-Project Traffic	5.9-2
	5.9.1.3	Year 2018 Non-Project Traffic	5.9-3
	5.9.1.4	Plant Operations Traffic	5.9-3
	5.9.1.5	2008 Total Traffic Capacity Analysis	5.9-5
	5.9.1.6	2018 Total Traffic Capacity Analysis	5.9-5
	5.9.1.7	Recommendations	5.9-6
5.9.2	Rail Traffic		5.9-7
	5.9.2.1	Introduction	5.9-7
	5.9.2.2	Methodology	5.9-7
5.9.3	Benefits to On-Site Wetlands		5.9-11
5.9.4	References		5.9-11
5.10	ARCHAEOLOGICAL SITES		5.10-1
5.11	RESOURCES COMMITTED		5.11-1
5.11.1	Physical Resources		5.11-1
5.11.2	Biological Resources		5.11-1
5.11.3	Economic and Cultural Resources		5.11-2
5.12	VARIANCES		5.12-1

TABLE OF CONTENTS (Continued)

Section/Title			Page
6.1	TRANSMISSION LINE		6.1-1
6.1.1	Project Introduction		6.1-1
6.1.2	Corridor Location and Layout		6.1-1
6.1.3	Transmission Line and Road Design Characteristics		6.1-2
6.1.4	Cost Projections		6.1-3
6.1.5	Corridor Selection		6.1-3
6.1.6	Socio-Political Environment of the Corridor Area		6.1-3
	6.1.6.1	Governmental Jurisdictions	6.1-3
	6.1.6.2	Zoning and Land Use Plans	6.1-3
	6.1.6.3	Easements, Title, Agency Works	6.1-4
	6.1.6.4	Vicinity Scenic, Cultural, and Natural Landmarks	6.1-5
	6.1.6.5	Archaeological and Historic Sites	6.1-5
6.1.7	Bio-Physical Environment of the Corridor Area		6.1-5
	6.1.7.1	Land Use/Vegetation	6.1-5
	6.1.7.2	Affected Waters and Wetlands	6.1-6
	6.1.7.3	Ecology	6.1-6
	6.1.7.4	Other Environmental Features	6.1-6
6.1.8	Effects of Right-of-Way Preparation and Transmission Line Construction		6.1-7
	6.1.8.1	Right-of-Way Clearing and Access	6.1-7
	6.1.8.2	Impact on Water Bodies and Uses	6.1-9
	6.1.8.3	Solid Wastes	6.1-10
	6.1.8.4	Changes to Vegetation, Wildlife and Aquatic Life	6.1-10
	6.1.8.5	Impact on Human Populations	6.1-11

TABLE OF CONTENTS (Continued)

Section/Title		Page
6.1.8.6	Impact on Regional Scenic, Cultural, and Natural Landmarks	6.1-11
6.1.8.7	Impact on Archaeological and Historic Sites	6.1-11
6.1.9	Post-Construction Impacts and Effects of Maintenance	6.1-11
6.1.9.1	Maintenance Techniques	6.1-11
6.1.9.2	Multiple Uses	6.1-12
6.1.9.3	Changes in Species Populations	6.1-12
6.1.9.4	Effects of Public Access	6.1-12
6.1.10	Electric and Magnetic Effects	6.1-12
6.1.11	References	6.1-15
6.2	GAS PIPELINE	6.2-1
6.2.1	Project Introduction	6.2-1
6.2.2	Corridor Location and Layout	6.2-2
6.2.3	Gas Pipeline and Road Design Characteristics	6.2-2
6.2.4	Cost Projections	6.2-3
6.2.5	Corridor Selection Process	6.2-3
6.2.5.1	Identification of a Study Area and Corridor Selection Criteria	6.2-4
6.2.5.2	Evaluation of Candidate Corridors	6.2-5
6.2.6	Socio-Political Environment of the Corridor Area	6.2-6
6.2.6.1	Governmental Jurisdictions	6.2-6
6.2.6.2	Zoning and Land Use Plans	6.2-7

TABLE OF CONTENTS (Continued)

Section/Title		Page
6.2.6.3	Easements, Title, Agency Works	6.2-10
6.2.6.4	Vicinity Scenic, Cultural, and Natural Landmarks	6.2-11
6.2.6.5	Archaeological and Historic Sites	6.2-11
6.2.7	Bio-Physical Environment of the Corridor Area	6.2-11
6.2.7.1	Land Use/Vegetation	6.2-11
6.2.7.2	Affected Waters and Wetlands	6.2-12
6.2.7.3	Ecology	6.2-12
6.2.7.4	Other Environmental Features	6.2-13
6.2.8	Effects of Right-of-Way Preparation and Pipeline Construction	6.2-13
6.2.8.1	Construction Techniques	6.2-13
6.2.8.2	Impact on Water Bodies and Uses	6.2-17
6.2.8.3	Solid Wastes	6.2-17
6.2.8.4	Changes to Vegetation, Wildlife and Aquatic Life	6.2-18
6.2.8.5	Impact on Human Populations	6.2-18
6.2.8.6	Impact on Regional Scenic, Cultural and Natural Landmarks	6.2-18
6.2.8.7	Impact on Archaeological and Historic Sites	6.2-18
6.2.9	Post-Construction Impacts and Effects of Maintenance	6.2-19
6.2.9.1	Maintenance Techniques	6.2-19
6.2.9.2	Right-of-Way Uses	6.2-19
6.2.9.3	Operational Safety Provisions	6.2-20
6.2.9.4	Changes in Species Populations	6.2-21
6.2.9.5	Effects of Public Access	6.2-21
6.2.10	References	6.2-21

TABLE OF CONTENTS (Continued)

Section/Title		Page
6.3	OTHER LINEAR FACILITIES	6.3-1
6.3.1	Project Introduction	6.3-1
6.3.2	Corridor Location and Layout	6.3-2
6.3.3	Reclaimed Water Pipeline and Road Design Characteristics	6.3-2
6.3.4	Cost Projections	6.3-2
6.3.5	Corridor Selection	6.3-2
6.3.6	Socio-Political Environment of the Corridor Area	6.3-3
6.3.6.1	Governmental Jurisdictions	6.3-3
6.3.6.2	Zoning and Land Use Plans	6.3-3
6.3.6.3	Easements, Title, Agency Works	6.3-6
6.3.6.4	Vicinity Scenic, Cultural and Natural Landmarks	6.3-6
6.3.6.5	Archaeological and Historic Sites	6.3-6
6.3.7	Bio-Physical Environment of the Corridor Area	6.3-7
6.3.7.1	Land Use/Vegetation	6.3-7
6.3.7.2	Affected Waters and Wetlands	6.3-7
6.3.7.3	Ecology	6.3-7
6.3.7.4	Other Environmental Features	6.3-8
6.3.8	Effects of Right-of-Way Preparation and Pipeline Construction	6.3-8
6.3.8.1	Construction Techniques	6.3-8
6.3.8.2	Impact on Water Bodies and Uses	6.3-11
6.3.8.3	Solid Wastes	6.3-11
6.3.8.4	Changes to Vegetation, Wildlife, and Aquatic Life	6.3-12
6.3.8.5	Impact on Human Populations	6.3-12
6.3.8.6	Impact on Regional Scenic, Cultural and Natural Landmarks	6.3-12
6.3.8.7	Impact on Archaeological and Historic Sites	6.3-12

TABLE OF CONTENTS (Continued)

Section/Title		Page
6.3.9	Post-Construction Impacts and Effects of Maintenance	6.3-13
6.3.9.1	Maintenance Techniques	6.3-13
6.3.9.2	Right-of-Way Uses	6.3-13
6.3.9.3	Changes in Species Populations	6.3-13
6.3.9.4	Effects of Public Access	6.3-14
6.3.10	Other Post-Construction Effects	6.3-14
6.3.11	References	6.3-14
7.0	ECONOMIC AND SOCIAL EFFECTS OF PROJECT CONSTRUCTION AND OPERATION	7.0-1
7.1	SOCIOECONOMIC BENEFITS	7.1-1
7.2	SOCIOECONOMIC COSTS	7.2-1
7.2.1	Temporary External Costs	7.2-1
7.2.2	Long-Term External Costs	7.2-1
7.2.2.1	Impact on Community Services	7.2-1
7.2.2.2	Aesthetic and Scenic Values	7.2-2
7.2.3	Long-Term Cost and Benefit Summary	7.2-4
7.3	REFERENCES	7.3-1
8.0	SITE AND DESIGN ALTERNATIVES	8.0-1
9.0	COORDINATION	9.0-1

TABLE OF CONTENTS (Continued)

Section/Title		Page
10.1	FEDERAL PERMIT APPLICATIONS OR APPROVALS	10.1.1-1
10.1.1	316 Demonstrations	10.1.1-1
10.1.2	NPDES Application/Permit	10.1.2-1
10.1.2.1	Estech NPDES Permit No. FL0001171	10.1.2-2
10.1.2.2	IMC NPDES Permit No. FL0000230	10.1.2-3
10.1.2.3	USAC NPDES Permit No. FL0001902	10.1.2-4
10.1.3	Hazardous Waste Management Application/Permit	10.1.3-1
10.1.4	Section 10 or 404 Application/Permit	10.1.4-1
10.1.5	Prevention of Significant Deterioration Permit Application	10.1.5-1
10.1.6	Coastal Zone Management Certifications	10.1.6-1
10.1.7	FAA Notice of Proposed Construction of Alteration	10.1.7-1
10.2	ZONING DESCRIPTIONS	10.2-1
10.2.1	Polk County Zoning	10.2-2
10.2.1.1	Definitions	10.2-3
10.2.1.2	Staff Report and Conditional Use Permit	10.2-4
10.2.1.3	Polk County Zoning Ordinance: Article VI, Conditional Use Permit	10.2-5
10.2.1.4	Minimum Standards for Buffers	10.2-6
10.2.1.5	District Regulations	10.2-7
10.2.2	Hillsborough County Zoning	10.2-8
10.2.2.1	Definitions	10.2-9
10.2.2.2	Official Schedule of Uses in Agricultural and Residential Districts	10.2-10

TABLE OF CONTENTS (Continued)

Section/Title		Page
10.2.2.3	Buffering and Screening Requirements	10.2-11
10.2.2.4	Standards for Limited Uses, Special Uses and Other Uses	10.2-12
10.2.2.5	Scenic Corridor Regulations	10.2-13
10.2.2.6	Land Alteration Regulations	10.2-14
10.2.3	Hillsborough County EPC Wetlands Rule	10.2-15
10.2.4	Tampa Port Authority Rules for Sovereignty Lands Management	10.2-16
10.3	LAND USE PLAN DESCRIPTION	10.3-1
10.3.1	Polk County Land Use Plan	10.3-2
10.3.1.1	Future Land Use Categories	10.3-3
10.3.1.2	Comprehensive Plan Policies on Utilities	10.3-4
10.3.2	Hillsborough County Future Land Use Plan	10.3-5
10.3.2.1	Future Land Use Classifications	10.3-6
10.3.2.2	Comprehensive Plan Policies on Public Facilities	10.3-7
10.3.2.3	Comprehensive Plan Policies on River Resources Generally and the Alafia River	10.3-8
10.3.2.4	Comprehensive Plan Policies on Scenic Corridors	10.3-9
10.3.2.5	Environmental Considerations-Objective A-8	10.3-10
10.3.2.6	Conservation and Aquifer Recharge Policies	10.3-11
10.4	EXISTING STATE PERMITS OR APPLICATIONS	10.4-1
10.4.1	Active State Construction or Operation Permits	10.4-1
10.4.1.1	IMC Permit Number I053-97271	10.4-2

TABLE OF CONTENTS (Continued)

Section/Title		Page
10.4.1.2	Estech Permit Number I053-146828	10.4-3
10.4.1.3	Modification to Estech Permit Number I053-146828	10.4-4
10.4.1.4	Estech Permit Number I053-160115	10.4-5
10.4.1.5	USAC Permit Number I053-137120	10.4-6
10.4.2	Developments of Regional Impact	10.4-7
10.4.2.1	Development Order for IMC Noralyn/Phosphoria Mine Extension (DRI 485-38)	10.4-8
10.4.2.2	Notice of Adoption of Amendments to Noralyn/Phosphoria Mine Extension (DRI 485-38)	10.4-9
10.4.2.3	Amendment to Development Order for the Noralyn/Phosphoria Mine Extension (Adopted October 27, 1987)	10.4-10
10.4.2.4	Amendment to Development Order for the Noralyn/Phosphoria Mine Extension (Adopted November 21, 1989)	10.4-11
10.4.3	Binding Written Agreement	10.4-13
10.5	MONITORING PROGRAMS	10.5.1-1
10.5.1	Visual Analysis	10.5.1-1
10.5.1.1	Field Methodology	10.5.1-1
10.5.1.2	Techniques Used in Preparation of Simulations	10.5.1-2
10.5.2	Cultural Resources and Sovereignty and Submerged Lands	10.5.2-1
10.5.2.1	Cultural Resources	10.5.2-1
10.5.2.2	Sovereignty and Submerged Lands	10.5.2-2

TABLE OF CONTENTS (Continued)

Section/Title		Page
10.5.3	Subsurface Investigations	10.5.3-1
10.5.3.1	Subsurface Soil Studies	10.5.3-1
10.5.3.2	Subsurface Water Quality Data	10.5.3-8
10.5.3.3	References	10.5.3-8
10.5.4	Surface Water	10.5.4-1
10.5.4.1	Cooling Pond Model	10.5.4-1
10.5.4.2	Metal Speciation Model	10.5.4-2
10.5.4.3	Water Recirculation System Analysis	10.5.4-3
10.5.4.4	Historical Surface Water Data	10.5.4-4
10.5.4.5	Surface Water Hydrology Field Program Results	10.5.4-5
10.5.4.6	Surface Water Hydrology Technical Procedures Manual	10.5.4-11
10.5.4.7	Stormwater Calculations	10.5.4-12
10.5.5	Ecology	10.5.5-1
10.5.5.1	Vegetation Community Data	10.5.5-1
10.5.5.2	Results of Fisheries and Wildlife Investigations	10.5.5-27
10.5.5.3	Results of Reclamation Area Biological Monitoring Survey - Tiger Bay	10.5.5-48
10.5.5.4	Results of Reclamation Area Biological Monitoring Survey - West of K-6	10.5.5-49
10.5.5.5	Results of Reclamation Area Biological Monitoring Survey - Hookers Prairie Site	10.5.5-50
10.5.5.6	Results of Reclamation Area Biological Monitoring Survey - Homeland-9 Site	10.5.5-51
10.5.5.7	Results of Hester-Dendy Sampling	10.5.5-52
10.5.5.8	Habitat and Status of Birds and Mammals Potentially Occurring at the Polk County Site	10.5.5-58

TABLE OF CONTENTS (Continued)

Section/Title		Page
10.5.6	Meteorology/Air Quality	10.5.6-1
10.5.6.1	Joint Frequency Distribution of Wind Directions and Wind Speed by Atmospheric Stability Class, Tampa, Florida, Yearly 1982-1986	10.5.6-1
10.5.6.2	Summary of On-Site Hourly Surface Meteorological Monitoring Data	10.5.6-2
10.5.6.3	Summary of On-Site Hourly Air Quality Monitoring Data	10.5.6-3
10.5.6.4	Summary of On-Site PM_{10} Monitoring Data	10.5.6-4
10.5.6.5	Air Quality Models	10.5.6-5
10.5.7	Noise	10.5.7-1
10.5.7.1	Noise Model Description	10.5.7-1
10.5.7.2	Sound Power Level Data	10.5.7-1
10.5.8	Aquifer Characteristics Program	10.5.8-1
10.5.8.1	Introduction	10.5.8-1
10.5.8.2	Scope of Work	10.5.8-2
10.5.8.3	Regional Setting	10.5.8-2
10.5.8.4	Aquifer Performance Test	10.5.8-6
10.5.8.5	References	10.5.8-21
10.5.9	Groundwater Supply Model	10.5.9-1
10.5.9.1	Introduction	10.5.9-1
10.5.9.2	Development of the Model	10.5.9-2
10.5.9.3	Predictive Simulations	10.5.9-21
10.5.9.4	Discussion of Results	10.5.9-24

TABLE OF CONTENTS (Continued)

Section/Title — Page

10.5.9.5 References 10.5.9-25

10.5.10 Construction Dewatering Impact Model 10.5.10-1

10.5.10.1 Identification of Modeling Purposes 10.5.10-1
10.5.10.2 Development of Conceptual Method 10.5.10-1
10.5.10.3 Numerical Model Code Selection 10.5.10-2
10.5.10.4 CDI Model Design 10.5.10-2
10.5.10.5 Collection of Initial Model Input Parameters 10.5.10-3
10.5.10.6 Performance of Validation Runs 10.5.10-6
10.5.10.7 Performance of Predictive Simulations 10.5.10-6
10.5.10.8 Conclusions 10.5.10-8

10.6 SUMMARY AIR QUALITY ANALYSIS 10.6-1

10.7 PSC ORDER ON NEED 10.7-1

10.8 TRANSPORTATION ANALYSIS 10.8-1

10.8.1 Existing Turning Movement Counts 10.8-2
10.8.2 Existing Intersection Analysis 10.8-3
10.8.3 2002 Non-Project Intersection Analysis 10.8-4
10.8.4 2002 Total Intersection Analysis 10.8-5
10.8.5 2008 Non-Project Intersection Analysis 10.8-6
10.8.6 2008 Total Intersection Analysis 10.8-7
10.8.7 2010 Non-Project Intersection Analysis 10.8-8
10.8.8 2010 Total Intersection Analysis 10.8-9
10.8.9 2018 Non-Project Intersection Analysis 10.8-10
10.8.10 2018 Total Intersection Analysis 10.8-11
10.8.11 Detail Arterial Analysis 10.8-12

TABLE OF CONTENTS (Continued)

Section/Title		Page
10.9	RECLAMATION INFORMATION	10.9-1
10.9.1	Final Order - IMC Application for Modification of Approved Conceptual Reclamation and Restoration Plan at Noralyn/Phosphoria Mine - IMC-NP-CPE	10.9-1
10.9.2	Final Order - IMC Application for Approval of Reclamation at the Noralyn/Phosphoria Mine - IMC-NP-SP(1-9)	10.9-2
10.9.3	Program Amendments and Concurrent Conceptual Plan Modifications - IMC-NP-SP(9), EST-SC-SP(4), EST-SC-SP(7), and EST-SC-MC(1)	10.9-3
10.9.4	Completeness Response - IMC-NP-CPF	10.9-4
10.9.5	Variance Application - IMC Noralyn/Phosphoria	10.9-5
10.9.6	Nonmandatory Land Reclamation Program Reclamation Contract IMC-P-B/D	10.9-6
10.9.7	Nonmandatory Land Reclamation Program Reclamation Contract IMC-P-061	10.9-7
10.9.8	Final Order - Estech Application for Modification to Approved Conceptual Plan EST-SC-CPC and for Approval of Reclamation and Restoration in Logical Reclamation Unit EST-SC-SM(2)	10.9-8
10.9.9	Plan of Reclamation for Program IMC-P-2	10.9-9
10.9.10	Plan of Reclamation for Program IMC-NP-SMC(5)	10.9-10

TABLE OF CONTENTS (Continued)

Section/Title		Page
10.9.11	Approval of Amendments to Approved Reclamation and Restoration Programs at the Noralyn/Phosphoria Mine	10.9-11
10.9.12	Final Order - Estech Application for Modification to Silver City Mine Conceptual Plan (EST-SC-CPF) Due to Application to Amend Program EST-SC-SP(7)C	10.9-12
10.9.13	Final Order - Estech Application to Amend Approved Program at Silver City Mine - EST-SC-SP(4)A	10.9-13
10.9.14	Final Order - Estech Application for Modification of Silver City Mine Conceptual Plan (EST-SC-CPF) due to Application to Amend Program EST-SC-SP(7)C	10.9-14
10.9.15	Final Order - Estech Application for Amendment to Approved Reclamation and Restoration Program - EST-SC-SP(8A)	10.9-15
10.9.16	Final Order - Estech Application for Modification to Approved Conceptual Plan EST-SC-CPD and for Approval of Reclamation and Restoration in Logical Reclamation Unit EST-SC-MC(1)	10.9-16
10.9.17	Program Amendments and Concurrent Conceptual Plan Modifications - IMC-NP-SP(9), EST-SC-SP(4), EST-SC-SP(7), and EST-SC-MC(1)	10.9-17
10.9.18	Variance Application - Estech Silver City Mine	10.9-18
10.9.19	Completeness Response - EST-SC-CPH, EST-SC-SP(4)B, EST-SC-SP(7)D, and EST-SC-MC(1)A	10.9-19

TABLE OF CONTENTS (Continued)

Section/Title — Page

10.9.20 Completeness Response - EST-SC-SP(4), EST-SC-SP(7)D, EST-SC-MC(1)A, and EST-SC-CPH 10.9-20

10.9.21 Final Order Allowing Development of a Wildlife Corridor 10.9-21

10.10 ELECTRIC AND MAGNETIC FIELD DETERMINATIONS 10.10-1

10.10.1 Modeling Run 1-1 . . . . . 10.10-2

10.10.2 Modeling Run 2-2 . . . . . 10.10-3

10.10.3 Modeling Run 3-3 . . . . . 10.10-4

10.10.4 Modeling Run 4-4 . . . . . 10.10-5

10.10.5 Modeling Run 5-5 . . . . . 10.10-6

10.10.6 Modeling Run 6-6 . . . . . 10.10-7

10.10.7 Modeling Run 7-7 . . . . . 10.10-8

10.11 BENEFICIAL USE OF TREATED SEWAGE EFFLUENT 10.11-1

LIST OF TABLES

Table/Title		Page
2.1.2-1	EXISTING APPROVED (PRE-1992) RECLAMATION PLAN FLUCCS DESIGNATIONS FOR POLK COUNTY SITE MANDATORY MINE LANDS	2.1-7
2.2.7-1	POLK COUNTY BUDGET FOR 1991 - 1992	2.2-27
2.2.7-2	EXISTING ROADWAY CONFIGURATION (TWO PAGES)	2.2-28
2.2.7-3	POLK COUNTY LEVEL OF SERVICE VOLUMES PEAK HOUR/PEAK DIRECTION (TWO PAGES)	2.2-30
2.2.7-4	FDOT LEVEL OF SERVICE VOLUMES PEAK HOUR/PEAK DIRECTION	2.2-32
2.2.7-5	DAILY ROADWAY VOLUMES	2.2-33
2.2.7-6	EXISTING PEAK SEASON ROADWAY CONDITIONS (TWO PAGES)	2.2-34
2.2.7-7	EXISTING INTERSECTION CONDITIONS	2.2-36
2.2.7-8	EXISTING CONDITIONS ON PROBABLE RAIL ROUTE FOR FPC COAL TRANSPORTATION IN POLK COUNTY	2.2-37
2.3.1-1	SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS	2.3.1-21
2.3.1-2	SUMMARY OF POROSITY AND PERMEABILITY VALUES CLAY POND AREAS	2.3.1-22
2.3.1-3	SUMMARY OF CONSOLIDATION TEST RESULTS	2.3.1-23

LIST OF TABLES (Continued)

Table/Title		Page
2.3.1-4	SUMMARY OF TRIAXIAL UU TEST RESULTS	2.3.1-24
2.3.1-5	RESULTS OF IN-SITU VANE SHEAR TESTS	2.3.1-25
2.3.1-6	SUMMARY OF REPRESENTATIVE SOIL PROPERTIES DAM AREAS	2.3.1-26
2.3.1-7	SUMMARY OF LABORATORY PROCTOR TEST RESULTS	2.3.1-27
2.3.1-8	RECOMMENDED *n* VALUE FOR DIFFERENT SOIL TYPES	2.3.1-28
2.3.2-1	SOLUTIONAL FEATURES FROM WELL DATA	2.3.2-21
2.3.3-1	MONTHLY TEMPERATURE MEANS AND EXTREMES, 1951-1980, BARTOW AND WAUCHULA, FLORIDA	2.3.3-6
2.3.3-2	MONTHLY PRECIPITATION MEANS, 1951-1980, BARTOW AND WAUCHULA, FLORIDA	2.3.3-7
2.3.3-3	ESTIMATED ANNUAL EVAPOTRANSPIRATION, RUNOFF, AND RECHARGE	2.3.3-8
2.3.3-4	CONSUMPTIVE USE PERMITS WITHIN A FIVE MILE RADIUS OF THE POLK COUNTY SITE POWER BLOCK (TWO PAGES)	2.3.3-9
2.3.3-5	WELLS WITHIN ONE MILE OF THE POLK COUNTY SITE (THREE PAGES)	2.3.3-11
2.3.4-1	PRE-MINING DRAINAGE BASINS	2.3.4-11
2.3.4-2	MAXIMUM AND MINIMUM STAGES - PEACE RIVER	2.3.4-12

LIST OF TABLES (Continued)

Table/Title		Page
2.3.4-3	MEASURED WATER TEMPERATURES	2.3.4-13
2.3.4-4	SURFACE WATER MONITORING DATA - POLK COUNTY SITE (TEN PAGES)	2.3.4-14
2.3.4-5	DETECTED WATER QUALITY MONITORING DATA (FOUR PAGES)	2.3.4-24
2.3.4-6	STANDARDS APPLICABLE TO CLASS III WATERS	2.3.4-28
2.3.4-7	DRY SEASON SUPPLEMENTAL WATER QUALITY MONITORING DATA	2.3.4-29
2.3.4.8	WET SEASON SUPPLEMENTAL WATER QUALITY MONITORING DATA	2.3.4-30
2.3.4-9	HISTORY OF MINING OPERATIONS ON POLK COUNTY SITE	2.3.4-31
2.3.5-1	ACREAGE AND QUALITY OF VEGETATION/LAND USE FOLLOWING RECLAMATION	2.3.5-11
2.3.5-2	QUANTITATIVE VEGETATION COMMUNITY DATA - P2 (WET SEASON)	2.3.5-12
2.3.5-3	QUANTITATIVE VEGETATION COMMUNITY DATA - P-2 (DRY SEASON)	2.3.5-13
2.3.5-4	BASELINE VEGETATION COVER SURVEY LOCATIONS	2.3.5-14
2.3.6-1	SUBSTRATE ANALYSES DURING FISHERIES INVESTIGATIONS	2.3.6-61

LIST OF TABLES (Continued)

Table/Title		Page
2.3.6-2	WATER QUALITY DURING FISHERIES INVESTIGATIONS	2.3.6-62
2.3.6-3	FISHERIES SPECIES COLLECTED	2.3.6-63
2.3.6-4	FULTON CONDITION FACTORS FOR SPORT FISH COLLECTED FROM THE SITE - WET SEASON (SEPTEMBER 1991)	2.3.6-64
2.3.6-5	FULTON CONDITION FACTORS FOR SPORT FISH COLLECTED FROM THE SITE - DRY SEASON (FEBRUARY 1992) (TWO PAGES)	2.3.6-65
2.3.6-6	MEANS AND RANGES OF FULTON CONDITION FACTORS (K VALUES) CALCULATED FROM SITE FISH DATA	2.3.6-67
2.3.6-7	PROTECTED PLANT SPECIES POTENTIALLY OCCURRING IN THE FPC POLK COUNTY SITE REGION	2.3.6-68
2.3.6-8	PROTECTED VERTEBRATE SPECIES POTENTIALLY OCCURRING ON THE FPC POLK COUNTY SITE FOLLOWING RECLAMATION (TWO PAGES)	2.3.6-69
2.3.6-9	SITE-SPECIFIC AQUATIC ECOLOGICAL FIELD SAMPLING PROGRAM	2.3.6-71
2.3.6-10	LABORATORY AND DATA ANALYSIS PROGRAM FOR AQUATIC ECOLOGICAL SAMPLES	2.3.6-72
2.3.6-11	CLASSIFICATION OF STREAM SUBSTRATE CHANNEL MATERIALS BY PARTICLE SIZE	2.3.6-73

LIST OF TABLES (Continued)

Table/Title		Page
2.3.6-12	TERRESTRIAL MONITORING PROGRAM - SPECIES COMPOSITION, DENSITY, DOMINANCE, DIVERSITY AND FREQUENCY	2.3.6-74
2.3.7-1	DIURNAL AND MONTHLY TEMPERATURE MEANS AND EXTREMES REPRESENTATIVE OF THE POLK COUNTY SITE	2.3.7-11
2.3.7-2	MONTHLY PRECIPITATION MEANS AND EXTREMES REPRESENTATIVE OF THE POLK COUNTY SITE	2.3.7-12
2.3.7-3	MEAN DIURNAL MIXING HEIGHTS, TAMPA, FLORIDA	2.3.7-13
2.3.7-4	REGIONAL 1990 AMBIENT AIR QUALITY DATA (THREE PAGES)	2.3.7-14
2.3.7-5	SUMMARY OF TAMPA ELECTRIC COMPANY POLK COUNTY AIR QUALITY MONITORING DATA	2.3.7-17
2.3.7-6	SUMMARY OF POLK COUNTY SITE ON-SITE AIR QUALITY MONITORING DATA	2.3.7-18
2.3.7-7	BACKGROUND AIR QUALITY DATA	2.3.7-19
2.3.8-1	SUMMARY OF EPA GUIDELINE NOISE LEVELS	2.3.8-8
3.1.0-1	SCHEDULE OF ESTIMATED SITE CAPACITY VS. TIME CASE A - 3,000 MW CGCC	3.1-3
3.1.0-2	SCHEDULE OF ESTIMATED SITE CAPACITY VS. TIME CASE B - 2,000 MW CGCC AND 1,200 MW PC	3.1-4

LIST OF TABLES (Continued)

Table/Title		Page
3.2.2-1	COOLING POND PARCEL PHYSICAL CHARACTERISTICS	3.2-6
3.3.1-1	TYPICAL NATURAL GAS ANALYSIS	3.3-5
3.3.2-1	TYPICAL NO. 2 FUEL OIL ANALYSIS	3.3-6
3.3.3-1	ULTIMATE COAL ANALYSIS	3.3-7
3.3.3-2	DESIGN FUEL ANALYSIS, COAL-DERIVED GAS	3.3-8
3.4.1-1	COAL GASIFICATION COMBINED CYCLE UNITS (3,000 MW) POLLUTANT EMISSION RATES (CASE A)	3.4-39
3.4.1-2	COAL GASIFICATION COMBINED CYCLE UNITS (2,000 MW) POLLUTANT EMISSION RATES (CASE B)	3.4-40
3.4.1-3	PULVERIZED COAL UNITS (1,200 MW) POLLUTANT EMISSION RATES (CASE B)	3.4-41
3.4.1-4	COAL GASIFICATION PLANT THERMAL OXIDATION UNITS POLLUTANT EMISSION RATES	3.4-42
3.4.1-5	AUXILIARY BOILER POLLUTANT EMISSION RATES	3.4-43
3.4.1-6	DIESEL GENERATOR POLLUTANT EMISSION RATES	3.4-44
3.4.1-7	EMERGENCY FLARES POLLUTANT EMISSION RATES	3.4-45
3.4.1-8	BULK MATERIAL HANDLING SYSTEMS FUGITIVE DUST EMISSION RATES	3.4-46

LIST OF TABLES (Continued)

Table/Title		Page
3.4.1-9	SIGNIFICANT EMISSION RATE THRESHOLDS	3.4-47
3.4.2-1	COAL GASIFICATION COMBINED CYCLE UNITS SUMMARY OF PRELIMINARY BACT ANALYSIS RESULTS	3.4-48
3.4.2-2	PULVERIZED COAL UNITS, SUMMARY OF PRELIMINARY BACT ANALYSIS RESULTS	3.4-49
3.4.2-3	COAL GASIFICATION PLANT THERMAL OXIDATION UNITS, SUMMARY OF PRELIMINARY BACT ANALYSIS	3.4-50
3.4.2-4	AUXILIARY BOILER, SUMMARY OF PRELIMINARY BACT ANALYSIS	3.4-51
3.4.2-5	BULK MATERIAL HANDLING SYSTEMS, SUMMARY OF PRELIMINARY BACT ANALYSIS	3.4-52
3.4.3-1	COAL GASIFICATION COMBINED CYCLE UNITS, OTHER REGULATED AND HAZARDOUS POLLUTANT EMISSIONS (CASE A)	3.4-53
3.4.3-2	COAL GASIFICATION COMBINED CYCLE UNITS OTHER REGULATED AND HAZARDOUS POLLUTANT EMISSIONS (CASE B)	3.4-54
3.4.3-3	PULVERIZED COAL UNITS, OTHER REGULATED AND HAZARDOUS POLLUTANT EMISSIONS	3.4-55
3.4.3-4	COAL GASIFICATION PLANT THERMAL OXIDATION UNITS, OTHER REGULATED AND HAZARDOUS POLLUTANT EMISSIONS	3.4-56

LIST OF TABLES (Continued)

Table/Title		Page
3.4.3-5	AUXILIARY BOILER, OTHER REGULATED AND HAZARDOUS POLLUTANT EMISSIONS	3.4-57
3.5.1-1	HEAT REJECTION - CASE A (3,000 MW CGCC)	3.5.1-40
3.5.1-2	HEAT REJECTION - CASE B (2,000 MW CGCC + 1,200 MW PC)	3.5.1-41
3.5.1-3	COOLING POND BASINS AND ASSOCIATED WATER CROP AREAS	3.5.1-42
3.5.1-4	WELL WATER QUALITY DATA (THREE PAGES)	3.5.1-43
3.5.1-5	REPRESENTATIVE PHOSPHATIC WASTE SETTLING POND WATER QUALITY (FIVE PAGES)	3.5.1-46
3.5.1-6	WATER QUALITY MODELING RESULTS - ONE CYCLE, DISSOLVED CONSTITUENTS	3.5.1-51
3.5.1-7	WATER QUALITY MODELING RESULTS - THREE CYCLES, DISSOLVED CONSTITUENTS	3.5.1-52
3.5.1-8	MUNICIPAL SEWAGE EFFLUENT QUALITY (TWO PAGES)	3.5.1-53
3.5.1-9	CLASSIFICATION OF MINE AREA DAMS	3.5.1-55
3.5.1-10	CATEGORY 1 DAMS - MINIMUM DESIGN FACTORS-OF-SAFETY	3.5.1-56
3.5.1-11	EFFECTIVE SOIL FRICTION ANGLES (Ø)	3.5.1-57
3.5.1-12	COMPARISON OF SOIL FRICTION ANGLES	3.5.1-58

LIST OF TABLES (Continued)

Table/Title		Page
3.5.1-13	MINIMUM FACTORS-OF-SAFETY FOR PERIMETER DAMS	3.5.1-59
3.5.1-14	SUMMARY OF BUFFER AREA CONSOLIDATION	3.5.1-60
3.5.1-15	SUMMARY OF GRAIN SIZE ANALYSES FOR EVALUATION OF SAND TAIL FILTER SUITABILITY	3.5.1-61
3.5.1-16	DESIRABLE LIMITS ON COOLING WATER QUALITY	3.5.1-62
3.5.3-1	ESTIMATED TREATED POTABLE WATER ANALYSIS	3.5.3-2
3.5.4-1	PROCESS WATER DEMAND	3.5.4-4
3.5.4-2	ESTIMATED COOLING POND CHEMICAL ANALYSIS	3.5.4-5
3.6.1-1	CLIMATOLOGICAL DATA - LAKE ALFRED, FLORIDA	3.6-10
3.7.1-1	SOLID WASTES AND BY-PRODUCTS FROM COAL GASIFICATION FACILITIES	3.7-31
3.7.1-2	SOLID WASTES AND BY-PRODUCTS FROM PULVERIZED COAL UNITS	3.7-32
3.7.1-3	WORST CASE (CASE B) SOLID WASTE GENERATED	3.7-33
3.7.1-4	SUMMARY OF CONSOLIDATION PREDICTIONS	3.7-34
3.7.1-5	WASTE STORAGE VOLUME AVAILABILITY	3.7-35
3.7.1-6	SWDA CLAY THICKNESS DATA	3.7-36

LIST OF TABLES (Continued)

Table/Title		Page
3.7.1-7	PARTICLE SIZE DISTRIBUTION AND PERCENT SOLIDS CONTENT, SA-9	3.7-37
3.7.1-8	BASIC SOIL CHEMISTRY, SA-9	3.7-38
3.7.1-9	CLAY MINERALOGY, SA-9	3.7-39
4.1.1-1	RECLAMATION STATUS OF SOLID WASTE DISPOSAL AREAS	4.1-8
4.3.2-1	DEWATERING MONITORING PROGRAM WELL INFORMATION	4.3-11
4.4.1-1	QUALITY OF VEGETATION/LAND USE REFLECTING BASELINE CONDITIONS FOLLOWING RECLAMATION	4.4-13
4.4.1-2	SITE LANDCOVER WITH FULL POWER PLANT BUILDOUT	4.4-14
4.4.1-3	COMPARISON OF SITE LAND COVER WITHOUT AND WITH PROJECT	4.4-15
4.4.1-4	SUMMARY OF BUFFER AREA VEGETATION COMMUNITIES	4.4-16
4.6.1-1	CONSTRUCTION TRAFFIC STUDY AREA	4.6-19
4.6.1-2	PEAK SEASON PEAK HOUR 2002 NON-PROJECT ROADWAY CONDITIONS	4.6-20
4.6.1-3	2002 NON-PROJECT PEAK HOUR INTERSECTION CONDITIONS	4.6-21
4.6.1-4	PEAK SEASON PEAK HOUR 2010 NON-PROJECT ROADWAY CONDITIONS	4.6-22

LIST OF TABLES (Continued)

Table/Title		Page
4.6.1-5	2010 NON-PROJECT PEAK HOUR INTERSECTION CONDITIONS	4.6-23
4.6.1-6	PEAK SEASON A.M. PEAK HOUR 2002 TOTAL ROADWAY CONDITIONS	4.6-24
4.6.1-7	PEAK SEASON P.M. PEAK HOUR 2002 TOTAL ROADWAY CONDITIONS	4.6-25
4.6.1-8	2002 TOTAL PEAK HOUR TRAFFIC INTERSECTION CONDITIONS	4.6-26
4.6.1-9	PEAK SEASON A.M. PEAK HOUR 2010 TOTAL ROADWAY CONDITIONS	4.6-27
4.6.1-10	PEAK SEASON P.M. PEAK HOUR 2010 TOTAL ROADWAY CONDITIONS	4.6-28
4.6.1-11	2010 TOTAL PEAK HOUR TRAFFIC INTERSECTION CONDITIONS	4.6-29
4.6.3-1	MAJOR NOISE SOURCES DURING PLANT CONSTRUCTION	4.6-30
5.1.3-1	WATER QUALITY OF TIGER BAY AND N-16 (THREE PAGES)	5.1-4
5.1.3-2	WATER QUALITY CONSTITUENTS OF CONCERN - TIGER BAY AND N-16	5.1-7
5.1.3-3	DISSOLVED OXYGEN MEASUREMENTS	5.1-8
5.3.2-1	SUMMARY OF SWFWMD THRESHOLD VALUES FOR EVALUATING PROPOSED GROUNDWATER USE IMPACTS	5.3-28

LIST OF TABLES (Continued)

Table/Title		Page
5.3.2-2	NUMBER OF PERMITTED WELLS IN THE UPPER FLORIDAN AQUIFER WITH PREDICTED DRAWDOWN GREATER THAN 5 FEET	5.3-29
5.3.2-3	POTENTIALLY IMPACTED WELLS UNDER 26.6 AND 31.6 MGD SCENARIOS - PRE-DEVELOPMENT BASELINE (FOUR PAGES)	5.3-30
5.3.5-1	GROUNDWATER QUALITY PARAMETERS	5.3-34
5.6.1-1	AMBIENT AIR QUALITY STANDARDS AND PSD INCREMENTS	5.6-62
5.6.1-2	COMPARISON OF CASE B EMISSIONS WITH SIGNIFICANT EMISSION RATES	5.6-63
5.6.1-3	PSD *DE MINIMIS* AMBIENT AIR QUALITY IMPACT LEVELS	5.6-64
5.6.1-4	AIR TOXICS ESTIMATED MAXIMUM SHORT-TERM AND ANNUAL EMISSION RATES (CASE B)	5.6-65
5.6.1-5	COMBUSTION TURBINE (235MW) ESTIMATED PERFORMANCE ON COAL-DERIVED GAS	5.6-66
5.6.1-6	COMBUSTION TURBINE (235MW) ESTIMATED PERFORMANCE ON FUEL OIL	5.6-67
5.6.1-7	PULVERIZED COAL UNIT (600MW) ESTIMATED PERFORMANCE	5.6-68
5.6.1-8	THERMAL OXIDATION UNIT ESTIMATED PERFORMANCE	5.6-69
5.6.1-9	AUXILIARY BOILER ESTIMATED PERFORMANCE ON NATURAL GAS & FUEL OIL	5.6-70

LIST OF TABLES (Continued)

Table/Title		Page
5.6.1-10	DIESEL GENERATOR ESTIMATED PERFORMANCE ON FUEL OIL	5.6-71
5.6.1-11	FUGITIVE DUST SOURCES MODELLED AS AREA SOURCES	5.6-72
5.6.1-12	CLASS II PSD SOURCE INVENTORY - NO_X (TWO PAGES)	5.6-73
5.6.1-13	CLASS II PSD SOURCE INVENTORY - SO_2 (TWO PAGES)	5.6-75
5.6.1-14	CLASS II PSD SOURCE INVENTORY - PM (TWO PAGES)	5.6-77
5.6.1-15	CLASS I PSD SOURCE INVENTORY - NO_X (THREE PAGES)	5.6-79
5.6.1-16	CLASS I PSD SOURCE INVENTORY - SO_2 (THREE PAGES)	5.6-82
5.6.1-17	AAQS SOURCE INVENTORY - NO_X (THREE PAGES)	5.6-85
5.6.1-18	AAQS SOURCE INVENTORY - SO_2 (TWO PAGES)	5.6-88
5.6.1-19	AAQS SOURCE INVENTORY - PM (FOUR PAGES)	5.6-90
5.6.1-20	RECEPTOR GRID FOR PSD CLASS I AREA	5.6-94
5.6.1-21	WORST-CASE LOAD ANALYSIS RESULTS (PC UNITS)	5.6-95
5.6.1-22	MAXIMUM OFF-SITE IMPACTS OF AUXILIARY BOILER AND DIESEL GENERATOR	5.6-96
5.6.1-23	SUMMARY OF SIGNIFICANT IMPACT AREAS (CASE B)	5.6-97
5.6.1-24	SUMMARY OF MAXIMUM OFF-SITE IMPACTS (CASE B)	5.6-98

LIST OF TABLES (Continued)

Table/Title		Page
5.6.1-25	CLASS II PSD INCREMENT ANALYSES RESULTS	5.6-99
5.6.1-26	MAXIMUM PROJECT IMPACTS PREDICTED USING ISCST VERSUS CLASS I PSD SIGNIFICANCE VALUES	5.6-100
5.6.1-27	AAQS ANALYSES RESULTS	5.6-101
5.6.1-28	AIR TOXICS ANALYSIS	5.6-102
5.6.1-29	OPTIONS SELECTED FOR READ 56 PROGRAM PROPOSED FPC POLK COUNTY SITE	5.6-103
5.6.1-30	OPTIONS SELECTED FOR MESOPAC II PROGRAM PROPOSED FPC POLK COUNTY SITE (TWO PAGES)	5.6-104
5.6.1-31	OPTIONS SELECTED FOR MESOPUFF II PROGRAM PROPOSED FPC POLK COUNTY SITE (FOUR PAGES)	5.6-106
5.6.1-32	SUMMARY OF 1982 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT USING THE ISCST AND MESOPUFF II MODELS (TWO PAGES)	5.6-110
5.6.1-33	SUMMARY OF 1983 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT USING THE ISCST AND MESOPUFF II MODELS (TWO PAGES)	5.6-112
5.6.1-34	SUMMARY OF 1984 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT USING THE ISCST AND MESOPUFF II MODELS (TWO PAGES)	5.6-114

LIST OF TABLES (Continued)

Table/Title		Page
5.6.1-35	SUMMARY OF 1985 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT USING THE ISCST AND MESOPUFF II MODELS (TWO PAGES)	5.6-116
5.6.1-36	SUMMARY OF 1986 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT USING THE ISCST AND MESOPUFF II MODELS (THREE PAGES)	5.6-118
5.6.1-37	SUMMARY OF 1983 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT REMAINING AFTER MESOPUFF II MODEL, STEPS 3 AND 4	5.6-121
5.6.1-38	SUMMARY OF 1983 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT REMAINING AFTER MESOPUFF II MODEL, STEPS 3 AND 4, CASE 4	5.6-122
5.6.1-39	SUMMARY OF 1984 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT REMAINING AFTER MESOPUFF II MODEL, STEPS 3 AND 4	5.6-123
5.6.1-40	SUMMARY OF 1985 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT REMAINING AFTER MESOPUFF II MODEL, STEPS 3 AND 4	5.6-124
5.6.1-41	SUMMARY OF 1985 PREDICTED CONCENTRATIONS COMPARED TO THE SO_2 PSD CLASS I INCREMENT AFTER MESOPUFF II MODEL, STEPS 3 AND 4, CASE 4	5.6-125
5.6.1-42	SUMMARY OF 1986 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT REMAINING AFTER MESOPUFF II MODEL, STEPS 3 AND 4,	5.6-126

LIST OF TABLES (Continued)

Table/Title		Page
5.6.1-43	SUMMARY OF 1986 PREDICTED CONCENTRATIONS COMPARED TO THE SO_2 PSD CLASS I INCREMENT AFTER MESOPUFF II MODEL, STEPS 3 AND 4, CASE 4	5.6-127
5.6.1-44	ESTIMATED PROJECT IMPACTS AND BACKGROUND CONCENTRATIONS IN CLASS I AREA	5.6-128
5.6.1-45	ESTIMATED PROJECT IMPACTS AND BACKGROUND CONCENTRATIONS IN THE GENERAL VICINITY OF THE PROPOSED PROJECT	5.6-129
5.6.1-46	THRESHOLD NO_2 CONCENTRATIONS FOR VISIBLE INJURY TO PLANT SPECIES	5.6-130
5.6.1-47	RESPONSE OR SENSITIVITY RATING OF VEGETATION TYPICAL OF THE PROPOSED PROJECT TO NO_2	5.6-131
5.6.1-48	THRESHOLD SO_2 CONCENTRATIONS FOR VISIBLE INJURY TO SENSITIVE VEGETATION	5.6-132
5.6.1-49	RESPONSE OR SENSITIVITY RATING OF VEGETATION TYPICAL OF THE PROPOSED PROJECT TO SO_2 (TWO PAGES)	5.6-133
5.6.1-50	THRESHOLD O_3 CONCENTRATIONS FOR VISIBLE INJURY TO PLANT SPECIES	5.6-135
5.6.1-51	RESPONSE OR SENSITIVITY RATING OF VEGETATION TYPICAL OF THE PROJECT AREA TO OZONE	5.6-136
5.6.1-52	RESPONSE OR SENSITIVITY RATING OF VEGETATION TO MIXTURES OF SO_2 AND NO_2	5.6-137

LIST OF TABLES (Continued)

Table/Title		Page
5.6.1-53	RESPONSE OR SENSITIVITY RATING OF VEGETATION TO MIXTURES OF SO_2 AND O_3 (TWO PAGES)	5.6-138
5.6.1-54	SUMMARY OF ESTIMATED TRACE ELEMENT SOIL CONCENTRATIONS IN THE CLASS I AREA	5.6-140
5.6.1-55	SUMMARY OF ESTIMATED TRACE ELEMENT SOIL CONCENTRATIONS IN THE GENERAL VICINITY OF THE PROPOSED PROJECT	5.6-141
5.6.1-56	REPORTED EFFECTS IN WILDLIFE OF SELECTED AIR CONTAMINANTS	5.6-142
5.6.1-57	VISIBILITY ANALYSIS	5.6-143
5.7.1-1	NOISE RECEPTOR LOCATIONS	5.7-5
5.7.2-1	PROJECT EQUIPMENT SOUND LEVELS	5.7-6
5.7.3-1	NOISE MODELING RESULTS	5.7-7
5.7.4-1	DAY/NIGHT (LDN) NOISE LEVELS	5.7-8
5.9.1-1	OPERATIONS STUDY AREA	5.9-13
5.9.1-2	PEAK SEASON, PEAK HOUR, PEAK DIRECTION 2008 NON-PROJECT ROADWAY CONDITIONS	5.9-14
5.9.1-3	2008 NON-PROJECT PEAK HOUR INTERSECTION CONDITIONS	5.9-15

LIST OF TABLES (Continued)

Table/Title		Page
5.9.1-4	PEAK SEASON, PEAK HOUR, PEAK DIRECTION 2018 NON-PROJECT ROADWAY CONDITIONS	5.9-16
5.9.1-5	2018 NON-PROJECT PEAK HOUR INTERSECTION CONDITIONS	5.9-17
5.9.1-6	COMPARISON OF POWER PLANT TRIP GENERATION RATES PER EMPLOYEE	5.9-18
5.9.1-7	OPERATIONS TRIP GENERATION	5.9-19
5.9.1-8	PEAK SEASON A.M. PEAK HOUR 2008 TOTAL ROADWAY CONDITIONS	5.9-20
5.9.1-9	PEAK SEASON P.M. PEAK HOUR 2008 TOTAL ROADWAY CONDITIONS	5.9-21
5.9.1-10	2008 TOTAL PEAK HOUR TRAFFIC INTERSECTION CONDITIONS	5.9-22
5.9.1-11	PEAK SEASON A.M. PEAK HOUR 2018 TOTAL ROADWAY CONDITIONS	5.9-23
5.9.1-12	PEAK SEASON P.M. PEAK HOUR 2018 TOTAL ROADWAY CONDITIONS	5.9-24
5.9.1-13	2018 TOTAL PEAK HOUR TRAFFIC INTERSECTION CONDITIONS	5.9-25
5.9.2-1	INVENTORY OF AT-GRADE RAIL-HIGHWAY CROSSINGS	5.9-26
5.9.2-2	SUMMARY OF TRAIN TRAFFIC IMPACT AT RAIL-HIGHWAY CROSSINGS	5.9-27

LIST OF TABLES (Continued)

Table/Title		Page
5.9.2-3	LEVEL-OF-SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS	5.9-28
6.1.1-1	ESTIMATED PER-MILE TRANSMISSION LINE COSTS	6.1-16
6.2.4-1	COST PER MILE FOR GAS PIPELINE CONSTRUCTION	6.2-23
6.2.5-1	CORRIDOR SELECTION CRITERIA	6.2-24
7.1.0-1	LOCAL PROPERTY TAX REVENUES	7.1-4
7.2.2-1	NET BENEFIT SUMMARY FOR POWER PLANTS AT COMPLETION	7.2-5
9.0-1	FEDERAL, STATE, REGIONAL, AND LOCAL GOVERNMENT AGENCY CONTACTS (TWELVE PAGES)	9.0-2
10.5.3-1	CLAY SETTLING AREAS INFORMATION	10.5.3-10
10.5.3-2	DAM AREA FIELD INVESTIGATION PROGRAM (THREE PAGES)	10.5.3-11
10.5.3-3	SUMMARY OF SURFICIAL AQUIFER WATER QUALITY DATA (18 PAGES)	10.5.3-14
10.5.3-4	AVERAGE VALUES OF SURFICIAL AQUIFER WATER QUALITY DATA (2 PAGES)	10.5.3-32
10.5.3-5	SUMMARY OF INTERMEDIATE AQUIFER WATER QUALITY DATA (9 PAGES)	10.5.3-34

LIST OF TABLES (Continued)

Table/Title		Page
10.5.3-6	AVERAGE VALUES OF INTERMEDIATE AQUIFER WATER QUALITY DATA (2 PAGES)	10.5.3-43
10.5.3-7	SUMMARY OF UPPER FLORIDAN AQUIFER WATER QUALITY DATA (11 PAGES)	10.5.3-45
10.5.3-8	AVERAGE VALUES OF UPPER FLORIDAN AQUIFER WATER QUALITY DATA (2 PAGES)	10.5.3-56
10.5.5-1	QUALITATIVE VEGETATION COMMUNITY DATA POLK COUNTY SITE - SA-8	10.5.5-2
10.5.5-2	QUALITATIVE VEGETATION COMMUNITY DATA POLK COUNTY - SA-9	10.5.5-3
10.5.5-3	QUALITATIVE VEGETATION COMMUNITY DATA POLK COUNTY SITE - P-2	10.5.5-4
10.5.5-4	QUALITATIVE VEGETATION COMMUNITY DATA POLK COUNTY SITE - N-9B (TWO PAGES)	10.5.5-5
10.5.5-5	QUALITATIVE VEGETATION COMMUNITY DATA POLK COUNTY SITE - N-11A (TWO PAGES)	10.5.5-7
10.5.5-6	QUALITATIVE VEGETATION COMMUNITY DATA POLK COUNTY SITE - N-11C (TWO PAGES)	10.5.5-9
10.5.5-7	QUALITATIVE VEGETATION COMMUNITY DATA POLK COUNTY SITE - N-13 (TWO PAGES)	10.5.5-11

LIST OF TABLES (Continued)

Table/Title		Page
10.5.5-8	QUALITATIVE VEGETATION COMMUNITY DATA POLK COUNTY SITE - SA-10	10.5.5-13
10.5.5-9	QUALITATIVE VEGETATION COMMUNITY DATA POLK COUNTY SITE - SA-11	10.5.5-14
10.5.5-10	QUALITATIVE VEGETATION COMMUNITY DATA POLK COUNTY SITE - SA-12 (TWO PAGES)	10.5.5-15
10.5.5-11	QUALITATIVE VEGETATION COMMUNITY DATA POLK COUNTY SITE - SA-13	10.5.5-17
10.5.5-12	QUALITATIVE VEGETATION COMMUNITY DATA POLK COUNTY SITE - N-15 (TWO PAGES)	10.5.5-18
10.5.5-13	QUALITATIVE VEGETATION COMMUNITY DATA POLK COUNTY SITE - N-11B (TWO PAGES)	10.5.5-20
10.5.5-14	QUALITATIVE VEGETATION COMMUNITY DATA POLK COUNTY SITE - N-16 (TWO PAGES)	10.5.5-22
10.5.5-15	QUALITATIVE VEGETATION COMMUNITY DATA TIGER BAY BUFFER AREA	10.5.5-24
10.5.5-16	QUALITATIVE VEGETATION COMMUNITY DATA TIGER BAY EAST (TWO PAGES)	10.5.5-25
10.5.5-17	SUMMARY OF LIFE HISTORIES (HABITAT AND FOOD) OF POTENTIAL FISH SPECIES - POLK COUNTY SITE (FOUR PAGES)	10.5.5-28

LIST OF TABLES (Continued)

Table/Title		Page
10.5.5-18	SUMMARY OF LIFE HISTORIES (SPAWNING) OF POTENTIAL FISH SPECIES - POLK COUNTY SITE (FOUR PAGES)	10.5.5-32
10.5.5-19	SEASONAL DATA FROM THE N-16 BENTHIC MACROINVERTEBRATE COLLECTIONS	10.5.5-36
10.5.5-20	SEASONAL DATA FROM THE TIGER BAY MACROINVERTEBRATE COLLECTIONS (THREE PAGES)	10.5.5-37
10.5.5-21	SEASONAL DATA FROM THE TIGER BAY EAST BENTHIC MACROINVERTEBRATE COLLECTIONS (TWO PAGES)	10.5.5-40
10.5.5-22	POPULATION PERCENTAGES OF MAJOR BENTHIC AQUATIC MACROINVERTEBRATE GROUPS	10.5.5-42
10.5.5-23	POPULATION DATA FOR BENTHIC MACROINVERTEBRATES	10.5.5-43
10.5.5-24	BENTHIC MACROINVERTEBRATE POPULATIONS COLLECTED FROM HESTER-DENDY SAMPLERS (TWO PAGES)	10.5.5-44
10.5.5-25	POPULATION PERCENTAGES OF MAJOR BENTHIC AQUATIC MACROINVERTEBRATE GROUPS COLLECTED USING HESTER-DENDY SAMPLERS	10.5.5-46
10.5.5-26	POPULATION DATA FOR BENTHIC MACROINVERTEBRATES COLLECTED USING HESTER-DENDY SAMPLERS	10.5.5-47

LIST OF TABLES (Continued)

Table/Title		Page
10.5.5-27	HABITAT AND STATUS OF AMPHIBIANS AND REPTILES POTENTIALLY OCCURRING AT THE POLK COUNTY SITE (FIVE PAGES)	10.5.5-53
10.5.5-28	HABITAT AND STATUS OF BIRDS POTENTIALLY OCCURRING AT THE POLK COUNTY SITE (SIX PAGES)	10.5.5-59
10.5.5-29	HABITAT AND STATUS OF MAMMALS POTENTIALLY OCCURRING AT THE POLK COUNTY SITE (TWO PAGES)	10.5.5-65
10.5.7-1	PLANT EQUIPMENT SOUND POWER LEVEL SPECTRA	10.5.7-3
10.5.8-1	FLORIDAN AQUIFER PUMP TESTS IN POLK COUNTY SITE VICINITY	10.5.8-23
10.5.8-2	SUMMARY OF SURVEY DATA - ESTECH SITE FPC AQUIFER CHARACTERISTICS PROGRAM	10.5.8-24
10.5.8-3	SUMMARY OF CALIBRATION OF WATER LEVEL INDICATORS	10.5.8-25
10.5.8-4	WATER QUALITY FIELD MEASUREMENT DATA AQUIFER PERFORMANCE TEST WELL SC-1	10.5.8-26
10.5.8-5	SUMMARY OF WATER LEVEL DATA - STEP DRAWDOWN PUMPING TEST - TEST/PRODUCTION WELL SC-1,	10.5.8-27
10.5.8-6	SUMMARY OF AQUIFER CHARACTERISTICS ESTECH SITE (TWO PAGES)	10.5.8-28

LIST OF TABLES (Continued)

Table/Title		Page
10.5.9-1	LIST OF MODFLOW PACKAGES USED FOR THE GWS MODEL	10.5.9-28
10.5.9-2	MEASURED POTENTIOMETRIC LEVELS FOR INTERMEDIATE AQUIFER MONITORING WELLS	10.5.9-29
10.5.9-3	MEASURED POTENTIOMETRIC LEVELS FOR THE UPPER FLORIDAN AQUIFER MONITORING WELLS (FOUR PAGES)	10.5.9-30
10.5.9-4	SURFICIAL AQUIFER CHARACTERISTICS TESTS PERFORMED WITHIN MODELING DOMAIN	10.5.9-34
10.5.9-5	INTERMEDIATE AQUIFER CHARACTERISTICS TESTS PERFORMED WITHIN MODELING DOMAIN (TWO PAGES)	10.5.9-35
10.5.9-6	FLORIDAN AQUIFER CHARACTERISTICS TESTS PERFORMED WITHIN MODELING DOMAIN (THREE PAGES)	10.5.9-37
10.5.9-7	PERMITTED AVERAGE DAILY GROUNDWATER WITHDRAWALS BY MODELING DOMAIN SECTION	10.5.9-40
10.5.9-8	MEASURED STAGE ELEVATIONS FOR SELECTED SURFACE WATER GAGING STATIONS - MAY	10.5.9-41
10.5.9-9	MEASURED STAGE ELEVATIONS FOR SELECTED SURFACE WATER GAGING STATIONS - SEPTEMBER	10.5.9-42
10.5.9-10	ESTIMATED VALUES OF YEARLY RECHARGE FOR THE MODEL DOMAIN (EIGHT PAGES)	10.5.9-43

LIST OF TABLES (Continued)

Table/Title		Page
10.5.9-11	COMPARISON OF MAY AND SEPTEMBER 1990 POTENTIOMETRIC LEVELS FOR SELECTED INTERMEDIATE AQUIFER WELLS	10.5.9-51
10.5.9-12	SUMMARY OF SENSITIVITY ANALYSES (TWO PAGES)	10.5.9-52
10.5.9-13	SUMMARY OF SWFWMD PRESUMPTIONS FOR EVALUATING PROPOSED GROUNDWATER USE IMPACTS	10.5.9-54
10.5.9-14	NUMBER OF PERMITTED WELLS IN THE UPPER FLORIDAN AQUIFER WITH PREDICTED DRAWDOWN GREATER THAN 5 FEET	10.5.9-55
10.5.9-15	POTENTIALLY IMPACTED WELLS UNDER 26.6 AND 31.6 MGD SCENARIOS, PRE-DEVELOPMENT USERS BASELINE (FOUR PAGES)	10.5.9-56
10.5.10-1	CDI MODEL: LIST OF MODFLOW PACKAGES USED BY THE MODEL	10.5.10-9
10.5.10-2	CDI MODEL: SUMMARY OF INPUT PARAMETERS FOR BLOCK-CENTERED FLOW PACKAGE	10.5.10-10
10.5.10-3	SIMULATED PUMPING RATES FOR DEWATERED AREAS	10.5.10-11
10.5.10-4	ESTIMATED PUMPING RATES NECESSARY TO DRAIN CONSTRUCTION AREAS DURING FIRST SIX MONTHS OF CONSTRUCTION	10.5.10-12

LIST OF FIGURES

Figure/Title		Page
2.1.1-1	SITE LOCATION MAP	2.1-8
2.1.1-2A	EXISTING TOPOGRAPHY OF SITE AND ADJACENT LANDS (SHEET A)	2.1-9
2.1.1-2B	EXISTING TOPOGRAPHY OF SITE AND ADJACENT LANDS (SHEET B)	2.1-10
2.1.2-1	MANDATORY AND NONMANDATORY RECLAMATION LANDS	2.1-11
2.1.2-2A	VEGETATION/LAND USE MAP BASELINE CONDITIONS (SHEET A)	2.1-12
2.1.2-2B	VEGETATION/LAND USE MAP BASELINE CONDITIONS (SHEET B)	2.1-13
2.1.2-3A	BASELINE CONDITION TOPOGRAPHY-IMC N-16 AND ESTECH (MANDATORY AREAS) (SHEET A)	2.1-14
2.1.2-3B	BASELINE CONDITION TOPOGRAPHY-IMC N-16 AND ESTECH (MANDATORY AREAS) (SHEET B)	2.1-15
2.1.2-4	OFF-SITE BASELINE STUDY AREAS	2.1-16
2.1.3-1A	GENERALIZED PROJECT SITE PLAN (SHEET A)	2.1-17
2.1.3-1B	GENERALIZED PROJECT SITE PLAN (SHEET B)	2.1-18
2.2.1-1	GOVERNMENTAL JURISDICTIONS WITHIN FIVE MILES OF THE PLANT ISLAND	2.2-38

LIST OF FIGURES (Continued)

Figure/Title		Page
2.2.1-2	PARKS AND RECREATION AREAS WITHIN FIVE MILES OF THE PLANT ISLAND	2.2-39
2.2.1-3A	PARKS AND RECREATION AREAS WITHIN ONE MILE OF THE PLANT ISLAND (SHEET A)	2.2-40
2.2.1-3B	PARKS AND RECREATION AREAS WITHIN ONE MILE OF THE PLANT ISLAND (SHEET B)	2.2-41
2.2.2-1	POLK COUNTY FUTURE LAND USE DESIGNATIONS	2.2-42
2.2.2-2	POLK COUNTY SITE ZONING	2.2-43
2.2.3-1	POPULATION GROWTH 1960 -1990, FLORIDA AND POLK COUNTY	2.2-44
2.2.3-2	PERCENT CHANGE IN POPULATION IN POLK COUNTY, 1970 - 1980 AND 1980 - 1990	2.2-45
2.2.3-3	POPULATION GROWTH BY CENSUS TRACT	2.2-46
2.2.3-4	POLK COUNTY POPULATION ESTIMATES AND PROJECTIONS	2.2-47
2.2.3-5	BEBR REVISED POPULATION PROJECTIONS VERSUS COMPREHENSIVE PLAN PROJECTIONS	2.2-48
2.2.3-6A	EXISTING LAND USE WITHIN FIVE MILES OF THE PLANT ISLAND (SHEET A)	2.2-49
2.2.3-6B	EXISTING LAND USE WITHIN FIVE MILES OF THE PLANT ISLAND (SHEET B)	2.2-50

LIST OF FIGURES (Continued)

Figure/Title		Page
2.2.7-1	POLK COUNTY CIVILIAN LABOR FORCE, EMPLOYMENT AND UNEMPLOYMENT, 1980 THROUGH 1991	2.2-51
2.2.7-2	UNEMPLOYMENT RATES, POLK COUNTY AND FLORIDA, 1980 THROUGH 1991	2.2-52
2.2.7-3	POLK COUNTY EMPLOYMENT ESTIMATES, 1986 THROUGH 1991	2.2-53
2.2.7-4	POLK COUNTY EMPLOYMENT BY INDUSTRY, 1990	2.2-54
2.2.7-5	AVERAGE WAGE BY INDUSTRY, POLK COUNTY 1990	2.2-55
2.2.7-6	POLK COUNTY EMPLOYMENT PROJECTIONS FOR YEAR 2000	2.2-56
2.2.7-7	EMPLOYMENT ESTIMATES AND PROJECTIONS - POLK COUNTY, 1988 THROUGH 2010	2.2-57
2.2.7-8	POLK COUNTY MINING EMPLOYMENT, 1980 THROUGH 1991	2.2-58
2.2.7-9	1988 PER CAPITA INCOME BY TYPE OF INCOME	2.2-59
2.2.7-10	DISTRIBUTION OF HOUSEHOLD INCOMES IN POLK COUNTY	2.2-60
2.2.7-11	TREND IN HOUSING UNITS IN UNINCORPORATED POLK COUNTY, 1960 THROUGH 1989	2.2-61
2.2.7-12	RESIDENTIAL BUILDING PERMITS IN POLK COUNTY, 1985 THROUGH 1990	2.2-62

LIST OF FIGURES (Continued)

Figure/Title		Page
2.2.7-13	RESIDENTIAL BUILDING PERMITS IN BARTOW AND FORT MEADE, 1985 THROUGH 1990	2.2-63
2.2.7-14	POLK COUNTY PER CAPITA REVENUES, 1991 THROUGH 1992	2.2-64
2.2.7-15	POLK COUNTY PER CAPITA EXPENDITURES, 1991 THROUGH 1992	2.2-65
2.2.7-16	MAKE-UP OF POLK COUNTY REVENUES	2.2-66
2.2.7-17	MAKE-UP OF POLK COUNTY EXPENDITURES	2.2-67
2.2.7-18	LOCATIONS OF PUBLIC SERVICES	2.2-68
2.2.7-19	SOLID WASTE FACILITIES AND SERVICE AREA BOUNDARIES	2.2-69
2.2.7-20	EXISTING DAILY TRAFFIC VOLUMES	2.2-70
2.2.7-21	EXISTING PEAK SEASON A.M. PEAK HOUR TRAFFIC VOLUMES	2.2-71
2.2.7-22	EXISTING PEAK SEASON P.M. PEAK HOUR TRAFFIC VOLUMES	2.2-72
2.2.7-23	EXISTING PEAK SEASON A.M. PEAK HOUR INTERSECTION CONDITIONS	2.2-73
2.2.7-24	EXISTING PEAK SEASON P.M. PEAK HOUR INTERSECTION CONDITIONS	2.2-74

LIST OF FIGURES (Continued)

Figure/Title		Page
2.2.7-25	RAIL TRANSPORTATION IN POLK COUNTY	2.2-75
2.3.1-1	SUBSURFACE INVESTIGATION PLAN, GENERAL SITE AREA	2.3.1-29
2.3.1-2	GENERALIZED LITHOSTRATIGRAPHIC AND HYDROGEOLOGIC FRAMEWORK - POLK COUNTY AREA	2.3.1-30
2.3.1-3	GENERALIZED GEOLOGICAL SECTION OF POLK COUNTY (EAST-WEST)	2.3.1-31
2.3.1-4	GENERALIZED GEOLOGICAL SECTION OF POLK COUNTY (NORTH-SOUTH)	2.3.1-32
2.3.1-5	HYDROGEOLOGIC FRAMEWORK, FPC SITE AREA	2.3.1-33
2.3.1-6	HYDROGEOLOGIC CROSS-SECTION LOCATION MAP ESTECH PLANT SITE	2.3.1-34
2.3.1-7	HYDROGEOLOGICAL CROSS-SECTION A-A' ESTECH PLANT SITE, DECEMBER 1991	2.3.1-35
2.3.1-8	HYDROGEOLOGIC CROSS-SECTION B-B' ESTECH PLANT SITE, DECEMBER 1991	2.3.1-36
2.3.1-9	HYDROGEOLOGIC CROSS-SECTION LOCATION MAP FPC SITE AREA	2.3.1-37
2.3.1-10	HYDROGEOLOGIC CROSS-SECTION N-S ESTECH PLANT SITE, DECEMBER 1991	2.3.1-38

LIST OF FIGURES (Continued)

Figure/Title		Page
2.3.1-11	HYDROGEOLOGIC CROSS-SECTION E-W ESTECH PLANT SITE, DECEMBER 1991	2.3.1-39
2.3.1-12	CROSS-SECTION LOCATION MAP	2.3.1-40
2.3.1-13	CROSS-SECTIONS A-A' AND E-E'	2.3.1-41
2.3.1-14	CROSS-SECTION B-B'	2.3.1-42
2.3.1-15	CROSS-SECTIONS C-C' AND D-D'	2.3.1-43
2.3.1-16	CROSS-SECTIONS F-F' AND G-G'	2.3.1-44
2.3.1-17	ATTERBERG LIMITS - POND AREAS N-9B, N-11A, N-11B, N-11C, N-13 AND N-15	2.3.1-45
2.3.1-18	ATTERBERG LIMITS - POND AREAS SA-8, SA-9, AND SA-10	2.3.1-46
2.3.1-19	ATTERBERG LIMITS - POND AREAS P-2 AND P-3	2.3.1-47
2.3.1-20	WASTE PHOSPHATIC CLAY-GRAIN SIZE DISTRIBUTION	2.3.1-48
2.3.1-21	EMBANKMENT OVERBURDEN MATERIAL-GRAIN SIZE DISTRIBUTION	2.3.1-49
2.3.1-22	UNDISTURBED GROUND - GRAIN SIZE DISTRIBUTION	2.3.1-50
2.3.1-23	SCHEMATIC OF SHALLOW FOUNDATION SUPPORT ALTERNATIVES FOR CONSTRUCTION	2.3.1-51

LIST OF FIGURES (Continued)

Figure/Title		Page
2.3.1-24	SCHEMATIC OF DEEP FOUNDATION SUPPORT ALTERNATIVES FOR CONSTRUCTION	2.3.1-52
2.3.1-25	GRAIN SIZE SUITABILITY FOR DYNAMIC COMPACTION	2.3.1-53
2.3.1-26	TREND BETWEEN APPARENT MAXIMUM DEPTH OF COMPACTION INFLUENCE AND ENERGY PER BLOW	2.3.1-54
2.3.1-27	SUITABILITY OF SOILS FOR VARIOUS GROUND IMPROVEMENT TECHNIQUES	2.3.1-55
2.3.2-1	GENERALIZED WATER TABLE CONTOUR MAP SURFICIAL AQUIFER, SEPTEMBER 1975	2.3.2-22
2.3.2-2	SURFICIAL AQUIFER BASELINE WATER QUALITY DATA SAMPLING LOCATION MAP	2.3.2-23
2.3.2-3	POTENTIOMETRIC SURFACE - INTERMEDIATE AQUIFER, MAY 1989	2.3.2-24
2.3.2-4	POTENTIOMETRIC SURFACE - INTERMEDIATE AQUIFER, MAY 1990	2.3.2-25
2.3.2-5	POTENTIOMETRIC SURFACE - INTERMEDIATE AQUIFER, MAY 1991	2.3.2-26
2.3.2-6	POTENTIOMETRIC SURFACE - INTERMEDIATE AQUIFER, SEPTEMBER 1989	2.3.2-27
2.3.2-7	POTENTIOMETRIC SURFACE - INTERMEDIATE AQUIFER, SEPTEMBER 1990	2.3.2-28

LIST OF FIGURES (Continued)

Figure/Title		Page
2.3.2-8	POTENTIOMETRIC SURFACE - INTERMEDIATE AQUIFER, SEPTEMBER 1991	2.3.2-29
2.3.2-9	INTERMEDIATE AQUIFER BASELINE WATER QUALITY DATA SAMPLING LOCATION MAP	2.3.2-30
2.3.2-10	POTENTIOMETRIC SURFACE - UPPER FLORIDAN AQUIFER, MAY 1989	2.3.2-31
2.3.2-11	POTENTIOMETRIC SURFACE - UPPER FLORIDAN AQUIFER, MAY 1990	2.3.2-32
2.3.2-12	POTENTIOMETRIC SURFACE - UPPER FLORIDAN AQUIFER, MAY 1991	2.3.2-33
2.3.2-13	POTENTIOMETRIC SURFACE - UPPER FLORIDAN AQUIFER, SEPTEMBER 1989	2.3.2-34
2.3.2-14	POTENTIOMETRIC SURFACE - UPPER FLORIDAN AQUIFER, SEPTEMBER 1990	2.3.2-35
2.3.2-15	POTENTIOMETRIC SURFACE - UPPER FLORIDAN AQUIFER, SEPTEMBER 1991	2.3.2-36
2.3.2-16	UPPER FLORIDAN AQUIFER BASELINE WATER QUALITY DATA SAMPLING LOCATION MAP	2.3.2-37
2.3.2-17	AREAS OF SINKHOLE OCCURRENCE IN FLORIDA	2.3.2-38
2.3.2-18	SINKHOLE LOCATIONS IN VICINITY OF SITE	2.3.2-39

LIST OF FIGURES (Continued)

Figure/Title		Page
2.3.2-19	REPORTED SINKHOLES WITHIN FIVE MILES OF SITE	2.3.2-40
2.3.2-20	FRACTURE TRACE MAP	2.3.2-41
2.3.2-21	LINEAMENT FEATURE ROSE	2.3.2-42
2.3.2-22	PLANT ISLAND AREA PRE-MINING SURFACE FEATURES AND DEPRESSIONS	2.3.2-43
2.3.3-1	WATER USE IN SITE VICINITY	2.3.3-14
2.3.4-1	MAJOR RIVER BASINS IN VICINITY OF SITE	2.3.4-32
2.3.4-2	PRE-MINING DRAINAGE BASIN BOUNDARIES	2.3.4-33
2.3.4-3	PROFILE OF PEACE RIVER	2.3.4-34
2.3.4-4	USGS STATION LOCATIONS	2.3.4-35
2.3.4-5	PRE-MINING DELINEATION OF MCCULLOUGH CREEK BASIN	2.3.4-36
2.3.4-6	PRE-MINING ON-SITE WATER BODIES	2.3.4-37
2.3.4-7	UNIT HYDROGRAPH - PEACE RIVER AT BARTOW, FLORIDA	2.3.4-38
2.3.4-8	PEAK FLOW, FLOOD FREQUENCY, AND DRAINAGE AREA RELATIONSHIP, POLK COUNTY STREAMS	2.3.4-39
2.3.4-9	PEAK FLOW REDUCTION COEFFICIENTS	2.3.4-40

LIST OF FIGURES (Continued)

Figure/Title		Page
2.3.4-10	WATER TEMPERATURE, PEACE RIVER AT BARTOW	2.3.4-41
2.3.4-11	WATER TEMPERATURE, PEACE RIVER NEAR HOMELAND	2.3.4-42
2.3.4-12	WATER TEMPERATURE, PEACE RIVER AT FORT MEADE	2.3.4-43
2.3.4-13	SURFACE WATER SAMPLING SITE LOCATIONS	2.3.4-44
2.3.4-14	CHEMICAL TYPES OF WATER IN FLORIDA STREAMS	2.3.4-45
2.3.4-15	RELATIONS AMONG CHEMICAL COMPOSITION, CONSTITUENT CONCENTRATION, AND DISCHARGE FOR SIX FLORIDA STREAMS AND CANALS DURING LOW VERSUS HIGH STREAMFLOW	2.3.4-46
2.3.4-16	SUPPLEMENTAL WATER QUALITY SAMPLING SITE LOCATIONS	2.3.4-47
2.3.4-17	IMC NPDES OUTFALLS	2.3.4-48
2.3.4-18	ESTECH NPDES OUTFALL	2.3.4-49
2.3.4-19	USAC N-9 NPDES OUTFALL	2.3.4-50
2.3.5-1	VEGETATION/LAND USE MAP, BASELINE CONDITIONS (KEY)	2.3.5-15
2.3.5-1A	VEGETATION/LAND USE MAP, BASELINE CONDITIONS (SHEET A)	2.3.5-16

LIST OF FIGURES (Continued)

Figure/Title		Page
2.3.5-1B	VEGETATION/LAND USE MAP, BASELINE CONDITIONS (SHEET B)	2.3.5-17
2.3.5-1C	VEGETATION/LAND USE MAP, BASELINE CONDITIONS (SHEET C)	2.3.5-18
2.3.5-1D	VEGETATION/LAND USE MAP, BASELINE CONDITIONS (SHEET D)	2.3.5-19
2.3.5-1E	VEGETATION/LAND USE MAP, BASELINE CONDITIONS (SHEET E)	2.3.5-20
2.3.5-1F	VEGETATION/LAND USE MAP, BASELINE CONDITIONS (SHEET F)	2.3.5-21
2.3.6-1	AQUATIC ECOLOGY STUDY AREA	2.3.6-75
2.3.6-2	AQUATIC ECOLOGY SAMPLING LOCATIONS	2.3.6-76
2.3.6-3	VEGETATION AND WILDLIFE SAMPLING LOCATIONS ON-SITE	2.3.6-77
2.3.6.4	VEGETATION AND WILDLIFE SAMPLING LOCATIONS OFF-SITE	2.3.6-78
2.3.7-1	ANNUAL WIND ROSE, TAMPA, FLORIDA 1982 THROUGH 1986	2.3.7-20
2.3.7-2	ISOPLETHS OF MEAN ANNUAL MORNING MIXING HEIGHTS	2.3.7-21

LIST OF FIGURES (Continued)

Figure/Title		Page
2.3.7-3	ISOPLETHS OF MEAN ANNUAL AFTERNOON MIXING HEIGHTS	2.3.7-22
2.3.7-4	ON-SITE WIND ROSE, OCTOBER 15, 1991 TO FEBRUARY 14, 1992	2.3.7-23
2.3.7-5	TAMPA, FLORIDA - NWS WIND ROSE OCTOBER 15, 1991 TO FEBRUARY 14, 1992	2.3.7-24
2.3.7-6	LOCATIONS OF FDER AND OTHER AMBIENT AIR QUALITY MONITORING SITES	2.3.7-25
2.3.7-7	SO_2 HOURLY AVERAGE CONCENTRATIONS COMPARED WITH 3-HOUR, 24-HOUR AND ANNUAL STANDARDS (OCTOBER 15, 1991 TO FEBRUARY 14, 1992)	2.3.7-26
2.3.7-8	O_3 HOURLY AVERAGE CONCENTRATIONS COMPARED WITH 1-HOUR STANDARD (OCTOBER 15, 1991 TO FEBRUARY 24, 1992)	2.3.7-27
2.3.7-9	PM_{10} 24-HOUR AVERAGE CONCENTRATIONS COMPARED WITH 24-HOUR AND ANNUAL STANDARDS (OCTOBER 15, 1991 TO FEBRUARY 14, 1992)	2.3.7-28
2.3.7-10	AIR QUALITY/METEOROLOGICAL MONITORING SITE LOCATION MAP	2.3.7-29
2.3.8-1	NOISE MONITORING LOCATIONS	2.3.8-9
2.3.8-2	NOISE MONITORING LOCATIONS #1 AND #2	2.3.8-10

LIST OF FIGURES (Continued)

Figure/Title		Page
2.3.8-3	NOISE MONITORING LOCATIONS #3 AND #4	2.3.8-11
2.3.8-4	NOISE MONITORING LOCATION #5	2.3.8-12
2.3.8-5	NOISE LEVELS - LOCATION 1 TRINITY GRACE CHURCH	2.3.8-13
2.3.8-6	NOISE LEVELS - LOCATION 2 NORTHWEST CORNER OF SITE	2.3.8-14
2.3.8-7	NOISE LEVELS - LOCATION 3 COMMUNITY OF HOMELAND	2.3.8-15
2.3.8-8	NOISE LEVELS - LOCATION 4 CITY OF FORT MEADE	2.3.8-16
2.3.8-9	NOISE LEVELS - LOCATION 5 POWER BLOCK AREA	2.3.8-17
3.2.1-1	PRELIMINARY ULTIMATE SITE ARRANGEMENT - CASE A, SIX COMBINED CYCLE UNITS	3.2-7
3.2.1-2	PRELIMINARY ULTIMATE SITE ARRANGEMENT - CASE B, FOUR COMBINED CYCLE AND TWO PULVERIZED COAL UNITS	3.2-8
3.2.1-3	CASE B ELEVATION VIEWS	3.2-9
3.2.1-4A	LANDSCAPE BUFFER, LANDSCAPE PLAN - SHEET A	3.2-10
3.2.1-4B	LANDSCAPE BUFFER, LANDSCAPE PLAN - SHEET B	3.2-11
3.2.1-4C	LANDSCAPE BUFFER, LANDSCAPE PLAN - SHEET C	3.2-12
3.2.2-1	COOLING POND AREA	3.2-13
3.2.2-2	SOLID WASTE DISPOSAL AREA	3.2-14

LIST OF FIGURES (Continued)

Figure/Title		Page
3.2.2-3	BRINE POND AREA	3.2-15
3.2.2-4	SITE BUFFER AREA	3.2-16
3.2.2-5	TRIANGLE LAKES AREA	3.2-17
3.5.1-1	ULTIMATE COOLING POND CONFIGURATION	3.5.1-63
3.5.1-2	INITIAL COOLING POND CONFIGURATION (N-16 ONLY)	3.5.1-64
3.5.1-3	PEAK GROUND WATER WITHDRAWAL - CASE A	3.5.1-65
3.5.1.4	PEAK GROUND WATER WITHDRAWAL - CASE B	3.5.1-66
3.5.1-5	TOTAL WATER CROP USED CASE A, SCENARIOS 1 AND 3	3.5.1-67
3.5.1-6	TOTAL WATER CROP AND GROUND WATER USED CASE A, SCENARIOS 1 AND 3	3.5.1-68
3.5.1-7	TOTAL WATER CROP AND GROUND WATER USED CASE B, SCENARIOS 1 AND 3	3.5.1-69
3.5.1-8	CYCLES OF CONCENTRATION CASE A, SCENARIOS 1 AND 3	3.5.1-70
3.5.1-9	CYCLES OF CONCENTRATION CASE A, SCENARIOS 2 AND 4	3.5.1-71
3.5.1-10	CYCLES OF CONCENTRATION CASE B, SCENARIOS 1 AND 3	3.5.1-72

LIST OF FIGURES (Continued)

Figure/Title		Page
3.5.1-11	CYCLES OF CONCENTRATION CASE B, SCENARIOS 2 AND 4	3.5.1-73
3.5.1-12	ESTIMATED PROCESS WATER USE - CASE A	3.5.1-74
3.5.1-13	ESTIMATED PROCESS WATER USE - CASE B	3.5.1-75
3.5.1-14	BLOWDOWN - CASE A, SCENARIOS 1 AND 3	3.5.1-76
3.5.1-15	RECYCLED BLOWDOWN - CASE A, SCENARIOS 1 AND 3	3.5.1-77
3.5.1-16	BLOWDOWN - CASE A, SCENARIOS 2 AND 4	3.5.1-78
3.5.1-17	RECYCLED BLOWDOWN - CASE A, SCENARIOS 2 AND 4	3.5.1-79
3.5.1-18	BLOWDOWN - CASE B, SCENARIOS 1 AND 3	3.5.1-80
3.5.1-19	RECYCLED BLOWDOWN - CASE B, SCENARIOS 1 AND 3	3.5.1-81
3.5.1-20	BLOWDOWN - CASE B, SCENARIOS 2 AND 4	3.5.1-82
3.5.1-21	RECYCLED BLOWDOWN - CASE B, SCENARIOS 2 AND 4	3.5.1-83
3.5.1-22	CONDENSER INLET TEMPERATURE CASE A (3,000 MW CGCC)	3.5.1-84
3.5.1-23	CONDENSER INLET TEMPERATURE CASE B (3,200 MW CGCC)	3.5.1-85
3.5.1-24	NATURAL EVAPORATION	3.5.1-86

LIST OF FIGURES (Continued)

Figure/Title		Page
3.5.1-25	CUMULATIVE PRECIPITATION AND EVAPORATION	3.5.1-87
3.5.1-26	PRE 17-672 AND POST 17-672 DAMS-POND SERVICE HISTORY	3.5.1-88
3.5.1-27	FRICTION ANGLE DATA-CLAY POND N-16 DAMS	3.5.1-89
3.5.1-28	FRICTION ANGLE DATA-CLAY POND N-15/N-11C DAMS	3.5.1-90
3.5.1-29	INITIAL STAGE COOLING EMBANKMENT PLAN - N-16	3.5.1-91
3.5.1-30	TYPICAL SLOPE REINFORCEMENT/WAVE EROSION PROTECTION DETAILS - N-16	3.5.1-92
3.5.1-31	CONCEPTUAL CROSS-SECTION A-A' SOUTH EMBANKMENT N-16	3.5.1-93
3.5.1-32	CONCEPTUAL CROSS-SECTION B-B' EAST EMBANKMENT N-16	3.5.1-94
3.5.1-33	CONCEPTUAL CROSS-SECTION C-C' NORTH EMBANKMENT N-16	3.5.1-95
3.5.1-34	CONCEPTUAL DETAIL OF EMBANKMENT SEEPAGE COLLECTION AND DISCHARGE SYSTEM	3.5.1-96
3.5.1-35	AS-BUILT CROSS-SECTION D-D' WEST EMBANKMENT N-16	3.5.1-97
3.5.1-36	TYPICAL STOPLOG STRUCTURE	3.5.1-98

LIST OF FIGURES (Continued)

Figure/Title		Page
3.5.1-37	CONCEPTUAL CROSS-SECTION E-E' NORTH-SOUTH DIVIDING EMBANKMENT N-16	3.5.1-99
3.5.1-38	CONCEPTUAL CROSS-SECTION F-F' EAST-WEST DIVIDING EMBANKMENT N-16	3.5.1-100
3.5.1-39	ULTIMATE STAGE COOLING EMBANKMENT PLAN N-15, N-11B, N-11C	3.5.1-101
3.5.1-40	CONCEPTUAL DESIGN OF FLOW-THROUGH PENETRATION	3.5.1-102
3.5.1-41	TYPICAL SLOPE REINFORCEMENT/WAVE EROSION PROTECTION DETAILS - N-15	3.5.1-103
3.5.1-42	TYPICAL SLOPE REINFORCEMENT/WAVE EROSION PROTECTION DETAILS - N-11B, N-11C	3.5.1-104
3.5.1-43	AS-BUILT CROSS-SECTION G-G' SOUTH EMBANKMENT N-15	3.5.1-105
3.5.1-44	AS-BUILT CROSS-SECTION H-H' NORTH AND WEST EMBANKMENTS N-15	3.5.1-106
3.5.1-45	TYPICAL CROSS-SECTION, PROPOSED MODIFICATION TO N-15 AREA SAND DRAIN	3.5.1-107
3.5.1-46	CONCEPTUAL CROSS-SECTION I-I' NORTH EMBANKMENT N-11C	3.5.1-108
3.5.1-47	CONCEPTUAL CROSS-SECTION K-K' EAST EMBANKMENT, N-11C, N-11B	3.5.1-109

LIST OF FIGURES (Continued)

Figure/Title		Page
3.5.1-48	CONCEPTUAL CROSS-SECTION J-J' INTERIOR ULTIMATE STAGE EMBANKMENT WASTE CLAY DEPOSITS	3.5.1-110
3.5.1-49	TYPICAL CROSS-SECTION AT SPILLWAY EMBANKMENT N-15	3.5.1-111
3.5.1-50	MINED/CLAY SETTLING AREAS SITE MAP	3.5.1-112
3.5.1-51	SOLIDS CONTENT PROFILE - CLAY POND N-15, BORING C-19	3.5.1-113
3.5.1-52	SOLIDS CONTENT PROFILE - CLAY POND N-11B, BORING C-14	3.5.1-114
3.5.1-53	SOLIDS CONTENT PROFILE - CLAY POND N-11C, BORING C-16	3.5.1-115
3.5.1-54	SOLIDS CONTENT PROFILE - CLAY POND N-11A, BORING C-3	3.5.1-116
3.5.1-55	SOLIDS CONTENT PROFILE - CLAY POND N-13, BORING C-4	3.5.1-117
3.5.1-56	SOLIDS CONTENT PROFILE - CLAY POND N-9B, BORING C-9	3.5.1-118
3.5.1-57	ATTERBERG TEST RESULTS - PROPOSED COOLING POND AREAS N-11B, N-11C AND N-15	3.5.1-119

LIST OF FIGURES (Continued)

Figure/Title		Page
3.5.1-58	CLAY CONSOLIDATION MODELING PREDICTION CLAY POND N-15	3.5.1-120
3.5.1-59	CLAY CONSOLIDATION MODELING PREDICTION CLAY POND N-11B, BORINGS C-13, C-14	3.5.1-121
3.5.1-60	CLAY CONSOLIDATION MODELING PREDICTION CLAY POND N-11C, BORINGS C-16, C-44	3.5.1-122
3.5.4-1	TYPICAL WATER MASS BALANCE ULTIMATE DEVELOPMENT CASE B, (WITH PULVERIZED COAL UNITS) ANNUAL AVERAGE CONDITIONS	3.5.4-6
3.5.4-2	PROJECTED WATER MASS BALANCE ULTIMATE DEVELOPMENT - CASE B, (WITH PULVERIZED COAL UNITS) PEAK CONDITIONS	3.5.4-7
3.5.4-3	TYPICAL WATER MASS BALANCE ULTIMATE DEVELOPMENT CASE A (ALL COAL GASIFICATION COMBINED CYCLE UNITS) ANNUAL AVERAGE CONDITIONS	3.5.4-8
3.5.4-4	TYPICAL WATER MASS BALANCE ULTIMATE DEVELOPMENT CASE A (ALL COAL GASIFICATION COMBINED CYCLE UNITS) PEAK CONDITIONS	3.5.4-9
3.7.1-1	INITIAL SOLID WASTE AREA - PLAN VIEW	3.7-40
3.7.1-2	INITIAL SOLID WASTE AREA - CROSS-SECTION	3.7-41
3.7.1-3	EMBANKMENT PLAN - SA-8 AND SA-9	3.7-42

LIST OF FIGURES (Continued)

Figure/Title		Page
3.7.1-4	EMBANKMENT PLAN - SA-10	3.7-43
3.7.1-5	EMBANKMENT PLAN - P-2	3.7-44
3.7.1-6	EMBANKMENT PLAN - P-3	3.7-45
3.7.1-7	SA-8 PROBE - SECTION 1, NORTH-SOUTH DIRECTION	3.7-46
3.7.1-8	SA-8 PROBE - SECTION 2, EAST-WEST DIRECTION	3.7-47
3.7.1-9	SA-8 PROBE - SECTION 3, NORTH-SOUTH DIRECTION	3.7-48
3.7.1-10	SA-8 PROBE - SECTION 4, EAST-WEST DIRECTION	3.7-49
3.7.1-11	SA-8 PROBE - SECTION 5, NORTH-SOUTH DIRECTION	3.7-50
3.7.1-12	SA-8 PROBE - SECTION 6, EAST-WEST DIRECTION	3.7-51
3.7.1-13	SA-8 PROBE - SECTION 7, NORTH-SOUTH DIRECTION	3.7-52
3.7.1-14	SA-9 PROBE - SECTION 8, NORTH-SOUTH DIRECTION	3.7-53
3.7.1-15	SA-10 PROBE - SECTION 1, NORTH-SOUTH DIRECTION	3.7-54
3.7.1-16	P-2 PROBE - SECTION 1, NORTH-SOUTH DIRECTION	3.7-55
3.7.1-17	P-2 PROBE - SECTIONS 2/3, EAST-WEST AND NORTH-SOUTH DIRECTIONS	3.7-56
3.7.1-18	P-3 PROBE - SECTIONS 1/2, NORTH-SOUTH AND EAST-WEST DIRECTIONS	3.7-57

LIST OF FIGURES (Continued)

Figure/Title		Page
3.7.1-19	P-3 PROBE - SECTIONS 5/6, EAST-WEST AND NORTH-SOUTH DIRECTIONS	3.7-58
3.7.1-20	P-3 PROBE - SECTIONS 3/4, NORTH-SOUTH AND EAST-WEST DIRECTIONS	3.7-59
3.7.1-21	CLAY CONSOLIDATION MODELING PREDICTION CLAY POND SA-8, BORINGS C-20, C-22, C-26, C-28	3.7-60
3.7.1-22	CLAY CONSOLIDATION MODELING PREDICTION CLAY POND SA-9, BORINGS C-23, C-24, C-25, C-27	3.7-61
3.7.1-23	CLAY CONSOLIDATION MODELING PREDICTION CLAY POND SA-10	3.7-62
3.7.1-24	CLAY CONSOLIDATION MODELING PREDICTION CLAY POND P-3, BORINGS C-37, C-38, C-39	3.7-63
3.7.1-25	PERMEABILITY RELATIONSHIPS SOLID WASTE DISPOSAL AREAS	3.7-64
3.7.1-26	ATTERBURG TEST RESULTS	3.7-65
3.7.1-27	TYPICAL EDGE LINER AND LEACHATE COLLECTION DETAIL SOLID WASTE DISPOSAL AREA	3.7-66
3.7.1-28	CONCEPTUAL CROSS-SECTION A-A' SA-8 EAST EMBANKMENT	3.7-67
3.7.1-29	CONCEPTUAL CROSS-SECTION B-B' SA-8 NORTH AND NORTHWEST EMBANKMENTS	3.7-68

LIST OF FIGURES (Continued)

Figure/Title		Page
3.7.1-30	CONCEPTUAL CROSS-SECTION C-C' SA-9 NORTH EMBANKMENT	3.7-69
3.7.1-31	CONCEPTUAL CROSS-SECTION D-D' SA-9 EAST EMBANKMENT	3.7-70
3.7.1-32	CONCEPTUAL CROSS-SECTION E-E' SA-9 WEST AND SOUTHWEST WALLS	3.7-71
3.7.1-33	CONCEPTUAL CROSS-SECTION F-F' SA-9 SOUTH EMBANKMENT	3.7-72
3.7.1-34	CONCEPTUAL CROSS-SECTION A-A', SA-10 EMBANKMENT	3.7-73
3.7.1-35	CONCEPTUAL CROSS-SECTION A-A', P-2 EMBANKMENT	3.7-74
3.7.1-36	CONCEPTUAL CROSS-SECTION B-B', P-2 EMBANKMENT	3.7-75
3.7.1-37	CONCEPTUAL CROSS-SECTION A-A', P-3 EAST EMBANKMENT	3.7-76
3.7.1-38	CONCEPTUAL CROSS-SECTION B-B' P-3 SOUTHEAST EMBANKMENT	3.7-77
3.7.1-39	CONCEPTUAL CROSS-SECTION C-C' P-3 SOUTH EMBANKMENT	3.7-78
3.7.1-40	CONCEPTUAL CROSS-SECTION D-D' P-3 WEST EMBANKMENT	3.7-79
3.7.1-41	CONCEPTUAL CROSS-SECTION E-E' P-3 NORTH EMBANKMENT	3.7-80

LIST OF FIGURES (Continued)

Figure/Title		Page
3.7.1-42	TYPICAL EDGE LINER DETAIL A SA-9 BRINE POND	3.7-81
3.7.1-43	SCHEMATIC OF FIRST LIFT - WASTE FILL ADVANCEMENT SEQUENCING	3.7-82
3.7.1-44	UNDRAINED SHEAR STRENGTH DATA CLAY SETTLING AREAS	3.7-83
3.7.1-45	STABILITY ANALYSIS - PLACEMENT OF FIRST SOLID WASTE LIFT	3.7-84
3.7.1-46	STABILITY ANALYSIS - PLACEMENT OF SECOND SOLID WASTE LIFT	3.7-85
3.7.1-47	PERIMETER STABILITY OF SOLID WASTE DISPOSAL AREA TEST 1	3.7-86
3.7.1-48	PERIMETER STABILITY OF SOLID WASTE DISPOSAL AREA TEST 2	3.7-87
3.8.2-1	SURFACE WATER DRAINAGE (DURING RECLAMATION)	3.8-7
3.8.2-2	SURFACE WATER DRAINAGE (DURING POWER PLANT CONSTRUCTION)	3.8-8
3.8.3-1	SITE DRAINAGE - INITIAL OPERATIONAL PHASE (NOVEMBER 1998 - JULY 2006)	3.8-9
3.8.3-2	SITE DRAINAGE - ULTIMATE DEVELOPMENT OPERATIONAL PHASE (POST-JULY 2006)	3.8-10

LIST OF FIGURES (Continued)

Figure/Title		Page
4.1.1-1	PLANT ISLAND GRADING	4.1-9
4.1.1-2	EXISTING APPROVED PLANT ISLAND TOPOGRAPHY	4.1-10
4.1.1-3	EXISTING APPROVED AREA N-16 TOPOGRAPHY	4.1-11
4.1.1-4	COOLING POND GRADING	4.1-12
4.1.1-5	TYPES OF BUFFER AREA	4.1-13
4.1.3-1	100-YEAR SITE FLOOD ZONE DESIGNATIONS	4.1-14
4.2.1-1	CONCEPTUAL DESIGN OF PLANT ISLAND AND COOLING POND DEWATERING SYSTEM	4.2-4
4.3.1-1	DEWATERING AREA MAP - POTENTIALLY SENSITIVE ENVIRONMENTAL AREAS	4.3-12
4.3.2-1	CONSTRUCTION DEWATERING WITH MITIGATION MEASURES AND POTENTIALLY SENSITIVE ENVIRONMENTAL AREAS	4.3-13
4.3.2-2	MONITORING SITE PLAN	4.3-14
4.4.1-1	BUFFER AREA LAND COVER	4.4-17
4.6.1-1	2002 PEAK SEASON - A.M. PEAK HOUR NON-PROJECT TRAFFIC	4.6-31
4.6.1-2	2002 PEAK SEASON - P.M. PEAK HOUR NON-PROJECT TRAFFIC	4.6-32

LIST OF FIGURES (Continued)

Figure/Title		Page
4.6.1-3	2010 PEAK SEASON - A.M. PEAK HOUR NON-PROJECT TRAFFIC	4.6-33
4.6.1-4	2010 PEAK SEASON - P.M. PEAK HOUR NON-PROJECT TRAFFIC	4.6-34
4.6.1-5	CONSTRUCTION PROJECT TRIPS - A.M. PEAK HOUR	4.6-35
4.6.1-6	CONSTRUCTION PROJECT TRIPS - P.M. PEAK HOUR	4.6-36
4.6.1-7	2002 PEAK SEASON - A.M. PEAK HOUR TOTAL TRAFFIC	4.6-37
4.6.1-8	2002 PEAK SEASON - P.M. PEAK HOUR TOTAL TRAFFIC	4.6-38
4.6.1-9	2010 PEAK SEASON - A.M. PEAK HOUR TOTAL TRAFFIC	4.6-39
4.6.1-10	2010 PEAK SEASON - P.M. PEAK HOUR TOTAL TRAFFIC	4.6-40
4.6.2-1	CONSTRUCTION EMPLOYMENT ESTIMATES	4.6-41
4.10.0-1	PROJECTION OF CONSTRUCTION WAGES	4.10-3
5.1.3-1	DISSOLVED OXYGEN MEASUREMENTS PEACE RIVER AT BARTOW, FLORIDA	5.1-9
5.1.3-2	DISSOLVED OXYGEN MEASUREMENTS PEACE RIVER NEAR HOMELAND, FLORIDA	5.1-10
5.1.3-3	DISSOLVED OXYGEN MEASUREMENTS PEACE RIVER AT FORT MEADE, FLORIDA	5.1-11

LIST OF FIGURES (Continued)

Figure/Title		Page
5.1.3-4	DISSOLVED OXYGEN SATURATION PEACE RIVER AT FORT MEADE, FLORIDA	5.1-12
5.1.3-5	DISSOLVED OXYGEN SATURATION PEACE RIVER AT BARTOW, FLORIDA	5.1-13
5.3.1-1	PEACE RIVER BASIN MAP	5.3-35
5.3.2-1	GENERALIZED GEOLOGIC SECTION A-A', HYDROSTRATIGRAPHIC SECTION, AND CONCEPTUAL MODEL OF THE GROUNDWATER SUPPLY (GWS) MODEL DOMAIN	5.3-36
5.3.2-2	GENERALIZED GEOLOGIC SECTION B-B', HYDROSTRATIGRAPHIC SECTION, AND CONCEPTUAL MODEL OF THE GROUNDWATER SUPPLY (GWS) MODEL DOMAIN	5.3-37
5.3.2-3	PROJECTED WATER USE FOR POLK COUNTY YEARS 1990-2020	5.3-38
5.3.2-4	UPPER FLORIDAN DRAWDOWN FOR 20.6 MGD FPC WITHDRAWALS WITH PREDEVELOPMENT BASELINE	5.3-39
5.3.2-5	UPPER FLORIDAN DRAWDOWN FOR 26.6 MGD FPC WITHDRAWALS WITH PREDEVELOPMENT BASELINE	5.3-40
5.3.2-6	UPPER FLORIDAN DRAWDOWN FOR 31.6 MGD FPC WITHDRAWALS WITH PREDEVELOPMENT BASELINE	5.3-41

LIST OF FIGURES (Continued)

Figure/Title		Page
5.3.2-7	UPPER FLORIDAN DRAWDOWN FOR 20.6 MGD FPC WITHDRAWALS EXISTING USERS BASELINE	5.3-42
5.3.2-8	UPPER FLORIDAN DRAWDOWN FOR 26.6 MGD FPC WITHDRAWALS EXISTING USERS BASELINE	5.3-43
5.3.2-9	UPPER FLORIDAN DRAWDOWN FOR 31.6 MGD FPC WITHDRAWALS EXISTING USERS BASELINE	5.3-44
5.3.2-10	INTERMEDIATE AQUIFER DRAWDOWN FOR 20.6 MGD FPC WITHDRAWALS WITH PREDEVELOPMENT BASELINE	5.3-45
5.3.2-11	INTERMEDIATE AQUIFER DRAWDOWN FOR 26.6 MGD FPC WITHDRAWALS WITH PREDEVELOPMENT BASELINE	5.3-46
5.3.2-12	INTERMEDIATE AQUIFER DRAWDOWN FOR 31.6 MGD FPC WITHDRAWALS WITH PREDEVELOPMENT BASELINE	5.3-47
5.3.2-13	INTERMEDIATE AQUIFER DRAWDOWN FOR 20.6 MGD FPC WITHDRAWALS EXISTING USERS BASELINE	5.3-48
5.3.2-14	INTERMEDIATE AQUIFER DRAWDOWN FOR 26.6 MGD FPC WITHDRAWALS EXISTING USERS BASELINE	5.3-49
5.3.2-15	INTERMEDIATE AQUIFER DRAWDOWN FOR 31.6 MGD FPC WITHDRAWALS EXISTING USERS BASELINE	5.3-50
5.3.2-16	ESTIMATES OF POTENTIAL BRINE POND FILLING AND SEEPAGE RATES	5.3-51
5.3.2-17	PLAN VIEW OF SA-9 EMBANKMENTS SHOWING POTENTIAL SEEPAGE DIRECTIONS	5.3-52

LIST OF FIGURES (Continued)

Figure/Title		Page
5.3.2-18	N-16 POND SEEPAGE MODEL	5.3-53
5.3.2-19	BRINE POND SEEPAGE MODEL	5.3-54
5.3.5-1	DRINKING WATER MONITORING WELL LOCATIONS	5.3-55
5.3.5-2	CONCEPTUAL OPEN HOLE INTERMEDIATE OBSERVATION WELL	5.3-56
5.6.1-1	RECEPTOR GRID FOR SIGNIFICANT IMPACT AREA ANALYSES	5.6-144
5.6.1-2	COARSE RECEPTOR GRID FOR CLASS II PSD AND AAQS ANALYSES	5.6-145
5.6.1-3	LOCATIONS OF SELECTED NEAR-SITE MODELLED PM SOURCES AND WIND DIRECTION SECTOR CONSIDERED FOR BACKGROUND PM CONCENTRATIONS	5.6-146
5.6.1-4	MAXIMUM PREDICTED OFF-SITE 3-HOUR AVERAGE SO_2 PROJECT IMPACTS ($\mu g/m^3$)	5.6-147
5.6.1-5	MAXIMUM PREDICTED OFF-SITE 24-HOUR AVERAGE SO_2 PROJECT IMPACTS ($\mu g/m^3$)	5.6-148
5.6.1-6	MAXIMUM PREDICTED OFF-SITE ANNUAL AVERAGE SO_2 PROJECT IMPACTS ($\mu g/m^3$)	5.6-149
5.7.1-1	NOISE MODELING RECEPTOR LOCATIONS	5.7-9

LIST OF FIGURES (Continued)

Figure/Title		Page
5.9.1-1	2008 PEAK SEASON A.M. PEAK HOUR NON-PROJECT TRAFFIC	5.9-29
5.9.1-2	2008 PEAK SEASON P.M. PEAK HOUR NON-PROJECT TRAFFIC	5.9-30
5.9.1-3	2018 PEAK SEASON A.M. PEAK HOUR NON-PROJECT TRAFFIC	5.9-31
5.9.1-4	2018 PEAK SEASON P.M. PEAK HOUR NON-PROJECT TRAFFIC	5.9-32
5.9.1-5	OPERATION PROJECT TRIPS - A.M. PEAK HOUR	5.9-33
5.9.1-6	OPERATION PROJECT TRIPS - P.M. PEAK HOURS	5.9-34
5.9.1-7	2008 PEAK SEASON A.M. PEAK HOUR TOTAL TRAFFIC	5.9-35
5.9.1-8	2008 PEAK SEASON P.M. PEAK HOUR TOTAL TRAFFIC	5.9-36
5.9.1-9	2018 PEAK SEASON A.M. PEAK HOUR TOTAL TRAFFIC	5.9.-37
5.9.1-10	2018 PEAK SEASON P.M. PEAK HOUR TOTAL TRAFFIC	5.9-38
5.9.2-1	PROBABLE RAILWAY TRANSPORTATION ROUTES	5.9-39
6.1.1-1	TRANSMISSION LINE CORRIDOR LOCATION MAP	6.1-17
6.1.1-2A	BARCOLA SUBSTATION TO FORT MEADE SUBSTATION TRANSMISSION LINE CORRIDOR - SHEET A	6.1-18
6.1.1-2B	BARCOLA SUBSTATION TO FORT MEADE SUBSTATION TRANSMISSION LINE CORRIDOR - SHEET B	6.1-19

LIST OF FIGURES (Continued)

Figure/Title		Page
6.1.1-2C	BARCOLA SUBSTATION TO FORT MEADE SUBSTATION TRANSMISSION LINE CORRIDOR - SHEET C	6.1-20
6.1.1-2D	BARCOLA SUBSTATION TO FORT MEADE SUBSTATION TRANSMISSION LINE CORRIDOR - SHEET D	6.1-21
6.1.1-3	TYPICAL "VEE" STRING DOUBLE-CIRCUIT TANGENT STRUCTURE	6.1-22
6.1.1-4	TYPICAL 230 KV DOUBLE CIRCUIT SMALL ANGLE SUSPENSION SELF-SUPPORTING STEEL STRUCTURE	6.1-23
6.1.1-5	TYPICAL DOUBLE CIRCUIT VERTICAL TANGENT HORIZONTAL "VEE" STRUCTURE	6.1-24
6.1.1-6	TYPICAL INSULATORS AND HARDWARE	6.1-25
6.1.1-7	TYPICAL ACCESS ROAD AND STRUCTURE PAD PLAN AND CROSS SECTION	6.1-26
6.1.6-1A	LOCAL GOVERNMENT JURISDICTIONS WITHIN 1/2 MILE OF TRANSMISSION LINE CORRIDOR - SHEET A	6.1-27
6.1.6-1B	LOCAL GOVERNMENT JURISDICTIONS WITHIN 1/2 MILE OF TRANSMISSION LINE CORRIDOR - SHEET B	6.1-28
6.1.6-2	FUTURE LAND USE DESIGNATIONS WITHIN THE TRANSMISSION LINE CORRIDOR	6.1-29
6.1.6-3A	ZONING DESIGNATIONS WITHIN THE TRANSMISSION LINE CORRIDOR - SHEET A	6.1-30

LIST OF FIGURES (Continued)

Figure/Title		Page
6.1.6-3B	ZONING DESIGNATIONS WITHIN THE TRANSMISSION LINE CORRIDOR - SHEET B	6.1-31
6.1.7-1A	LAND USE AND VEGETATION OF TRANSMISSION LINE CORRIDOR AREA - SHEET A	6.1-32
6.1.7-1B	LAND USE AND VEGETATION OF TRANSMISSION LINE CORRIDOR AREA - SHEET B	6.1-33
6.2.1-1	NATURAL GAS PIPELINE PREFERRED CORRIDOR LAYOUT	6.2-25
6.2.2-1	PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR - KEY	6.2-26
6.2.2-1A	PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR - SHEET A	6.2-27
6.2.2-1B	PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR - SHEET B	6.2-28
6.2.2-1C	PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR - SHEET C	6.2-29
6.2.2-1D	PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR - SHEET D	6.2-30
6.2.2-1E	PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR - SHEET E	6.2-31
6.2.2-1F	PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR - SHEET F	6.2-32

LIST OF FIGURES (Continued)

Figure/Title		Page
6.2.2-1G	PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR - SHEET G	6.2-33
6.2.2-1H	PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR - SHEET H	6.2-34
6.2.5-1	CANDIDATE CORRIDOR ROUTES	6.2-35
6.2.6-1	LOCAL GOVERNMENT JURISDICTIONS WITHIN ONE-HALF MILE OF THE CORRIDOR	6.2-36
6.2.6-2	FUTURE LAND USE DESIGNATIONS, HILLSBOROUGH COUNTY, FLORIDA	6.2-37
6.2.6-3	FUTURE LAND USE DESIGNATIONS, POLK COUNTY, FLORIDA	6.2-38
6.2.6-4A	ZONING DESIGNATIONS IN THE PIPELINE CORRIDOR, SHEET A	6.2-39
6.2.6-4B	ZONING DESIGNATIONS IN THE PIPELINE CORRIDOR, SHEET B	6.2-40
6.2.6-4C	ZONING DESIGNATIONS IN THE PIPELINE CORRIDOR, SHEET C	6.2-41
6.2.6-4D	ZONING DESIGNATIONS IN THE PIPELINE CORRIDOR, SHEET D	6.2-42
6.2.7-1A	LAND USE AND VEGETATION IN PREFERRED CORRIDOR, SHEET A	6.2-43

LIST OF FIGURES (Continued)

Figure/Title		Page
6.2.7-1B	LAND USE AND VEGETATION IN PREFERRED CORRIDOR, SHEET B	6.2-44
6.2.7-1C	LAND USE AND VEGETATION IN PREFERRED CORRIDOR, SHEET C	6.2-45
6.2.7-1D	LAND USE AND VEGETATION IN PREFERRED CORRIDOR, SHEET D	6.2-46
6.2.8-1	TYPICAL CROSS SECTION, NATURAL GAS PIPELINE DURING CONSTRUCTION	6.2-47
6.3.0-1	RECLAIMED WATER PIPELINE CORRIDOR CENTERLINE LOCATION MAP	6.3-16
6.3.2-1A	BARTOW SEWAGE TREATMENT PLANT RECLAIMED WATER PIPELINE CORRIDOR - SHEET A	6.3-17
6.3.2-1B	BARTOW SEWAGE TREATMENT PLANT RECLAIMED WATER PIPELINE CORRIDOR - SHEET B	6.3-18
6.3.2-1C	BARTOW SEWAGE TREATMENT PLANT RECLAIMED WATER PIPELINE CORRIDOR - SHEET C	6.3-19
6.3.6-1A	LOCAL GOVERNMENT JURISDICTIONS WITHIN 1/2 MILE OF THE RECLAIMED WATER PIPELINE CORRIDOR - SHEET A	6.3-20
6.3.6-1B	LOCAL GOVERNMENT JURISDICTIONS WITHIN 1/2 MILE OF THE RECLAIMED WATER PIPELINE CORRIDOR - SHEET B	6.3-21

LIST OF FIGURES (Continued)

Figure/Title		Page
6.3.6-2	POLK COUNTY FUTURE LAND USE DESIGNATIONS WITHIN THE RECLAIMED WATER PIPELINE CORRIDOR	6.3-22
6.3.6-3A	POLK COUNTY ZONING DESIGNATIONS WITHIN THE RECLAIMED WATER PIPELINE CORRIDOR - SHEET A	6.3-23
6.3.6-3B	POLK COUNTY ZONING DESIGNATIONS WITHIN THE RECLAIMED WATER PIPELINE CORRIDOR - SHEET B	6.3-24
6.3.7-1A	LAND USE AND VEGETATION OF THE PREFERRED RECLAIMED WATER PIPELINE CORRIDOR AND AREA ONE QUARTER MILE BEYOND EACH EDGE OF CORRIDOR, SHEET A	6.3-25
6.3.7-1B	LAND USE AND VEGETATION OF THE PREFERRED RECLAIMED WATER PIPELINE CORRIDOR AND AREA ONE QUARTER MILE BEYOND EACH EDGE OF CORRIDOR, SHEET B	6.3-26
7.1.0-1	OPERATIONS EMPLOYMENT ESTIMATES	7.1-5
7.1.0-2	OPERATING EMPLOYEE WAGES	7.1-6
7.1.0-3	LOCAL PROPERTY TAX REVENUES	7.1-7
7.2.2-1	PHOTOGRAPHIC SIMULATION OF PLANT FACILITIES	7.2-6
7.2.2-2	PHOTOGRAPHIC SIMULATION VIEWPOINT LOCATION	7.2-7
10.4.2-1	GENERAL LOCATION, IMC NORALYN/PHOSPHORIA MINE DRI	10.4-12

LIST OF FIGURES (Continued)

Figure/Title		Page
10.5.3-1	SUBSURFACE INVESTIGATION PLAN, CLAY POND AREAS	10.5.3-58
10.5.3-2 THROUGH 10.5.3-49	LOGS OF BORINGS (C-1 THROUGH C-48)	10.5.3-59
10.5.3-50	SUBSURFACE INVESTIGATION PLAN, DAM AREAS	10.5.3-107
10.5.3-51 THROUGH 10.5.3-172	LOGS OF BORINGS (D-1 THROUGH D-71)	10.5.3-108
10.5.3-173	SUBSURFACE INVESTIGATION PLAN, PLANT ISLAND AREAS	10.5.3-291
10.5.3-174 THROUGH 10.5.3-204	LOGS OF BORINGS (P-1 THROUGH P-31)	10.5.3-292
10.5.3-205	SUBSURFACE INVESTIGATION PLAN, BORROW SOURCE AREAS	10.5.3-331
10.5.3-206A THROUGH 10.5.3-217D	LOGS OF BORINGS (B-1 THROUGH B-23)	10.5.3-332
10.5.3-218	SUBSURFACE INVESTIGATION PLAN, SINKHOLE BORINGS	10.5.3-353
10.5.3-219A THROUGH 10.5.3-221E	LOGS OF BORINGS (SH-1 THROUGH SH-3)	10.5.3-354

LIST OF FIGURES (Continued)

Figure/Title		Page
10.5.3-222 THROUGH 10.5.3-262	SOLIDS CONTENT PROFILE (BORINGS C-1 THROUGH C-44)	10.5.3-369
10.5.3-263	SCHEMATIC OF SPT AND THIN-WALL SAMPLERS	10.5.3-410
10.5.3-264	TYPE U SAMPLER	10.5.3-411
10.5.3-265	UNIFIED SOIL CLASSIFICATION SYSTEM	10.5.3-412
10.5.3-266	ELECTRIC CONE AND TYPICAL ECPT DATA	10.5.3-413
10.5.3-267	FLAT DILATOMETER TEST	10.5.3-414
10.5.3-268	VANE SHEAR TEST ARRANGEMENT	10.5.3-415
10.5.8-1	GENERAL LOCATION MAP	10.5.8-30
10.5.8-2	SITE MAP	10.5.8-31
10.5.8-3	GENERALIZED LITHOSTRATIGRAPHIC AND HYDROGEOLOGIC FRAMEWORK - POLK COUNTY AREA	10.5.8-32
10.5.8-4	CROSS-SECTION LOCATION MAP	10.5.8-33
10.5.8-5	CONCEPTUAL HYDROGEOLOGIC CROSS-SECTION OF WEST-CENTRAL FLORIDA	10.5.8-34
10.5.8-6	FLORIDAN AQUIFER PUMP TEST SITES IN POLK COUNTY	10.5.8-35

LIST OF FIGURES (Continued)

Figure/Title		Page
10.5.8-7	OBSERVATION WELL LOCATION MAP	10.5.8-36
10.5.8-8	UPPER FLORIDAN AQUIFER PUMP TEST WELL SC-1 WELL CONSTRUCTION DETAILS	10.5.8-37
10.5.8-9	UPPER FLORIDAN AQUIFER OBSERVATION WELL SC-2 WELL CONSTRUCTION DETAILS	10.5.8-38
10.5.8-10	UPPER FLORIDAN AQUIFER OBSERVATION WELL SC-3 WELL CONSTRUCTION DETAILS	10.5.8-39
10.5.8-11	UPPER FLORIDAN AQUIFER OBSERVATION WELL SC-5, WELL CONSTRUCTION DETAILS	10.5.8-40
10.5.8-12	INTERMEDIATE AQUIFER OBSERVATION WELL DM-2, WELL CONSTRUCTION DETAILS	10.5.8-41
10.5.8-13	SURFICIAL AQUIFER OBSERVATION WELL DM-3, WELL CONSTRUCTION DETAILS	10.5.8-42
10.5.8-14	UPPER FLORIDAN AQUIFER OBSERVATION WELL DM-6, WELL CONSTRUCTION DETAILS	10.5.8-43
10.5.8-15	GEOPHYSICAL LOG, WELL DM-2	10.5.8-44
10.5.8-16	GEOPHYSICAL LOG, WELL DM-3	10.5.8-45
10.5.8-17	GEOPHYSICAL LOG, WELL SC-1	10.5.8-46
10.5.8-18	GEOPHYSICAL LOG, WELL SC-2	10.5.8-47

LIST OF FIGURES (Continued)

Figure/Title		Page
10.5.8-19	GEOPHYSICAL LOG, WELL SC-3	10.5.8-48
10.5.8-20	GEOPHYSICAL LOG, WELL SC-5	10.5.8-49
10.5.8-21A	LOG OF PILOT HOLE - SHEET A	10.5.8-50
10.5.8-21B	LOG OF PILOT HOLE - SHEET B	10.5.8-51
10.5.8-21C	LOG OF PILOT HOLE - SHEET C	10.5.8-52
10.5.8-21D	LOG OF PILOT HOLE - SHEET D	10.5.8-53
10.5.8-21E	LOG OF PILOT HOLE - SHEET E	10.5.8-54
10.5.8-22	GEOPHYSICAL LOG - PILOT HOLE	10.5.8-55
10.5.8-23	SURFICIAL AQUIFER OBSERVATION WELL S-1, WELL CONSTRUCTION DETAILS	10.5.8-56
10.5.8-24	SURFICIAL AQUIFER OBSERVATION WELL S-2, WELL CONSTRUCTION DETAILS	10.5.8-57
10.5.8-25	SURFICIAL AQUIFER OBSERVATION WELL S-3, WELL CONSTRUCTION DETAILS	10.5.8-58
10.5.8-26	LOG OF BORING S-1	10.5.8-59
10.5.8-27	LOG OF BORING S-2	10.5.8-60
10.5.8-28	LOG OF BORING S-3	10.5.8-61

LIST OF FIGURES (Continued)

Figure/Title		Page
10.5.8-29	CONFINING UNIT OBSERVATION WELL C-1, WELL CONSTRUCTION DETAILS	10.5.8-62
10.5.8-30A	LOG OF BORING C-1 - SHEET A	10.5.8-63
10.5.8-30B	LOG OF BORING C-1 - SHEET B	10.5.8-64
10.5.8-30C	LOG OF BORING C-1 - SHEET C	10.5.8-65
10.5.8-30D	LOG OF BORING C-1 - SHEET D	10.5.8-66
10.5.8-30E	LOG OF BORING C-1 - SHEET E	10.5.8-67
10.5.8-31	INTERMEDIATE AQUIFER OBSERVATION WELL I-1, WELL CONSTRUCTION DETAILS	10.5.8-68
10.5.8-32A	LOG OF BORING I-1 - SHEET A	10.5.8-69
10.5.8-32B	LOG OF BORING I-1 - SHEET B	10.5.8-70
10.5.8-32C	LOG OF BORING I-1 - SHEET C	10.5.8-71
10.5.8-32D	LOG OF BORING I-1 - SHEET D	10.5.8-72
10.5.8-33	HYDROGEOLOGIC FRAMEWORK - FPC SITE AREA	10.5.8-73
10.5.8-34	HYDROGEOLOGIC CROSS-SECTION LOCATION MAP - ESTECH SILVER CITY MINE SITE	10.5.8-74
10.5.8-35	HYDROGEOLOGIC CROSS-SECTION A-A' - ESTECH SILVER CITY MINE SITE	10.5.8-75

LIST OF FIGURES (Continued)

Figure/Title		Page
10.5.8-36	HYDROGEOLOGIC CROSS-SECTION B-B' - ESTECH SILVER CITY MINE SITE	10.5.8-76
10.5.8-37	DETAILED WELL LOCATION MAP, AQUIFER PERFORMANCE TESTING	10.5.8-77
10.5.8-38	AQUIFER CHARACTERISTICS PROGRAM, WATER LEVEL TRENDS SC-1	10.5.8-78
10.5.8-39	AQUIFER CHARACTERISTICS PROGRAM, WATER LEVEL TRENDS SC-2	10.5.8-79
10.5.8-40	AQUIFER CHARACTERISTICS PROGRAM, WATER LEVEL TRENDS SC-3	10.5.8-80
10.5.8-41	AQUIFER CHARACTERISTICS PROGRAM, WATER LEVEL TRENDS SC-5	10.5.8-81
10.5.8-42	AQUIFER CHARACTERISTICS PROGRAM, WATER LEVEL TRENDS DM-2	10.5.8-82
10.5.8-43	AQUIFER CHARACTERISTICS PROGRAM, WATER LEVEL TRENDS DM-3	10.5.8-83
10.5.8-44	AQUIFER CHARACTERISTICS PROGRAM, WATER LEVEL TRENDS DM-6	10.5.8-84
10.5.8-45	AQUIFER CHARACTERISTICS PROGRAM, WATER LEVEL TRENDS C-1	10.5.8-85

LIST OF FIGURES (Continued)

Figure/Title		Page
10.5.8-46	AQUIFER CHARACTERISTICS PROGRAM, WATER LEVEL TRENDS I-1	10.5.8-86
10.5.8-47	AQUIFER CHARACTERISTICS PROGRAM, WATER LEVEL TRENDS S-1	10.5.8-87
10.5.8-48	AQUIFER CHARACTERISTICS PROGRAM, WATER LEVEL TRENDS S-2	10.5.8-88
10.5.8-49	AQUIFER CHARACTERISTICS PROGRAM, WATER LEVEL TRENDS S-3	10.5.8-89
10.5.8-50	AQUIFER CHARACTERISTICS PROGRAM, BAROMETRIC PRESSURE DATA - 25 DAYS	10.5.8-90
10.5.8-51	AQUIFER CHARACTERISTICS PROGRAM, BAROMETRIC PRESSURE DATA - 40 DAYS	10.5.8-91
10.5.8-52	AQUIFER CHARACTERISTICS PROGRAM, BAROMETRIC PRESSURE DATA - 50 DAYS	10.5.8-92
10.5.8-53	AQUIFER CHARACTERISTICS PROGRAM, STEP-DRAWDOWN PUMPING TEST, WELL SC-1	10.5.8-93
10.5.8-54	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - DRAWDOWN SC-1	10.5.8-94
10.5.8-55	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - RECOVERY SC-1	10.5.8-95

LIST OF FIGURES (Continued)

Figure/Title		Page
10.5.8-56	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - DRAWDOWN SC-1	10.5.8-96
10.5.8-57	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - DRAWDOWN SC-2	10.5.8-97
10.5.8-58	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - DRAWDOWN SC-3	10.5.8-98
10.5.8-59	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - RECOVERY SC-3	10.5.8-99
10.5.8-60	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - DRAWDOWN SC-3	10.5.8-100
10.5.8-61	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - DRAWDOWN SC-5	10.5.8-101
10.5.8-62	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - RECOVERY SC-5	10.5.8-102
10.5.8-63	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - DRAWDOWN SC-5	10.5.8-103
10.5.8-64	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - DRAWDOWN DM-2	10.5.8-104
10.5.8-65	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - RECOVERY DM-2	10.5.8-105
10.5.8-66	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - DRAWDOWN DM-6	10.5.8-106

LIST OF FIGURES (Continued)

Figure/Title		Page
10.5.8-67	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - RECOVERY DM-6	10.5.8-107
10.5.8-68	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - DRAWDOWN DM-6	10.5.8-108
10.5.8-69	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - DRAWDOWN I-1	10.5.8-109
10.5.8-70	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - RECOVERY I-1	10.5.8-110
10.5.8-71	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - DRAWDOWN I-1	10.5.8-111
10.5.8-72	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - DRAWDOWN SC-5, JACOB'S STRAIGHT-LINE METHOD	10.5.8-112
10.5.8-73	AQUIFER CHARACTERISTICS PROGRAM, HANTUSH-JACOB VS. DISTANCE METHOD	10.5.8-113
10.5.8-74	AQUIFER CHARACTERISTICS PROGRAM, BOULTON'S METHOD - DRAWDOWN SC-5	10.5.8-114
10.5.8-75	AQUIFER CHARACTERISTICS PROGRAM, BOULTON'S METHOD - DRAWDOWN SC-3	10.5.8-115
10.5.8-76	AQUIFER CHARACTERISTICS PROGRAM, WALTON'S METHOD - DRAWDOWN SC-5	10.5.8-116

LIST OF FIGURES (Continued)

Figure/Title		Page
10.5.8-77	AQUIFER CHARACTERISTICS PROGRAM, WALTON'S METHOD - DRAWDOWN SC-3	10.5.8-117
10.5.8-78	AQUIFER CHARACTERISTICS PROGRAM, WALTON'S METHOD - DRAWDOWN DM-6	10.5.8-118
10.5.8-79	AQUIFER CHARACTERISTICS PROGRAM, THEIS CURVE MATCHING - DRAWDOWN SC-5	10.5.8-119
10.5.8-80	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - DRAWDOWN SC-5, HANTUSH INFLECTION POINT METHOD	10.5.8-120
10.5.8-81	AQUIFER CHARACTERISTICS PROGRAM, CONSTANT RATE PUMPING TEST - DRAWDOWN SC-5, HANTUSH INFLECTION POINT METHOD (EXTRAPOLATED S)	10.5.8-121
10.5.8-82	AQUIFER CHARACTERISTICS PROGRAM, CONE OF INFLUENCE IN INTERMEDIATE AQUIFER, DISTANCE VS. DRAWDOWN	10.5.8-122
10.5.8-83	AQUIFER CHARACTERISTICS PROGRAM, CONE OF INFLUENCE IN FLORIDAN AQUIFER, DISTANCE VS. DRAWDOWN	10.5.8-123
10.5.8-84	WATER LEVEL RECOVERY TEST, WELL C-1	10.5.8-124
10.5.9-1	STEPS IN GWS MODEL DEVELOPMENT/IMPLEMENTATION	10.5.9-60
10.5.9-2	LOCATIONS OF SURFICIAL AQUIFER TEST SITES	10.5.9-61

LIST OF FIGURES (Continued)

Figure/Title		Page
10.5.9-3	LOCATIONS OF INTERMEDIATE AQUIFER TEST SITES	10.5.9-62
10.5.9-4	LOCATIONS OF FLORIDAN AQUIFER TEST SITES	10.5.9-63
10.5.9-5	INTERMEDIATE AQUIFER SYSTEM TRANSMISSIVITIES	10.5.9-64
10.5.9-6	UPPER FLORIDAN AQUIFER SYSTEM TRANSMISSIVITIES	10.5.9-65
10.5.9-7	TYPE-USE DISTRIBUTION OF PERMITTED GROUNDWATER WITHDRAWALS WITHIN GWS DOMAIN	10.5.9-66
10.5.9-8	SWFWMD PERMITTED WELLS MODEL LAYER 3 (FLORIDAN AQUIFER)	10.5.9-67
10.5.9-9	MODELED RIVER REACHES	10.5.9-68
10.5.9-10	SURFICIAL AQUIFER SYSTEM HISTORICAL VALIDATION COMPARISON OF MODEL HEADS VS. OBSERVED HEADS FOR DRY SEASON	10.5.9-69
10.5.9-11	SURFICIAL AQUIFER SYSTEM HISTORICAL VALIDATION COMPARISON OF MODEL HEADS VS. OBSERVED HEADS FOR WET SEASON	10.5.9-70
10.5.9-12	INTERMEDIATE AQUIFER SYSTEM HISTORICAL VALIDATION COMPARISON OF MODEL HEADS VS. OBSERVED HEADS FOR DRY SEASON	10.5.9-71
10.5.9-13	INTERMEDIATE AQUIFER SYSTEM HISTORICAL VALIDATION COMPARISON OF MODEL HEADS VS. OBSERVED HEADS FOR WET SEASON	10.5.9-72

LIST OF FIGURES (Continued)

Figure/Title		Page
10.5.9-14	UPPER FLORIDAN AQUIFER SYSTEM HISTORICAL VALIDATION COMPARISON OF MODEL HEADS VS. OBSERVED HEADS FOR DRY SEASON	10.5.9-73
10.5.9-15	UPPER FLORIDAN AQUIFER SYSTEM HISTORICAL VALIDATION COMPARISON OF MODEL HEADS VS. OBSERVED HEADS FOR WET SEASON	10.5.9-74
10.5.10-1	PREDICTIVE SIMULATIONS - 6 MONTH TRANSIENT RUN WITH MITIGATION MEASURES	10.5.10-13
10.5.10-2	PREDICTIVE SIMULATIONS - 12 MONTH TRANSIENT RUN WITH MITIGATION MEASURES	10.5.10-14
10.5.10-3	PREDICTIVE SIMULATIONS - 30 MONTH TRANSIENT RUN WITH MITIGATION MEASURES	10.5.10-15
10.5.10-4	PREDICTIVE SIMULATIONS - 6 MONTH TRANSIENT RUN WITHOUT MITIGATION MEASURES	10.5.10-16
10.5.10-5	PREDICTIVE SIMULATIONS - 12 MONTH TRANSIENT RUN WITHOUT MITIGATION MEASURES	10.5.10-17
10.5.10-6	PREDICTIVE SIMULATIONS - 30 MONTH TRANSIENT RUN WITHOUT MITIGATION MEASURES	10.5.10-18

LIST OF ACRONYMS AND ABBREVIATIONS

AAQS	Ambient Air Quality Standards
ac	Acre(s)
ACOE	U.S. Army Corps of Engineers
ACSR	Aluminum Conductor, Steel Reinforced
AM	Amplitude Modulated
ANOVA	Analysis of Variance
API	American Petroleum Institute
APT	Aquifer Performance Test
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
BACT	Best Available Control Technology
BEBR	Bureau of Economic and Business Research
BOCC	Board of County Commissioners
BOD	Biochemical Oxygen Demand
BuRec	U.S. Department of the Interior, Bureau of Reclamation
Btu	British Thermal Unit
CAA	Clean Air Act
CARL	Conservation and Recreation Land
CC	Combined Cycle
CEC	Cation Exchange Capacity
CFR	Code of Federal Regulations
CFRPC	Central Florida Regional Planning Council
cfs	Cubic Feet Per Second
CG	Coal Gasification
CGCC	Coal Gasification Combined Cycle
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
CompQAP	Comprehensive Quality Assurance Plan
CR	County Road
CT	Combustion Turbine
CUP	Conditional Use Permit
CWA	Clean Water Act
DACS	Florida Department of Agriculture and Consumer Services

dB	Decibel
dBA	Decibel (A-weighted level)
dBμv/m	Decibels above one micro volt per meter
DCA	Florida Department of Community Affairs
DHR	Florida Department of State, Division of Historical Resources
DHRS	Florida Department of Health and Rehabilitative Services
DO	Dissolved Oxygen
DRI	Development of Regional Impact
EMF	Electric and Magnetic Field
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
FAA	Federal Aviation Administration
FAAQS	Florida Ambient Air Quality Standards
F.A.C.	Florida Administrative Code
FDER	Florida Department of Environmental Regulation
FDLES	Florida Department of Labor and Employment Security
FDNR	Florida Department of Natural Resources
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FGFWFC	Florida Game and Fresh Water Fish Commission
FGD	Flue Gas Desulfurization
FGS	Florida Geological Survey
FGT	Florida Gas Transmission Company
FICA	Florida Industrial Cogeneration Association
FIPR	Florida Institute for Phosphate Research
FLUCCS	Florida Land Use, Cover and Forms Classification System
FM	Frequency Modulated
FNAI	Florida Natural Areas Inventory
FPC	Florida Power Corporation
FRG	Floridians for Responsible Utility Growth
F.S.	Florida Statutes
FSRI	Florida Sinkhole Research Institute
ft	Foot (feet)
FWS	U.S. Fish and Wildlife Service
GEP	Good Engineering Practice

HCM	Highway Capacity Manual
HRSG	Heat Recovery Steam Generator
IMC	International Minerals & Chemical Corporation
in	Inch(es)
ISCST	Industrial Source Complex, Short-Term
ISO	International Standards Organization
kcm	Thousand Circular Mils
km	Kilometers
kV	Kilovolt
L_{eq}	Equivalent Noise Level
LDN	Day/Night Noise Levels
LOS	Level of Service
m	Meter(s)
MBtu	Million British Thermal Units
mcy	Million Cubic Yards
$\mu g/m^3$	Micrograms Per Cubic Meter
MGD	Million Gallons Per Day
mi	Mile(s)
MSL	Mean Sea Level
MVA	Megavolt Amperes
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NFPA	National Fire Prevention Association
NGVD	National Geodetic Vertical Datum
NO_x	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NSPS	New Source Performance Standards
NWS	National Weather Service
O_3	Ozone
OBERS	Office of Business Economics and Economic Research Service (now U.S. Department of Commerce, Bureau of Economic Analysis)
OSN	Outfall Serial Number
Pb	Lead
PC	Pulverized Coal

PM	Particulate Matter
PM_{10}	Particulate Matter less than 10 Microns in Diameter
POD	Point of Discharge
POS	Plan of Study
ppm	Parts Per Million
PPSA	Florida Electrical Power Plant Siting Act
PSC	Florida Public Service Commission
PSD	Prevention of Significant Deterioration
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAPP	QA Project Plan
RARE	Roadless Area Review and Evaluation Area
RCRA	Resource Conservation Recovery Act
ROW	Right of Way
SAR	Staff Analysis Report
SCA	Site Certification Application
SCR	Selective Catalytic Reduction
SCS	U.S. Soil Conservation Service
SNCR	Selective Non-Catalytic Reduction
SO_2	Sulfur Dioxide
SOQAP	Standard Operating and Quality Assurance Procedures
SR	State Road
ST	Steam Turbine
STP	Sewage Treatment Plant
SWCFGWB	Southern West-Central Florida Groundwater Basin
SWDA	Solid Waste Disposal Area
SWFWMD	Southwest Florida Water Management District
TDS	Total Dissolved Solids
TECO	Tampa Electric Company
TSS	Total Suspended Solids
TSP	Total Suspended Particulates
TPA	Tampa Port Authority
UMTA	Urban Mass Transit Administration
UNAMAP	User Network for Applied Modelling of Air Pollution
USAC	U.S. Agri-Chemical Company

USCS	Unified Soil Classification System
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
VOC	Volatile Organic Compound
WMA	Wildlife Management Area
WPI	Work Program Improvement

PREFACE

Florida Power Corporation (FPC) is an investor-owned utility which supplies electricity to about 4.4 million people in 32 Florida counties. FPC has over 5,500 employees and is headquartered in St. Petersburg, Florida. The corporate goal now and for the past 95 years has been to provide reliable, reasonably-priced power to our customers.

To meet the increasing demand for electricity, FPC proposes to develop generating capacity at the Polk County Site in phases, with the first phase consisting of about 940 megawatts (MW) of combined cycle power plants fueled primarily with natural gas. Over a period of about 20 years, the Polk County Site will be developed for up to 3,200 MW, potentially using a variety of technologies and fossil fuels.

FPC is seeking approval for development of the Polk County Site under the Florida Electrical Power Plant Siting Act (PPSA), Chapter 403, Part II, Florida Statutes (F.S.). The PPSA provides a centralized review process for new electrical generating facilities in Florida, involving a balancing of "the increasing demand for electrical power plants with the broad interests of the public," including human health, the environment, state waters and wildlife. Under the PPSA, the Florida Public Service Commission (PSC) is the sole forum for the determination of need for a proposed facility. The Florida Department of Environmental Regulation (FDER) acts as the coordinator for the remainder of the certification process, with input from various state, regional and local agencies. The ultimate disposition for this review process is by the Governor and Cabinet sitting as the Siting Board.

On February 25, 1992, the PSC determined the need for the first 470 MW of combined cycle power plants, fueled primarily with natural gas. The PSC concluded that

> [T]he first two proposed combined cycle units on Florida Power Corporation's proposed Polk County site will contribute to electric system reliability and integrity.... [T]he addition of the first two units will enable Florida Power to meet...winter reserve margin criteria and to withstand the outage of its largest unit at time of system peak. The combined cycle technology chosen is a sufficiently mature and reliable generating option for Florida Power's system. The first two Polk County Units will contribute to diversifying Florida Power's system fuel mix, and thus contribute to the integrity of Florida Power's system.

This Site Certification Application (SCA) is being filed with the FDER pursuant to requirements of the PPSA and Chapter 17-17, Florida Administrative Code (F.A.C.). It addresses the environmental and socioeconomic aspects of the Polk County Site by presenting information on the existing natural and human environments, on the generating and associated facilities proposed to be constructed and operated, and on the impacts of those facilities on those environments. The SCA fulfills the provisions of a binding written agreement issued by FDER, which establishes the scope, quantity and specificity of information to be supplied by FPC in this application. The binding written agreement is found in Appendix 10.4.3 of this SCA. That agreement was developed pursuant to Section 403.5063, F.S., and Rule 17-17.041, F.A.C., following review of FPC's proposed Plan of Study (POS) for this SCA by state, regional and local agencies. In accordance with the POS, this SCA is based upon data developed on the Polk County Site to reflect current conditions and planned conditions, based on completion of reclamation activities at the site.

Polk County's adopted comprehensive plan allows power plants in the phosphate mining land use category, provided certain criteria are met. The Polk County Site meets all the criteria and fits well into the comprehensive plan. The Polk County Board of County Commissioners approved a conditional use permit (CUP) for the site on June 2, 1992.

FPC is seeking certification under the PPSA for the construction and operation of approximately 470 MW of natural gas-fired combined cycle units with distillate oil as the backup fuel. FPC also is seeking a determination that the site has ultimate capacity to accommodate the retrofitting of these units with coal gasification facilities, enabling them to burn coal-derived gas, and the addition of subsequent units that would be fueled by either coal-derived gas or pulverized coal, with an ultimate site capacity of up to 3,200 MW. The SCA, as proposed in the POS, addresses the total impacts that would occur from the construction and operation of all these proposals and their associated facilities, including power generating facilities, coal gasification facilities, fuel delivery and storage facilities, a gas pipeline lateral, and an initial electrical transmission line upgrade. However, additional transmission lines will be addressed in supplemental SCAs for generating capacity increments with which they will be associated.

This project represents a beneficial reuse of a mined-out phosphate area. Construction over a number of years will enable FPC to implement capital expenditures in the best interests of its customers consistent with the need for power. Accommodation of several types of fuels will provide flexibility to respond to construction phasing and future conditions of fuel availability

and price. Certification that the site and affected environments have adequate ultimate capacity to accommodate these proposals will maximize regulatory and utility efficiency while enabling all agencies to conduct coordinated, comprehensive reviews of the Polk County Site.

CHAPTER 1

NEED FOR POWER AND THE PROPOSED FACILITIES

Section/Title		Page
1.1	NEED SUMMARY	1.1-1
1.2	PSC ORDER ON NEED	1.2-1
1.3	POLK COUNTY SITE SELECTION PROCESS	1.3-1
1.4	TECHNOLOGY SELECTION	1.4-1
1.4.1	Generation Alternatives	1.4-1
1.4.2	Combined Cycle Design	1.4-2
1.5	POLK COUNTY SITE STRATEGIC ASSESSMENT	1.5-1
1.5.1	Schedule Flexibility	1.5-1
1.5.2	Fuel Flexibility	1.5-1
1.5.3	Clean Air Act Requirements	1.5-1

1.1 NEED SUMMARY

In August 1991, Florida Power Corporation (FPC) petitioned the Florida Public Service Commission (PSC) for a determination of the need to construct four natural gas-fired combined cycle (CC) generating units in Polk County during the years 1998-2000. In that petition, an integrated resource study demonstrated that FPC will require additional generating resources to meet customer load growth in the years following 1997.

FPC's use of integrated resource planning has led to the development of a balanced, cost-effective portfolio of resources for supplying its customers' needs. The integrated resource plan, which includes the proposed Polk County CC units, first makes aggressive use of the demand side management resources inherent in its service area. The plan further diversifies the resource portfolio by placing a significant reliance on capacity and energy from qualifying facilities, out-of-state purchases, and the installation of new transmission resources.

FPC's planning studies call for meeting 1,445 megawatts (MW) of demand - almost 30 percent of projected load growth - with demand side management programs. An additional 751 MW - about 15 percent of load growth - will be provided by qualifying facilities, all of which have signed contracts with FPC. FPC also will install about 364 MW of combustion turbine (CT) peaking capacity in November 1992 and 404 MW of CT peaking capacity in November 1993. Additional capacity equivalent to 984 MW will be added with the completion of a 500-kilovolt (kV) tie line to the Southern Company, a purchase from the Southern Company, and the addition of interruptible load customers. The integrated resource study demonstrated that the remainder of FPC's load growth - approximately 940 MW - can be supplied in a cost-effective manner by the Polk County units.

The proposed plants will be sited on a parcel of mined phosphate lands in Polk County. This site was chosen by a lengthy, careful search conducted in consultation with community and environmental interests. The existing site has clay settling ponds and other topographic features that are readily adaptable to power plant use. Moreover, the site can accommodate more than 2,000 additional MW of future electrical generating capacity, as well as coal gasification (CG) facilities. Finally, the site is centrally located with respect to FPC's load and will require minimal additional transmission construction.

The Polk County units, together with the proposed conversion of existing FPC generation, will allow FPC to make a substantial commitment to the use of natural gas. This commitment will play a key role in bringing new natural gas transportation capacity to Florida. The use of natural gas also will play a vital role in FPC's compliance strategies for meeting the Clean Air Act requirements for the year 2000.

On February 25, 1992, the PSC approved its Hearing Officer's recommendations on FPC's petition of need for the first two Polk County CC units (470 MW). The additional 470 MW of natural gas-fired CC capacity, will require further PSC consideration near the time of their construction.

1.2 PSC ORDER ON NEED

On February 25, 1992, the PSC determined the need for the first 470 MW of CC power plants, fueled primarily with natural gas. The PSC, which has sole responsibility for the determination of need for the facility, concluded that

> [T]he first two proposed combined cycle units on Florida Power Corporation's proposed Polk County site will contribute to electric system reliability and integrity.... [T]he addition of the first two units will enable Florida Power to meet...winter reserve margin criteria and to withstand the outage of its largest unit at time of system peak. The combined cycle technology chosen is a sufficiently mature and reliable generating option for Florida Power's system. The first two Polk County units will contribute to diversifying Florida Power's system fuel mix, and thus contribute to the integrity of Florida Power's system.

The PSC also concluded that

> [T]he first two proposed Polk County units will contribute to the provision of adequate electricity to Florida Power and the State of Florida at a reasonable cost....
>
> * * *
>
> [T]he reasonably anticipated costs of environmental compliance of the first two Polk County units have been adequately considered...
>
> * * *
>
> Florida Power selected the Polk County site...with the assistance of a group of educators, environmentalists, and community leaders.... The site preparation will be predominantly the same for two units as it would be for four units....[I]t is important for Florida Power to secure a site to meet its future generation needs; and approval of the first two Polk County units will be sufficient to that end.
>
> * * *

Florida Power has demonstrated that it reasonably considered capacity purchases from other utilities and nonutility generators to meet future generation needs.

* * *

Florida Power has adequately considered the conservation measures that are reasonably available to it to avoid the need for capacity as required by section 403.519, F. S.

A copy of the February 25, 1992 PSC Order (Docket No. 910759-EI) is provided as Appendix 10.7. This Order represents approval for the initial 470 MW of generation at the Polk County Site.

On March 26, 1992, the Florida Industrial Cogeneration Association (FICA) filed a notice of appeal of the Commission's Order No. 25805 granting FPC's petition for a determination of need. On April 7, 1992, the Florida Supreme Court stayed the appeal pending disposition of a motion for reconsideration filed by the Floridians for Responsible Utility Growth (FRG).

On June 11, 1992, the PSC denied the motion for reconsideration filed by FRG, leaving its original February order unchanged. FRG has agreed to not pursue an appeal, leaving FICA as the sole appellant.

Briefing on the FICA appeal will begin in September of 1992, with oral argument and a decision expected in 1993.

1.3 POLK COUNTY SITE SELECTION PROCESS

In January 1989, recognizing that forecasts indicated a need for additional generation capacity, FPC began the comprehensive process of locating a suitable site for a large new generation facility. A large site is desirable in order to maximize the economies of development and long-term operation.

Specifically, the objective of the site selection program was to determine a primary and alternate site that would be:

- Multi-unit and clean coal capable
- Technology- and fuel-flexible
- Cost effective
- Fully compatible with FPC's commitment to environmental protection
- In compliance with all government regulations
- Consistent with state and local land use policies

FPC used a systematic site selection approach to ensure that all of the above concerns were fully addressed. The process involved the following five phases, each with a specific objective:

Phase I

The first phase, **Area Screening**, began by screening the entire state of Florida. This phase screened out or eliminated areas that were either environmentally protected or clearly unsuited for development of the proposed facility. Phase I concluded by defining 172 large potential areas suitable for the project.

Phase II

The next phase, **Area Ranking**, ranked the 172 potential areas using criteria that evaluated environmental, socioeconomic and engineering issues. Phase II concluded by defining the top 60 candidate areas.

Phase III

The third phase, **Site Identification**, identified specific sites among the 60 candidate areas by conducting another screening process on a more refined geographic basis. Phase III concluded by defining 22 potential "semifinalist" sites.

Phase IV

The fourth phase, **Site Ranking**, ranked the 22 semifinalist sites using advanced criteria that further evaluated environmental, socioeconomic and engineering issues. Phase IV concluded by defining the top five candidate sites.

Phase V

The final phase, **Site Selection**, confirmed the Phase IV site ranking with additional field data and/or analytical evaluation. Phase V concluded in October 1990 by identifying the preferred and alternate sites.

Throughout this lengthy and careful process, FPC was assisted by an independent group of environmentalists, educators, and community leaders. This Environmental Advisory Group provided advice on matters of public concern, with their major function being to review plans for each of the five phases of the siting process and suggest changes in the evaluation process. FPC also systematically elicited the preferences of this independent panel for use in the development of ranking criteria used in the evaluation process. In addition to the input received from the Environmental Advisory Group, FPC consulted with various regulatory agencies at specific points in the process to obtain their perspective on siting criteria.

As a result of this extensive statewide search, FPC selected a location in Polk County as the primary site of its next generating units and an alternative site in Hardee County. Both locations meet FPC's goal for a large site capable of handling staged development of various generation and fuel options. FPC's research indicates that the Polk County Site is capable of supporting approximately 3,000 MW total generation. Providing for the use of coal as a fuel ensures the flexibility to switch to gasification or other future coal-based technologies as economies dictate. Obtaining a site with this flexibility and capacity was the primary objective of the site selection process.

1.4 TECHNOLOGY SELECTION

1.4.1 Generation Alternatives

FPC's need for additional generation is based upon specific system reliability criteria. A set of 10 generation expansion alternatives were developed which would satisfy FPC's system reliability criteria. These 10 alternatives were evaluated to ensure that FPC examined and quantified the costs and benefits of a variety of generation expansion technologies, plant sizes, and construction options.

In developing the expansion alternatives, FPC considered four major constraints. First, the technologies used in alternative plans must meet FPC's criteria for technical feasibility, reliability, and potential cost effectiveness. Second, the alternative plans must result in a system that meets or exceeds FPC's reliability criteria during each year of the plan. Third, the alternative plan must be consistent with FPC's commitment to environmental protection, and in particular must permit FPC to comply with the revised Clean Air Act limitations on sulfur dioxide emissions. Finally, the alternative must represent a plan that is well integrated with the present operation and configuration of the FPC system.

The 10 generation alternatives that were evaluated included combinations of large and small pulverized coal (PC) units, CTs, CCs, fluidized bed, and coal and orimulsion (emulsified low grade Venezuelan crude oil) gasification plants, and additional capacity purchases from existing, low cost units. Each of the alternatives would come into service between 1997 and 2000.

FPC's economic evaluation of the 10 alternatives included cumulative present worth revenue requirement comparisons. In addition, FPC evaluated 27 different uncertainties for each alternative based on the high, medium and low demand and energy forecast; the high, medium, and low fuel forecast; and the high, medium, and low conceptual cost estimates. The final result of this decision analysis was an expected cumulative present worth revenue requirement of that alternative on FPC's system. Supporting data was also generated for 27 various scenarios which, when accumulated with their probability of occurring, would equal their expected value. Cumulative and annual cost curves were also generated over time to enable revenue requirement cash flow comparisons.

The Polk County CC plants emerged from all of these calculations as the most cost-effective alternative. In other words, these units are expected to lead to the lowest cost of service and the lowest rates, when viewed on a present value or present worth basis. The units also do not pose any unusual risks in the event that some of the key planning assumptions used by FPC turn out to vary according to their expected probability distribution.

1.4.2 Combined Cycle Design

The technology selected for the initial development of the Polk County Site is based on the use of modern, high efficiency gas-fired CTs and steam turbines (ST) configured in a "combined cycle." Generating stations are referred to as CC when they have two sequential electrical generating stages. The first stage of a CC plant is a CT, much like a utility peaking plant. In the second stage of the process, the hot gas from the CT is passed through a heat recovery steam generator (HRSG), where steam is produced and directed to the ST. The CT and ST can be designed to drive individual electrical generators or to drive a single generator.

In sum, because CC plants make excellent use of the energy in their input fuel, they have an extremely low heat rate. The modern CC power plant is one of the most efficient power cycles available today.

1.5 POLK COUNTY SITE STRATEGIC ASSESSMENT

1.5.1 Schedule Flexibility

Development of the Polk County Site provides FPC with the flexibility to add incremental capacity to approximate anticipated load growth. It is expected that additional generating units planned for the Polk County Site will have a relatively short construction lead time, thus delaying decisions on future additions as long as possible. For example, a supplemental site certification application for the second 470 MW block of CC units could be filed during 1996 in order to meet FPC's scheduled in-service dates of 1999 and 2000 for those additional units.

1.5.2 Fuel Flexibility

The Polk County Site provides FPC with the flexibility to convert to CG or to add PC capacity in the future should circumstances warrant. Not only is the site an excellent one for receiving and handling coal fuel, but the CC units are very adaptable to coal-derived gas.

As approved by the PSC Order, the initial Polk County CC units will also be capable of burning natural gas or distillate fuel oil. Natural gas, the primary fuel initially, is considered one of the cleanest fuels and will be a major factor in meeting future environmental regulations. To maintain fuel flexibility, the CC units will be capable of converting to burn gas produced by a gasification process using coal as a feedstock.

1.5.3 Clean Air Act Requirements

The requirements of the recently amended Clean Air Act make it essential for FPC to have a plan that not only meets the expected number of sulfur dioxide allowances FPC will receive, but also has the operational flexibility to meet environmental regulations under unexpected circumstances such as longer than expected unit outages. An extended outage of a major base load plant may require that other units be run off of economic dispatch in order to comply with the FPC emissions limit. The CC units can be run at high capacity factors in order to reduce the total system emissions. In addition to their high efficiency, the Polk County CC units are being designed to have relatively low environmental impact. Airborne emissions will be limited by the use of a clean fuel and the application of control technologies.

TABLE OF CONTENTS

CHAPTER 2

SITE AND VICINITY CHARACTERISTICS

Section/Title			Page
2.0	SITE AND VICINITY CHARACTERISTICS		2.0-1
2.1	SITE AND ASSOCIATED FACILITIES DELINEATION		2.1-1
2.1.1		Description of the Site and Surrounding Area	2.1-1
2.1.2		Establishment of the Baseline Condition	2.1-2
2.1.3		Proposed Site Delineation	2.1-5
2.1.4		References	2.1-5
2.2	SOCIOPOLITICAL ENVIRONMENT		2.2-1
2.2.1		Governmental Jurisdictions	2.2-1
2.2.2		Zoning and Land Use Plans	2.2-3
2.2.3		Demography and Ongoing Land Use	2.2-3
2.2.4		Easements, Title, Agency Works	2.2-6
2.2.5		Regional Scenic, Cultural and Natural Landmarks	2.2-6
2.2.6		Archeological and Historic Sites	2.2-6
2.2.7		Socioeconomics and Public Services	2.2-6
	2.2.7.1	Socioeconomics	2.2-6
	2.2.7.2	Public Services	2.2-12
2.2.8		References	2.2-22

TABLE OF CONTENTS (Continued)

Section/Title			Page
2.3	BIOPHYSICAL ENVIRONMENT		2.3.0-1
2.3.1	Geohydrology		2.3.1-1
	2.3.1.1	General Geology	2.3.1-3
	2.3.1.2	Detailed Site Lithologic Description	2.3.1-5
	2.3.1.3	Geologic Maps	2.3.1-15
	2.3.1.4	Bearing Strength	2.3.1-15
	2.3.1.5	References	2.3.1-20
2.3.2	Subsurface Hydrology		2.3.2-1
	2.3.2.1	Subsurface Hydrological Data For Site Area	2.3.2-1
	2.3.2.2	Karst Hydrogeology	2.3.2-6
	2.3.2.3	References	2.3.2-19
2.3.3	Site Water Budget and Area Uses		2.3.3-1
	2.3.3.1	Site Water Budget	2.3.3-1
	2.3.3.2	Area Uses	2.3.3-3
	2.3.3.3	References	2.3.3-4
2.3.4	Surficial Hydrology		2.3.4-1
	2.3.4.1	Hydrologic Characterization	2.3.4-1
	2.3.4.2	Measurement Programs	2.3.4-9
	2.3.4.3	References	2.3.4-10

TABLE OF CONTENTS (Continued)

Section/Title		Page
2.3.5	Vegetation/Land Use	2.3.5-1
2.3.5.1	Baseline Conditions	2.3.5-1
2.3.5.2	Existing Conditions	2.3.5-8
2.3.5.3	References	2.3.5-9
2.3.6	Ecology	2.3.6-1
2.3.6.1	Species - Environmental Relationships	2.3.6-2
2.3.6.2	Pre-existing Stresses	2.3.6-33
2.3.6.3	Measurement Program	2.3.6-35
2.3.6.4	References	2.3.6-49
2.3.7	Meteorology and Ambient Air Quality	2.3.7-1
2.3.7.1	Meteorology	2.3.7-1
2.3.7.2	Ambient Air Quality	2.3.7-5
2.3.7.3	Ambient Monitoring Program Description	2.3.7-7
2.3.7.4	References	2.3.7-9
2.3.8	Noise	2.3.8-1
2.3.8.1	Introduction	2.3.8-1
2.3.8.2	Study Area Description	2.3.8-1
2.3.8.3	Noise Standards or Guidelines	2.3.8-2
2.3.8.4	Noise Monitoring Methodology	2.3.8-2
2.3.8.5	Data Analysis	2.3.8-3
2.3.8.6	Survey Results	2.3.8-4
2.3.8.7	Summary	2.3.8-7
2.3.8.8	References	2.3.8-7

TABLE OF CONTENTS (Continued)

Section/Title		Page
2.3.9	Other Environmental Features	2.3.9-1
2.3.9.1	References	2.3.9-1

LIST OF TABLES

Table/Title		Page
2.1.2-1	EXISTING APPROVED (PRE-1992) RECLAMATION PLAN FLUCCS DESIGNATIONS FOR POLK COUNTY SITE MANDATORY MINE LANDS	2.1-7
2.2.7-1	POLK COUNTY BUDGET FOR 1991 - 1992	2.2-27
2.2.7-2	EXISTING ROADWAY CONFIGURATION (TWO PAGES)	2.2-28
2.2.7-3	POLK COUNTY LEVEL OF SERVICE VOLUMES PEAK HOUR/PEAK DIRECTION (TWO PAGES)	2.2-30
2.2.7-4	FDOT LEVEL OF SERVICE VOLUMES PEAK HOUR/PEAK DIRECTION	2.2-32
2.2.7-5	DAILY ROADWAY VOLUMES	2.2-33
2.2.7-6	EXISTING PEAK SEASON ROADWAY CONDITIONS (TWO PAGES)	2.2-34
2.2.7-7	EXISTING INTERSECTION CONDITIONS	2.2-36
2.2.7-8	EXISTING CONDITIONS ON PROBABLE RAIL ROUTE FOR FPC COAL TRANSPORTATION IN POLK COUNTY	2.2-37
2.3.1-1	SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS	2.3.1-21
2.3.1-2	SUMMARY OF POROSITY AND PERMEABILITY VALUES CLAY POND AREAS	2.3.1-22
2.3.1-3	SUMMARY OF CONSOLIDATION TEST RESULTS	2.3.1-23

LIST OF TABLES (Continued)

Table/Title		Page
2.3.1-4	SUMMARY OF TRIAXIAL UU TEST RESULTS	2.3.1-24
2.3.1-5	RESULTS OF IN-SITU VANE SHEAR TESTS	2.3.1-25
2.3.1-6	SUMMARY OF REPRESENTATIVE SOIL PROPERTIES DAM AREAS	2.3.1-26
2.3.1-7	SUMMARY OF LABORATORY PROCTOR TEST RESULTS	2.3.1-27
2.3.1-8	RECOMMENDED *n* VALUE FOR DIFFERENT SOIL TYPES	2.3.1-28
2.3.2-1	SOLUTIONAL FEATURES FROM WELL DATA	2.3.2-21
2.3.3-1	MONTHLY TEMPERATURE MEANS AND EXTREMES, 1951-1980, BARTOW AND WAUCHULA, FLORIDA	2.3.3-6
2.3.3-2	MONTHLY PRECIPITATION MEANS, 1951-1980, BARTOW AND WAUCHULA, FLORIDA	2.3.3-7
2.3.3-3	ESTIMATED ANNUAL EVAPOTRANSPIRATION, RUNOFF, AND RECHARGE	2.3.3-8
2.3.3-4	CONSUMPTIVE USE PERMITS WITHIN A FIVE MILE RADIUS OF THE POLK COUNTY SITE POWER BLOCK (TWO PAGES)	2.3.3-9
2.3.3-5	WELLS WITHIN ONE MILE OF THE POLK COUNTY SITE (THREE PAGES)	2.3.3-11
2.3.4-1	PRE-MINING DRAINAGE BASINS	2.3.4-11
2.3.4-2	MAXIMUM AND MINIMUM STAGES - PEACE RIVER	2.3.4-12

LIST OF TABLES (Continued)

Table/Title		Page
2.3.4-3	MEASURED WATER TEMPERATURES	2.3.4-13
2.3.4-4	SURFACE WATER MONITORING DATA - POLK COUNTY SITE (TEN PAGES)	2.3.4-14
2.3.4-5	DETECTED WATER QUALITY MONITORING DATA (FOUR PAGES)	2.3.4-24
2.3.4-6	STANDARDS APPLICABLE TO CLASS III WATERS	2.3.4-28
2.3.4-7	DRY SEASON SUPPLEMENTAL WATER QUALITY MONITORING DATA	2.3.4-29
2.3.4.8	WET SEASON SUPPLEMENTAL WATER QUALITY MONITORING DATA	2.3.4-30
2.3.4-9	HISTORY OF MINING OPERATIONS ON POLK COUNTY SITE	2.3.4-31
2.3.5-1	ACREAGE AND QUALITY OF VEGETATION/LAND USE FOLLOWING RECLAMATION	2.3.5-11
2.3.5-2	QUANTITATIVE VEGETATION COMMUNITY DATA - P2 (WET SEASON)	2.3.5-12
2.3.5-3	QUANTITATIVE VEGETATION COMMUNITY DATA - P-2 (DRY SEASON)	2.3.5-13
2.3.5-4	BASELINE VEGETATION COVER SURVEY LOCATIONS	2.3.5-14
2.3.6-1	SUBSTRATE ANALYSES DURING FISHERIES INVESTIGATIONS	2.3.6-61

LIST OF TABLES (Continued)

Table/Title		Page
2.3.6-2	WATER QUALITY DURING FISHERIES INVESTIGATIONS	2.3.6-62
2.3.6-3	FISHERIES SPECIES COLLECTED	2.3.6-63
2.3.6-4	FULTON CONDITION FACTORS FOR SPORT FISH COLLECTED FROM THE SITE - WET SEASON (SEPTEMBER 1991)	2.3.6-64
2.3.6-5	FULTON CONDITION FACTORS FOR SPORT FISH COLLECTED FROM THE SITE - DRY SEASON (FEBRUARY 1992) (TWO PAGES)	2.3.6-65
2.3.6-6	MEANS AND RANGES OF FULTON CONDITION FACTORS (K VALUES) CALCULATED FROM SITE FISH DATA	2.3.6-67
2.3.6-7	PROTECTED PLANT SPECIES POTENTIALLY OCCURRING IN THE FPC POLK COUNTY SITE REGION	2.3.6-68
2.3.6-8	PROTECTED VERTEBRATE SPECIES POTENTIALLY OCCURRING ON THE FPC POLK COUNTY SITE FOLLOWING RECLAMATION (TWO PAGES)	2.3.6-69
2.3.6-9	SITE-SPECIFIC AQUATIC ECOLOGICAL FIELD SAMPLING PROGRAM	2.3.6-71
2.3.6-10	LABORATORY AND DATA ANALYSIS PROGRAM FOR AQUATIC ECOLOGICAL SAMPLES	2.3.6-72
2.3.6-11	CLASSIFICATION OF STREAM SUBSTRATE CHANNEL MATERIALS BY PARTICLE SIZE	2.3.6-73

LIST OF TABLES (Continued)

Table/Title		Page
2.3.6-12	TERRESTRIAL MONITORING PROGRAM - SPECIES COMPOSITION, DENSITY, DOMINANCE, DIVERSITY AND FREQUENCY	2.3.6-74
2.3.7-1	DIURNAL AND MONTHLY TEMPERATURE MEANS AND EXTREMES REPRESENTATIVE OF THE POLK COUNTY SITE	2.3.7-11
2.3.7-2	MONTHLY PRECIPITATION MEANS AND EXTREMES REPRESENTATIVE OF THE POLK COUNTY SITE	2.3.7-12
2.3.7-3	MEAN DIURNAL MIXING HEIGHTS, TAMPA, FLORIDA	2.3.7-13
2.3.7-4	REGIONAL 1990 AMBIENT AIR QUALITY DATA (THREE PAGES)	2.3.7-14
2.3.7-5	SUMMARY OF TAMPA ELECTRIC COMPANY POLK COUNTY AIR QUALITY MONITORING DATA	2.3.7-17
2.3.7-6	SUMMARY OF POLK COUNTY SITE ON-SITE AIR QUALITY MONITORING DATA	2.3.7-18
2.3.7-7	BACKGROUND AIR QUALITY DATA	2.3.7-19
2.3.8-1	SUMMARY OF EPA GUIDELINE NOISE LEVELS	2.3.8-8

LIST OF FIGURES

Figure/Title		Page
2.1.1-1	SITE LOCATION MAP	2.1-8
2.1.1-2A	EXISTING TOPOGRAPHY OF SITE AND ADJACENT LANDS (SHEET A)	2.1-9
2.1.1-2B	EXISTING TOPOGRAPHY OF SITE AND ADJACENT LANDS (SHEET B)	2.1-10
2.1.2-1	MANDATORY AND NONMANDATORY RECLAMATION LANDS	2.1-11
2.1.2-2A	VEGETATION/LAND USE MAP BASELINE CONDITIONS (SHEET A)	2.1-12
2.1.2-2B	VEGETATION/LAND USE MAP BASELINE CONDITIONS (SHEET B)	2.1-13
2.1.2-3A	BASELINE CONDITION TOPOGRAPHY-IMC N-16 AND ESTECH (MANDATORY AREAS) (SHEET A)	2.1-14
2.1.2-3B	BASELINE CONDITION TOPOGRAPHY-IMC N-16 AND ESTECH (MANDATORY AREAS) (SHEET B)	2.1-15
2.1.2-4	OFF-SITE BASELINE STUDY AREAS	2.1-16
2.1.3-1A	GENERALIZED PROJECT SITE PLAN (SHEET A)	2.1-17
2.1.3-1B	GENERALIZED PROJECT SITE PLAN (SHEET B)	2.1-18
2.2.1-1	GOVERNMENTAL JURISDICTIONS WITHIN FIVE MILES OF THE PLANT ISLAND	2.2-38

LIST OF FIGURES (Continued)

Figure/Title		Page
2.2.1-2	PARKS AND RECREATION AREAS WITHIN FIVE MILES OF THE PLANT ISLAND	2.2-39
2.2.1-3A	PARKS AND RECREATION AREAS WITHIN ONE MILE OF THE PLANT ISLAND (SHEET A)	2.2-40
2.2.1-3B	PARKS AND RECREATION AREAS WITHIN ONE MILE OF THE PLANT ISLAND (SHEET B)	2.2-41
2.2.2-1	POLK COUNTY FUTURE LAND USE DESIGNATIONS	2.2-42
2.2.2-2	POLK COUNTY SITE ZONING	2.2-43
2.2.3-1	POPULATION GROWTH 1960 -1990, FLORIDA AND POLK COUNTY	2.2-44
2.2.3-2	PERCENT CHANGE IN POPULATION IN POLK COUNTY, 1970 - 1980 AND 1980 - 1990	2.2-45
2.2.3-3	POPULATION GROWTH BY CENSUS TRACT	2.2-46
2.2.3-4	POLK COUNTY POPULATION ESTIMATES AND PROJECTIONS	2.2-47
2.2.3-5	BEBR REVISED POPULATION PROJECTIONS VERSUS COMPREHENSIVE PLAN PROJECTIONS	2.2-48
2.2.3-6A	EXISTING LAND USE WITHIN FIVE MILES OF THE PLANT ISLAND (SHEET A)	2.2-49
2.2.3-6B	EXISTING LAND USE WITHIN FIVE MILES OF THE PLANT ISLAND (SHEET B)	2.2-50

LIST OF FIGURES (Continued)

Figure/Title		Page
2.2.7-1	POLK COUNTY CIVILIAN LABOR FORCE, EMPLOYMENT AND UNEMPLOYMENT, 1980 THROUGH 1991	2.2-51
2.2.7-2	UNEMPLOYMENT RATES, POLK COUNTY AND FLORIDA, 1980 THROUGH 1991	2.2-52
2.2.7-3	POLK COUNTY EMPLOYMENT ESTIMATES, 1986 THROUGH 1991	2.2-53
2.2.7-4	POLK COUNTY EMPLOYMENT BY INDUSTRY, 1990	2.2-54
2.2.7-5	AVERAGE WAGE BY INDUSTRY, POLK COUNTY 1990	2.2-55
2.2.7-6	POLK COUNTY EMPLOYMENT PROJECTIONS FOR YEAR 2000	2.2-56
2.2.7-7	EMPLOYMENT ESTIMATES AND PROJECTIONS - POLK COUNTY, 1988 THROUGH 2010	2.2-57
2.2.7-8	POLK COUNTY MINING EMPLOYMENT, 1980 THROUGH 1991	2.2-58
2.2.7-9	1988 PER CAPITA INCOME BY TYPE OF INCOME	2.2-59
2.2.7-10	DISTRIBUTION OF HOUSEHOLD INCOMES IN POLK COUNTY	2.2-60
2.2.7-11	TREND IN HOUSING UNITS IN UNINCORPORATED POLK COUNTY, 1960 THROUGH 1989	2.2-61
2.2.7-12	RESIDENTIAL BUILDING PERMITS IN POLK COUNTY, 1985 THROUGH 1990	2.2-62

LIST OF FIGURES (Continued)

Figure/Title		Page
2.2.7-13	RESIDENTIAL BUILDING PERMITS IN BARTOW AND FORT MEADE, 1985 THROUGH 1990	2.2-63
2.2.7-14	POLK COUNTY PER CAPITA REVENUES, 1991 THROUGH 1992	2.2-64
2.2.7-15	POLK COUNTY PER CAPITA EXPENDITURES, 1991 THROUGH 1992	2.2-65
2.2.7-16	MAKE-UP OF POLK COUNTY REVENUES	2.2-66
2.2.7-17	MAKE-UP OF POLK COUNTY EXPENDITURES	2.2-67
2.2.7-18	LOCATIONS OF PUBLIC SERVICES	2.2-68
2.2.7-19	SOLID WASTE FACILITIES AND SERVICE AREA BOUNDARIES	2.2-69
2.2.7-20	EXISTING DAILY TRAFFIC VOLUMES	2.2-70
2.2.7-21	EXISTING PEAK SEASON A.M. PEAK HOUR TRAFFIC VOLUMES	2.2-71
2.2.7-22	EXISTING PEAK SEASON P.M. PEAK HOUR TRAFFIC VOLUMES	2.2-72
2.2.7-23	EXISTING PEAK SEASON A.M. PEAK HOUR INTERSECTION CONDITIONS	2.2-73
2.2.7-24	EXISTING PEAK SEASON P.M. PEAK HOUR INTERSECTION CONDITIONS	2.2-74
2.2.7-25	RAIL TRANSPORTATION IN POLK COUNTY	2.2-75

LIST OF FIGURES (Continued)

Figure/Title		Page
2.3.1-1	SUBSURFACE INVESTIGATION PLAN, GENERAL SITE AREA	2.3.1-29
2.3.1-2	GENERALIZED LITHOSTRATIGRAPHIC AND HYDROGEOLOGIC FRAMEWORK - POLK COUNTY AREA	2.3.1-30
2.3.1-3	GENERALIZED GEOLOGICAL SECTION OF POLK COUNTY (EAST-WEST)	2.3.1-31
2.3.1-4	GENERALIZED GEOLOGICAL SECTION OF POLK COUNTY (NORTH-SOUTH)	2.3.1-32
2.3.1-5	HYDROGEOLOGIC FRAMEWORK, FPC SITE AREA	2.3.1-33
2.3.1-6	HYDROGEOLOGIC CROSS-SECTION LOCATION MAP ESTECH PLANT SITE	2.3.1-34
2.3.1-7	HYDROGEOLOGICAL CROSS-SECTION A-A' ESTECH PLANT SITE, DECEMBER 1991	2.3.1-35
2.3.1-8	HYDROGEOLOGIC CROSS-SECTION B-B' ESTECH PLANT SITE, DECEMBER 1991	2.3.1-36
2.3.1-9	HYDROGEOLOGIC CROSS-SECTION LOCATION MAP FPC SITE AREA	2.3.1-37
2.3.1-10	HYDROGEOLOGIC CROSS-SECTION N-S ESTECH PLANT SITE, DECEMBER 1991	2.3.1-38
2.3.1-11	HYDROGEOLOGIC CROSS-SECTION E-W ESTECH PLANT SITE, DECEMBER 1991	2.3.1-39

LIST OF FIGURES (Continued)

Figure/Title		Page
2.3.1-12	CROSS-SECTION LOCATION MAP	2.3.1-40
2.3.1-13	CROSS-SECTIONS A-A' AND E-E'	2.3.1-41
2.3.1-14	CROSS-SECTION B-B'	2.3.1-42
2.3.1-15	CROSS-SECTIONS C-C' AND D-D'	2.3.1-43
2.3.1-16	CROSS-SECTIONS F-F' AND G-G'	2.3.1-44
2.3.1-17	ATTERBERG LIMITS - POND AREAS N-9B, N-11A, N-11B, N-11C, N-13 AND N-15	2.3.1-45
2.3.1-18	ATTERBERG LIMITS - POND AREAS SA-8, SA-9, AND SA-10	2.3.1-46
2.3.1-19	ATTERBERG LIMITS - POND AREAS P-2 AND P-3	2.3.1-47
2.3.1-20	WASTE PHOSPHATIC CLAY-GRAIN SIZE DISTRIBUTION	2.3.1-48
2.3.1-21	EMBANKMENT OVERBURDEN MATERIAL-GRAIN SIZE DISTRIBUTION	2.3.1-49
2.3.1-22	UNDISTURBED GROUND - GRAIN SIZE DISTRIBUTION	2.3.1-50
2.3.1-23	SCHEMATIC OF SHALLOW FOUNDATION SUPPORT ALTERNATIVES FOR CONSTRUCTION	2.3.1-51
2.3.1-24	SCHEMATIC OF DEEP FOUNDATION SUPPORT ALTERNATIVES FOR CONSTRUCTION	2.3.1-52
2.3.1-25	GRAIN SIZE SUITABILITY FOR DYNAMIC COMPACTION	2.3.1-53

LIST OF FIGURES (Continued)

Figure/Title		Page
2.3.1-26	TREND BETWEEN APPARENT MAXIMUM DEPTH OF COMPACTION INFLUENCE AND ENERGY PER BLOW	2.3.1-54
2.3.1-27	SUITABILITY OF SOILS FOR VARIOUS GROUND IMPROVEMENT TECHNIQUES	2.3.1-55
2.3.2-1	GENERALIZED WATER TABLE CONTOUR MAP SURFICIAL AQUIFER, SEPTEMBER 1975	2.3.2-22
2.3.2-2	SURFICIAL AQUIFER BASELINE WATER QUALITY DATA SAMPLING LOCATION MAP	2.3.2-23
2.3.2-3	POTENTIOMETRIC SURFACE - INTERMEDIATE AQUIFER, MAY 1989	2.3.2-24
2.3.2-4	POTENTIOMETRIC SURFACE - INTERMEDIATE AQUIFER, MAY 1990	2.3.2-25
2.3.2-5	POTENTIOMETRIC SURFACE - INTERMEDIATE AQUIFER, MAY 1991	2.3.2-26
2.3.2-6	POTENTIOMETRIC SURFACE - INTERMEDIATE AQUIFER, SEPTEMBER 1989	2.3.2-27
2.3.2-7	POTENTIOMETRIC SURFACE - INTERMEDIATE AQUIFER, SEPTEMBER 1990	2.3.2-28
2.3.2-8	POTENTIOMETRIC SURFACE - INTERMEDIATE AQUIFER, SEPTEMBER 1991	2.3.2-29

LIST OF FIGURES (Continued)

Figure/Title		Page
2.3.2-9	INTERMEDIATE AQUIFER BASELINE WATER QUALITY DATA SAMPLING LOCATION MAP	2.3.2-30
2.3.2-10	POTENTIOMETRIC SURFACE - UPPER FLORIDAN AQUIFER, MAY 1989	2.3.2-31
2.3.2-11	POTENTIOMETRIC SURFACE - UPPER FLORIDAN AQUIFER, MAY 1990	2.3.2-32
2.3.2-12	POTENTIOMETRIC SURFACE - UPPER FLORIDAN AQUIFER, MAY 1991	2.3.2-33
2.3.2-13	POTENTIOMETRIC SURFACE - UPPER FLORIDAN AQUIFER, SEPTEMBER 1989	2.3.2-34
2.3.2-14	POTENTIOMETRIC SURFACE - UPPER FLORIDAN AQUIFER, SEPTEMBER 1990	2.3.2-35
2.3.2-15	POTENTIOMETRIC SURFACE - UPPER FLORIDAN AQUIFER, SEPTEMBER 1991	2.3.2-36
2.3.2-16	UPPER FLORIDAN AQUIFER BASELINE WATER QUALITY DATA SAMPLING LOCATION MAP	2.3.2-37
2.3.2-17	AREAS OF SINKHOLE OCCURRENCE IN FLORIDA	2.3.2-38
2.3.2-18	SINKHOLE LOCATIONS IN VICINITY OF SITE	2.3.2-39
2.3.2-19	REPORTED SINKHOLES WITHIN FIVE MILES OF SITE	2.3.2-40
2.3.2-20	FRACTURE TRACE MAP	2.3.2-41

LIST OF FIGURES (Continued)

Figure/Title		Page
2.3.2-21	LINEAMENT FEATURE ROSE	2.3.2-42
2.3.2-22	PLANT ISLAND AREA PRE-MINING SURFACE FEATURES AND DEPRESSIONS	2.3.2-43
2.3.3-1	WATER USE IN SITE VICINITY	2.3.3-14
2.3.4-1	MAJOR RIVER BASINS IN VICINITY OF SITE	2.3.4-32
2.3.4-2	PRE-MINING DRAINAGE BASIN BOUNDARIES	2.3.4-33
2.3.4-3	PROFILE OF PEACE RIVER	2.3.4-34
2.3.4-4	USGS STATION LOCATIONS	2.3.4-35
2.3.4-5	PRE-MINING DELINEATION OF MCCULLOUGH CREEK BASIN	2.3.4-36
2.3.4-6	PRE-MINING ON-SITE WATER BODIES	2.3.4-37
2.3.4-7	UNIT HYDROGRAPH - PEACE RIVER AT BARTOW, FLORIDA	2.3.4-38
2.3.4-8	PEAK FLOW, FLOOD FREQUENCY, AND DRAINAGE AREA RELATIONSHIP, POLK COUNTY STREAMS	2.3.4-39
2.3.4-9	PEAK FLOW REDUCTION COEFFICIENTS	2.3.4-40
2.3.4-10	WATER TEMPERATURE, PEACE RIVER AT BARTOW	2.3.4-41
2.3.4-11	WATER TEMPERATURE, PEACE RIVER NEAR HOMELAND	2.3.4-42

LIST OF FIGURES (Continued)

Figure/Title		Page
2.3.4-12	WATER TEMPERATURE, PEACE RIVER AT FORT MEADE	2.3.4-43
2.3.4-13	SURFACE WATER SAMPLING SITE LOCATIONS	2.3.4-44
2.3.4-14	CHEMICAL TYPES OF WATER IN FLORIDA STREAMS	2.3.4-45
2.3.4-15	RELATIONS AMONG CHEMICAL COMPOSITION, CONSTITUENT CONCENTRATION, AND DISCHARGE FOR SIX FLORIDA STREAMS AND CANALS DURING LOW VERSUS HIGH STREAMFLOW	2.3.4-46
2.3.4-16	SUPPLEMENTAL WATER QUALITY SAMPLING SITE LOCATIONS	2.3.4-47
2.3.4-17	IMC NPDES OUTFALLS	2.3.4-48
2.3.4-18	ESTECH NPDES OUTFALL	2.3.4-49
2.3.4-19	USAC N-9 NPDES OUTFALL	2.3.4-50
2.3.5-1	VEGETATION/LAND USE MAP, BASELINE CONDITIONS (KEY)	2.3.5-15
2.3.5-1A	VEGETATION/LAND USE MAP, BASELINE CONDITIONS (SHEET A)	2.3.5-16
2.3.5-1B	VEGETATION/LAND USE MAP, BASELINE CONDITIONS (SHEET B)	2.3.5-17
2.3.5-1C	VEGETATION/LAND USE MAP, BASELINE CONDITIONS (SHEET C)	2.3.5-18

LIST OF FIGURES (Continued)

Figure/Title		Page
2.3.5-1D	VEGETATION/LAND USE MAP, BASELINE CONDITIONS (SHEET D)	2.3.5-19
2.3.5-1E	VEGETATION/LAND USE MAP, BASELINE CONDITIONS (SHEET E)	2.3.5-20
2.3.5-1F	VEGETATION/LAND USE MAP, BASELINE CONDITIONS (SHEET F)	2.3.5-21
2.3.6-1	AQUATIC ECOLOGY STUDY AREA	2.3.6-75
2.3.6-2	AQUATIC ECOLOGY SAMPLING LOCATIONS	2.3.6-76
2.3.6-3	VEGETATION AND WILDLIFE SAMPLING LOCATIONS ON-SITE	2.3.6-77
2.3.6-4	VEGETATION AND WILDLIFE SAMPLING LOCATIONS OFF-SITE	2.3.6-78
2.3.7-1	ANNUAL WIND ROSE, TAMPA, FLORIDA 1982 THROUGH 1986	2.3.7-20
2.3.7-2	ISOPLETHS OF MEAN ANNUAL MORNING MIXING HEIGHTS	2.3.7-21
2.3.7-3	ISOPLETHS OF MEAN ANNUAL AFTERNOON MIXING HEIGHTS	2.3.7-22
2.3.7-4	ON-SITE WIND ROSE, OCTOBER 15, 1991 - FEBRUARY 14, 1992	2.3.7-23

LIST OF FIGURES (Continued)

Figure/Title		Page
2.3.7-5	TAMPA, FLORIDA - NWS WIND ROSE OCTOBER 15, 1991 - FEBRUARY 14, 1992	2.3.7-24
2.3.7-6	LOCATIONS OF FDER AND OTHER AMBIENT AIR QUALITY MONITORING SITES	2.3.7-25
2.3.7-7	SO_2 HOURLY AVERAGE CONCENTRATIONS COMPARED WITH 3-HOUR, 24-HOUR AND ANNUAL STANDARDS (OCTOBER 15, 1991 - FEBRUARY 14, 1992)	2.3.7-26
2.3.7-8	O_3 HOURLY AVERAGE CONCENTRATIONS COMPARED WITH 1-HOUR STANDARD (OCTOBER 15, 1991 - FEBRUARY 24, 1992)	2.3.7-27
2.3.7-9	PM_{10} 24-HOUR AVERAGE CONCENTRATIONS COMPARED WITH 24-HOUR AND ANNUAL STANDARDS (OCTOBER 15, 1991 - FEBRUARY 14, 1992)	2.3.7-28
2.3.7-10	AIR QUALITY/METEOROLOGICAL MONITORING SITE LOCATION MAP	2.3.7-29
2.3.8-1	NOISE MONITORING LOCATIONS	2.3.8-9
2.3.8-2	NOISE MONITORING LOCATIONS #1 AND #2	2.3.8-10
2.3.8-3	NOISE MONITORING LOCATIONS #3 AND #4	2.3.8-11
2.3.8-4	NOISE MONITORING LOCATION #5	2.3.8-12
2.3.8-5	NOISE LEVELS - LOCATION 1 TRINITY GRACE CHURCH	2.3.8-13

LIST OF FIGURES (Continued)

Figure/Title		Page
2.3.8-6	NOISE LEVELS - LOCATION 2 NORTHWEST CORNER OF SITE	2.3.8-14
2.3.8-7	NOISE LEVELS - LOCATION 3 COMMUNITY OF HOMELAND .	2.3.8-15
2.3.8-8	NOISE LEVELS - LOCATION 4 CITY OF FORT MEADE	2.3.8-16
2.3.8-9	NOISE LEVELS - LOCATION 5 POWER BLOCK AREA	2.3.8-17

2.0 SITE AND VICINITY CHARACTERISTICS

This chapter covers the basic information on those physical, biological, and sociological characteristics of the area environment that might be affected by the construction and operation of power plant facilities on the proposed Florida Power Corporation (FPC) Polk County Site. Linear features associated with the site are addressed in Chapter 6.

2.1 SITE AND ASSOCIATED FACILITIES DELINEATION

The FPC Polk County Site is in southwest Polk County, Florida, approximately 3.5 miles northwest of Fort Meade, 3 miles south of Bartow, and about 40 miles east of Tampa (Figure 2.1.1-1). The nearest unincorporated community, Homeland, lies about 1 mile to the northeast of the site boundary. The site is bounded on the north by County Road (CR) 640, and along the southeast and south by a U.S. Agri-Chemical Company (USAC) mine. CR 555 runs through the site.

2.1.1 Description of the Site and Surrounding Area

The Polk County Site encompasses approximately 8,200 acres, over 900 acres of which will be occupied ultimately by generating and related facilities. It lies in a region of the state dominated by phosphate mining operations including mines, settling ponds, sand tailings piles, gypsum stacks, and chemical and beneficiation plants. Figures 2.1.1-2A and 2.1.1-2B show existing topography.

The majority of the land surrounding the proposed power plant site is being or has been mined and either has been or can be expected to be reclaimed primarily as pasture, cropland, wetlands or lakes. Some of the land surrounding the site still remains to be mined. Also, as some mining operations are completed, processing plant sites on unmined areas, such as the adjoining Estech facilities, may be abandoned and come onto the market as potential industrial sites, or may be mined and then later reclaimed.

Adjacent land uses also consist entirely of phosphate mining, except for one mobile home on the corner of CR 555 and CR 640, approximately 3 miles from the proposed plant island. The adjacent phosphate mine owners are Estech, Inc. (Estech); IMC Fertilizer, Inc. (IMC); USAC; and Mobil Mining and Minerals Company (Mobil). The three nearest residential areas of Bradley Junction, Homeland, and Fort Meade are several miles away from the primary area to be developed, i.e., the plant island area. From the standpoint of land use compatibility and potential noise and visual impact during construction and operation, the site location is suitable for power plant facilities. A complete discussion of land use in the area of the Polk County Site is presented in Section 2.2 of this Site Certification Application (SCA).

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2.1.2 Establishment of the Baseline Condition

This section describes the baseline conditions against which the impacts of project construction and operation are then measured in Chapters 4 and 5, respectively. Usually, these baseline conditions are the existing conditions of the site and the surrounding area. Due to the unique character of the Polk County Site, a site that has been and is still being mined for phosphate, the question of what is the baseline condition is not so straightforward as in the typical case of a power plant proposed for a so-called "green field" site.

An important factor in the selection of the Polk County Site was its disturbed character. The site met the essential criteria of access to transmission, fuel delivery, proximity to FPC's load center, and similar considerations. However, the site did not rank best on cost of development, nor did it present the fewest engineering issues. The tradeoff recognized by FPC and the Environmental Advisory Group during the site selection process was that while the cost of site development would be higher on this entirely disturbed site, there would be minimal environmental impact from power plant development. In fact, the site presented opportunities for net gain in environmental benefit.

For purposes of the impact analysis included in this SCA, FPC has defined the baseline condition as the future condition without the project. That projected condition is then compared to the "with project" scenario to establish the impacts. Because the Polk County Site is in various stages of phosphate mining, ranging from yet-to-be-mined to recently reclaimed and released by Florida Department of Natural Resources (FDNR), existing conditions throughout the site are transitory. The following paragraphs describe how the baseline condition, the future without-project condition, was determined.

The entire site consists of properties owned by three mining companies: IMC, Estech, and USAC. Each mine parcel has a designation referring either to IMC's Noralyn or Phosphoria mine (N-series and P-series) or to a geographic area in the Estech Silver City mine (SA-series). Also, a small portion of the site to be used as a buffer area is currently part of the USAC N-9 settling area within the Rockland mine and is referred to as N-9. These mine parcel designations are useful for identifying specific areas of the site and are referred to throughout the SCA.

The various mine parcels can be divided roughly into areas that are subject to either mandatory reclamation requirements under FDNR's 1975 rules (mandatory areas) or potentially eligible for

nonmandatory reclamation funding under the pre-1975 or "old lands" program (nonmandatory areas). Mandatory and nonmandatory areas of the Polk County Site are shown along with the mine parcel designations on Figure 2.1.2-1. Mandatory areas cover about half the site, including most or all of SA-9, SA-10, SA-11, SA-12, SA-13, N-9 (USAC), N-16, P-2, P-3, Phosphoria and the Triangle Lakes area. Nonmandatory areas include N-9B, N-11A, N-11B, N-11C, N-13, N-15, most of SA-8, portions of P-2 and P-3, and a portion of Camp Meeting Ground Branch. The vast majority of the nonmandatory areas have been used for clay disposal.

Mandatory reclamation regulations require that the pre-mining wetland acreage be reclaimed and that a minimum of 10 percent of the upland be returned to forested land uses. Clay settling areas, comprising more than half of the mandatory reclamation areas on-site, are normally drained and returned to row crop or pasture uses in an effort to restore the economic use of the land. Future without-project conditions in the mandatory areas are described and presented in the approved (pre-1992) reclamation plans for those areas. Approved reclamation plans for mandatory areas of the Polk County Site showing Florida Land Use, Cover and Forms Classification System (FLUCCS) designations (FDOT, 1985) are provided in Table 2.1.2-1, shown (along with FLUCCS designations for nonmandatory areas) on Figures 2.1.2-2A and 2.1.2-2B. This information is also included in Appendix 10.9. Figures 2.1.2-3A and 2.1.2-3B depict baseline topography, based on existing approved (pre-1992) reclamation plans, in the IMC N-16 and Estech mandatory areas.

In addition to the approved reclamation plans, characteristics or conditions not readily ascertainable from the reclamation plans themselves, including such characteristics as habitat quality, have been projected based on a review of existing on-site and off-site reclaimed areas with similar land use/vegetation and topography. These nearby on-site and off-site areas were taken to be representative of future without-project conditions for areas of the Polk County Site yet to be reclaimed. They were chosen from among IMC's reclamation projects and included those at Homeland-9, West of K-6, Hookers Prairie and Tiger Bay. These were among the most mature reclamation projects and included both upland and wetland communities. Three of the projects were ground-inspected and all four were thoroughly inspected by helicopter. Figure 2.1.2-4 shows where these baseline study areas were located.

A similar approach was used to project the future (without-project) conditions for nonmandatory areas of the site, except that in the case of the nonmandatory areas on the Polk County Site no approved reclamation plans were available. For purposes of establishing the baseline condition

for nonmandatory areas, FPC assumed that the nonmandatory areas would also be reclaimed. This assumption was based on common industry practices and the economic incentives for returning the land to productive use. In informal discussions with FPC, IMC, the owner of most of the nonmandatory areas on-site, also confirmed their intent to reclaim the "old lands."

Nonmandatory reclamation is accomplished by the mining company either privately or under a reimbursement program established by the state to encourage the economic and environmental return of lands mined prior to 1975. The nonmandatory reclamation program is voluntary and the publicly funded portion is limited by the amount of funding (derived from phosphate severance taxes) available in any one fiscal year. Most mining companies and private owners of nonmandatory lands are active in the state's reimbursement program which provides a fixed amount of reimbursement per acre of eligible mined land.

Nonmandatory reclamation standards are less stringent than mandatory requirements in terms of requirements for reclamation of wetlands and forested uplands. The reclaimed landforms tend to favor the economic use of the land. Agriculture is the dominant reclaimed nonmandatory landform. Pastureland, citrus, and row crop production are in high demand in the central Florida region.

A 1990 Florida Institute of Phosphate Research (FIPR) study, Regional Study of Land Use Planning and Reclamation, predicted that much of Polk County's mined land, including nonmandatory areas, will be reclaimed to upland pasture, with clay settling areas being especially suitable for reclamation as upland pasture. The FIPR study report also cited promising research results on the use of old clay settling areas for alfalfa and row crops. In a comparison of pre-mining and post-reclamation land uses throughout the study area, the FIPR report projected pasture and cropland to increase substantially, while rangeland and forested uplands were expected to decrease from pre-mining coverage. Based on this study, nonmandatory areas of the site can be expected to be reclaimed as agricultural land, predominantly pasture, but including some row crops.

Information was also obtained from preliminary in-house Estech Silver City and IMC Noralyn mine reclamation plans confirming that the nonmandatory lands are to be reclaimed to nonforested uplands (pasture, citrus, or grasslands) and forested areas. For instance, IMC's N-9C nonmandatory clay settling area (IMC-N-024C), adjacent to the FPC Polk County Site,

has been submitted by IMC to FDNR for nonmandatory funding consideration. The proposed land uses are 310 (grassland) and 430 (upland mixed forest).

In summary, based on this review of industry practices and plans, the baseline (future without-project) condition of nonmandatory reclamation areas of the Polk County Site, consisting almost entirely of clay settling areas, was assumed to be reclaimed agricultural land, likely a combination of mostly pasture with some row crops or citrus. The baseline condition of mandatory reclamation areas was assumed to reflect the approved (pre-1992) reclamation plans for those areas. These plans show a combination of agricultural uses, grassland, forested uplands, forested and herbaceous wetlands, and water bodies. The baseline condition (in terms of land use/vegetation) for the entire site, including both mandatory and nonmandatory areas, is shown on Figures 2.1.2-2A and 2.1.2-2B.

2.1.3 Proposed Site Delineation

Figures 2.1.3-1A and 2.1.3-1B show the Polk County Site as it is planned. It will be subdivided into five key project components as follows:

- Plant Island 964 acres
- Cooling Ponds 2,600 acres
- Brine Pond 311 acres
- Solid Waste Disposal Areas 2,179 acres
- Buffer Areas 1,649 acres

No portion of the FPC Polk County Site is within the 100-year floodplain of any surface water body in the area.

2.1.4 References

FDNR (Florida Department of Natural Resources). 1992. Mine Reclamation Monitoring Report. Unpublished. FDNR, Bureau of Mine Reclamation. Tallahassee, Florida.

FDOT (Florida Department of Transportation), State Topographic Bureau, Thematic Mapping Section. 1985. Florida Land Use, Cover and Forms Classification System. Procedure No. 550-010-001-a, Second Edition. September.

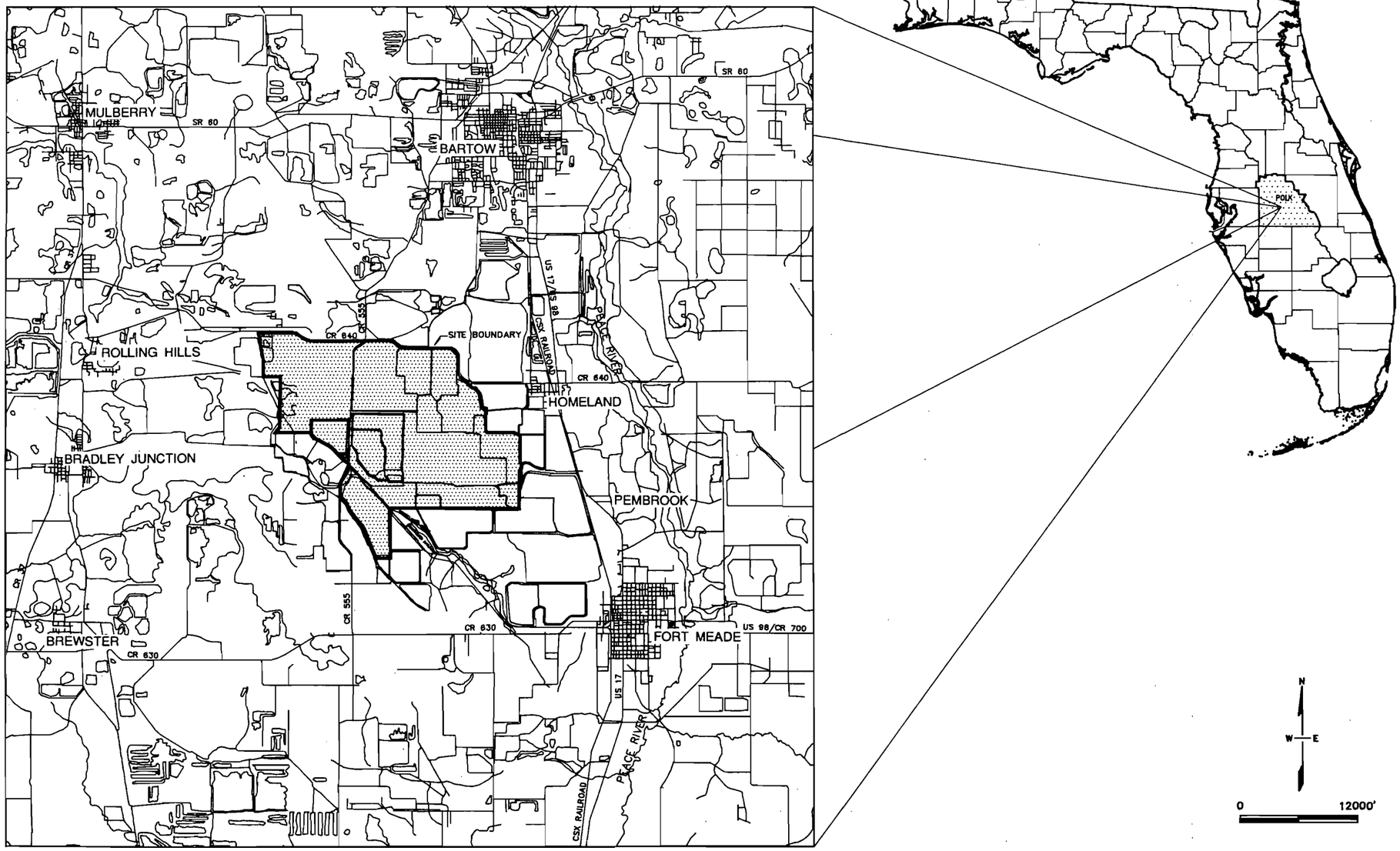
FIPR (Florida Institute of Phosphate Research). 1990. Regional Study of Land Use Planning and Reclamation. Publication No. 04-041-085. Prepared by the Central Florida Regional Planning Council. Bartow, Florida. August, 1990.

Polk County Comprehensive Plan. April, 1991.

TABLE 2.1.2-1
EXISTING APPROVED (PRE-1992) RECLAMATION PLAN
FLUCCS DESIGNATIONS FOR POLK COUNTY SITE
MANDATORY MINE LANDS

Land Use Designation	FLUCCS CODE	Acreage by Mine/Owner		
		IMC's Noralyn and Phosphoria	Estech Silver City	USAC N-9
Nonforested Uplands (Cropland and Pasture)	210/310	1,066	933	20
Forested Uplands	430	98	91	53
Waterbody	520	340	301	0
Forested Wetlands	630	68	172	0
Herbaceous Wetlands	640	539	0	0
Subtotal		2,111	1,497	73
TOTAL (All Acreages)		3,681		

Sources: FDOT, 1985
FDNR, 1992
Ebasco Environmental, 1992



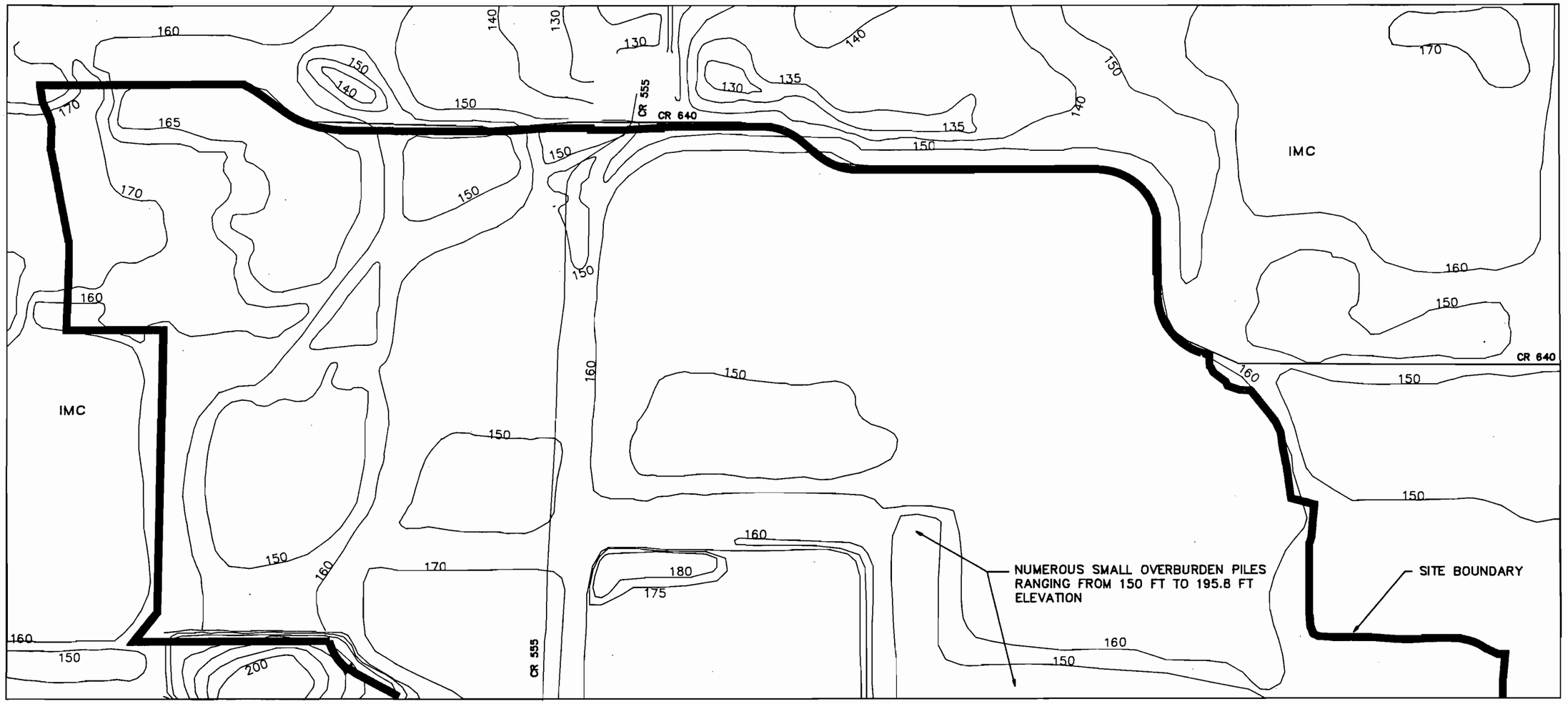
SOURCE: DAMES & MOORE, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.1.1-1

SITE LOCATION MAP

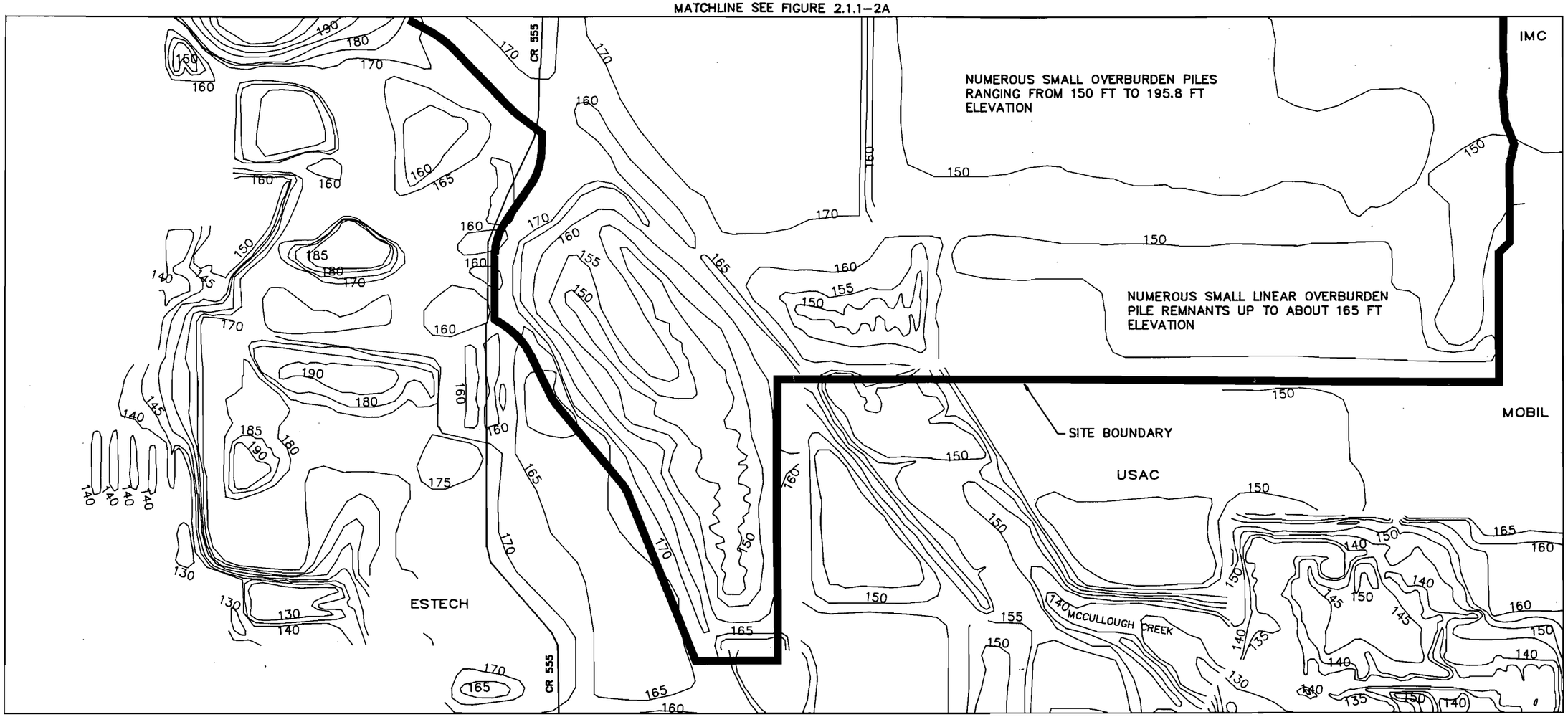


SOURCE: DAMES & MOORE, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.1.1-2A
EXISTING TOPOGRAPHY OF SITE AND ADJACENT LANDS
SHEET A

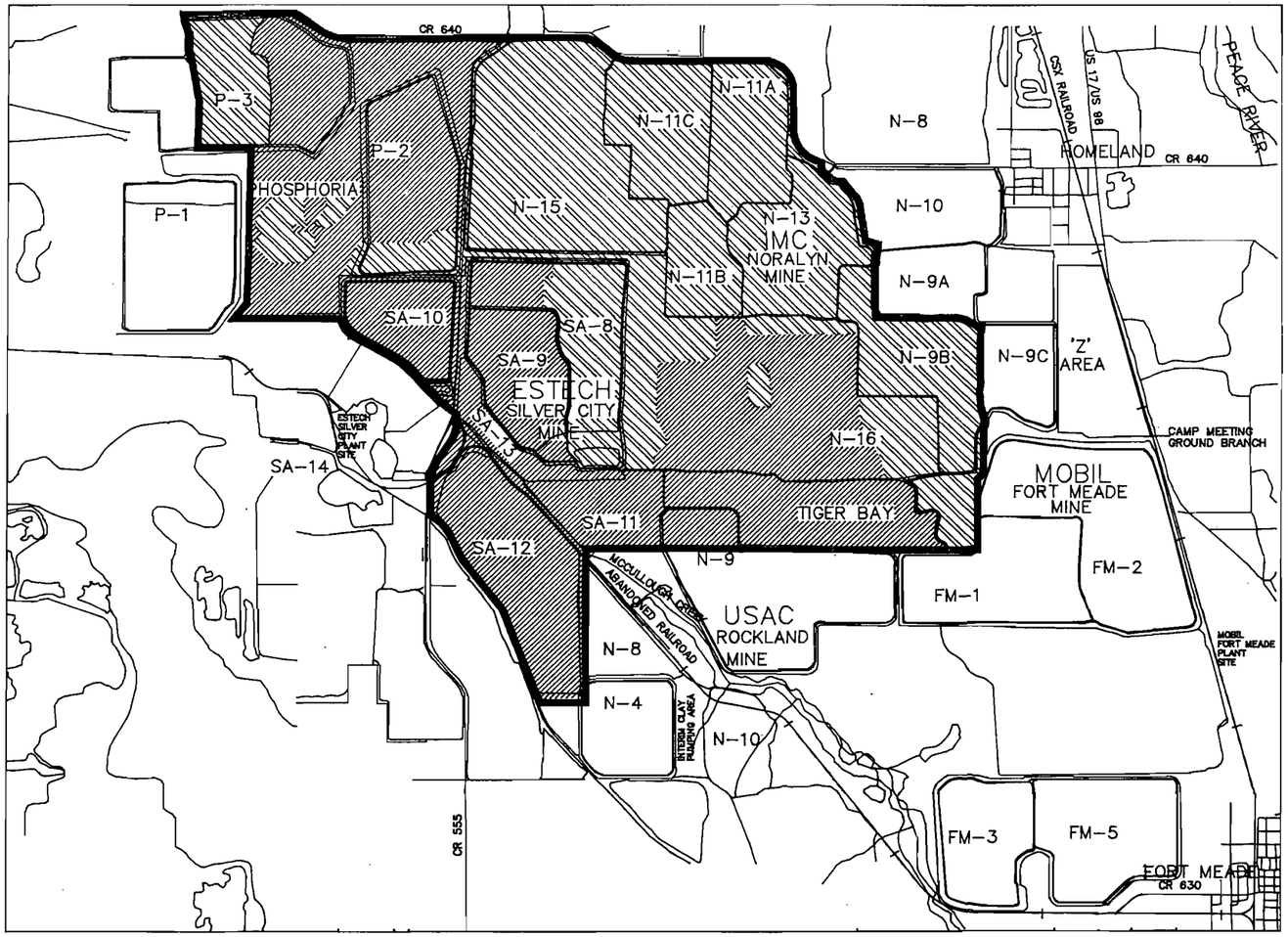


SOURCE: DAMES & MOORE, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.1.1-2B
EXISTING TOPOGRAPHY OF SITE AND ADJACENT LANDS
SHEET B

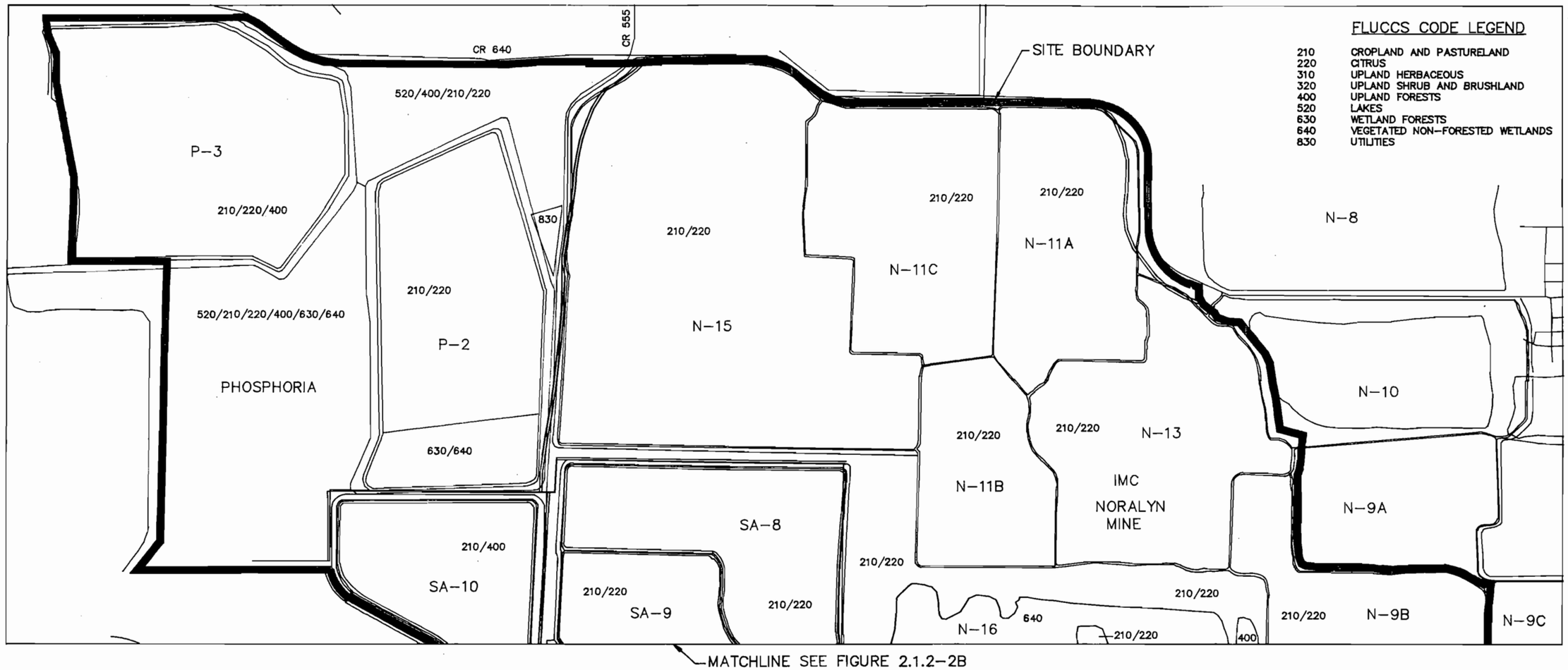


SOURCE: DAMES & MOORE, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.1.2-1
MANDATORY AND NONMANDATORY RECLAMATION LANDS

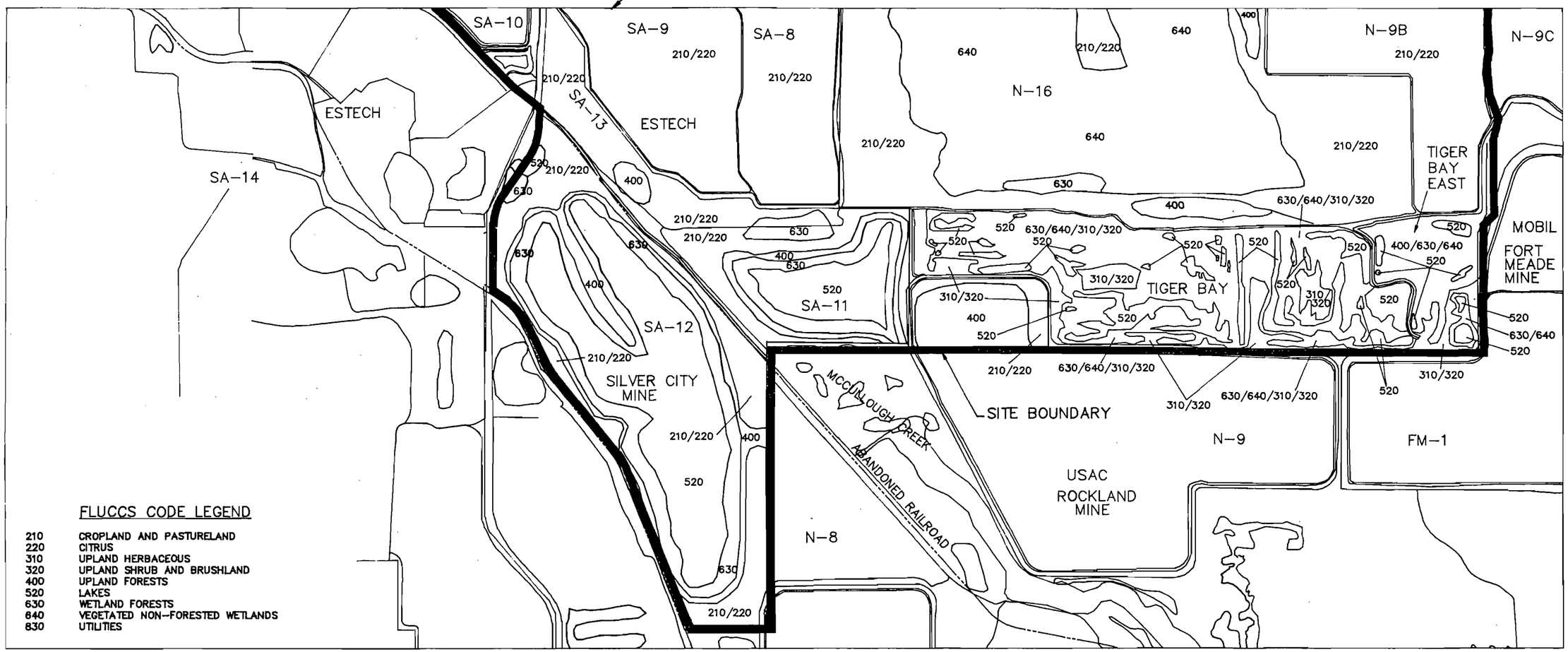


SOURCES: DAMES & MOORE, 1992
EBASCO ENVIRONMENTAL, 1992
FDNR, 1991

Florida Power CORPORATION

Polk County Site

FIGURE 2.1.2-2A
VEGETATION/LAND USE MAP
BASELINE CONDITIONS
SHEET A



FLUCCS CODE LEGEND

210	CROPLAND AND PASTURELAND
220	CITRUS
310	UPLAND HERBACEOUS
320	UPLAND SHRUB AND BRUSHLAND
400	UPLAND FORESTS
520	LAKES
630	WETLAND FORESTS
640	VEGETATED NON-FORESTED WETLANDS
830	UTILITIES

SOURCES: DAMES & MOORE, 1992
EBASCO ENVIRONMENTAL, 1992
FDNR, 1991

Florida Power CORPORATION

Polk County Site

FIGURE 2.1.2-2B
VEGETATION/LAND USE MAP
BASELINE CONDITIONS
SHEET B



LEGEND

130 EXISTING FDNR TOPOGRAPHY

GENERAL FLOW DIRECTION–STORM WATER RUN–OFF

DRAINAGE DIVIDE

SITE BOUNDARY

FDNR RECLAMATION PROGRAMS

EST–SC–MC(1)
EST–SC–SP(4)
EST–SC–SP(5)
EST–SC–SP(7)
EST–SC–SP(8)
IMC–NP–SP(9)

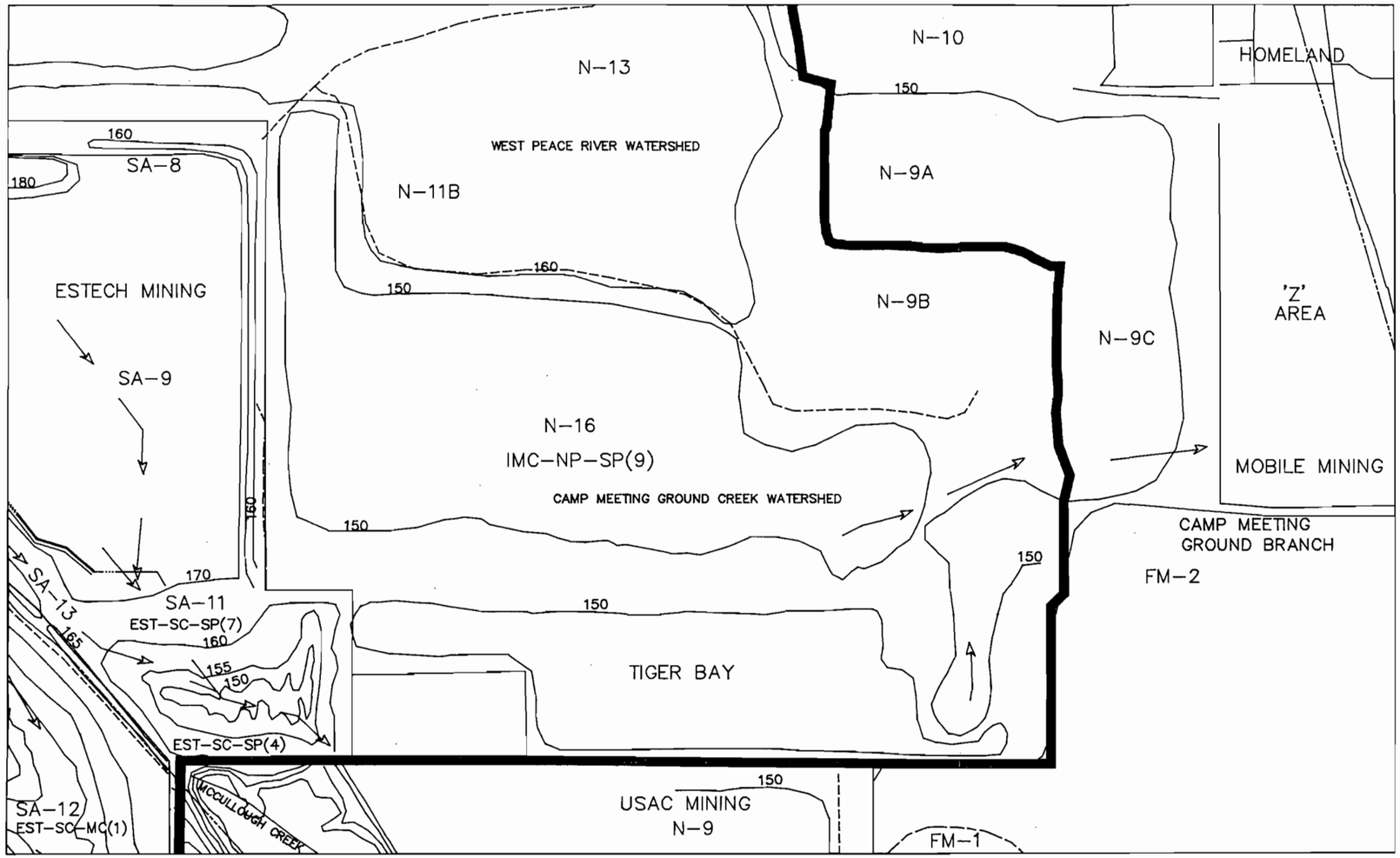
N
W E
0 2000'

SOURCES: DAMES & MOORE, 1992
FDNR, 1991

Florida Power CORPORATION

Polk County Site

FIGURE 2.1.2–3A
BASELINE CONDITION TOPOGRAPHY
IMC N–16 AND ESTECH (MANDATORY AREAS)
SHEET A



LEGEND

150 EXISTING FDNR TOPOGRAPHY

GENERAL FLOW DIRECTION-STORM WATER RUN-OFF

DRAINAGE DIVIDE

SITE BOUNDARY

FDNR RECLAMATION PROGRAMS

EST-SC-MC(1)
EST-SC-SP(4)
EST-SC-SP(7)
IMC-NP-SP(9)

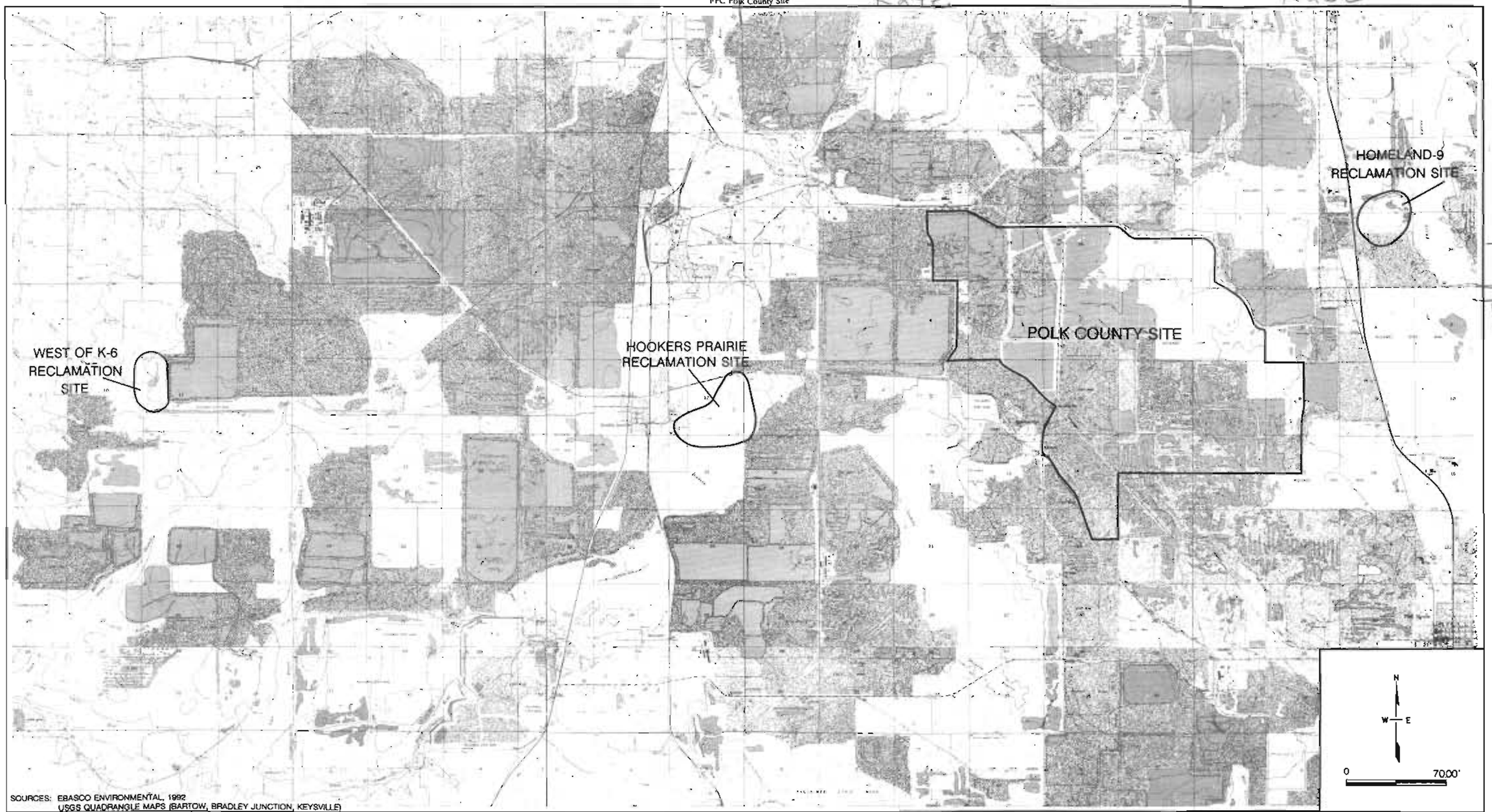
N
W E
0 2000'

SOURCES: DAMES & MOORE, 1992
FDNR, 1991

Florida Power CORPORATION

Polk County Site

FIGURE 2.1.2-3B
BASELINE CONDITION TOPOGRAPHY
IMC N-16 AND ESTECH (MANDATORY AREAS)
SHEET B



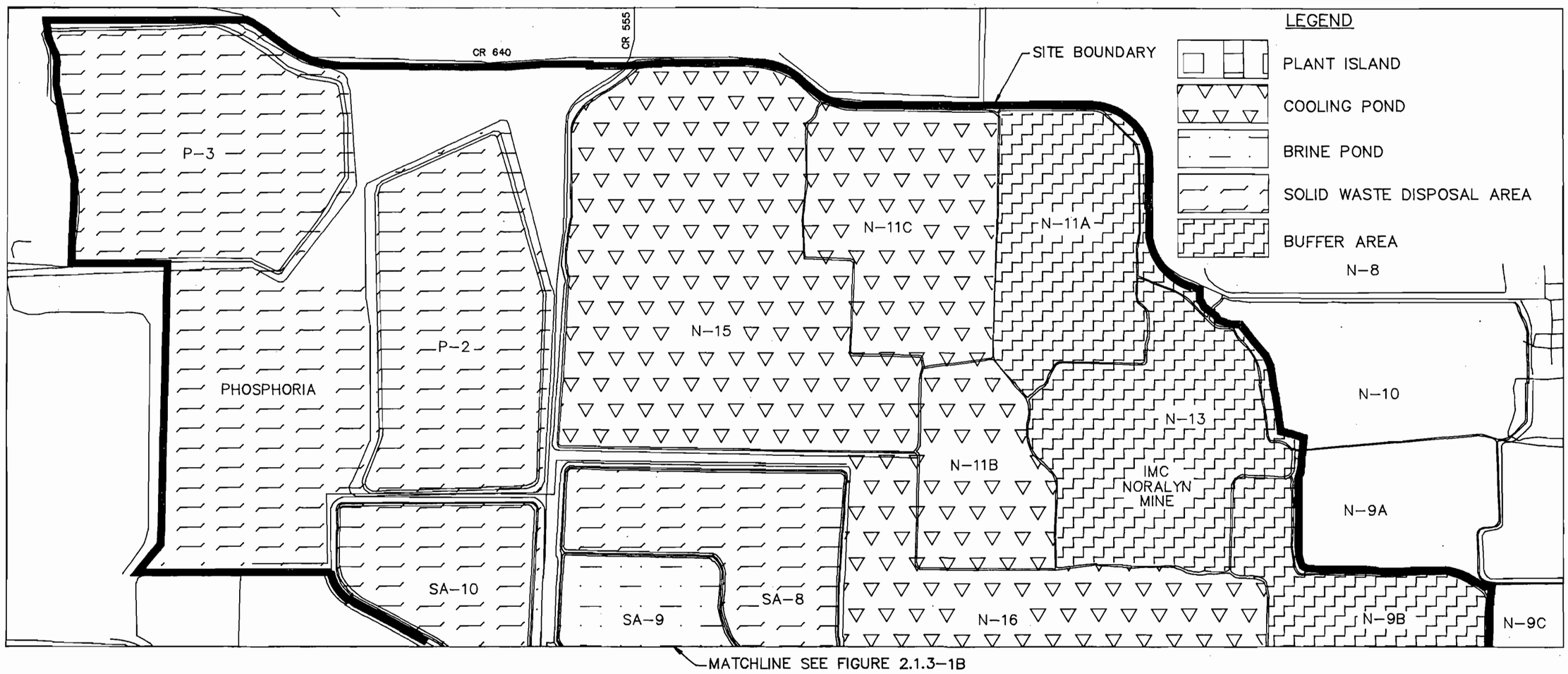
Florida Power
CORPORATION

Polk County Site

FIGURE 2.1.2-4

OFF-SITE BASELINE STUDY AREAS

POLK CO.

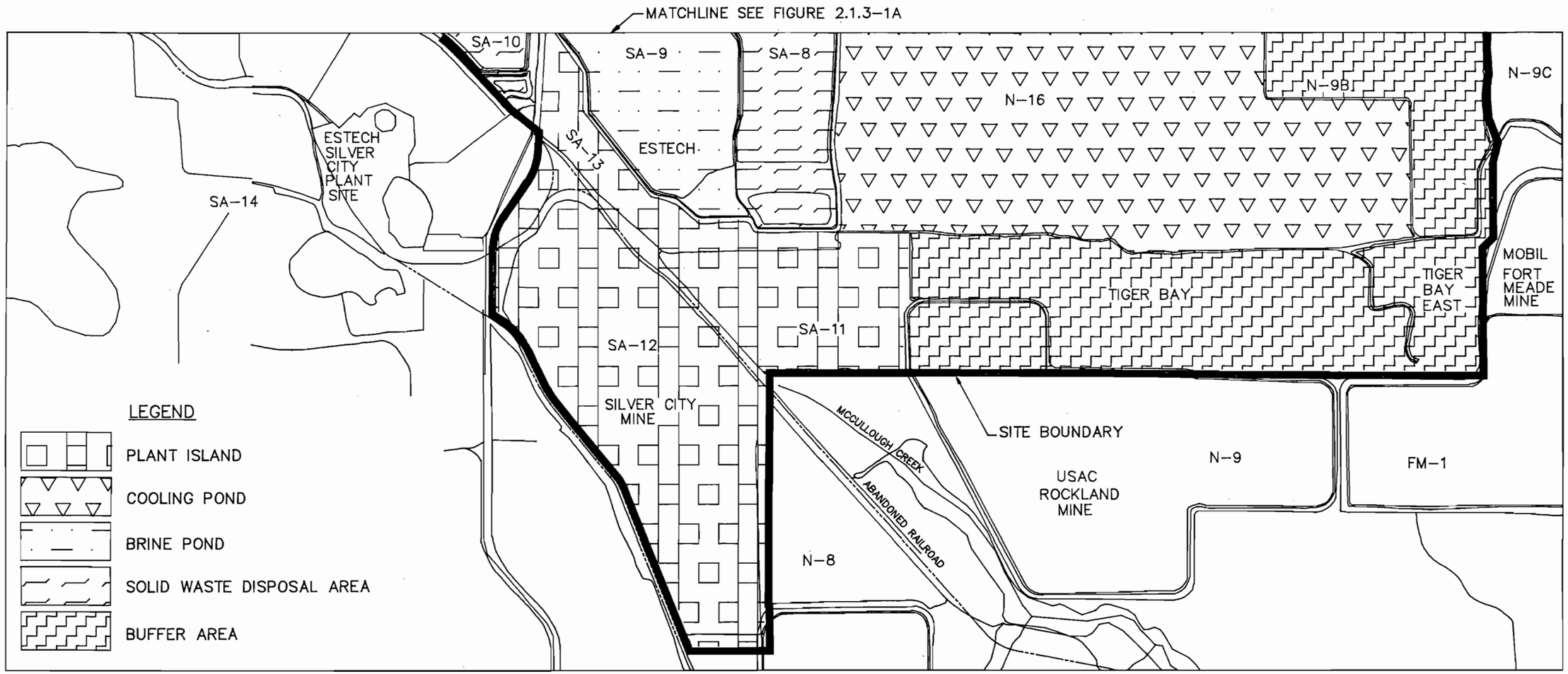


SOURCE: DAMES & MOORE, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.1.3-1A
GENERALIZED PROJECT SITE PLAN
SHEET A



SOURCE: DAMES & MOORE, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.1.3-1B

GENERALIZED PROJECT SITE PLAN SHEET B

2.2 SOCIOPOLITICAL ENVIRONMENT

2.2.1 Governmental Jurisdictions

The project site is located in an unincorporated area in southwest Polk County approximately 3 miles south of Bartow, 3.5 miles northwest of the City of Fort Meade, and 1 mile southwest of Homeland, an unincorporated community. As Figure 2.2.1-1 indicates, the City of Fort Meade is the only governmental jurisdiction within a five mile radius of the plant island.

The following areas are not found within 5 miles of the plant island:

- National Parks
- National Forests
- National Seashores
- National Wildlife Refuges
- National Wilderness Areas
- National Memorials or Monuments
- National Marine and Estuarine Sanctuaries
- Roadless Area Review and Evaluation Areas
- National Wild and Scenic Rivers
- Critical Habitat of Endangered Species
- State Parks
- State Forests
- Areas of Critical State Concern
- Conservation and Recreation Lands
- State Archaeological Landmarks or Landmark Zones

- Save Our Rivers Lands
- State Aquatic Preserves
- Outstanding Florida Waters
- Scenic and Wild Rivers
- Indian Reservations
- Military Lands
- Major private land-holdings for environmental protection

The Florida Game and Fresh Water Fish Commission (FGFWFC) currently leases an area known as the IMC Wildlife Management Area (WMA) on the southeast corner of CR 555 and CR 640 (Figure 2.2.1-2). This area is an active clay settling pond which is being used by IMC in its phosphate mining operations and is part of the proposed power plant site. Although the WMA is completely owned by IMC and is used as a clay settling area, the FGFWFC is allowed to use the area for a waterfowl hunting. FGFWFC's involvement with the area is limited due to its active use as part of the mining operation, which does not allow for control of water levels for wildlife management purposes. Signs are provided to inform visitors of hunting regulations, and access is controlled by FGFWFC. IMC has an agreement with FGFWFC, which uses the area with the knowledge that the use of the property for a WMA will be discontinued in the future as mining and mine reclamation progress.

Polk County owns two parks within a 5-mile radius of the plant island (Figure 2.2.1-2). The County's IMC Peace River Park, a regional park consisting of 640 acres of reclaimed phosphate land, is located approximately 3 miles northeast of the plant island, near the community of Homeland. This park is currently undeveloped but is scheduled to be developed in the near future as described in Section 2.2.7. The County also owns and maintains the Homeland Historic and Pioneer Park, a 3-acre neighborhood park located southwest of the intersection of CR 640 and SR 17.

Figures 2.2.1-3A and 2.2.1-3B show the area within a 1-mile radius of the plant island and the area within a 1-mile buffer around the plant island boundaries. There are no special areas identified within a 1-mile radius and only the area currently used by FGFWFC as the IMC WMA is within a 1-mile buffer of the plant island.

2.2.2 Zoning and Land Use Plans

In April 1991, Polk County adopted a Comprehensive Plan in accordance with the Local Government Comprehensive Plan and Land Development Regulation Act, Chapter 163, Part II, F.S. Appendix 10.3 provides further details regarding the Comprehensive Plan.

The proposed site is located in the Phosphate Mining (PM) land use category on the Polk County Future Land Use Maps (Figure 2.2.2-1). Certified electric power generation facilities are required to be located in the Phosphate Mining land use category. The Comprehensive Plan states that these facilities must be consistent with the requirements of the Plan and must be approved by the County via a conditional use permit (CUP). Locational criteria, environmental criteria, and development approval criteria, as well as buffering requirements, are specified in the Comprehensive Plan.

The proposed site is zoned Rural Conservation (RC) (Figure 2.2.2-2). Polk County's zoning regulations define electric generating facilities as Class III Essential Services and allow them as conditional uses in all zoning categories. Conditional use provisions listed in the RC category state that all Class III Essential Service facilities must be buffered from adjacent properties used for residential dwellings. The Polk County Board of County Commissioners approved a CUP for the Polk County Site on June 2, 1992. Appendix 10.2 provides further zoning and CUP detail.

Parcels adjacent to the proposed site are primarily zoned RC with two small residentially-zoned parcels located north of the site at the northeast corner of CR 555 and CR 640 and some industrially-zoned (GI) parcels located north of CR 640 near the northwest corner of the project site and directly across CR 555 from the plant island at the Estech Silver City plant site.

2.2.3 Demography and Ongoing Land Use

Two municipalities, Bartow and Fort Meade, are located within 5 miles of the project boundaries. The City of Bartow, with a population of 14,716 according to the 1990 census, is the county seat and the third largest city in Polk County. The City of Fort Meade had a 1990 population of 4,976. Unincorporated communities in southwest Polk County include Homeland, located about one mile northeast of the project boundaries; Bradley Junction, located about 5

miles west of the project boundaries; and Rolling Hills, located about 5 miles northwest of the project boundaries.

The rate of population growth in Florida and Polk County is illustrated on Figure 2.2.3-1. Florida's population increased 37.2 percent between 1960 and 1970, 43.5 percent between 1970 and 1980, and 32.7 percent from 1980 to 1990. Polk County's population growth has changed from 17.1 percent growth in the 1960s, to 40.8 percent growth in the 1970s, to 26 percent growth in the 1980s. Although Polk County's population increased 26 percent from the 1980 census to the 1990 census, most of the growth occurred in the northern part of the County. The 1990 Census shows a decline in population in most areas in the southern portion of the County, including population decreases in both Bartow and Fort Meade (Figure 2.2.3-2). Bartow's population decreased 1 percent from 14,789 in 1980 to 14,716 in 1990; while Fort Meade lost 10 percent of its population, dropping from 5,546 to 4,976. The two census tracts south and west of the site (160 and 161.98) lost population between 1980 and 1990 (Figure 2.2.3-3). Other census tracts in the area grew at a rate of 0 to 21 percent, except for the census tract which includes the majority of the proposed site, tract 159. The population in tract 159 increased almost 29 percent from 1,346 in 1980 to 1,730 in 1990. Tract 159 is a very large tract which includes Homeland, the outskirts of Bartow, and areas on either side of Fort Meade. Although the population in this tract increased by 384 persons, there was no significant increase in population in the direct vicinity of the site. A news article by the *Ledger* on the 1990 census attributed the overall population decrease in southern Polk County to the loss of jobs in the area resulting from the migration of citrus and mining jobs to areas south of Polk County (Rufty, 1991).

Polk County's Comprehensive Plan lists population data for the unincorporated area and the total County dating back to 1950. The Plan projects population in Polk County to reach 546,700 in the year 2000, with 57 percent of the population, or 311,164, living in the unincorporated area (Figure 2.2.3-4). The Comprehensive Plan projections increase to 599,400 (341,481 unincorporated) for the year 2005, and 648,400 (370,674 unincorporated) for the year 2010. These population projections were based on the Bureau of Economic and Business Research's (BEBR) high population projections that were published prior to the 1990 census. Since the 1990 census data became available, BEBR has revised its projections for Polk County. The new BEBR medium and high population projections for Polk County are shown on Figure 2.2.3-5. This figure compares BEBR's post-1990 Census projections with the population projections listed in the Polk County Comprehensive Plan. BEBR's medium projections are consistently lower

than the Polk County Comprehensive Plan projections. BEBR's high projection for 1995 is lower than Polk County's projection, but BEBR's high projections exceed the Polk County projections after 1995. The population in the three census tracts surrounding the project site (tracts 159, 160, and 161) is projected to increase 12 percent from 1990 to 1995, or to increase from 13,130 to 14,759.

The proposed site is located in southwestern Polk County in an area which has been dominated by phosphate mining operations, including mines, clay settling ponds, sand tailings piles, gypsum stacks, and chemical and beneficiation plants. Most of the area within a 5-mile radius of the plant island consists of lands being actively mined, unreclaimed mining land, and lands in various stages of reclamation. Most of the reclaimed lands revert to pastureland or land-and-lakes after reclamation. Other land uses found within a 5-mile area include pastureland, citrus groves, and limited residential, commercial and industrial uses. Land uses within the 5-mile radius are mapped on Figures 2.2.3-6A and 2.2.3-6B.

Southwest Polk County is an area in transition. The phosphate industry has completed mining many of the phosphate deposits in Polk County, and the industry is moving into surrounding counties such as Hillsborough, Hardee, and Manatee. Polk County's Comprehensive Plan recognizes the changes occurring in the County. The County's Future Land Use Element states that most of the phosphate lands in Polk County will be mined out by the year 2010. The Economic Element of the Comprehensive Plan includes an objective of diversifying the County's economy by recruiting non-traditional industries and working with the phosphate industry to study the feasibility of using reclaimed and non-reclaimed phosphate lands for uses that would enhance the county's economic base. The plan specifically states that because the mined-out phosphate areas are uninhabited and have already been disturbed, they are a prime location for facilities such as electric-power generation plants. It also states that southwest Polk County has several advantages for the siting of electric-power generating facilities including the availability of reclaimed phosphate lands with few environmentally sensitive areas, a location close to the growth centers along Florida's west coast, and the availability of requisite infrastructure, such as rail facilities and an adequate transportation network. Recognizing these factors, the County's Future Land Use Element requires electric power generation facilities to be located in phosphate mining areas with at least 50 percent of the site comprised of lands previously disturbed by phosphate mining. The FPC Polk County Site consists entirely of lands which have been or will be disturbed by phosphate mining activities.

2.2.4 Easements, Title, Agency Works

CR 555 runs through the proposed project site and CR 640 borders the site on the north. Polk County requires a use permit for any facilities crossing these highways. No other easements, title, or agency works crossing approvals are known to be required, except for linear facilities which are addressed in Chapter 6 of this SCA.

2.2.5 Regional Scenic, Cultural and Natural Landmarks

The proposed plant site is located in an area which has been dominated by phosphate mining operations for decades. There are no regional scenic, cultural, or natural landmarks within 5 miles of the plant site.

2.2.6 Archaeological and Historic Sites

According to a letter from the Florida Department of State, Division of Historical Resources (DHR), dated January 6, 1992, the Florida Master Site File does not list any archaeological or historic sites on the project site. As mentioned above, the proposed site is composed of lands which have already been disturbed by phosphate mining. The DHR issued a letter January 30, 1992, stating that because of the project location and/or nature it is considered unlikely that any significant archaeological or historical sites will be affected. These letters are included in Appendix 10.5.2.

2.2.7 Socioeconomics and Public Services

2.2.7.1 Socioeconomics

EMPLOYMENT AND INCOME

Polk County's labor force was 183,067 in July 1991 (Figure 2.2.7-1). Out of this total, 161,684 were employed, resulting in an unemployment rate of 11.7 percent. This compares to a statewide unemployment rate of 7.9 percent for the same time period. Polk County's unemployment rate has consistently been higher than the state average in the last 10 years (Figure 2.2.7-2), and Polk County has been designated as a labor surplus area by the U.S. Department of Labor. (This designation means that companies in the Polk County area are

eligible for preference in obtaining federal contracts.) The trend in employment in Polk County from 1986 to 1991 is shown on Figure 2.2.7-3. Employment actually decreased between 1989 and 1991.

Annual average employment for Polk County was 157,062 for 1990, according to the Florida Department of Labor and Employment Security (FDLES). Major industries in terms of employment were retail trade (26 percent), services (25 percent), manufacturing (17 percent), and government employment (federal, state and local), which accounted for 15 percent of total employment (Figure 2.2.7-4). Mining employment accounted for less than 3 percent of total employment. The average wages for these industries in 1990 were $13,467 for retail, $19,159 for services and $23,740 for manufacturing (Figure 2.2.7-5). The average wage for all government employees was $23,574. Average wages for all non-government employees in Polk County in 1990 were $19,106. The highest average wages were in the mining industry ($29,961), while the lowest were in retail.

Employment in Polk County is projected to increase to 233,052 by the year 2000, according to the FDLES's publication on Industry and Occupational Employment Projections. According to these projections, 26 percent of the employment will be in services and 24 percent will be in wholesale and retail trade (Figure 2.2.7-6). Manufacturing jobs are expected to account for 12 percent of total employment, with mining accounting for less than 2 percent. The FDLES's employment projections show increasing employment in all industries. The greatest growth in projected employment is in wholesale and retail trade and services, which are both projected to increase by 29 percent between 1989 and 2000. The least growth occurs in the mining industry.

The Polk County Comprehensive Plan's Economic Element contains regional employment projections developed by the Bureau of Economic Analysis of the U.S. Department of Commerce, commonly referred to as OBERS projections (Figure 2.2.7-7). These projections are consistent with the FDLES projections in that total employment is expected to exceed 200,000 by the year 2000, and mining employment is expected to increase through the year 2000.

Although the FDLES and OBERS projections show mining employment increasing through the year 2000, recent historical data on mining employment in Polk County shows a downward trend, from over 6,000 employees in 1981, to a low of 3,500 as of October 1991 (Figure 2.2.7-8). The projection methodology used by FDLES and OBERS does not account for changes in

employment patterns, such as the shift of mining and mining-related employment from Polk County into other counties, such as Hardee and DeSoto. These projections are made at a state or regional level and then distributed to the counties within the region based on historical employment patterns. For example, FDLES's industry and occupational employment projections are based on data covering the period from 1972 through 1989. During that time period, Polk County has accounted for the majority of mining employment in central Florida. Therefore, most of the mining employment projected for the future is allocated to Polk County. However, the majority of the phosphate reserves in Polk County are mined out. Mining companies are preparing to move their mining operations into adjoining counties (Hillsborough, Manatee, Hardee, and DeSoto Counties). Therefore, the FDLES projections overstate mining employment in Polk County and understate mining employment in other counties. The downward trend in mining employment in Polk County, as shown on Figure 2.2.7-8, is expected to continue.

The per capita personal income for Polk County was $13,427 in 1988, or 81 percent of the Florida average and the national average per capita income (Figure 2.2.7-9). Polk County's nonfarm per capita income was $12,736 compared to the Florida average of $16,289 and the national average of $16,317. Per capita transfer payments (including unemployment, retirement and other payments) were $1,621 for Polk County compared to $1,705 for Florida and $1,531 nationally. The 1988 per capita income for Polk County represented a 7 percent increase over the 1987 per capita income of $12,498.

The County's Economic Element of the Comprehensive Plan lists the distribution of household incomes for 1980 and 1988 and a projection for 1993 (Figure 2.2.7-10). Households in the lowest income range, less than $15,000, made up 53 percent of total households in 1980. The percentage of households in this range decreased to 36 percent in 1988 and is projected to decrease to 34 percent by 1993. Middle income households made up 46 percent of all households in 1980, 61 percent in 1988, and are projected to make up 62 percent of all households by 1993. The highest income level, greater than $74,999, made up 1 percent of all households in 1980, 3 percent of all households in 1988, and are projected to account for 4 percent of all households by 1993. However, since this household income information has not been adjusted for inflation, the apparent increases shown on Figure 2.2.7-10 are an overly optimistic portrayal of the change in real household incomes over the time period.

HOUSING

The breakdown of housing units by type in unincorporated Polk County was listed in the County's Comprehensive Plan. In 1960, conventional single family units made up 89 percent of all housing units, mobile homes made up 7 percent, and multi-family units made up 4 percent. By 1989, conventional single family units had decreased to 58 percent of all housing units, while mobile homes increased to 33 percent of units, and multi-family units increased to 9 percent. Figure 2.2.7-11 illustrates the trend of increasing reliance on mobile homes and multi-family units for housing and shows how the number of conventional single family units has leveled off. Census data from 1990 indicate that detached single-family units have decreased to 53 percent of total units, mobile homes have decreased to 29 percent of total units and multi-family units have increased and now account for 18 percent of all units.

Polk County's Comprehensive Plan included housing cost information from the 1980 Census. In 1980, 22 percent of the County's housing stock was occupied by renters, 71 percent was occupied by owners, and the remainder was vacant. According to the 1980 Census, 47 percent of the County's families living in rented units were paying more than 25 percent of their income for rent. The median monthly rent charged in the County was $218. The average monthly cost of owner-occupied units was $303 if the home was mortgaged and $95 per month if the home was not mortgaged. The 1990 Census reported that the percentage of units occupied by renters has increased to 25 percent, while units occupied by owners dropped to 59 percent. Vacant units accounted for 16 percent of all units in the county. Housing cost data from the 1990 Census indicate that 92 percent of the rental units in the county rented for less than $500 per month, with a median monthly rent of $300. The monthly cost of home ownership was not available for 1990. However, the Census showed that the median value of owner occupied units was $61,000. The majority of these units (84 percent) had a value less than $150,000 while 34 percent of these units were valued at less than $50,000.

Figure 2.2.7-12 illustrates the trend in residential building permits issued in Polk County between 1985 and 1990 for the unincorporated area of the county and the total county. The County reached a peak of 3,765 residential permits in 1988, while permits in the unincorporated area peaked at 2,296 in 1989. Residential permits for both jurisdictions decreased between 1989 and 1990. The unincorporated area of the county has accounted for approximately 70 percent of the residential permits issued in the county during the time period shown. The municipalities of Bartow and Fort Meade issue building permits for construction within their boundaries

(Figure 2.2.7-13). Bartow has issued an average of 37 residential permits annually between 1985 and 1990 reaching a low of 28 in 1987 and a high of 48 in 1988. Fort Meade has issued an average of 16 residential permits per year with a high of 57 in 1986 and a low of 2 in 1987. Bartow issued 29 single-family building permits in 1990, while Fort Meade issued 11 single-family permits. Neither municipality issued any multi-family permits in 1990.

Temporary housing available in Polk County in 1991 included 116 hotels and motels with over 6,000 units total, as well as 47 rooming houses and 88 transient apartment buildings. Most of these facilities are located north of the site in cities and towns near Interstate Highway 4.

LOCAL GOVERNMENT REVENUES AND EXPENDITURES

Polk County's revenue sources include taxes, licenses and permits, intergovernmental revenues, charges for services, fines and forfeitures, miscellaneous revenues, and enterprise revenues. Polk County's total revenues were $311,744,893 in 1990-1991, and are projected to be $342,497,639 in fiscal year 1991-1992, according to the Polk County Budget. Taxes, intergovernmental revenues, and enterprise revenues make up 49 percent of the County's revenues. Polk County's budgeted revenues and expenditures for the fiscal year 1991-1992 are listed in Table 2.2.7-1. Per capita revenues and expenditures are shown on Figures 2.2.7-14 and 2.2.7-15.

Tax revenues contribute 24 percent of Polk County's total revenues (Figure 2.2.7-16). Tax revenues in Polk County include ad valorem taxes, resort taxes, a local option gas tax, and franchise fees and taxes. Polk County's total non-exempt assessment of property values for the fiscal year ending September 30, 1990, was $9.77 billion, according to the Local Government Financial Report Fiscal Year 1989-90. Ad valorem taxes are expected to contribute 87 percent of the County's tax revenues in 1991-1992. The local option gas tax will contribute another 11 percent of total taxes, while the resort tax, franchise taxes, and other taxes will make up the remaining 2 percent of total tax revenues. Licensing and permit revenues make up less than 1 percent of total County revenues. Licenses and permits include professional and occupational licenses, building permits, pet licenses, and other licenses and permits.

Intergovernmental revenues include state and federal grants for transportation projects, low income housing projects, and cultural/recreational projects, as well as tax and license revenues which are collected by the state and then distributed to the counties. These revenues include

mobile home license revenues, sales tax revenues, revenue sharing funds, and many others. A complete list of intergovernmental revenue sources from the Polk County Budget is shown below.

Civil Defense
Urban Mass Transportation
Other Transportation
Community Development
Block Grant
Low Income Housing
Economic Environment Grant
Human Service Grant
Federal Shared Revenue
Judicial
Public Safety
Aquatic Weeds
Landfill Grants
Physical Environment
Transportation
Economic Environment
Mosquito Control I
Mosquito Control II
Other Human Services
Other Cultural/Recreational
Other State Grants
State Revenue Sharing
Insurance Agents Licenses
Mobil Home Licenses
Alcoholic Beverage Licenses
Racing Tax
Sales Tax
State Shared Revenue
Fire Fighting Supplement
Public Safety
Motor Fuel Tax Rebate
Construction Gas Tax
County Gas Tax
Other Transportation

Charges for services make up 2 percent of the County's projected revenues. These revenues include charges for recording legal instruments, zoning fees, concurrency management fees, circuit court fees, emergency service fees, ambulance fees, animal control fees, park and recreational fees, and many other fees and charges.

Fines and forfeitures make up 1 percent of the budgeted revenues. This category includes court fines, confiscated property, fines from violations of local ordinances, and other fines.

Miscellaneous revenues include interest, rents and royalties, special assessments, proceeds from the sale of surplus land and equipment, contributions and donations, and other miscellaneous revenues. These revenues make up 6 percent of total budgeted revenues for 1991-1992.

Enterprise operations in the county include internal services (fleet maintenance and a print shop), landfills, utilities, the county hospital, and Rohr Home, a nursing home operated by the County. The enterprises are set up to cover the costs of operation by charging fees for services. The landfill enterprise and the utilities enterprise are very successful and have generated revenue in excess of their expenditures. However, the internal services, the hospital, and the Rohr Home,

all report expenditures greater than their revenues. Revenues from these enterprises are expected to make up 12 percent of total revenues in 1991-1992.

The Polk County Budget includes another category titled "Non-Revenues." This category contains court remittances, interfund transfers, debt proceeds, trust fund receipts, budgeted non-revenue, and other non-revenues. This category accounts for 40 percent of the County's total revenues.

Polk County's 1991-1992 Budget lists nine categories of expenditures. Public safety expenditures, including expenses for fire protection, sheriff's office, and emergency medical services, make up 20 percent of budgeted expenditures in 1991-1992 (Figure 2.2.7-17). Physical environment expenditures, which include expenditures on garbage, utilities, and water resources, were also expected to total 20 percent of total expenditures in 1990-1991. Miscellaneous expenditures are budgeted at 18 percent of all expenditures, human services (including hospital expenses, social programs, etc.) are budgeted at 15 percent of total expenditures, and general government services account for 13 percent of the budgeted expenses. The remaining 14 percent of total expenditures includes spending on transportation, the economic environment, culture and recreation, and internal services.

2.2.7.2 Public Services

PARKS AND RECREATION

Polk County's Parks and Recreation Division maintains 74 parks covering more than 2,300 acres and providing facilities for camping, fishing, water sports, ball games, and equestrian events. Two county parks are located within 5 miles of the plant island. The IMC Peace River Park is located just outside a 5-mile radius of the plant island. The IMC Peace River Park is a 640-acre regional park consisting of reclaimed phosphate lands. The park has not been developed, but Polk County has applied for a grant from the FDNR to aid in the park development. Phase I of the park development is expected to entail picnic facilities and a boardwalk in a 30-acre area along the Peace River. Construction on Phase I may start as early as the summer of 1992. The City of Bartow and the City of Fort Meade also provide recreation facilities. Bartow has 12 recreational facilities including a civic center, parks, ball fields, picnic areas, a recreation center, and a community center. Fort Meade has eight recreational facilities including parks, boat

ramps, picnic areas, ball fields, and a community center. The Fort Meade Recreation Area on the Peace River provides access to the Peace River, picnic tables, pavilions, and nature trails.

EDUCATIONAL SERVICES

Several colleges and technical schools are located in Polk County, including Florida Southern College and Polk Community College. The University of South Florida is located in Tampa, 30 miles west of Polk County. There are 124 schools in the county, including 59 elementary schools, 29 secondary schools, and 36 other schools including vocational centers and exceptional student centers. Four elementary schools, a middle school, a junior high school, and a high school are located in Bartow. Fort Meade contains two elementary schools, a middle school, and a junior/senior high school. The Florida Department of Education's Statistical Report for 1989-1990 states that Polk County had a classroom teacher to student ratio of 1:16.60. The Polk County School Board's 1991-1992 total budget is $447,124,457 including general revenue, debt service, capital expenditures, and special revenues. Polk County's expenditure per student is $3,965. Local revenue makes up 25 percent of the school board's budget, with federal funds contributing 10 percent and state funds contributing the remaining 65 percent.

Polk County does not provide county-wide library services, but there are nine city-operated libraries and one private library within the county, including city-operated libraries in Bartow and Fort Meade.

The Heartland Private Industry Council provides educational job services to Polk County and the surrounding counties. The center uses federal funds to train and place unemployed persons. Services offered by the council include staffing assistance, occupational skills training, customized training, on-the-job training reimbursement to employers, targeted jobs tax credits to employers, and recruiting services for employers.

PUBLIC SAFETY

Polk County provides public safety services for the entire county. The County's Public Safety offices are located at the Bartow Airbase on Highway 17 between Bartow and Eagle Lake. These offices include the Emergency Management Division, Fire Services, and Emergency Medical Services. The County's Fire Services Division provides fire protection throughout the county through county fire stations and volunteer fire stations. There are 323 full-time

firefighters in the county and 982 volunteers. There is a volunteer fire department located in Fort Meade staffed with 27 volunteers. There are two fire departments located in Bartow, the Bartow Fire Department, staffed with 25 paid personnel and 25 volunteers, and the Polk County Fire Department, staffed with 110 paid personnel and 350 volunteers. The County has a Hazardous Materials Team of 22 persons especially trained to handle chemicals and industrial incidents. This team is located at the Bartow Airbase.

The County Emergency Medical Services has ambulances located at approximately 25 locations throughout the County, including one location in Bartow and one in Fort Meade. There are eight hospitals in Polk County, with major hospitals located in Lakeland and Winter Haven. Two hospitals are located in Bartow. Bartow Memorial has 56 beds and the Polk County General Hospital in Bartow has 180 beds.

Law enforcement is provided by the Polk County Sheriff's Office located in downtown Bartow. A new command center for the Sheriff's office is under construction just south of Winter Haven. The county correctional facilities include a jail and a jail annex in Bartow. In addition to the Polk County Sheriff's Office, the Highway Patrol employs 48 full-time staff in Polk County, and the Cities of Bartow and Fort Meade each have a municipal police force.

Figure 2.2.7-18 shows the location of public service sites including law enforcement, emergency medical services, fire stations, hospitals, and schools.

UTILITY SERVICES

Central water and wastewater services are not currently available at the proposed site. The closest public water and wastewater systems are in the City of Fort Meade, approximately 4 miles southeast of the plant island. The Fort Meade Water Treatment Facility has a capacity of 1.7 million gallons per day (MGD) with current usage at 1.0 MGD or 59% of capacity. The Fort Meade wastewater treatment facility has a capacity of 1.0 MGD and a current usage of 0.49 MGD or 49 percent of capacity. According to the Fort Meade Comprehensive Plan, the wastewater facility is expected to provide sufficient capacity for the City through the year 2010. Expansion of the water treatment facility to a capacity of 2.0 MGD by the year 1995 is listed as a policy in the City's plan. Expansion of the water treatment facility is listed in the capital improvements element as a project for 1993.

SOLID WASTE SERVICES

Solid waste disposal in Polk County is handled by the County. The County operates three regional landfills which are used by the municipalities and the unincorporated areas of the County. In addition to the County's landfills, Lakeland and Fort Meade operate city-owned incinerator facilities. These incinerators are owned and operated by the individual municipality and the County does not use these facilities.

The County's North Central Landfill, located on SR 540 between Lakeland and Winter Haven serves the project site (Figure 2.2.7-19). The North Central Landfill serves 67 percent of the County's population. The landfill began operation in 1980 and consists of 120 acres, 17 acres of which have been filled. The level of service provided by this landfill was 6.3 pounds per capita per day in 1991 according to the Polk County Comprehensive Plan, and is projected to increase to 6.62 pounds per capita per day by 2010. The landfill has a capacity of 24,362,900 cubic yards (10,963,300 tons) and is expected to have excess capacity through the year 2010.

Waste collection services are provided by private companies through county-maintained contracts. The County has contracts with four collection companies: BFI Waste Systems, AAA Disposal, Florida Refuse Service, and Disposall. Florida Refuse provides collection services in the project site area.

TRANSPORTATION

EXISTING TRAFFIC CONDITIONS. Existing traffic conditions in the vicinity of the project have been quantified. Roadway and intersection volumes have been obtained along with the geometric configurations to determine the existing levels of service (LOS) in the study area for the morning and afternoon peak hours.

STUDY AREA. Roadways and intersections on which project traffic is expected to have a significant impact were included in the area of study. Since construction and operations traffic have significantly different traffic generation characteristics, two study areas have been defined. The study area for each analysis was based on the project traffic assigned to the roadways.

The study area was determined to be roadways on which the construction or operation traffic contributes 5 percent or more of the LOS C volume. In accordance with Polk County guidelines, the determination of project impact is based on peak-hour peak-direction volumes.

LEVELS OF SERVICE. The concept of LOS is defined as a qualitative measure describing operational conditions within a traffic stream, and the perception of those conditions by motorists and passengers (TRB, 1985). A LOS definition generally describes these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety.

Six levels of service are defined. They are given letter designations, from A to F, with LOS A representing the best operating conditions and LOS F representing the worst. The operational conditions for these six designations can be conceptually described as follows (TRB, 1985):

- *LOS A* - Motorists are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist and passenger is excellent.

- *LOS B* - Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver within the traffic stream from LOS A. The level of comfort and convenience provided is somewhat less than at LOS A, because the presence of others in the traffic stream begins to affect individual motorist behavior.

- *LOS C* - The operation of individual motorists becomes significantly affected by interactions with others in the traffic stream. The selection of speed is affected by the presence of others, and maneuvering within the traffic stream requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeably at this level.

- *LOS D* - Speed and freedom to maneuver are severely restricted, and the motorist experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.

- *LOS E* - All speeds are reduced to a low, but relatively uniform value. Freedom to maneuver within the traffic stream is extremely difficult, and it is generally accomplished by forcing a vehicle to "give way" to accommodate such maneuvers. Comfort and convenience levels are extremely poor.

- *LOS F* - Operational conditions are forced or have broken down. This condition exists wherever the amount of traffic approaching a point exceeds the amount which can traverse the point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go waves. Vehicles may progress at reasonable speeds for several hundred feet or more, then be required to stop in a cyclic fashion.

These definitions are general and conceptual in nature, and they apply primarily to uninterrupted flow. Levels of service for other facilities, such as intersections, vary widely in terms of both the user's perception of service quality and the operational variables used to describe them.

Roadways in the study area all have an adopted LOS standard, from the Florida Department of Transportation (FDOT) and/or Polk County, indicating the lowest acceptable LOS for that roadway. These standards are adopted by local governments as part of their comprehensive plans and are enforced in the development review process. The adopted LOS standards for roadways in the study area are shown in Table 2.2.7-2.

The following existing conditions analysis includes the roadways and intersections from the construction traffic impact area since it is the larger of the two study areas.

ROADWAY CONFIGURATION. Roadways in the project area were evaluated to determine their existing lane configuration and LOS volumes. Polk County and FDOT have different LOS volumes adopted for the state roads within the study area. FDOT has recently adopted the 1992 Florida's Level of Service Standards and Guidelines Manual for Planning. As a part of the Comprehensive Plan, Polk County has adopted LOS volumes which are based on the 1989 Florida's Level of Service Standards and Guidelines Manual for Planning. Since Polk County cannot accept the new FDOT volumes until a plan amendment accepting the new manual has been adopted, two capacity analyses have been performed for each roadway.

Roadways were divided into segments for analysis purposes. The segments were defined with major intersections or changes in roadway geometry at each end. Table 2.2.7-2 summarizes the existing roadway configuration, area type, and government agency responsible for maintenance for each segment. Table 2.2.7-3 provides the LOS volumes used by Polk County in determining existing conditions for each road. A similar table provides the FDOT LOS volumes (Table 2.2.7-4). The LOS volumes are provided for peak hour/peak direction assessment as required by Polk County and FDOT.

ROADWAY VOLUMES. Existing volumes were obtained for the roads in the vicinity of the power plant site. Volumes were obtained from FDOT and Polk County in locations where they were available. Additional traffic counts were conducted as necessary, the results of which are provided in Appendix 10.8.1.

Daily volumes were available on several area roads. Table 2.2.7-5 shows the daily volumes on area roads, as well as the date of the count. Figure 2.2.7-20 illustrates the daily volumes on area roads.

For the determination of LOS, actual a.m. and p.m. peak hour volumes were obtained for roadway links that are in the study network by conducting turning movement volume counts at the study intersections. Volumes were converted to a peak season basis using weekly adjustment factors provided by FDOT for Polk County. For some of the roads outside of the study area, peak hour volumes were determined using generalized K and D factors. K and D factors are used to quantitatively relate peak hour and peak direction volumes to daily volumes on a roadway segment. The K factor, also called a Design Hour factor, is the ratio of the two-way design hour volume to the average annual daily traffic. The D, or Directional, factor is a measure of the peak direction of traffic relative to the total volume of peak hour traffic. The roads for which volumes were determined using generalized K and D factors were listed for reporting purposes. The existing peak season roadway conditions are listed in Table 2.2.7-6. Figures 2.2.7-21 and 2.2.7-22 illustrate the a.m. and p.m. peak hour volumes.

SR 37 from CR 630 to the beginning of the 4-lane section at Cameron Street was found to be operating at a LOS D using both the FDOT and Polk County generalized LOS tables. The adopted LOS for this roadway segment is C. For future conditions, a more detailed analysis was performed as described in Section 4.6.1.4.

No other capacity deficiencies were found to exist on area roads. A deficiency unrelated to capacity exists on CR 555. The section of CR 555 between CR 640 and Agricola Road is currently in extremely poor condition. The pavement is severely damaged and prone to flooding.

PROGRAMMED IMPROVEMENTS. FDOT has scheduled work projects which will improve the existing conditions of some roads in the study area. Using federal aid, FDOT has a project funded to widen and resurface the section of CR 555 which is in poor condition. The project is funded in fiscal year 1991-1992 under Work Program Improvement (WPI) No. 1127904.

FDOT is also currently funding a Project Development and Environmental study for SR 60A (Van Fleet Drive) from CR 555 to the Peace River (WPI No. 1118291). The project is to identify a long term solution to expected future capacity deficiencies on SR 60A and U.S. 98 in the Bartow area. The study is evaluating not only improvements to existing roads, but also the construction of new roads which would alter travel patterns through critical areas. While an alternative has not yet been selected for implementation, it is expected that the improvement will be in place prior to the construction traffic peak examined in Section 4.6.1.

INTERSECTION VOLUMES. Volumes were obtained for the eleven intersections that are in the study area for the power plant. Volumes at the five intersections in Bartow were obtained from FDOT. Volumes at the remaining intersections were collected by FPC's consultants in the latter half of 1991.

Using hourly volumes from 24-hour machine counters, it was found that the peak hour of the day occurs between 6:00 and 8:00 a.m., depending on the facility. The highest afternoon hours were found to occur between the 3:00 to 4:30 p.m. time period.

The early peak hours, with the highest hour occurring in the morning, is a result of the industrial related traffic. Data were collected between 6:00 and 8:00 a.m., and between 3:00 and 4:30 p.m. The counts were conducted in December 1991 and July 1991. Turning movement volumes are included in Appendix 10.8.1.

Existing traffic volumes were increased to peak season levels using the FDOT weekly adjustment factors for Polk County. Peak season intersection volumes are shown in Appendix 10.8.2. For this analysis, the highest hour during the a.m and p.m. periods was used.

The study intersections were analyzed to determine the existing LOS. Unsignalized intersections were evaluated to determine if the installation of a traffic signal is warranted. None of the five unsignalized intersections was found to meet traffic signal volume warrants at this time.

All of the study intersections were analyzed using the Transportation Research Board's 1985 Highway Capacity Manual (HCM) signalized intersection methodology. Use of this methodology does not indicate the need for signalization nor is its use predicated upon the installation of a traffic signal. Rather its use at both signalized and unsignalized intersections is intended to derive an overall intersection LOS indication for each.

The results of the intersection analysis are shown in Table 2.2.7-7 and graphically on Figures 2.2.7-23 and 2.2.7-24. All of the intersections are currently operating at an acceptable LOS.

RAIL TRANSPORTATION. Rail transportation in Polk County is provided by CSX Transportation, Inc., and Florida Midland Railroad. The active rail lines on Florida Midland Railroad consist of a north-south route serving locally between Frostproof and Lake Wales, an east-west route serving locally through Lake Wales, and a northeast-southwest route connecting the Bartow Airbase to the CSX route SX-810. Since the remaining active rail lines on Florida Midland Railroad are local lines and are irrelevant to the FPC power plant site, the existing condition study for rail transportation in Polk County was focused on CSX transportation routes.

There are several north-south CSX rail routes currently serving Polk County, with an east-west route (A-301) connecting all the north-south routes (Figure 2.2.7-25). Route A-301 enters Polk County from the northeast at the County line adjacent to Osceola County, runs westward mostly along US 92/17 through Haines City, Lake Alfred, East Lakeland Carters Corner, and Lakeland. It then leaves Polk County and enters Hillsborough County. This key east-west rail route also serves the Tampa area and connects with rail routes through the northern area of Florida. In addition to route A-301, east-west route SV-820 runs from Bartow westward through Mulberry to the Polk/Hillsborough County line and route SV-822/SV-825 runs from Fort Meade northwesterly through Bradley Junction, Agricola, Brewster, and Pinedale/Pierce, and then leaves Polk County at the vicinity of route SV-820.

The north-south CSX rail routes in Polk County include routes AY-306, SV-822, AR-370, AX-330, and SX-810. Route AY-306 starts from route A-301 in West Lakeland and runs southward

through Mulberry and Green Bay and terminates at the FPC Polk County Site. Route SV-822 enters Polk County from Hardee County, runs northerly through Baird Station, west of Bradley Junction, Agricola/Brewster, and turns northwesterly towards Hillsborough County. Route SVH-823 connects route A-306 and route SV-822 to form a complete north-south rail route from Lakeland to the Polk/Hardee County line. Another CSX north-south rail route that runs between Lakeland and the Polk/Hardee County line is route AX-330. Route AX-330 runs along U.S. 17 from route A-301 through Lakeland, Highland City, Bartow, and Fort Meade. The portion of route AX-330 between Bartow and CR 640 is partially abandoned. The continuity of route AX-330 is maintained by the connections with route SVE-824 which runs just east of U.S. 17. Route AR-370 runs northwesterly from route A-301 to the Polk/Pasco County line, northwesterly through North Lakeland and Kathleen. Route SX-810 is the north-south rail route that runs through central Polk County between route A-301 and the Polk/Highlands County line. This rail route starts from A-301 in Auburndale, runs through Winter Haven, Eagle Lake, west of Lake Wales and Highland Park, west of Frostproof, and leaves Polk County just east of U.S. 27/98. At Eagle Lake, a local Florida Midland Railroad connects with CSX route SX-810 and runs southwesterly to Bartow Airbase.

In addition to the main east-west and north-south CSX rail routes, a few local spur lines also serve the Polk County area.

The most probable rail route for transporting coal overland to the FPC Polk County Site includes route A-301 and route AY-306. The existing conditions on the probable rail route such as number of crossings, number of trains per day, traffic volumes on crossing highways, and the maximum train travel speed limits were identified by using the FDOT Railroad Crossing Locator maps and the Rail-Highway Crossing Inventory. The resulting information is summarized in Table 2.2.7-8. As shown in Table 2.2.7-8, the total number of rail crossings on the probable rail route in Polk County is 86, including 14 private crossings. The number of trains per day ranges mostly from 11 to 24 with some crossings having less train traffic. One private crossing has 45 trains per day.

The maximum train speed falls mostly between 40 mph and 79 mph. Most of the highway crossings carry less than 5,000 vehicles per day (vpd) and the highest volume, 21,800 vpd, occurred at the crossing of U.S. 98 and CSX route A-301 in Lakeland.

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TABLE 2.2.7-1
POLK COUNTY BUDGET FOR 1991-1992

Revenues	Million $	Per Capita	Expenditures	Million $	Per Capita
Taxes	82.72	204.05	General Government	44.88	110.71
Licenses/Permits	2.31	5.70	Public Safety	69.39	171.17
Intergovernmental	42.43	104.67	Physical Environment	69.13	170.53
Charges for Services	7.87	19.41	Transportation	28.33	69.88
Fines/Forfeitures	3.43	8.46	Economic Environment	8.67	21.39
Miscellaneous	20.83	51.38	Human Services	51.45	126.92
Non-Revenues(1)	138.31	341.18	Culture/Recreation	6.01	14.83
Internal Service	2.01	4.96	Internal Services	2.15	5.30
Enterprises	42.59	105.06	Miscellaneous	62.50	154.18
Total(2)	342.50	844.87	Total(2)	342.50	844.91

(1) Non-Revenues are defined by Polk County to include court remittances, interfund transfers, trust fund receipts, debt proceeds, budgeted non-revenue, and other non-revenue.

(2) Differences due to rounding.

Sources: Polk County Office of Management and Budget, 1991
Moore/Bowers, 1992

TABLE 2.2.7-2
EXISTING ROADWAY CONFIGURATION

Roadway Segment	No. of Lanes	Type	Agency	Polk LOS Standard[1]	FDOT LOS Standard[2]
State Road 37:					
Carter Rd to SR 60	4 Divided	Urban	FDOT	D	D
SR 60 to Cameron St	4 Divided	Urban	FDOT	D	D
Cameron Stt to CR 640	2 Undivided	Rural	FDOT	C	C
CR 640 to CR 630	2 Undivided	Rural	FDOT	C	C
CR 630 to CR 674	2 Undivided	Rural	FDOT	C	C
County Road 555:					
SR 60 to CR 640	2 Undivided	Rural	Polk	D	N/A
CR 640 to Plant Entrance	2 Undivided	Rural	Polk	D	N/A
Plant Entrance to CR 630	2 Undivided	Rural	Polk	D	N/A
U.S. 98:					
CR 540A to Manor Dr	4 Divided	Rural	FDOT	D	B
Manor Dr to SR 60A	6 Divided	Urban	FDOT	D	C
U.S. 17:					
CR 630 to S. 9th Street	4 Divided	Urban	FDOT	D	C
S. 9th Street to Sand Mountain Rd	4 Divided	Rural	FDOT	D	B
U.S. 17/98:					
SR 60 to CR 640	4 Divided	Rural	FDOT	C	B
CR 640 to CR 630	4 Divided	Rural	FDOT	C	B

TABLE 2.2.7-2
EXISTING ROADWAY CONFIGURATION

Roadway Segment	No. of Lanes	Type	Agency	Polk LOS Standard[1]	FDOT LOS Standard[2]
State Road 60:					
County Road 676 to State Road 37	4 Divided	Urban	FDOT	D	D
State Road 37 to County Road 555	4 Divided	Rural	FDOT	C	B
County Road 555 to State Road 60A	4 Divided	Urban	FDOT	D	C
State Road 60A:					
State Road 60 to U.S. 98	4 Divided	Urban	FDOT	D	C
U.S. 98 to Wilson Avenue	4 Divided	Urban	FDOT	D	C
Wilson Avenue to Van Fleet Drive	4 Divided	Urban	FDOT	D	C
County Road 640:					
Hillsborough County to State Road 37	2 Undivided	Rural	Polk	D	N/A
State Road 37 to County Road 555	2 Undivided	Rural	Polk	D	N/A
County Road 555 to U.S. 17/98	2 Undivided	Rural	Polk	D	N/A
U.S. 17/98 to Pool Branch Road	2 Undivided	Rural	Polk	D	N/A
County Road 630:					
State Road 37 to County Road 555	2 Undivided	Rural	Polk	D	N/A
County Road 555 to U.S. 17/98	2 Undivided	Rural	Polk	D	N/A

Note: N/A = Not Applicable

(1) Polk County Comprehensive Plan adopted 1989 FDOT standards.

(2) FDOT, 1992. Florida's Level of Service Standards and Guidelines for Planning, 1992.

Source: Kimley-Horn, 1992

TABLE 2.2.7-3
POLK COUNTY LEVEL OF SERVICE VOLUMES
PEAK HOUR/PEAK DIRECTION

Roadway Segment	A	B	C	D	E
SR 37:					
Carter Rd to SR 60	1,620	1,730	1,790	1,890	1,990
SR 60 to Cameron St	1,080	1,610	1,680	1,760	1,850
Cameron St to CR 640	170	330	540	870	1,400
CR 640 to CR 630	170	330	540	870	1,400
CR 630 to CR 674	170	330	540	870	1,400
CR 555:					
SR 60 to CR 640	170	330	540	870	1,400
CR 640 to Plant Entrance	170	330	540	870	1,400
Plant Entrance to CR 630	170	330	540	870	1,400
U.S. 98:					
CR 540A to Manor Dr	1,620	1,730	1,790	1,890	1,990
Manor Dr to SR 60A	--	--	1,660	2,510	2,720
U.S. 17:					
CR 630 to S. 9th St	--	--	1,090	1,640	1,800
S. 9th St to Sand Mountain Rd	1,160	1,690	2,280	2,810	3,520

TABLE 2.2.7-3
POLK COUNTY LEVEL OF SERVICE VOLUMES
PEAK HOUR/PEAK DIRECTION

Roadway Segment	A	B	C	D	E
U.S. 17/98:					
SR 60 to CR 640	1,160	1,690	2,280	2,810	3,520
CR 640 to CR 630	1,160	1,690	2,280	2,810	3,520
SR 60:					
CR 676 to SR 37	1,160	1,690	2,280	2,810	3,520
SR 37 to CR 555	1,160	1,690	2,280	2,810	3,520
CR 555 to SR 60A	1,160	1,690	2,280	2,810	3,520
SR 60A:					
SR 60 to U.S. 98*	1,080	1,610	1,680	1,760	1,850
U.S. 98 to Wilson Ave	1,080	1,610	1,680	1,760	1,850
Wilson Ave to Van Fleet Dr	1,080	1,610	1,680	1,760	1,850
CR 640:					
Hillsborough County to SR 37	170	330	540	870	1,400
SR 37 to CR 555	170	330	540	870	1,400
CR 555 to U.S. 17/98	170	330	540	870	1,400
U.S. 17/98 to Pool Branch Rd	170	330	540	870	1,400
CR 630:					
SR 37 to CR 555	170	330	540	870	1,400
CR 555 to U.S. 17/98	170	330	540	870	1,400

Note: *Based on 4 Lane Service Volume
Source: Kimley-Horn, 1992; Polk County

TABLE 2.2.7-4
FDOT LEVEL OF SERVICE VOLUMES
PEAK HOUR/PEAK DIRECTION

Roadway Segment	A	B	C	D	E
SR 37:					
Carter Rd to SR 60	--	1,340	1,650	1,770	1,770
SR 60 to Cameron St	--	1,340	1,650	1,770	1,770
Cameron St to CR 640	140	280	460	740	1,190
CR 640 to CR 630	140	280	460	740	1,190
CR 630 to CR 674	140	280	460	740	1,190
U.S. 98:					
CR 540A to Manor Dr	1,110	1,660	2,190	2,680	3,080
Manor Dr to SR 60A	--	1,920	2,330	2,510	2,510
U.S. 17:					
CR 630 to S. 9th St	--	1,250	1,540	1,660	1,670
S. 9th St to Sand Mountain Rd	1,110	1,660	2,190	2,680	3,080
U.S. 17/98:					
SR 60 to CR 640	1,110	1,660	2,190	2,680	3,080
CR 640 to CR 630	1,110	1,660	2,190	2,680	3,080
SR 60:					
CR 676 to SR 37	570	1,450	1,900	2,210	2,600
SR 37 to CR 555	1,110	1,660	2,190	2,680	3,080
CR 555 to SR 60A	--	1,250	1,540	1,660	1,670
SR 60A:					
SR 60 to U.S. 98	--	1,250	1,540	1,660	1,670
U.S. 98 to Wilson Ave	--	1,250	1,540	1,660	1,670
Wilson Ave to Van Fleet Dr	--	1,250	1,540	1,660	1,670

Source: Kimley-Horn, 1992; FDOT, 1992.

TABLE 2.2.7-5
DAILY ROADWAY VOLUMES

Roadway Segment*	Daily Volume	Date of Count	Source
SR 37:			
Carter Rd to SR 60	14,404	2-21-90	FDOT
SR 60 to Cameron St	12,027	2-21-90	FDOT
Cameron St to CR 640	7,963	2-21-90	FDOT
CR 640 to CR 630	3,620	5-3-89	FDOT
CR 630 to CR 674	3,907	3-29-89	FDOT
CR 555:			
SR 60 to CR 640	4,400	1991 AADT	FDOT
CR 640 to Plant Entrance	1,667	7/91	KHA
Plant Entrance to CR 630	1,666	7/91	KHA
U.S. 98:			
CR 540A to Manor Dr	28,400	1991 AADT	FDOT
Manor Dr to SR 60A	27,400	1991 AADT	FDOT
U.S. 17:			
CR 630 to S.E. 9th Street	8,950	4-10-89	FDOT
U.S. 17/98:			
SR 60 to CR 640	9,174	4-10-89	FDOT
CR 640 to CR 630	13,770	2-21-90	FDOT
State Road 60:			
CR 676 to SR 37	21,422	2-21-90	FDOT
SR 37 to CR 555	18,000	1991 AADT	FDOT
CR 555 to SR 60A	19,800	1991 AADT	FDOT
SR 60A:			
SR 60 to U.S. 98	14,600	1991 AADT	FDOT
U.S. 98 to Wilson Ave	24,100	1991 AADT	FDOT
CR 640:			
Hillsborough County to SR 37	N/A	N/A	N/A
SR 37 to CR 555	3,737	1989	PC
CR 555 to U.S. 17/98	2,448	1989	PC
U.S. 17/98 to Pool Branch Rd	N/A	N/A	N/A
CR 630:			
SR 37 to CR 555	2,455	1989	PC
CR 555 to U.S. 17/98	N/A	N/A	N/A

* See Figure 2.2.7-20 for locations

Sources: N/A = Not Available
AADT = Average Annual Daily Traffic
FDOT = Florida Department of Transportation
KHA = Kimley-Horn & Associates
PC = Polk County Engineering Department

TABLE 2.2.7-6
EXISTING PEAK SEASON ROADWAY CONDITIONS

Roadway Segment[1]	A.M. Peak Hour				P.M. Peak Hour			
	Northbound/ Eastbound	Southbound/ Westbound	Polk LOS	FDOT LOS	Northbound/ Eastbound	Southbound/ Westbound	Polk LOS	FDOT LOS
SR 37:								
Carter Rd to SR 60	491	934	A	B	1,255	661	A	B
SR 60 to Cameron St	360	592	A	B	973	354	A	B
Cameron St to CR 640	201	661	D	D	572	192	D	D
CR 640 to CR 630	546	163	D	D	458	142	C	C
CR 630 to CR 674[2]	214	168	B	B	168	214	B	B
CR 555:								
SR 60 to CR 640	140	309	B	N/A	287	90	B	N/A
CR 640 to Plant Entrance	42	204	B	N/A	170	31	A	N/A
Plant Entrance to CR 630	46	147	A	N/A	120	40	A	N/A
U.S. 98:								
CR 540A to Manor Dr	931	1,670	B	C	1,844	1,241	D	C
Manor Dr to SR 60A	1,046	1,677	D	B	1,946	1,357	D	C
U.S. 17:								
CR 630 to S.E. 9th Street	416	392	C	B	494	544	C	B
U.S. 17/98:								
SR 60 to CR 640	458	337	A	A	489	477	A	A
CR 640 to CR 630	513	445	A	A	546	506	A	A

TABLE 2.2.7-6
EXISTING PEAK SEASON ROADWAY CONDITIONS

Roadway Segment[1]	A.M. Peak Hour				P.M. Peak Hour			
	Northbound/ Eastbound	Southbound/ Westbound	Polk LOS	FDOT LOS	Northbound/ Eastbound	Southbound/ Westbound	Polk LOS	FDOT LOS
SR 60:								
CR 676 to SR 37	864	692	A	B	722	1,085	A	B
SR 37 to CR 555	944	669	A	A	780	935	A	A
CR 555 to SR 60A	798	621	A	B	996	928	A	B
SR 60A:								
SR 60 to U.S. 98	587	486	B	B	834	664	C	B
U.S. 98 to Wilson Ave	999	1,035	A	B	1,114	1,217	B	B
Wilson Ave to Van Fleet Dr	990	1,131	B	B	1,228	1,244	B	B
CR 640:								
Hillsborough County to SR 37	240	291	B	N/A	243	201	B	N/A
SR 37 to CR 555	108	201	B	N/A	161	122	A	N/A
CR 555 to U.S. 17/98	76	128	A	N/A	131	99	A	N/A
U.S. 17/98 to Pool Branch Rd	69	116	A	N/A	111	68	A	N/A
CR 630:								
SR 37 to CR 555	64	247	B	N/A	167	50	A	N/A
CR 555 to U.S. 17/98	125	210	B	N/A	240	162	B	N/A

Notes: [1] See Figures 2.2.7-21 and 2.2.7-22 for locations.
[2] Volumes estimated from generalized K and D factors.
N/A = Not Available

Source: Kimley-Horn, 1992.

TABLE 2.2.7-7
EXISTING INTERSECTION CONDITIONS

Intersection*	Count Source	A.M. LOS	P.M. LOS
SR 37 and SR 60	KHA	C	C
SR 37 and CR 640	KHA	A	B
CR 555 and SR 60	KHA/FDOT	B	B
CR 555 and CR 640	KHA	A	B
CR 555 and CR 630	FDOT	A	A
SR 60 and SR 60A	FDOT	A	C
U.S. 98 and Manor Dr	FDOT	C	C
U.S. 98 and SR 60A	FDOT	D	D
SR 60A and Wilson Ave	FDOT	B	B
U.S. 17/98 and CR 640	KHA	A	A
U.S. 17/98 and CR 630	KHA	C	C

Note: *See Figures 2.2.7-23 and 2.2.7-24 for location.

Sources: KHA = Kimley-Horn & Associates, 1991
FDOT = Florida Department of Transportation, calibrated December 1991 by Kimley-Horn & Associates

TABLE 2.2.7-8
EXISTING CONDITIONS ON PROBABLE RAIL ROUTE
FOR FPC COAL TRANSPORTATION IN POLK COUNTY

Total Number of Private Crossings	14
Total Number of Public Crossings	72
Total Number of Active Crossings	86

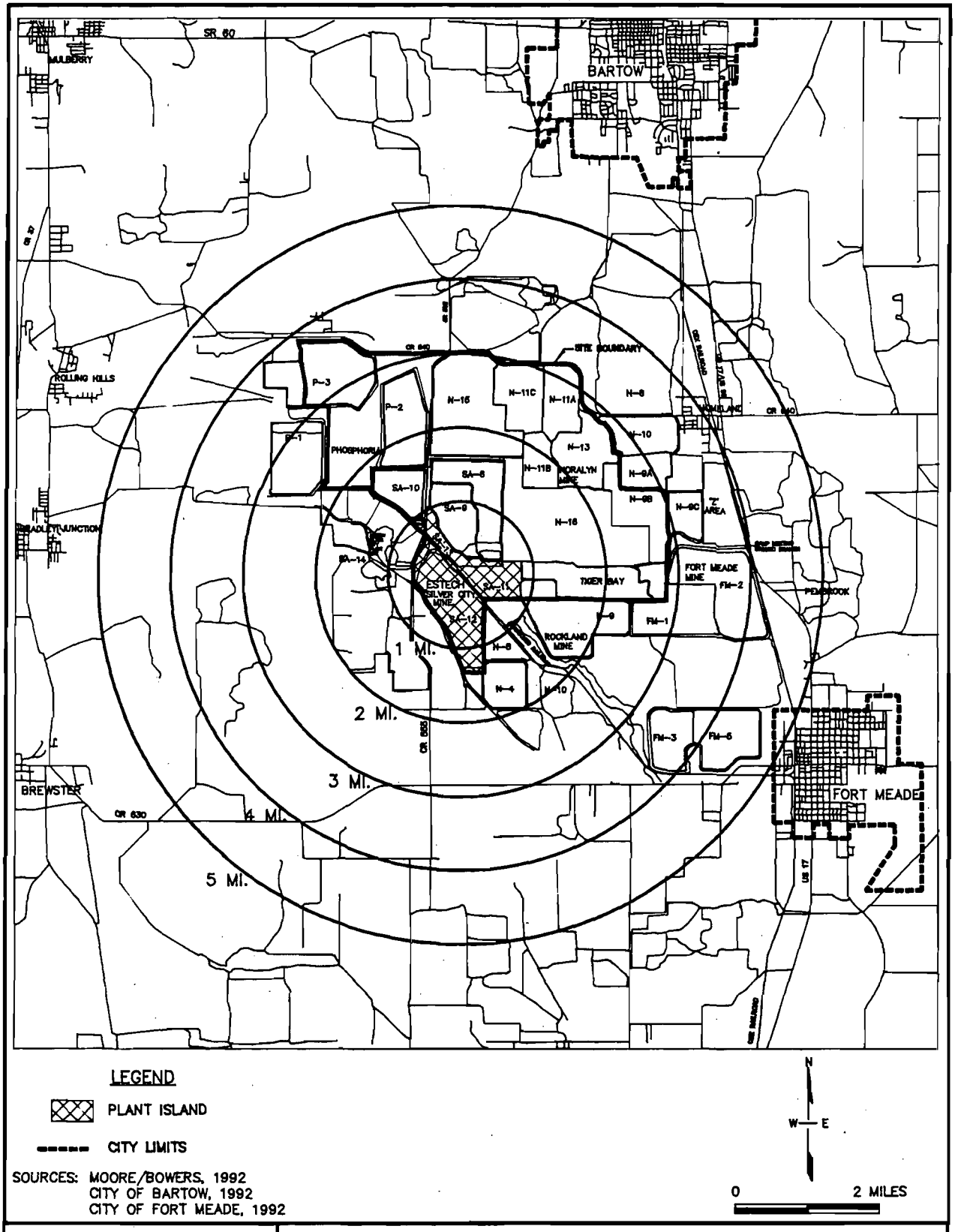
Number of Trains per Day		Maximum Train Speed	
No. of Trains	No. of Crossings	Maximum Speed	No. of Crossings
Less than 10	6	Less than 20	5
11	21	40	29
13	21	45	13
18	1	50	12
20	12	65	1
22	8	70	7
24	16	79	19
45	1	Avg Max Speed	Total
Total	86	52	86
Avg No. Trains	16		

Volumes on Crossing Highways at Public Crossings

Daily Volumes	Number of Crossings
Less than 500	6
501 to 5,000	44
5,001 to 10,000	7
10,001 to 15,000	8
15,001 to 20,000	6
20,001 and up	1
Total	72
Average Volume	5,000

Note: Probable rail route includes route A-301 and route AY-306.

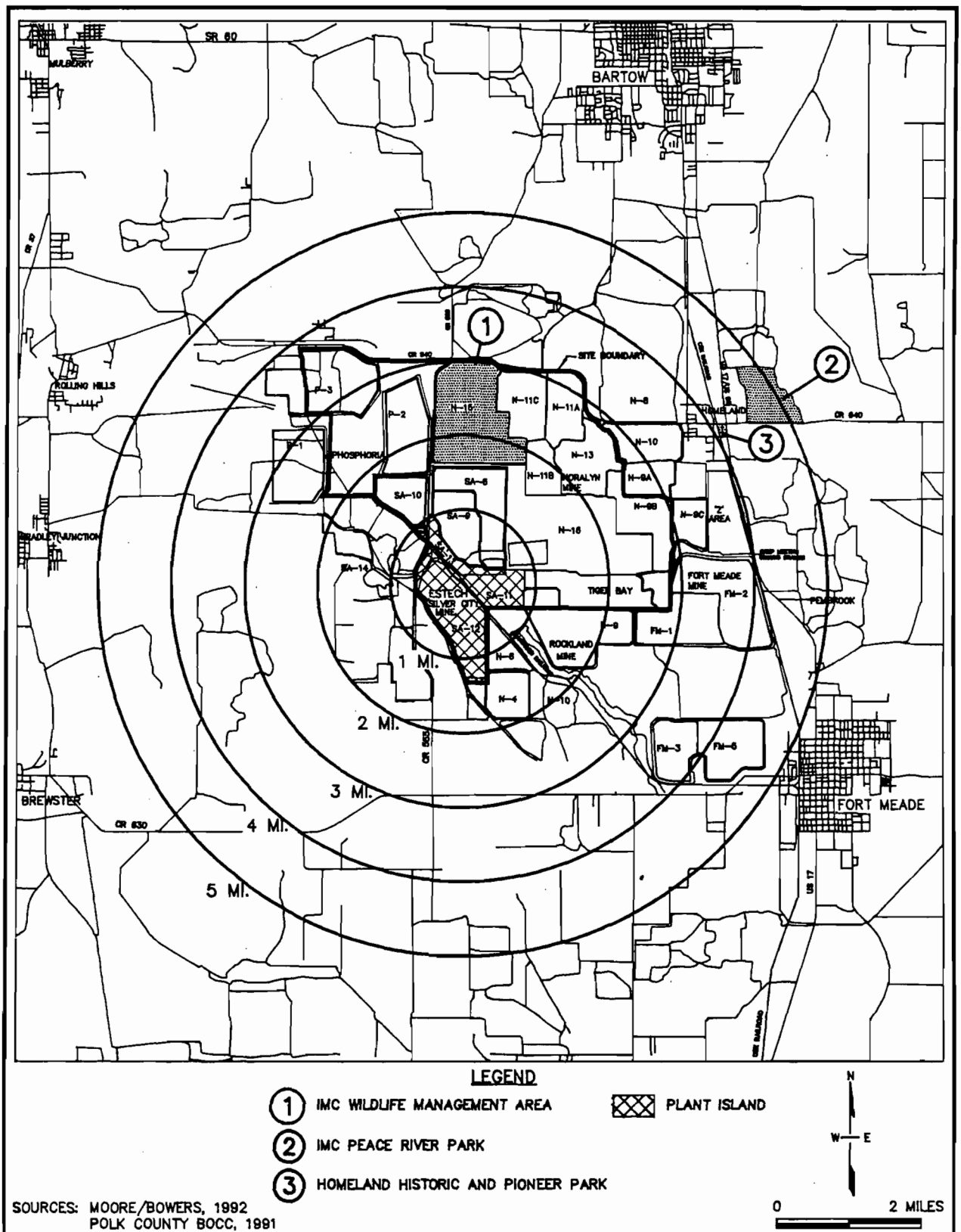
Sources: Kimley-Horn, 1992
FDOT, 1980s. Railroad Crossing Location Maps.
FDOT, 1990. Rail-Highway Crossing Inventory.



Florida Power CORPORATION

Polk County Site

FIGURE 2.2.1-1
GOVERNMENTAL JURISDICTIONS WITHIN FIVE MILES OF THE PLANT ISLAND

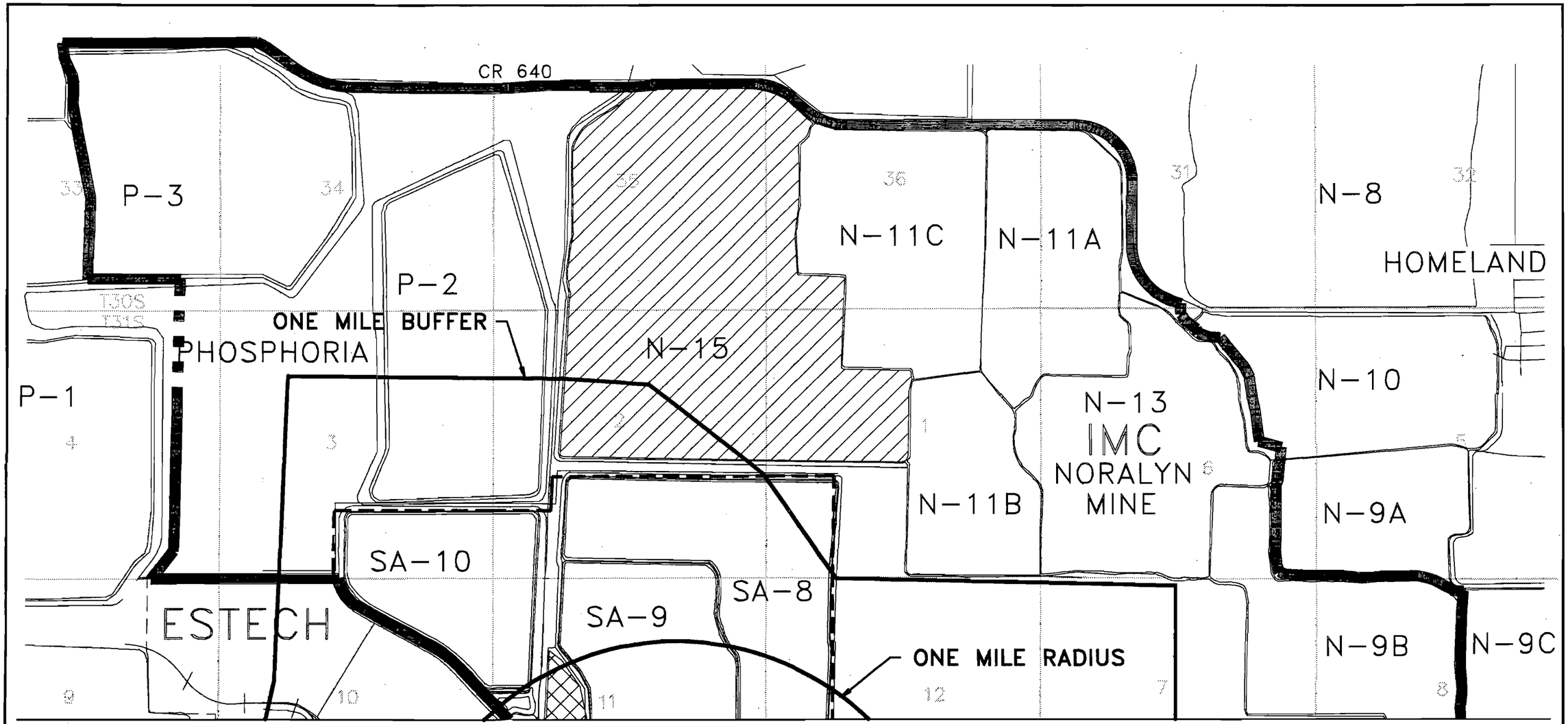


SOURCES: MOORE/BOWERS, 1992
POLK COUNTY BOCC, 1991

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.1-2
PARKS AND RECREATION AREAS WITHIN FIVE MILES OF THE PLANT ISLAND

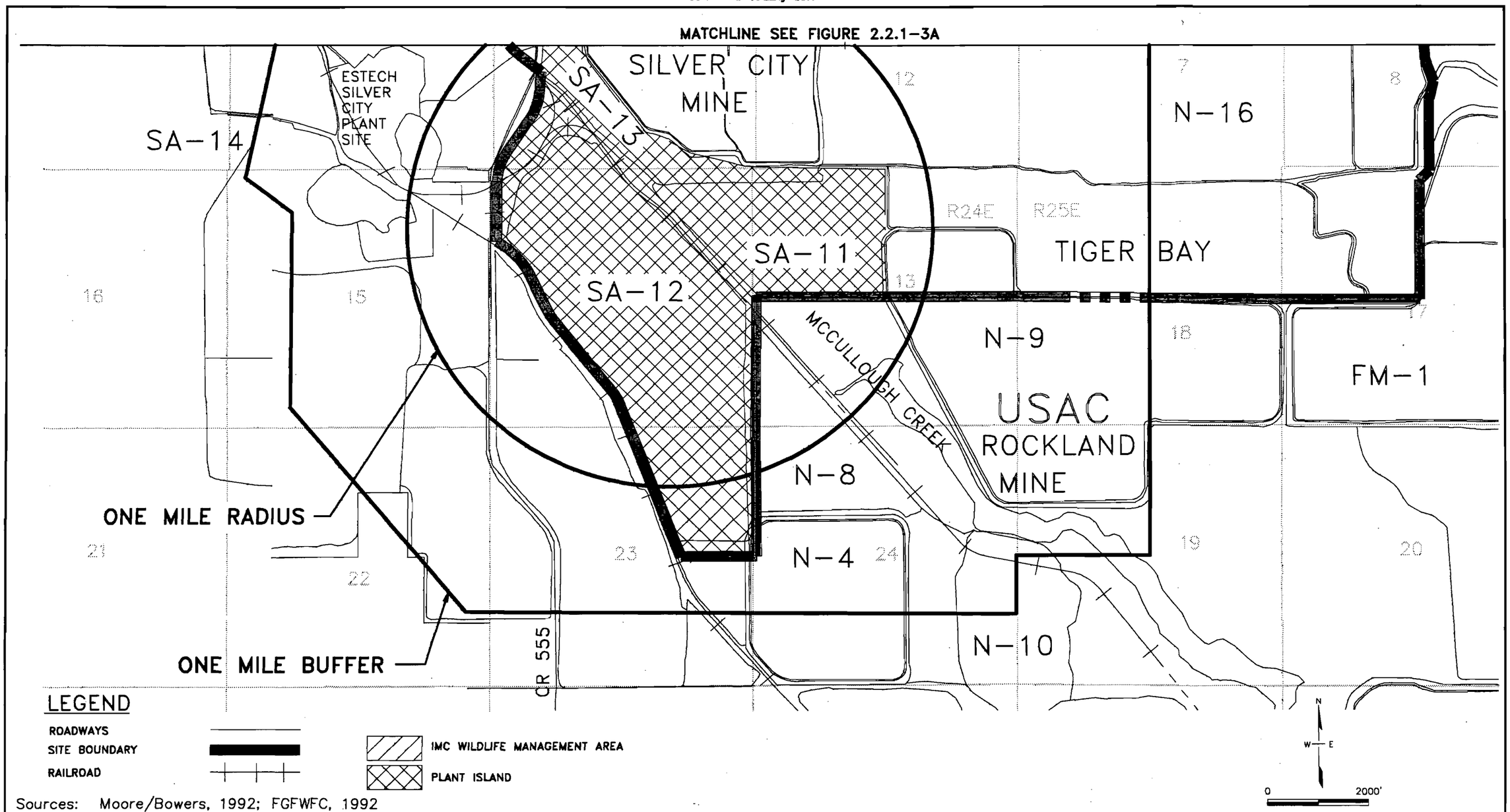


Sources: Moore/Bowers, 1992; FGFWFC, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.1-3A
PARKS AND RECREATION AREAS WITHIN ONE MILE OF THE PLANT ISLAND
SHEET A

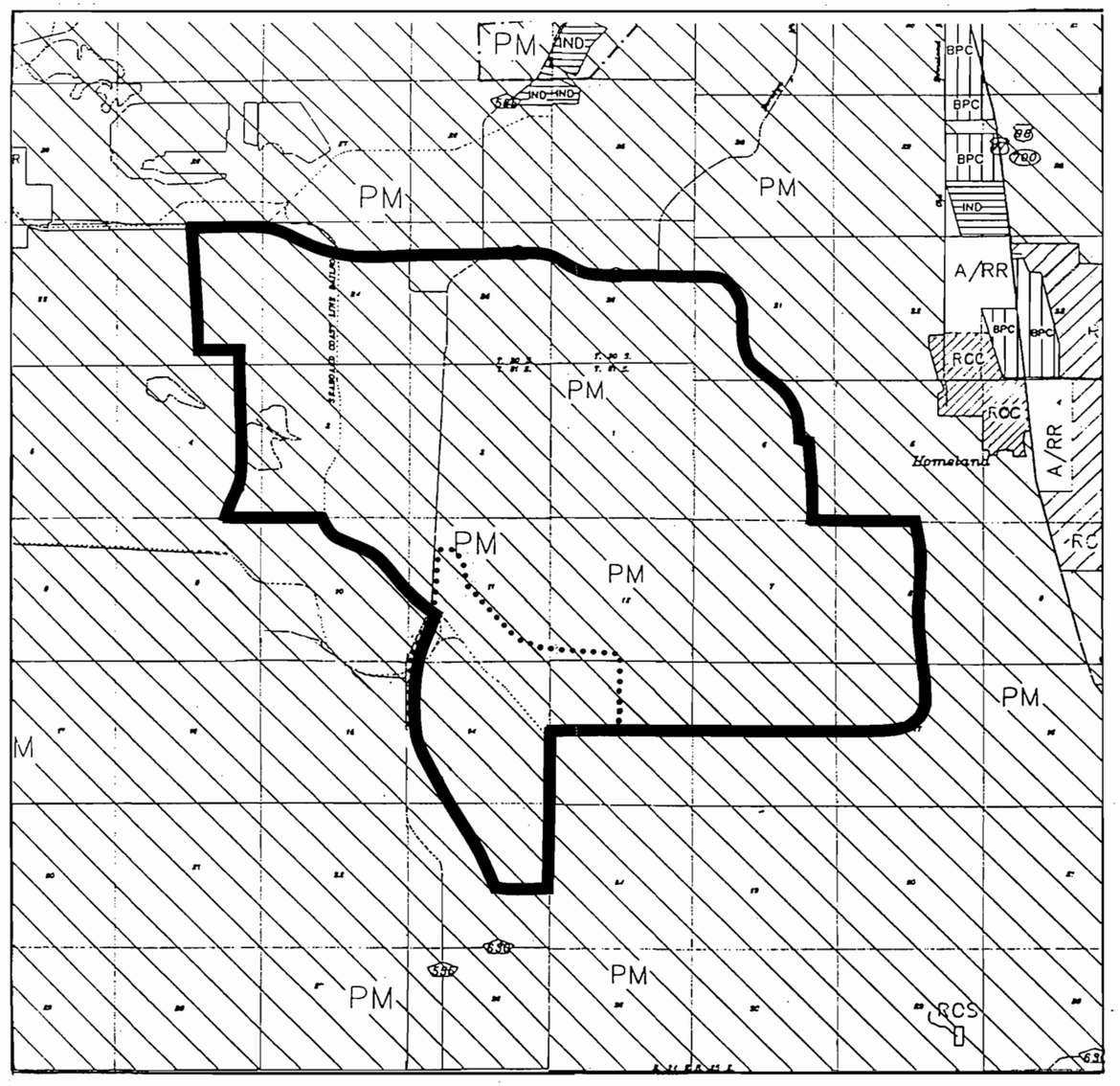


Sources: Moore/Bowers, 1992; FGFWFC, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.1-3B
PARKS AND RECREATION AREAS WITHIN ONE MILE OF THE PLANT ISLAND
SHEET B



LEGEND

A/RR	AGRICULTURE/RESIDENTIAL-RURAL
BPC	BUSINESS-PARK CENTER
CE	COMMERCIAL ENCLAVE
IND	INDUSTRIAL
LCC	LINEAR COMMERCIAL CENTER
PM	PHOSPHATE MINING
RCC	RURAL-CLUSTER CENTER
RL	RESIDENTIAL-LOW DENSITY
ROS	RECREATION AND OPEN SPACE

SITE BOUNDARY

PLANT ISLAND

N
W — E

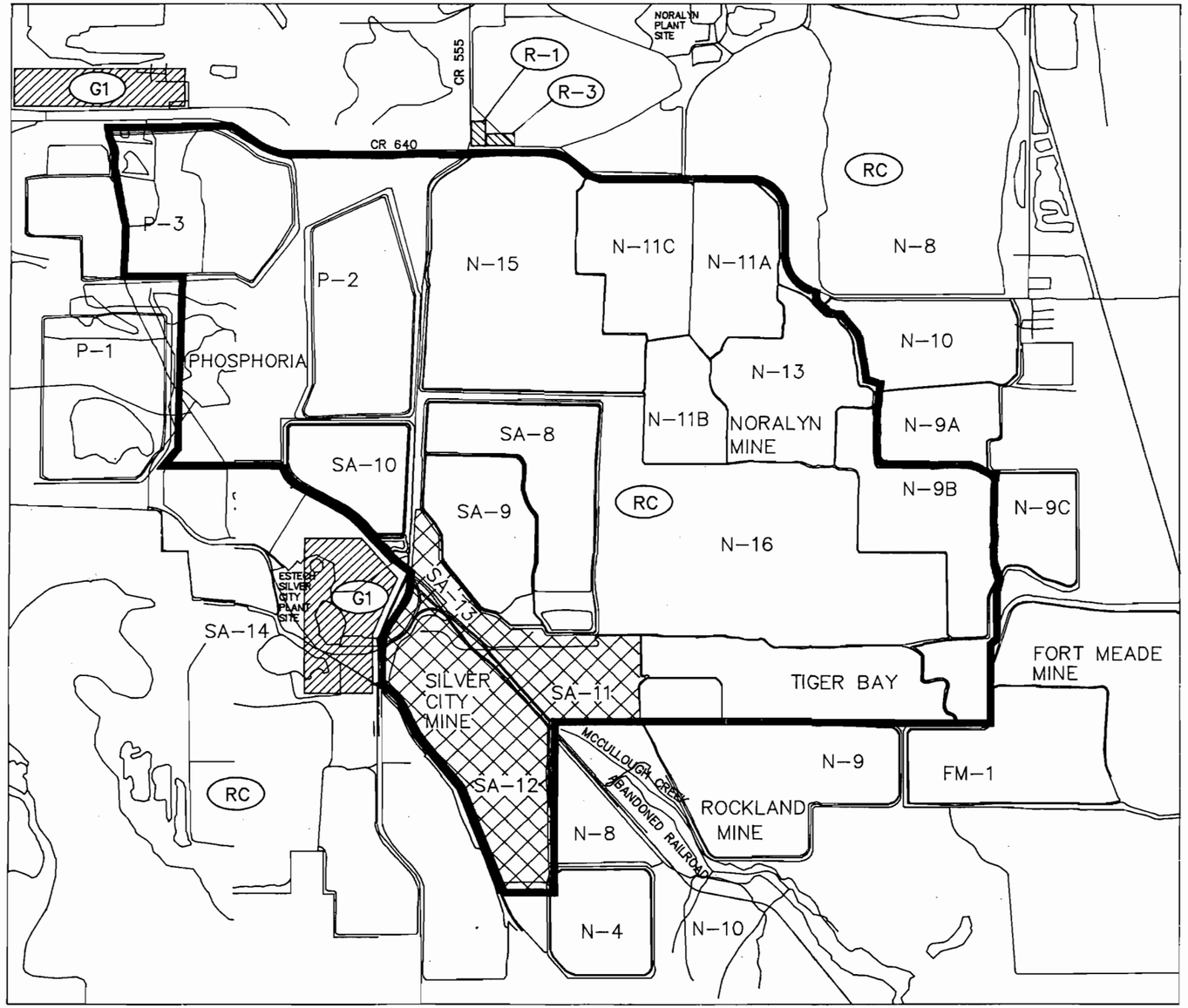
0 1 MILE

Sources: Moore/Bowers, 1992; Polk County Comprehensive Plan Map Series, 1990

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.2-1
POLK COUNTY FUTURE LAND USE DESIGNATIONS



LEGEND

SITE BOUNDARY

PLANT ISLAND

ZONING DISTRICTS

RC — RURAL CONSERVATION DISTRICT

G1 — GENERAL INDUSTRIAL DISTRICT

R-1 — RESIDENTIAL DISTRICT

R-3 — RESIDENTIAL DISTRICT

N
W — E

0 4000'

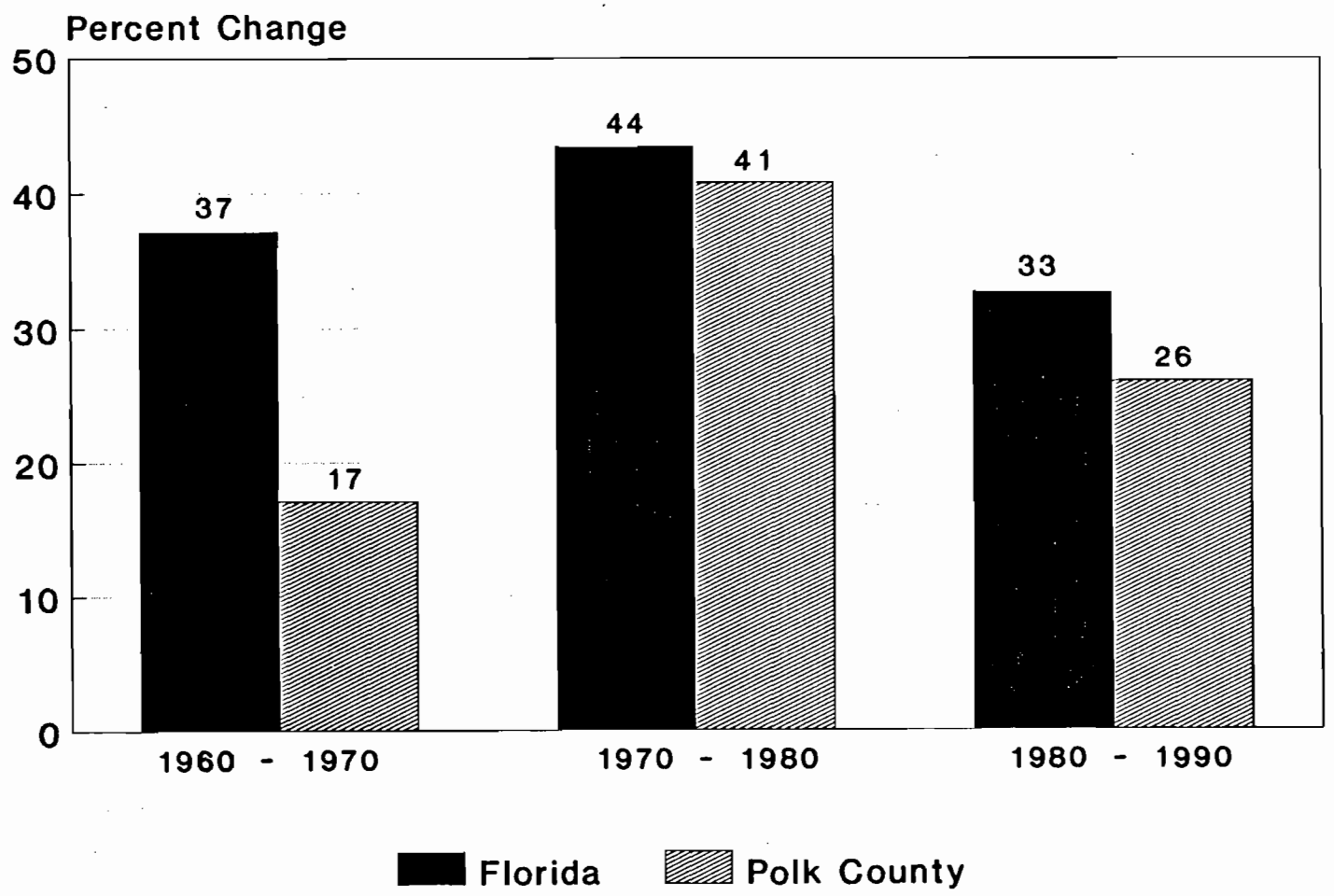
SOURCES: POLK COUNTY ZONING DEPARTMENT, 1991
MOORE/BOWERS, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.2-2

POLK COUNTY SITE ZONING

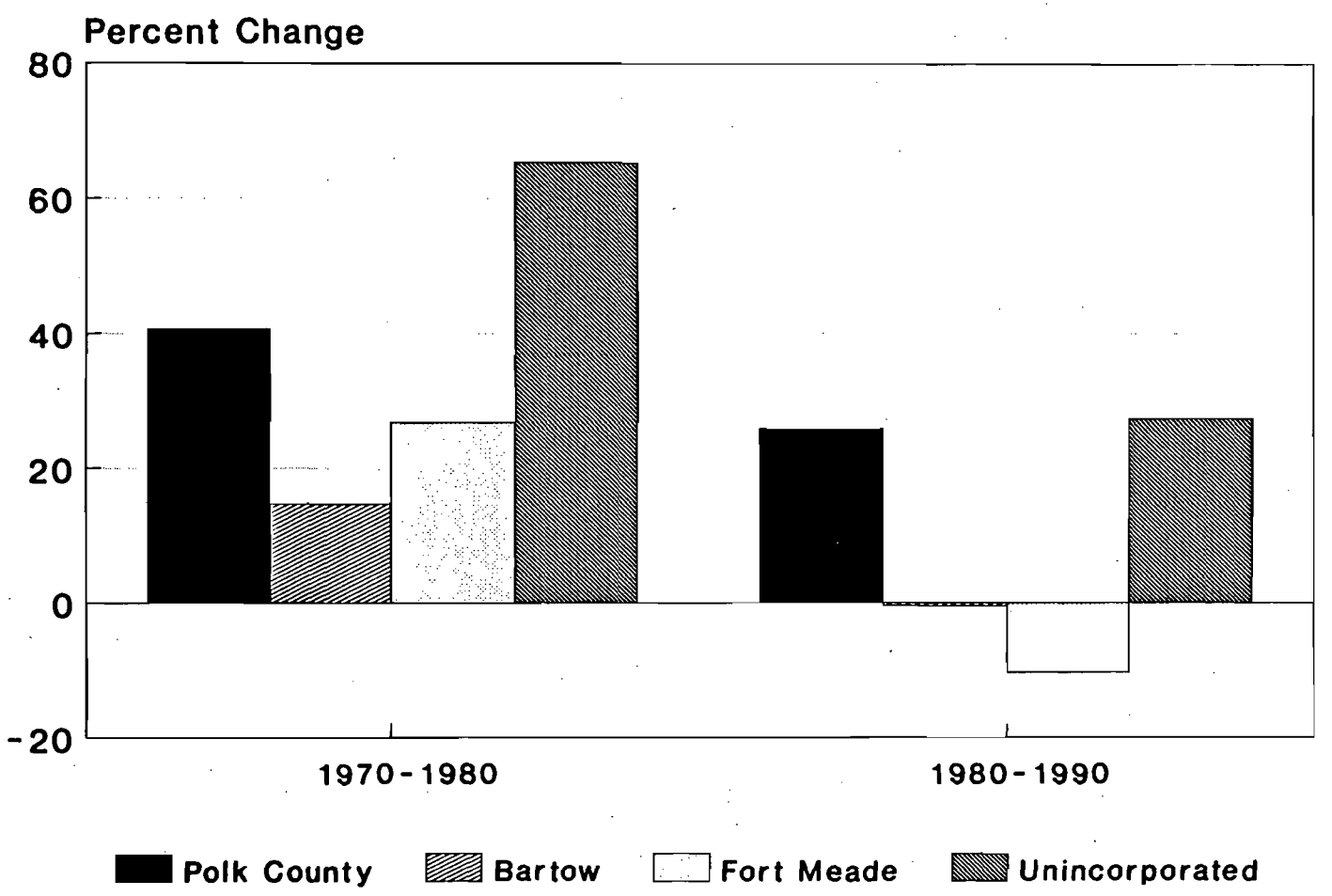


Source: BEBR, Florida Population: Census Summary 1990, 1991

Florida Power CORPORATION

Polk County Site

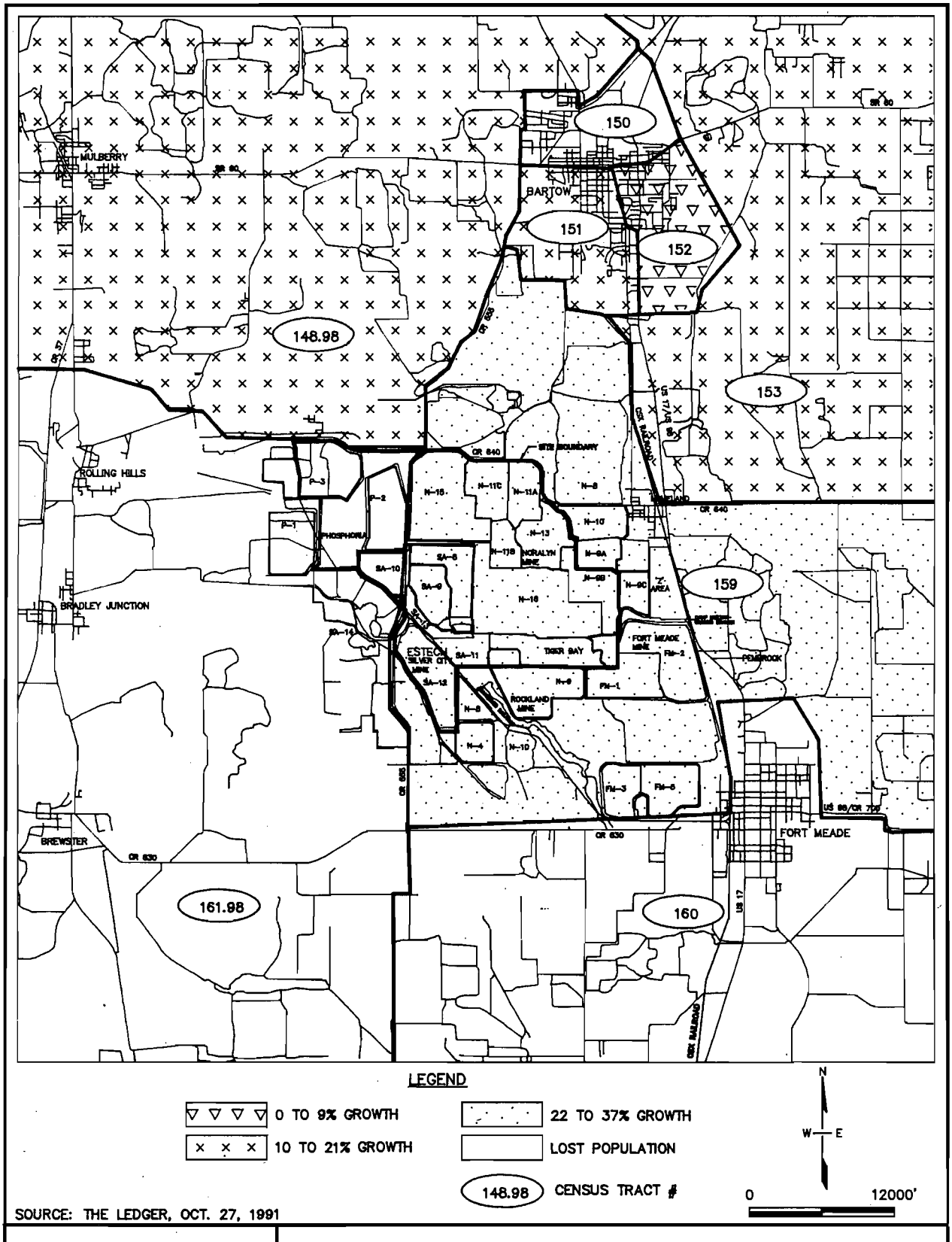
FIGURE 2.2.3-1
POPULATION GROWTH 1960 - 1990
FLORIDA AND POLK COUNTY



Source: BEBR, Florida Population: Census Summary 1990, 1991

Florida Power CORPORATION
Polk County Site

FIGURE 2.2.3-2
PERCENT CHANGE IN POPULATION IN POLK COUNTY
1970 - 1980 AND 1980 - 1990



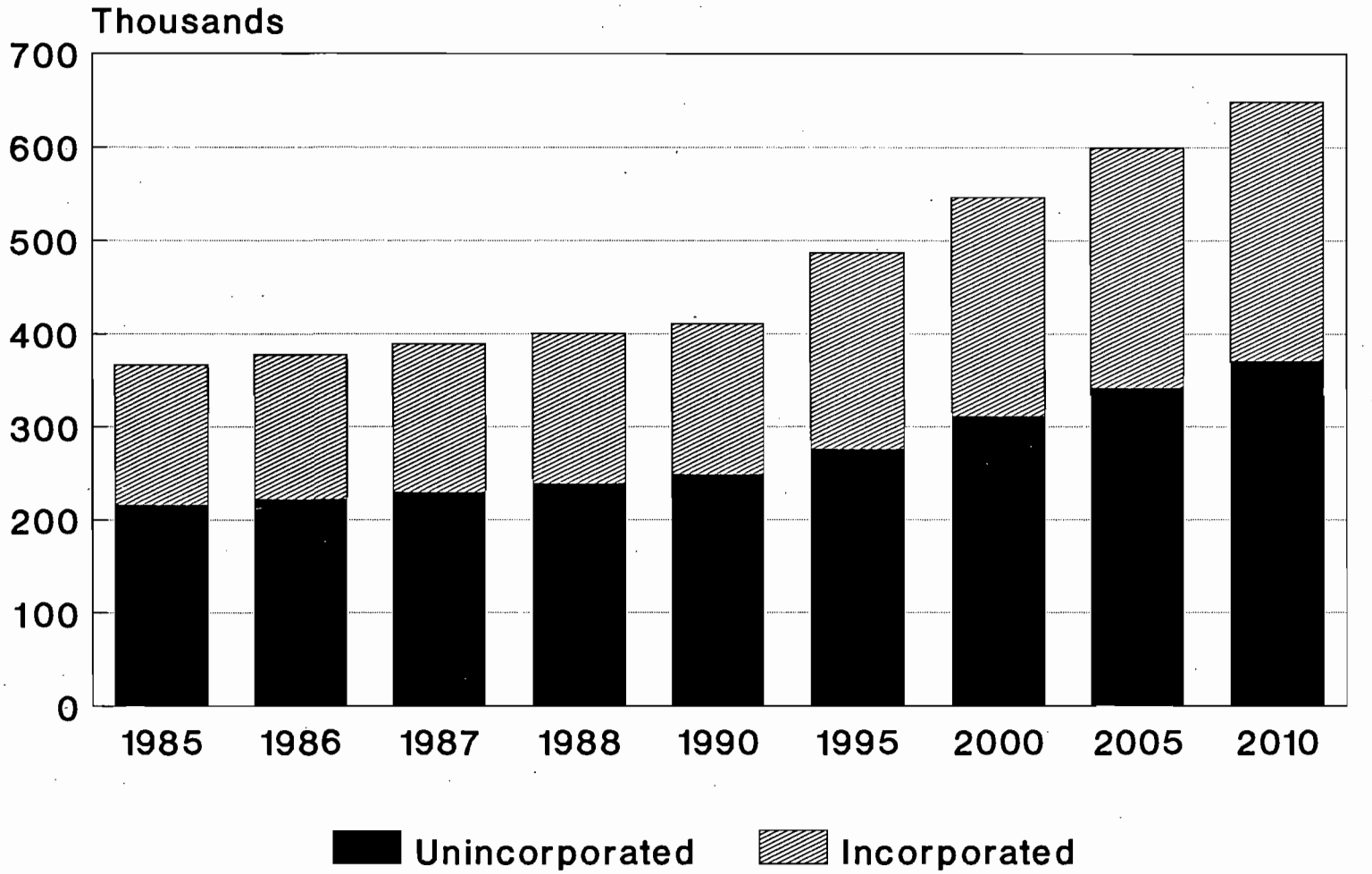
SOURCE: THE LEDGER, OCT. 27, 1991

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.3-3

POPULATION GROWTH BY CENSUS TRACT

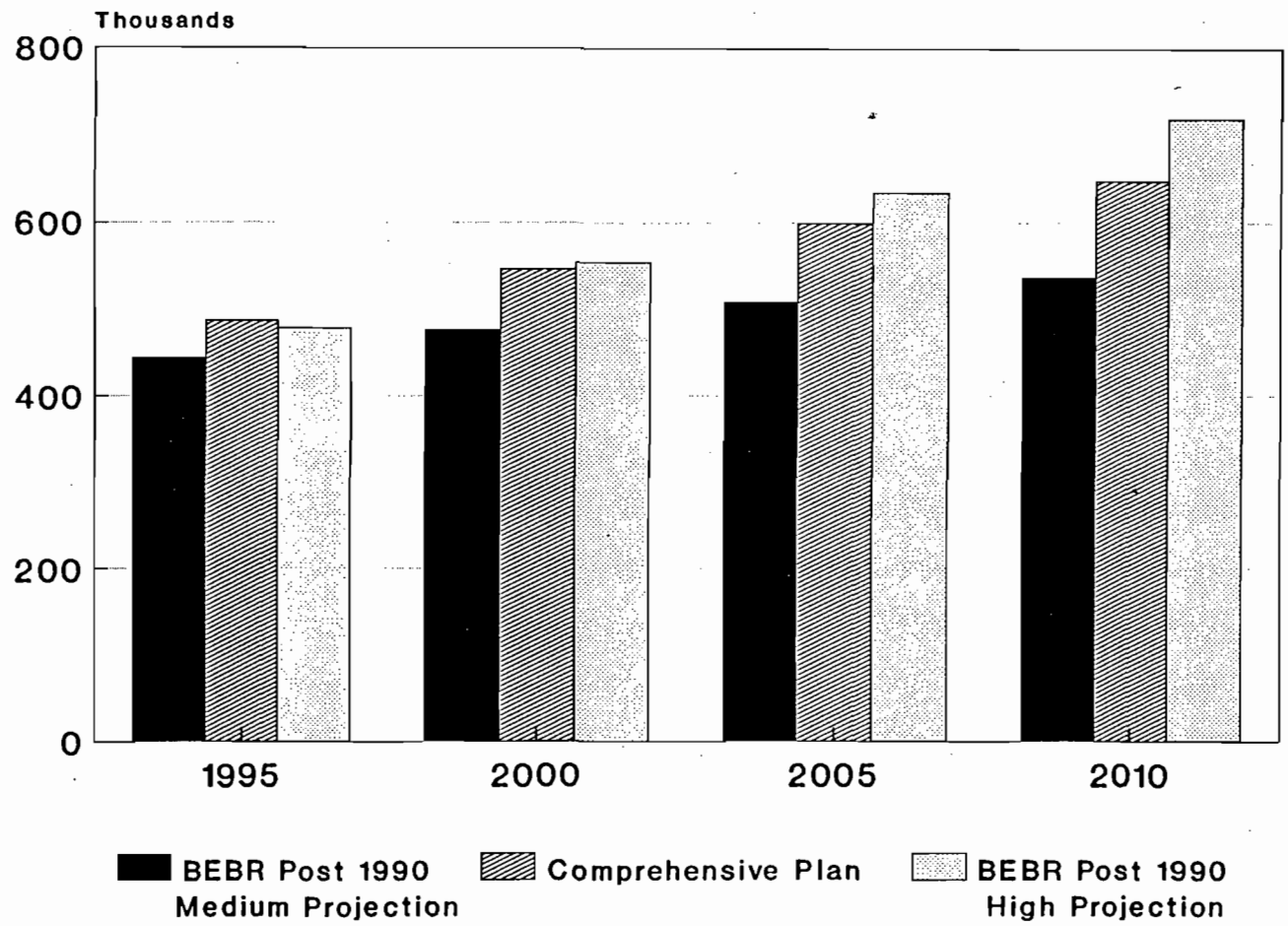


Source: Polk County Comprehensive Plan, 1991

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.3-4
POLK COUNTY POPULATION ESTIMATES AND PROJECTIONS



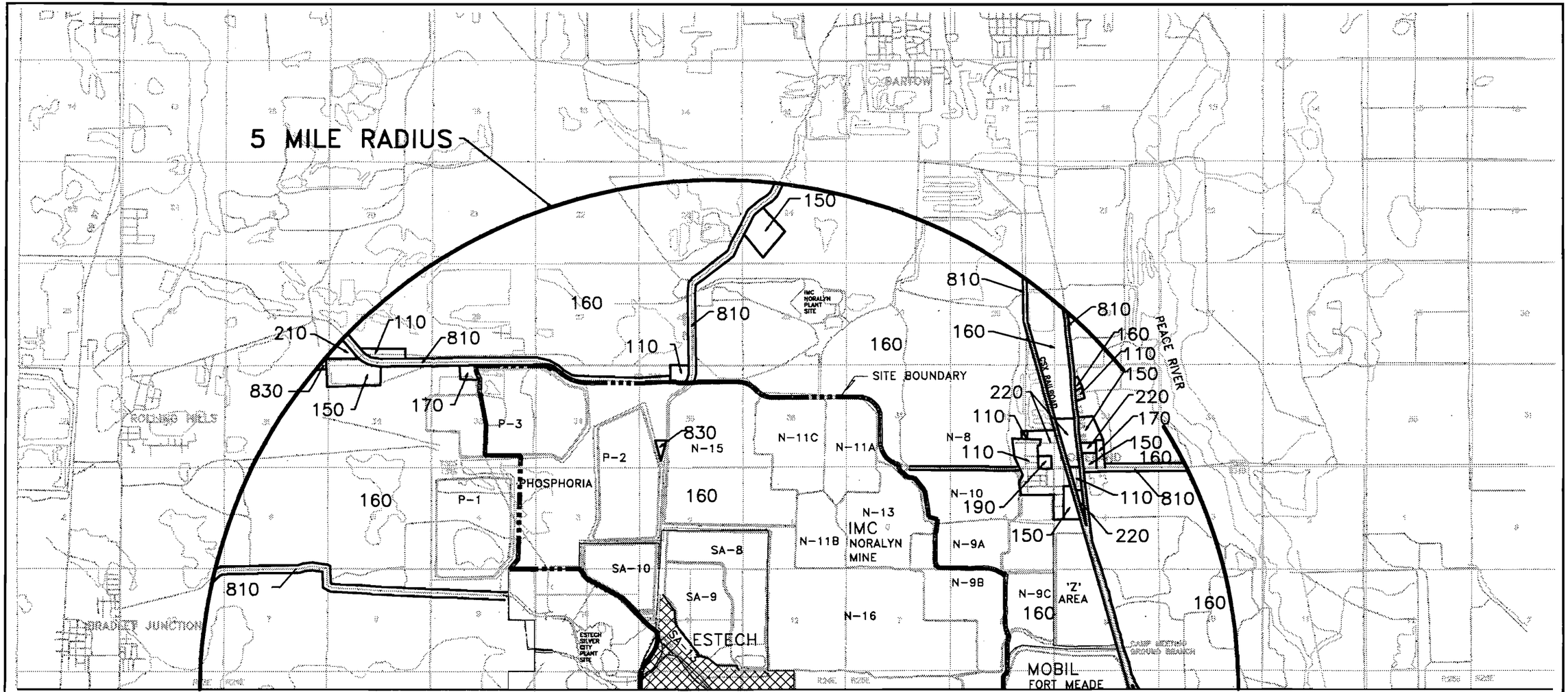
Sources: Polk County Comprehensive Plan, 1991
BEBR, Florida Statistical Abstract 1991, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.3-5

BEBR REVISED POPULATION PROJECTIONS VERSUS COMPREHENSIVE PLAN PROJECTIONS



LEGEND

SURFACE WATER
ROADWAYS
SITE BOUNDARY
RAILROAD
PLANT ISLAND

110 RESIDENTIAL, LOW DENSITY
120 RESIDENTIAL, MEDIUM DENSITY
140 COMMERCIAL AND SERVICES
150 INDUSTRIAL
160 EXTRACTIVE
170 INSTITUTIONAL
180 RECREATIONAL
190 OPEN LAND

210 CROPLAND AND PASTURELAND
220 TREE CROPS
240 NURSERIES AND VINEYARDS
250 SPECIALTY FARMS
260 OTHER OPEN LANDS (RURAL)
810 TRANSPORTATION
820 COMMUNICATIONS
830 UTILITIES

N
W E
0 1 mile

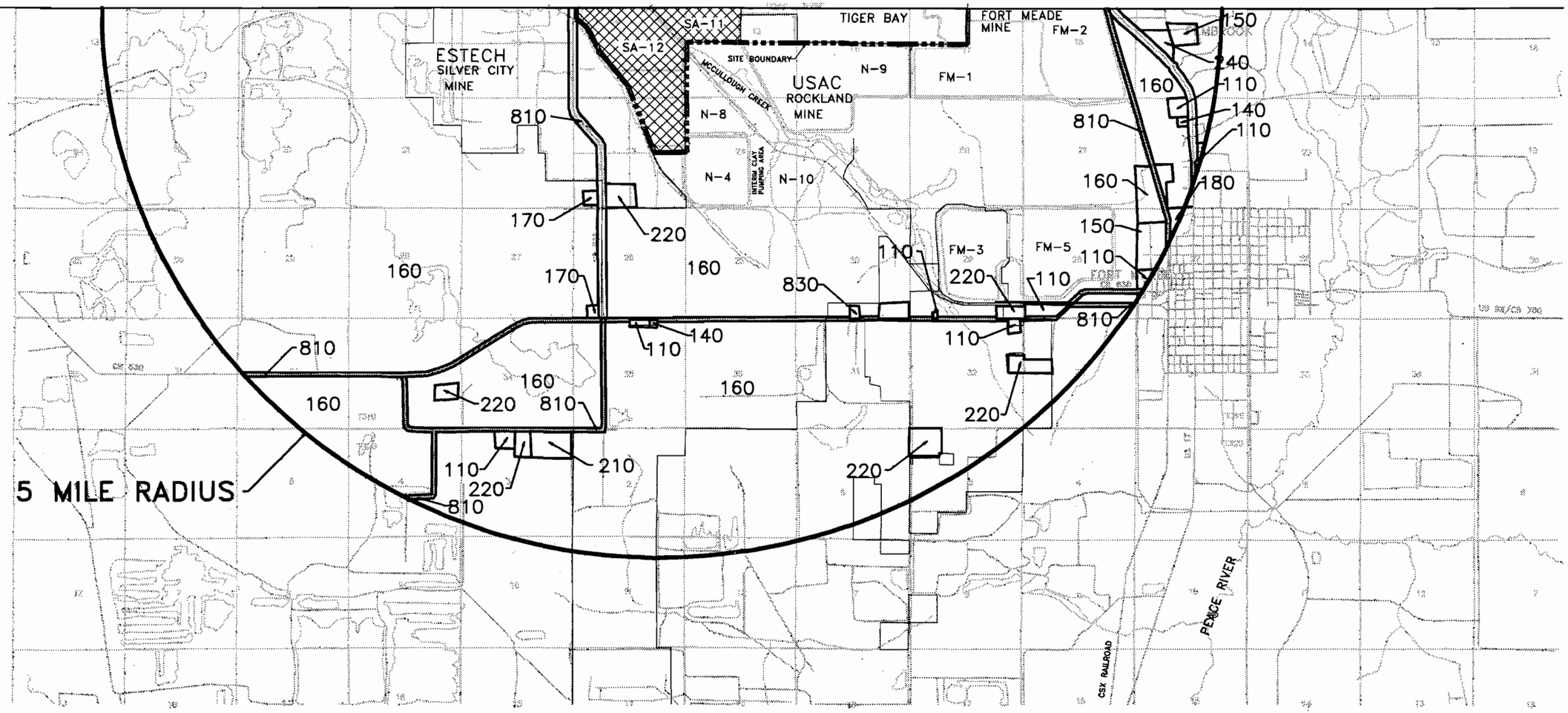
SourceS: Moore/Bowers, 1992; FDOT, Florida Land Use Cover and Forms Classification System, 1985

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.3-6A
EXISTING LAND USE WITHIN 5 MILES
OF THE PLANT ISLAND
SHEET A

MATCHLINE SEE FIGURE 2.2.3-6A



LEGEND

SURFACE WATER
ROADWAYS
SITE BOUNDARY
RAILROAD
PLANT ISLAND

110 RESIDENTIAL, LOW DENSITY
120 RESIDENTIAL, MEDIUM DENSITY
140 COMMERCIAL AND SERVICES
150 INDUSTRIAL
160 EXTRACTIVE
170 INSTITUTIONAL
180 RECREATIONAL
190 OPEN LAND
210 CROPLAND AND PASTURELAND
220 TREE CROPS
240 NURSERIES AND VINEYARDS
250 SPECIALTY FARMS
260 OTHER OPEN LANDS (RURAL)
810 TRANSPORTATION
820 COMMUNICATIONS
830 UTILITIES

N
W E

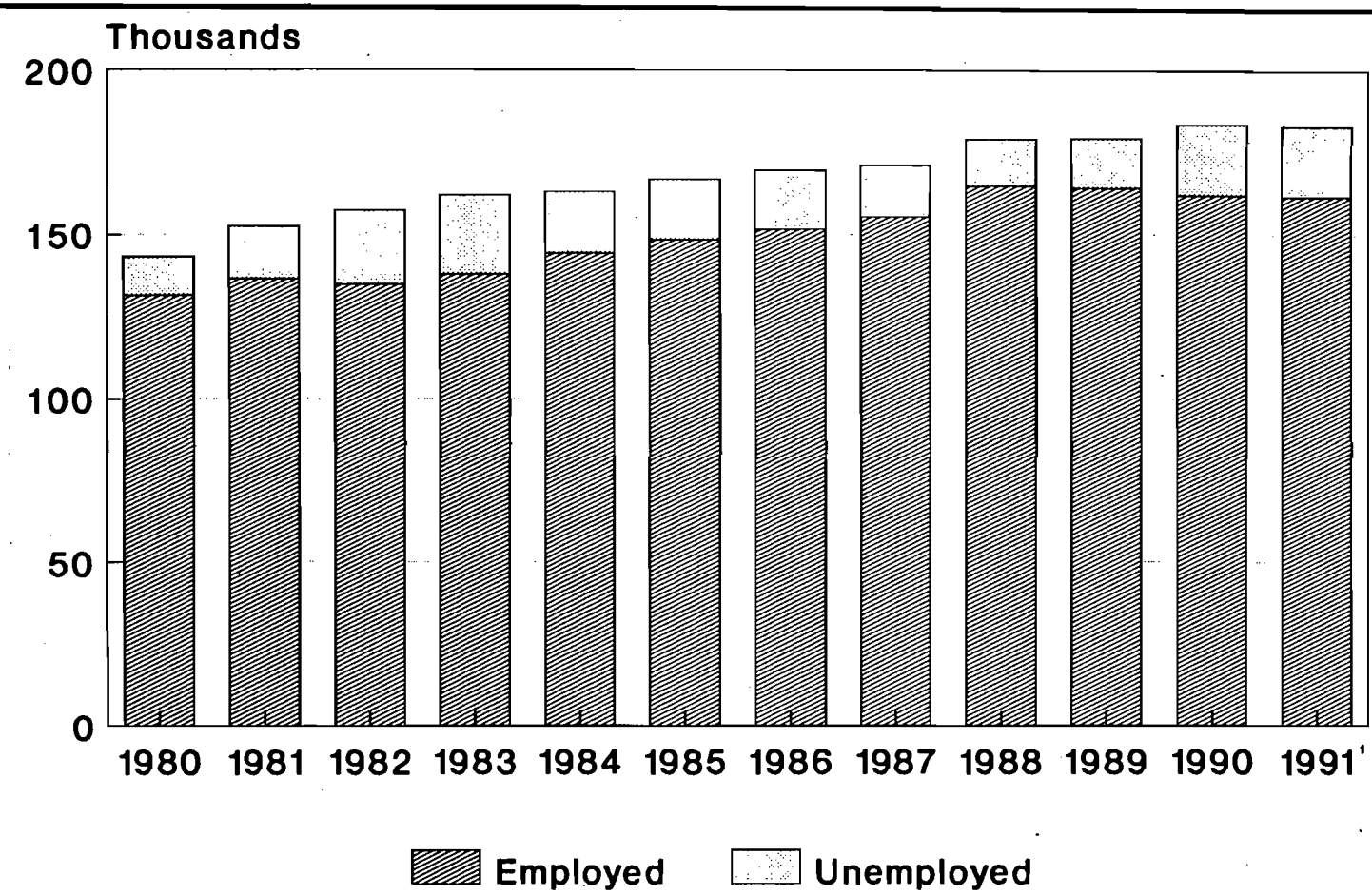
0 1 mile

Sources: Moore/Bowers, 1992; FDOT, Florida Land Use Cover and Forms Classification System, 1985

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.3-6B
EXISTING LAND USE WITHIN 5 MILES
OF THE PLANT ISLAND
SHEET B



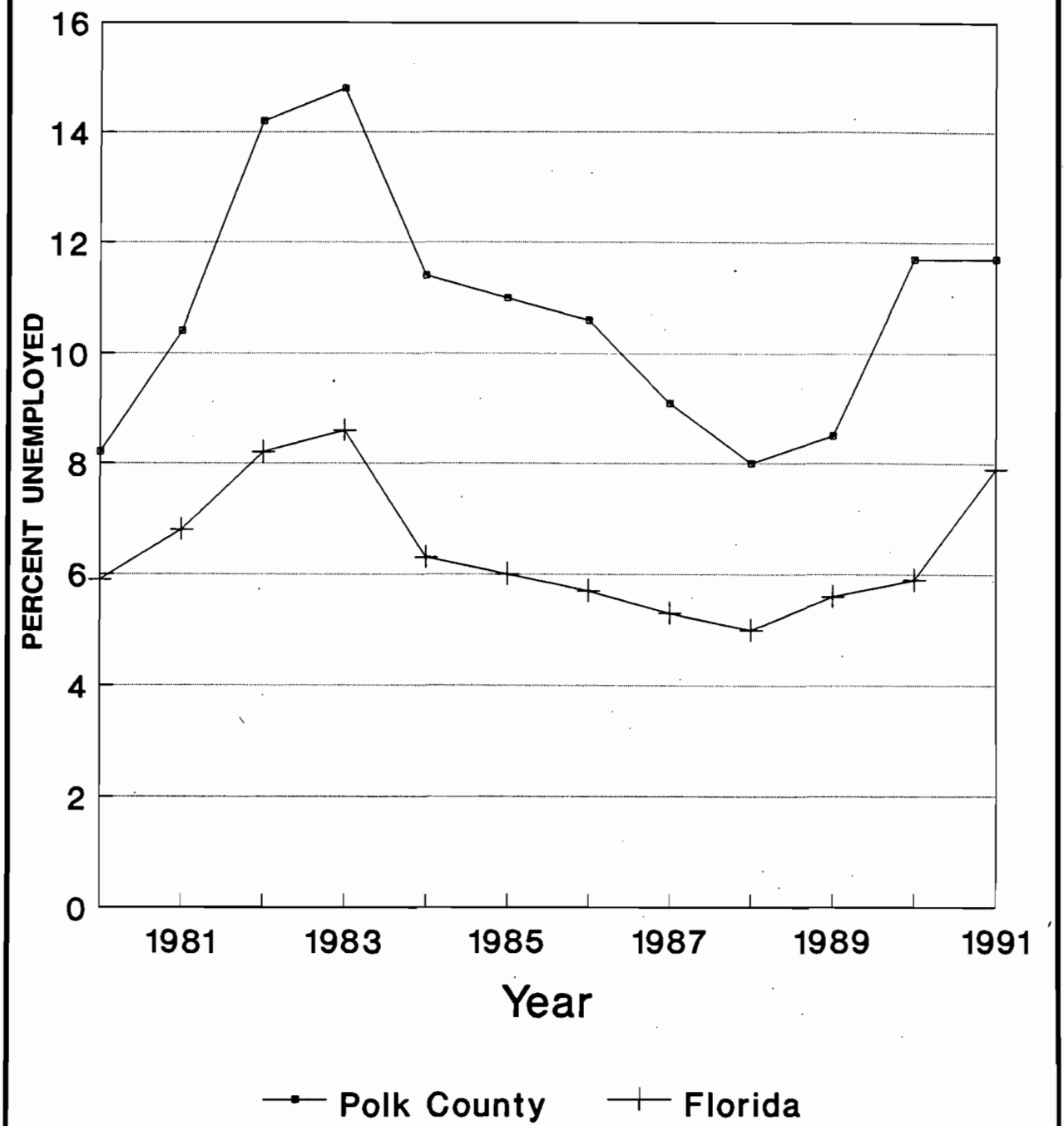
Note: Labor Force as of July 1991

Source: Florida Department of Labor & Employment Security, 1992

Florida Power CORPORATION

Polk County Site

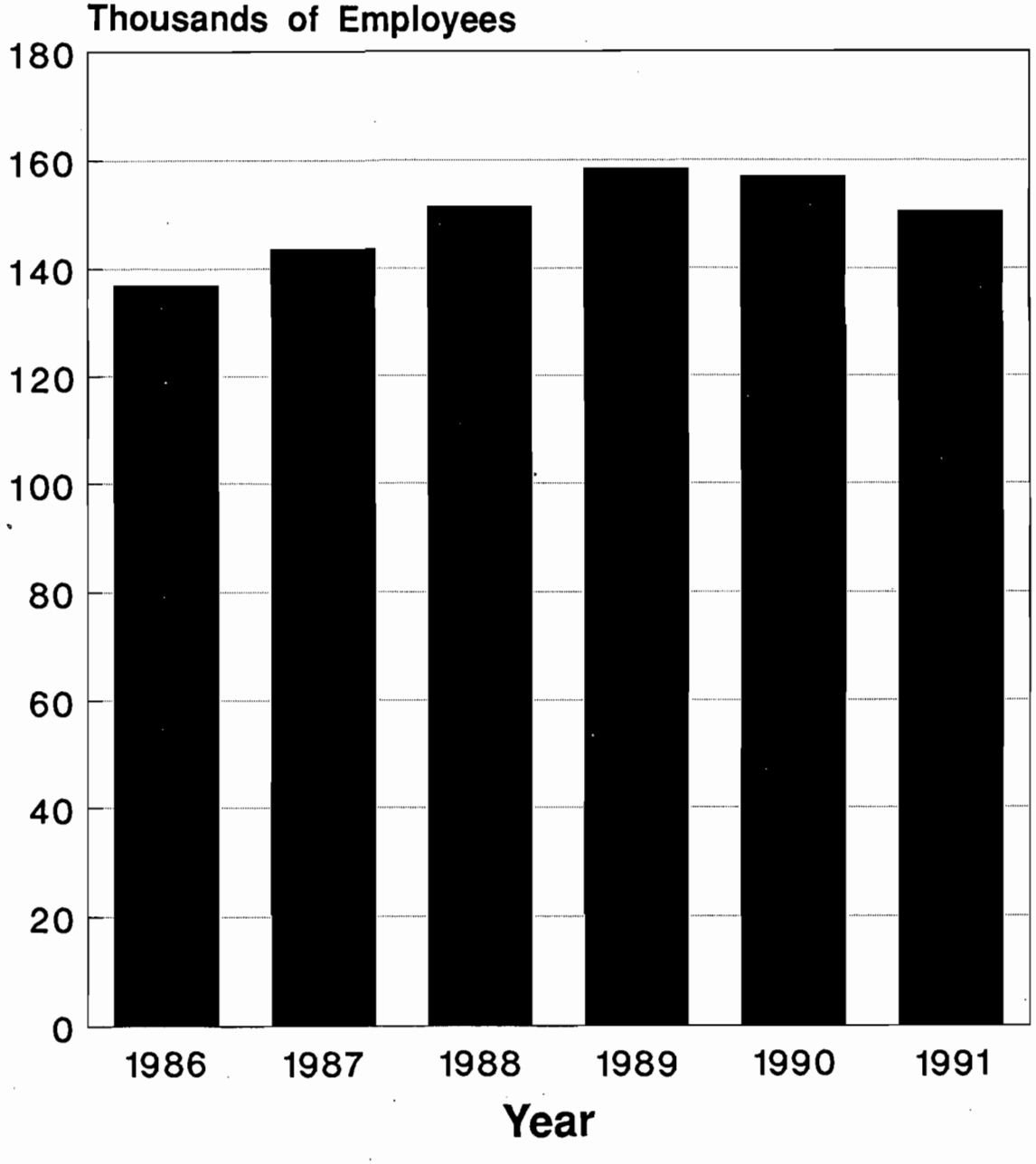
FIGURE 2.2.7-1
POLK COUNTY CIVILIAN LABOR FORCE
EMPLOYMENT AND UNEMPLOYMENT
1980 THROUGH 1991



Source: Florida Department of Labor & Employment Security, 1991

Florida Power CORPORATION
Polk County Site

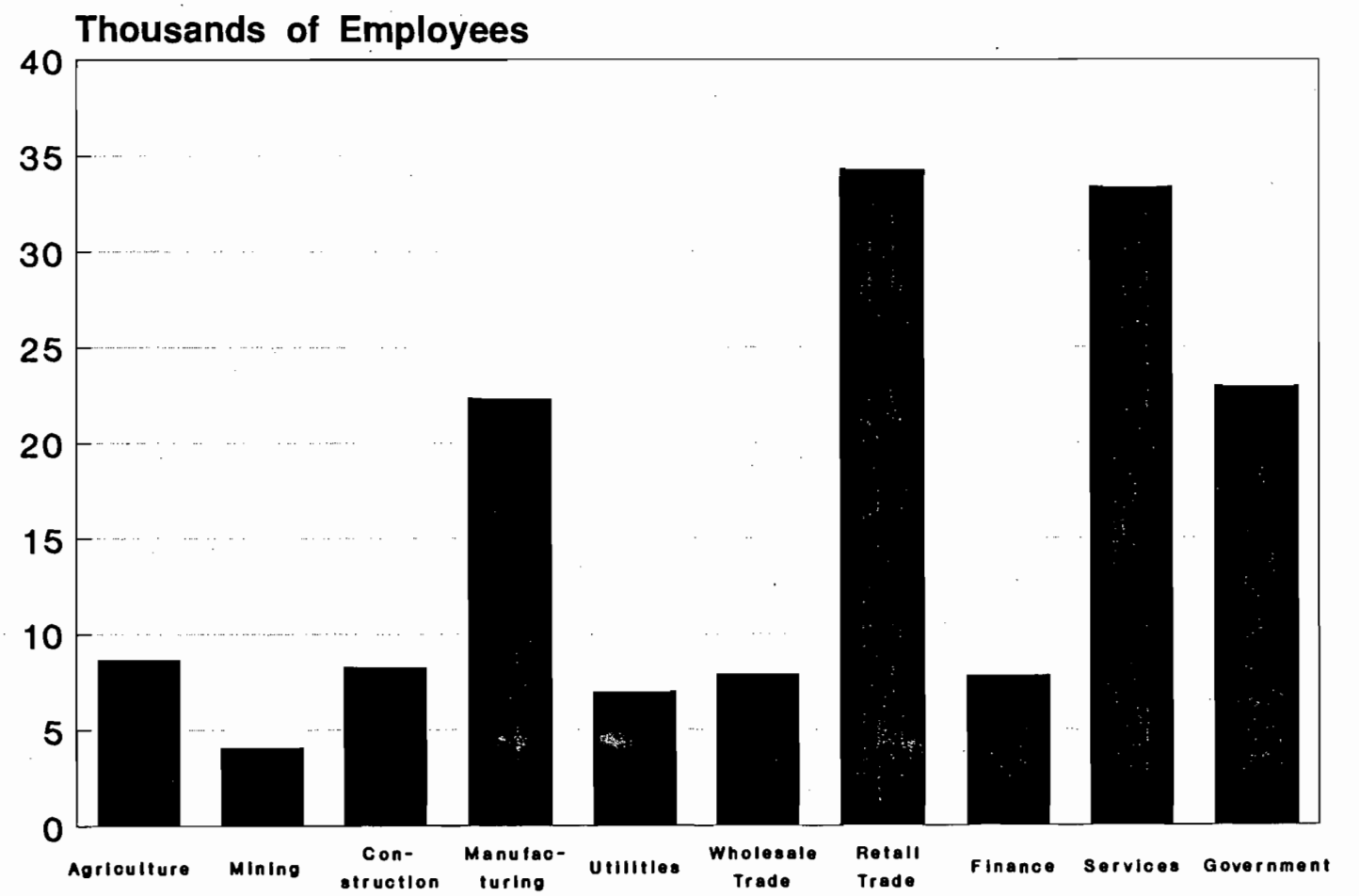
FIGURE 2.2.7-2
UNEMPLOYMENT RATES
POLK COUNTY AND FLORIDA
1980 THROUGH 1991



Source: FDLES, ES-202 Reports, various years

Florida Power CORPORATION
Polk County Site

FIGURE 2.2.7-3
POLK COUNTY EMPLOYMENT ESTIMATES
1986 THROUGH 1991

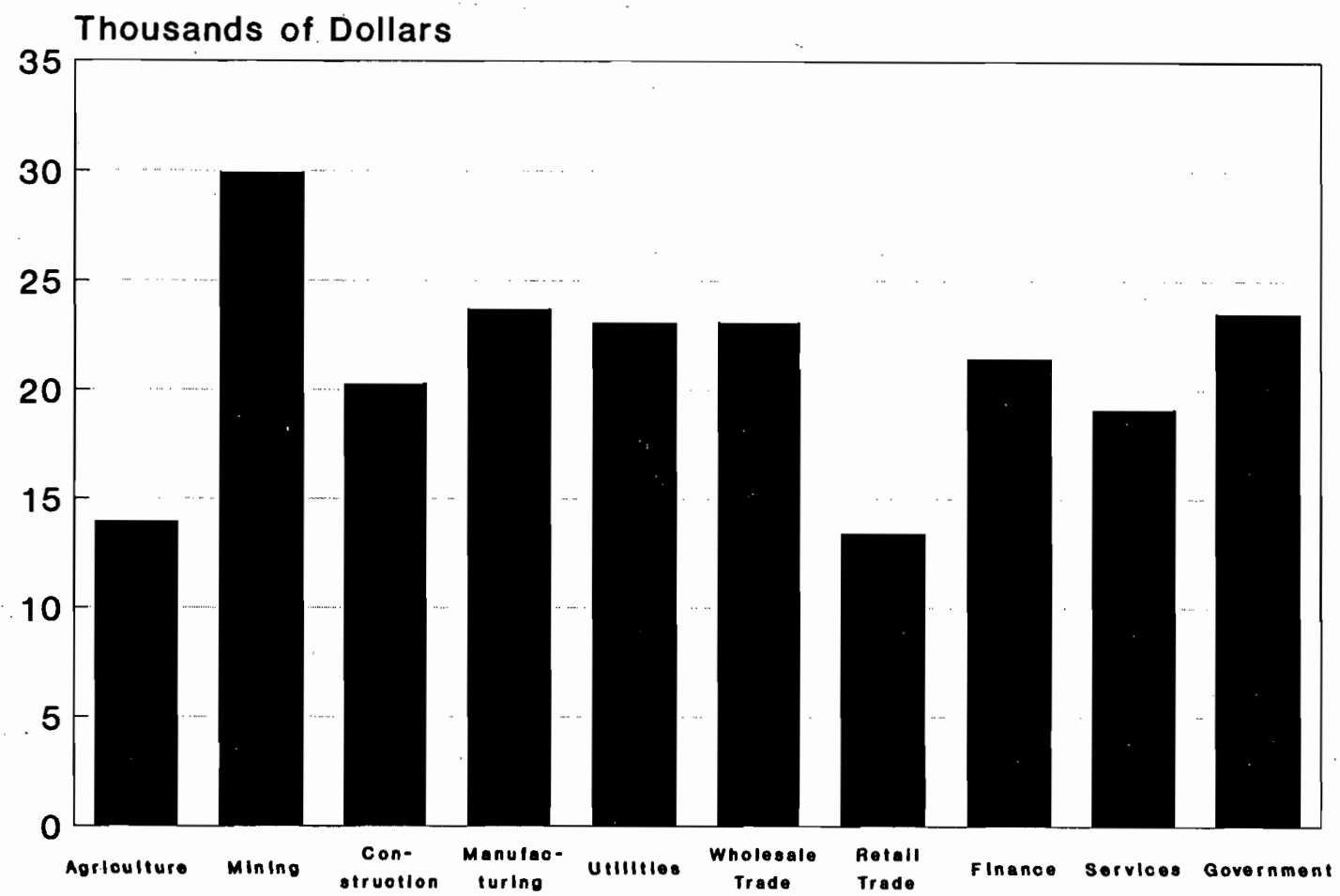


Source: FDLES, 1991

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.7-4
POLK COUNTY EMPLOYMENT BY INDUSTRY
1990

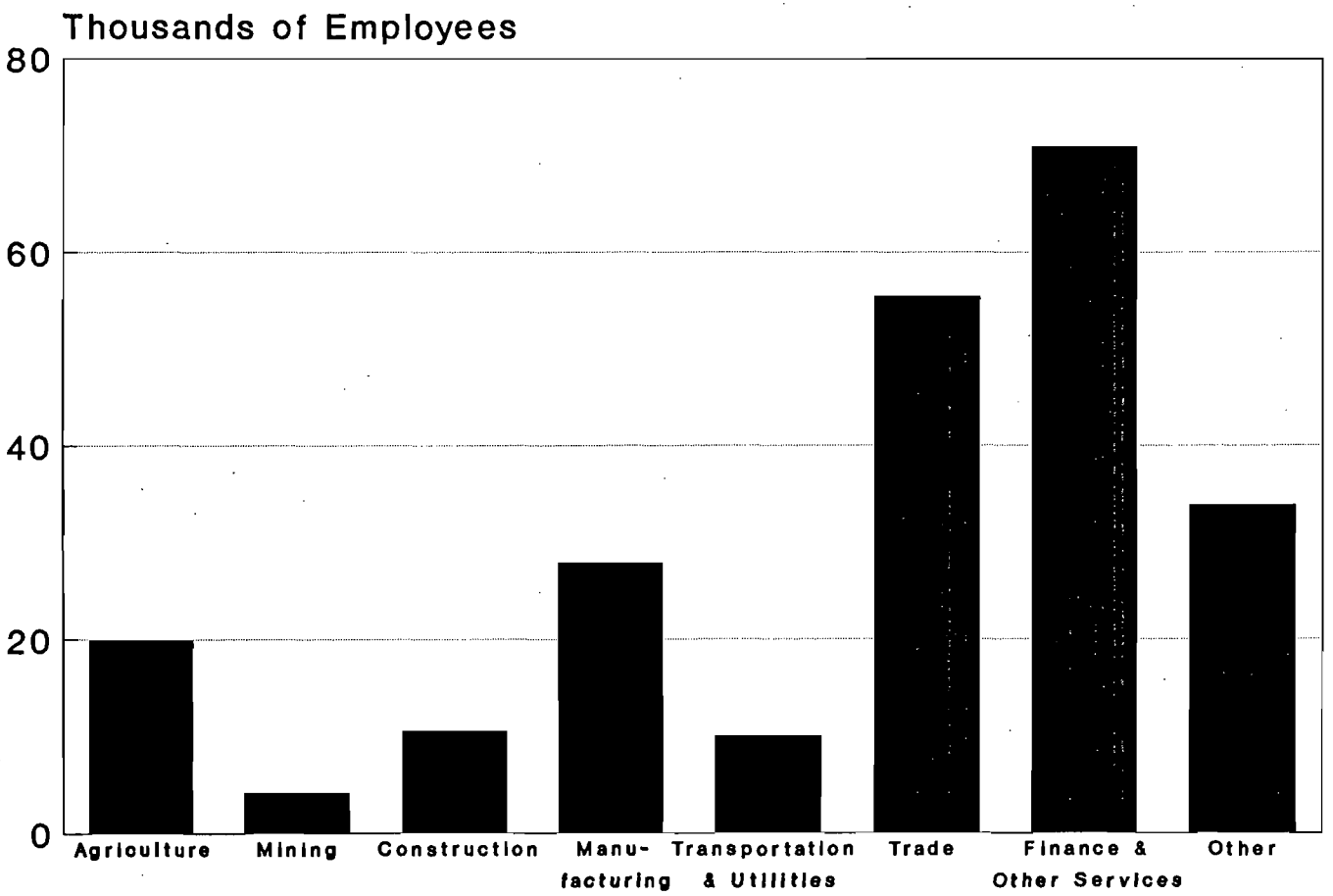


Source: FDLES, 1991

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.7-5
AVERAGE WAGE BY INDUSTRY
POLK COUNTY 1990

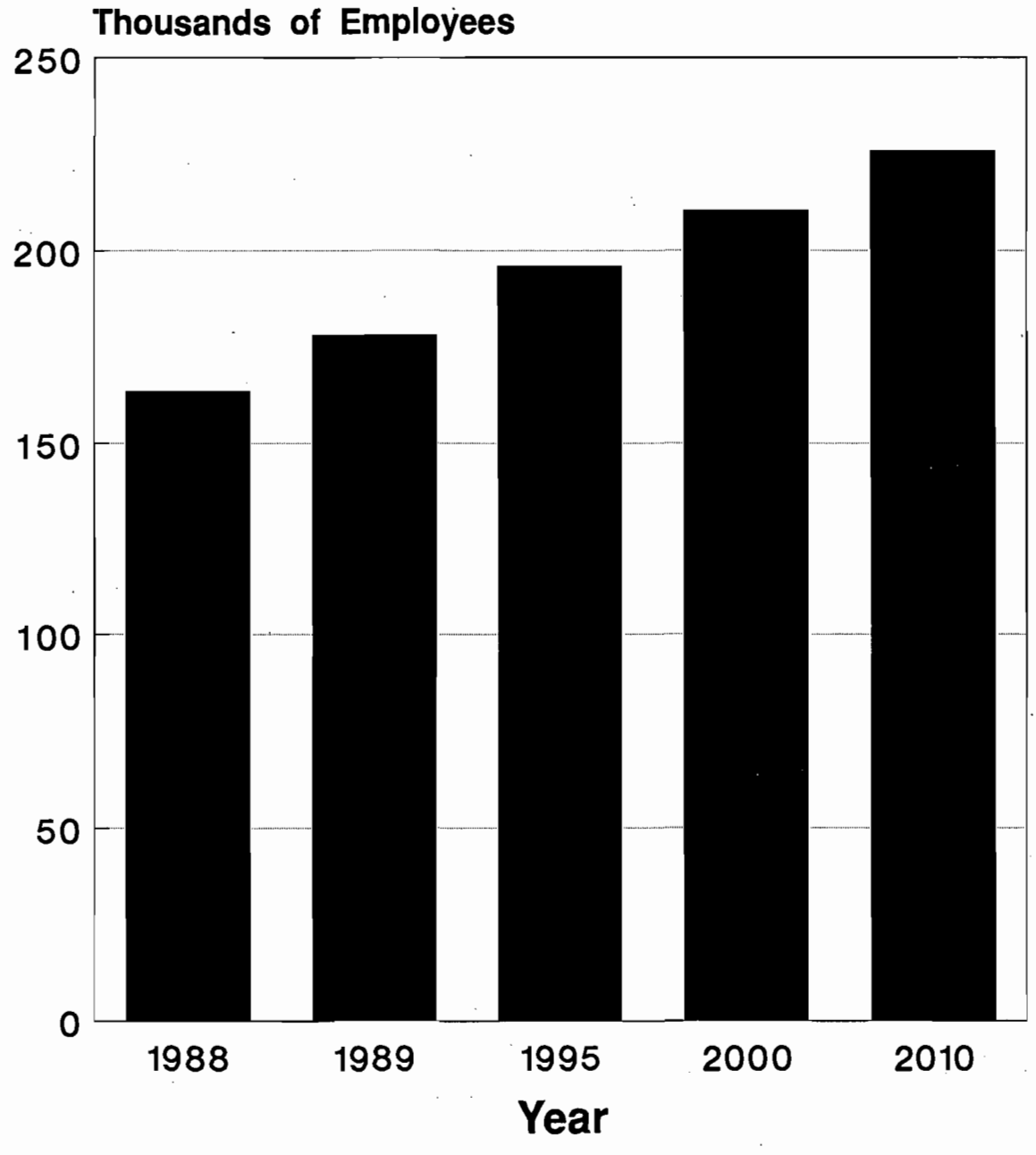


Source: FDLES, 1992

Florida Power CORPORATION

Polk County Site

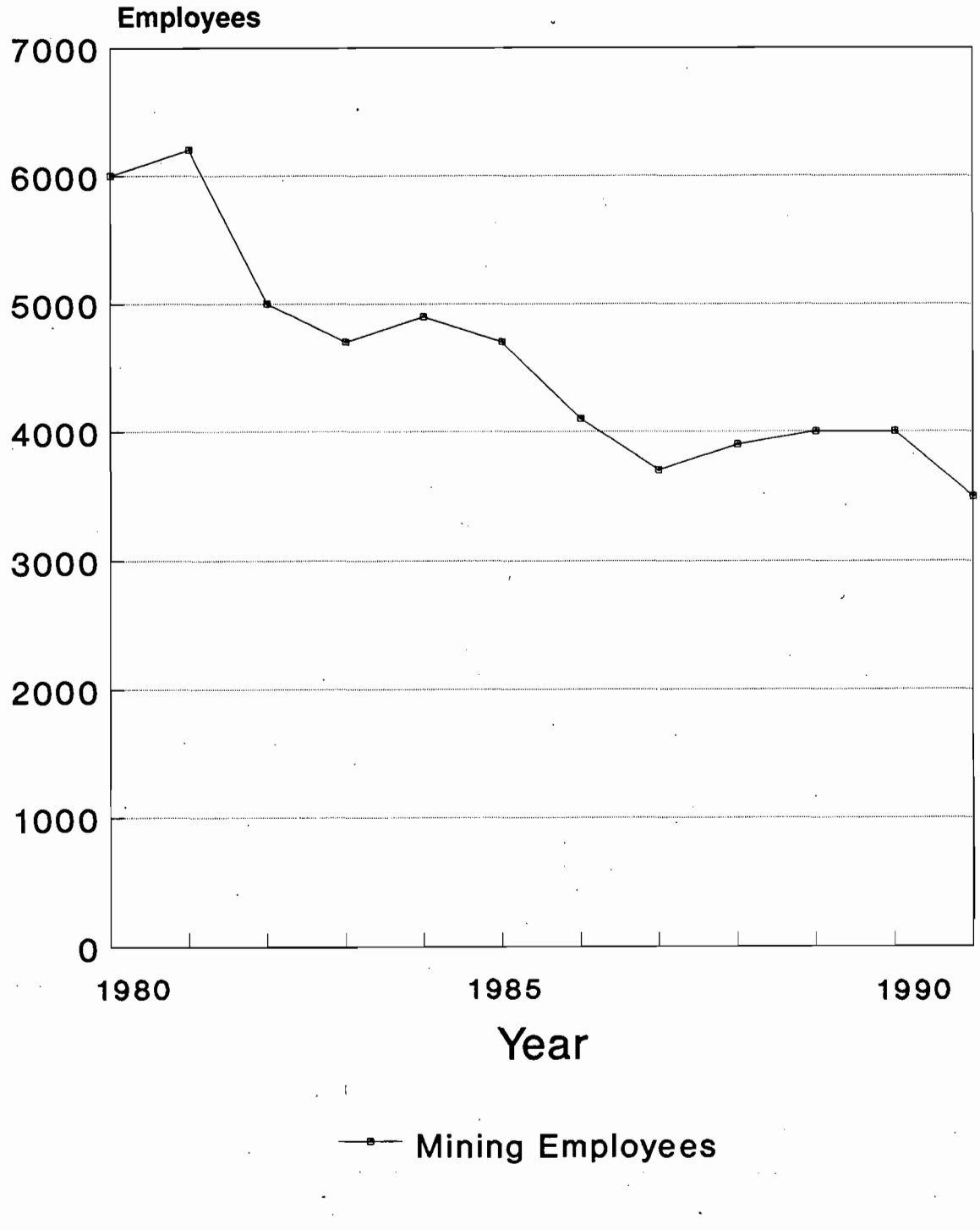
FIGURE 2.2.7-6
POLK COUNTY EMPLOYMENT PROJECTIONS FOR YEAR 2000



Source: Polk County Comprehensive Plan, Economic Element, April 1991

Florida Power CORPORATION
Polk County Site

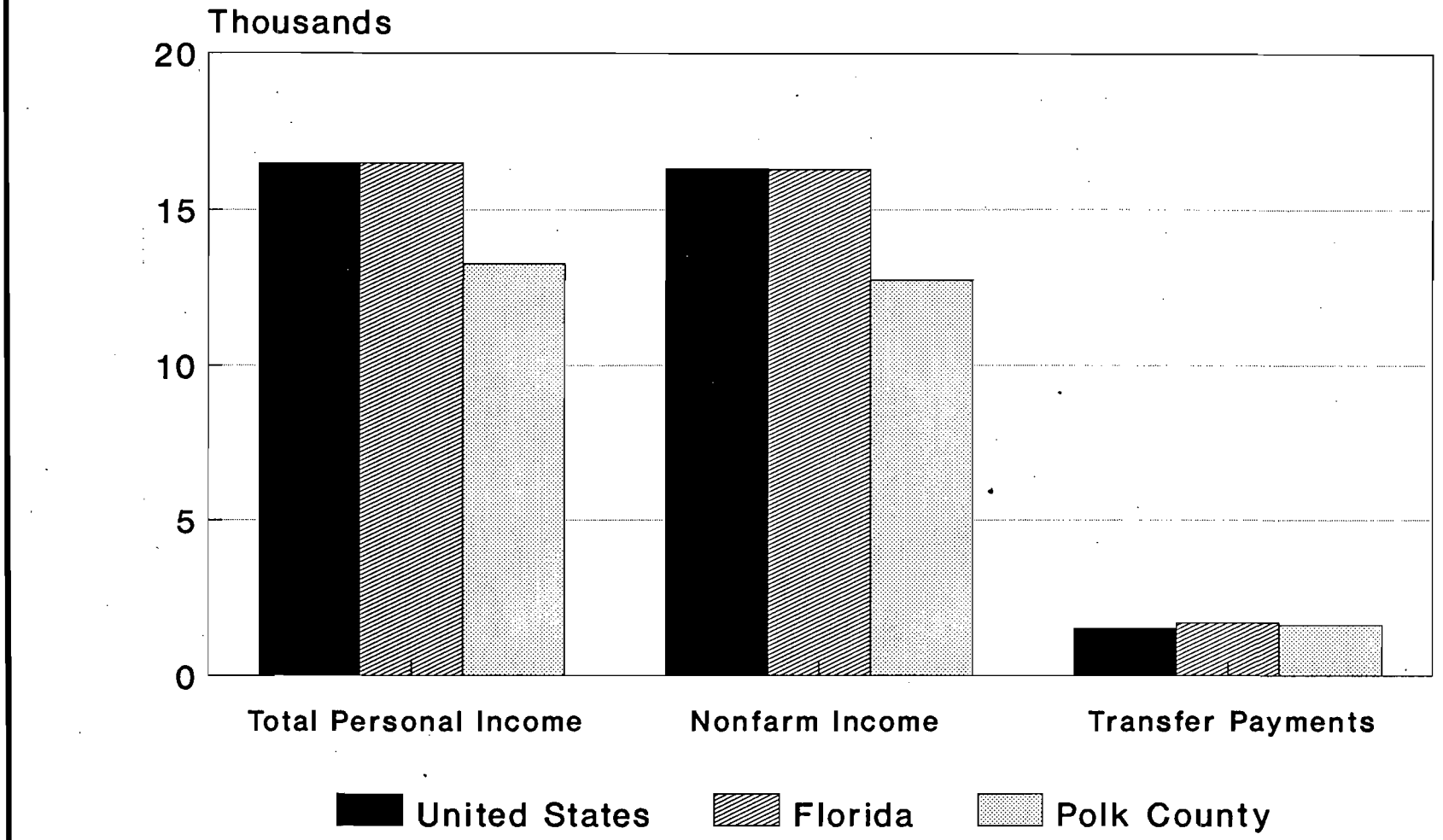
FIGURE 2.2.7-7
EMPLOYMENT ESTIMATES AND PROJECTIONS - POLK COUNTY 1988 THROUGH 2010



Source: FDLES, 1991

Florida Power CORPORATION
Polk County Site

FIGURE 2.2.7-8
POLK COUNTY MINING EMPLOYMENT
1980 THROUGH 1991

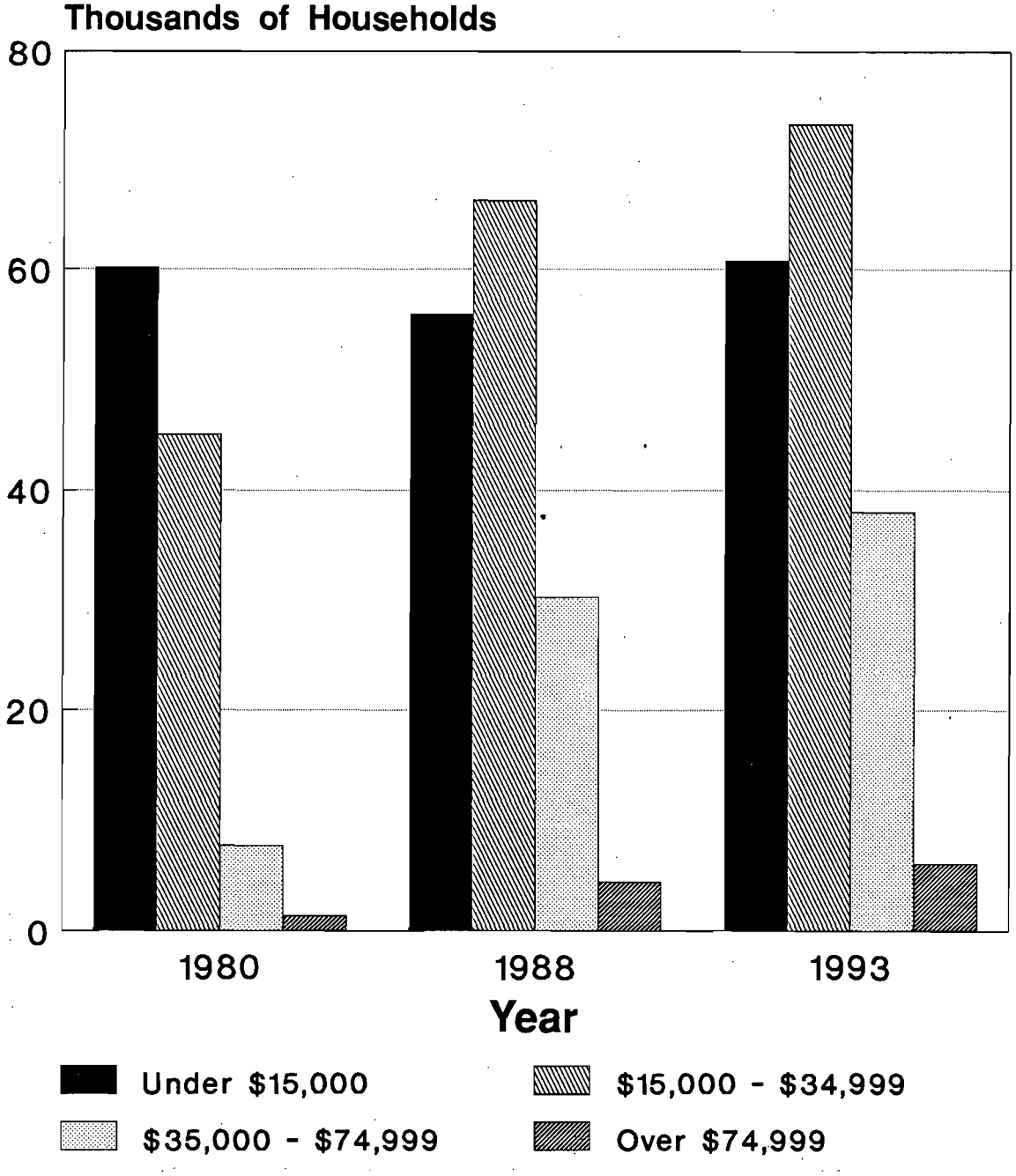


Source: BEBR, Statistical Abstract 1991, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.7-9
1988 PER CAPITA INCOME
BY TYPE OF INCOME

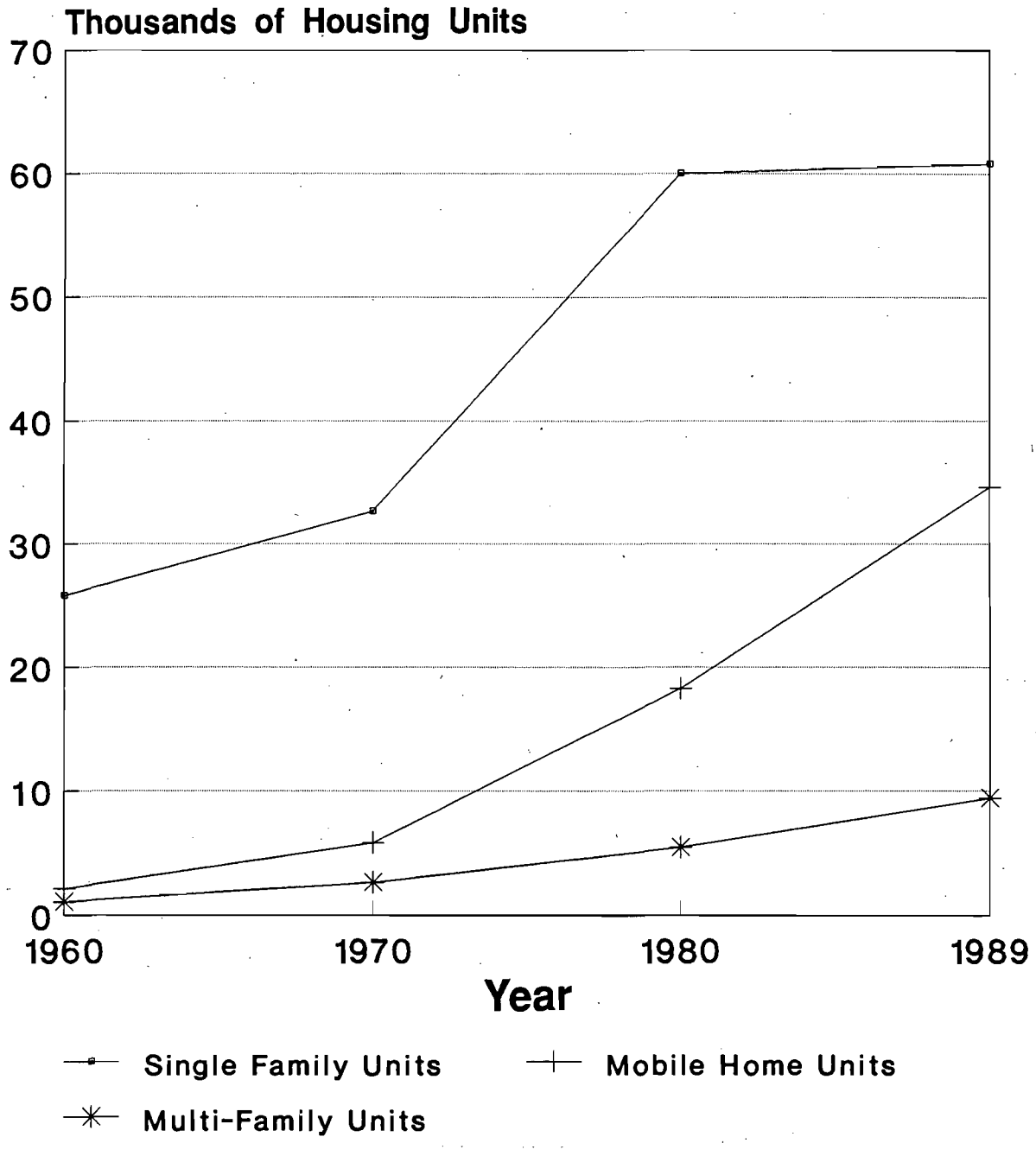


Source: Polk County Comprehensive Plan, Sub-Appendix B-A, Economic Base Study, April 1989

Florida Power CORPORATION

Polk County Site

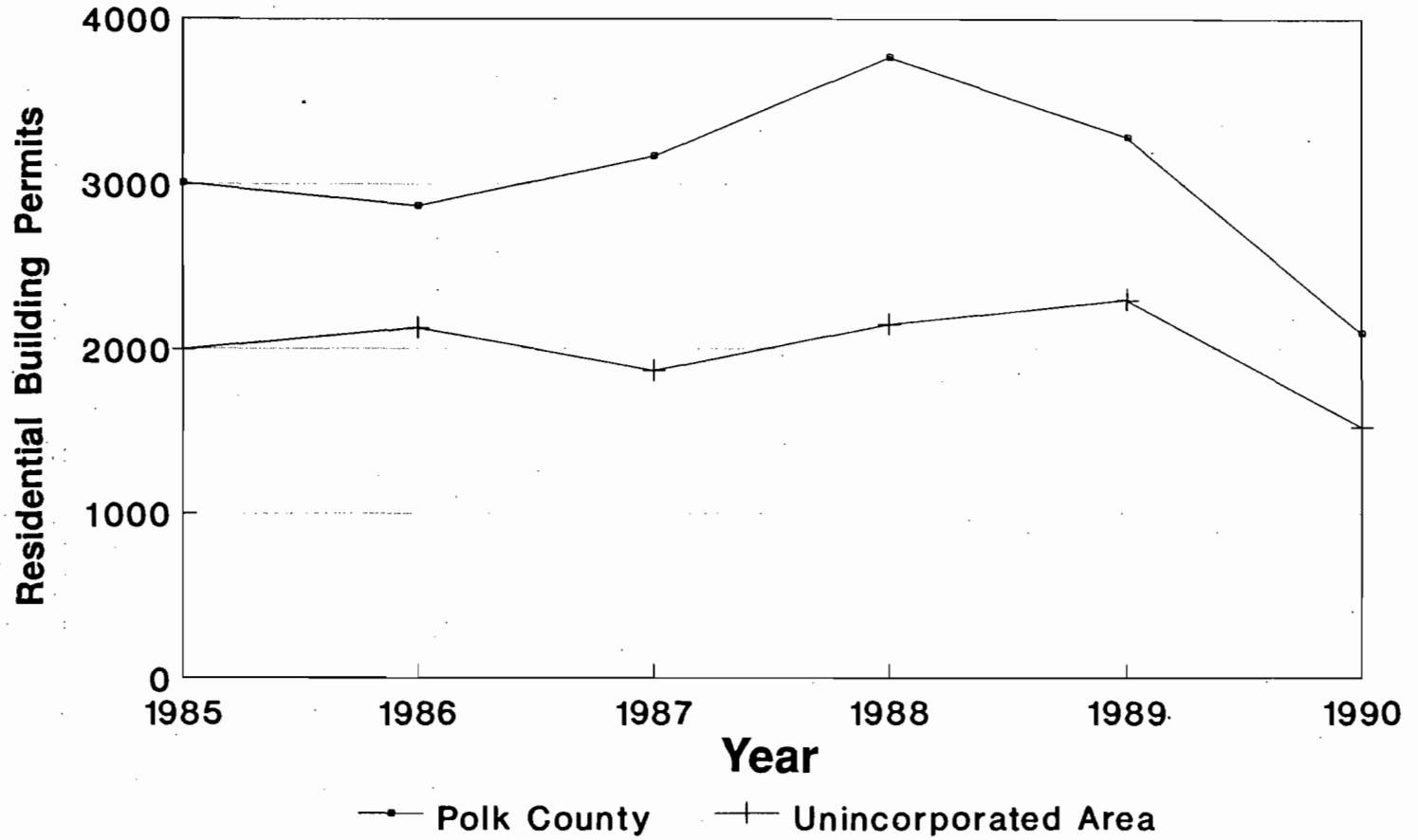
FIGURE 2.2.7-10
DISTRIBUTION OF HOUSEHOLD INCOMES IN POLK COUNTY



Source: Polk County Comprehensive Plan,
Housing Element Support Documentation, 1990

Florida Power CORPORATION
Polk County Site

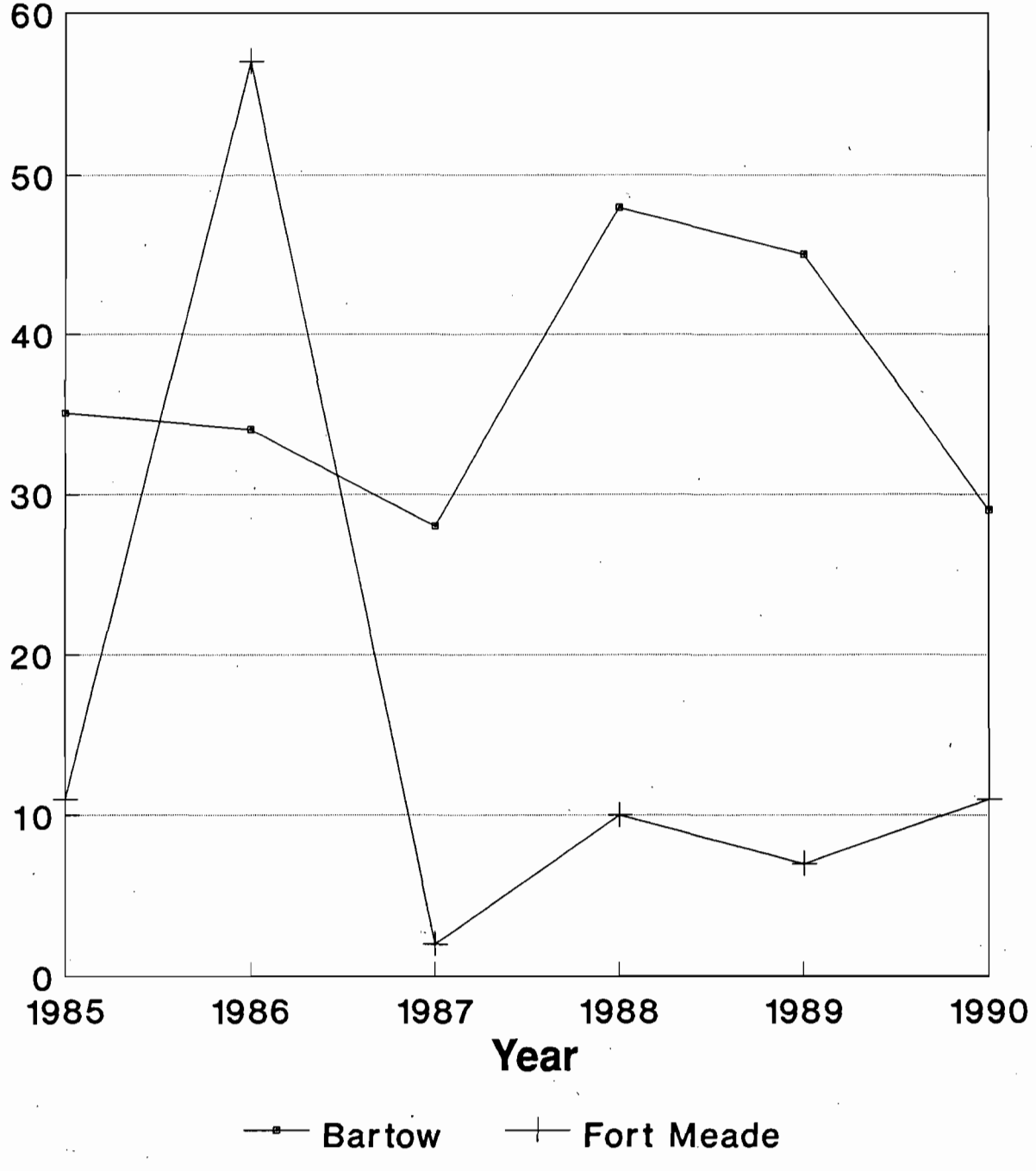
FIGURE 2.2.7-11
TREND IN HOUSING UNITS
IN UNINCORPORATED POLK COUNTY
1960 THROUGH 1989



Source: Florida County Perspectives, 1990 Edition
BEBR, Florida Statistical Abstracts, various years

Florida Power CORPORATION
Polk County Site

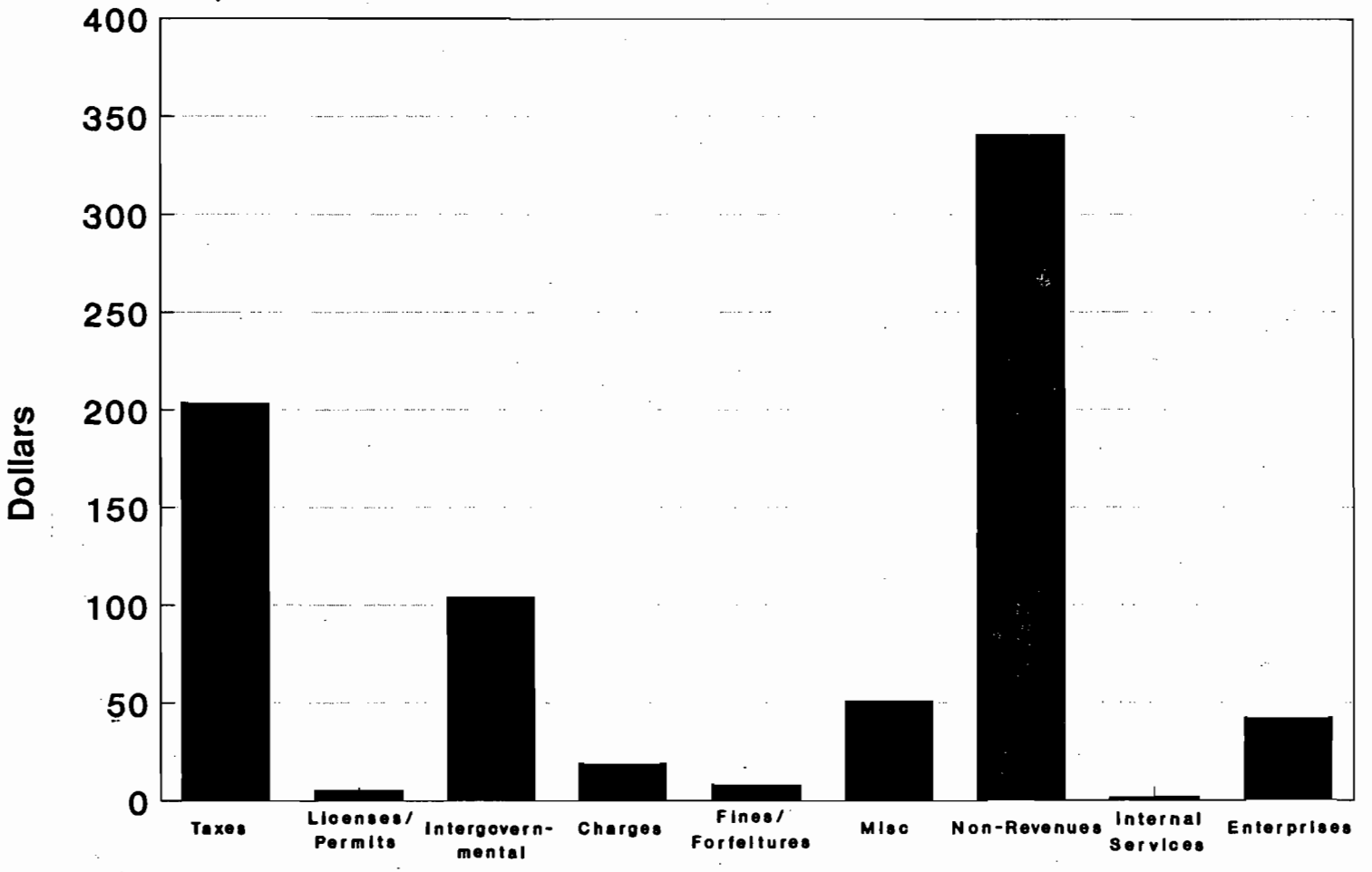
FIGURE 2.2.7-12
RESIDENTIAL BUILDING PERMITS
IN POLK COUNTY
1985 THROUGH 1990



Source: Florida County Perspectives, 1990 Edition
BEBR, Florida Statistical Abstracts, various years

Florida Power CORPORATION
Polk County Site

FIGURE 2.2.7-13
RESIDENTIAL BUILDING PERMITS IN BARTOW AND FORT MEADE 1985 THROUGH 1990

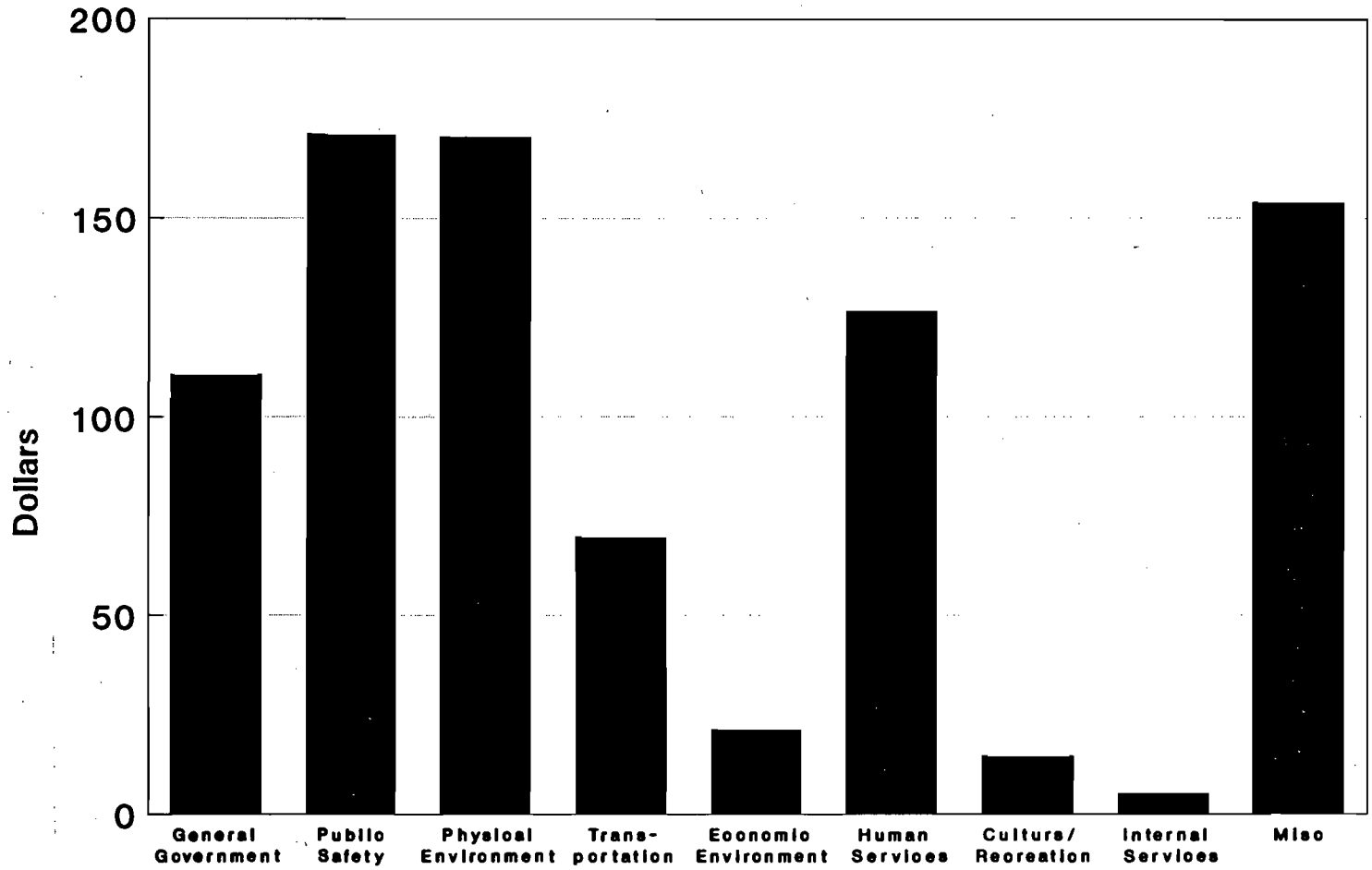


Source: Polk County Office of Management & Budget, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.7-14
POLK COUNTY PER CAPITA REVENUES
1991 THROUGH 1992

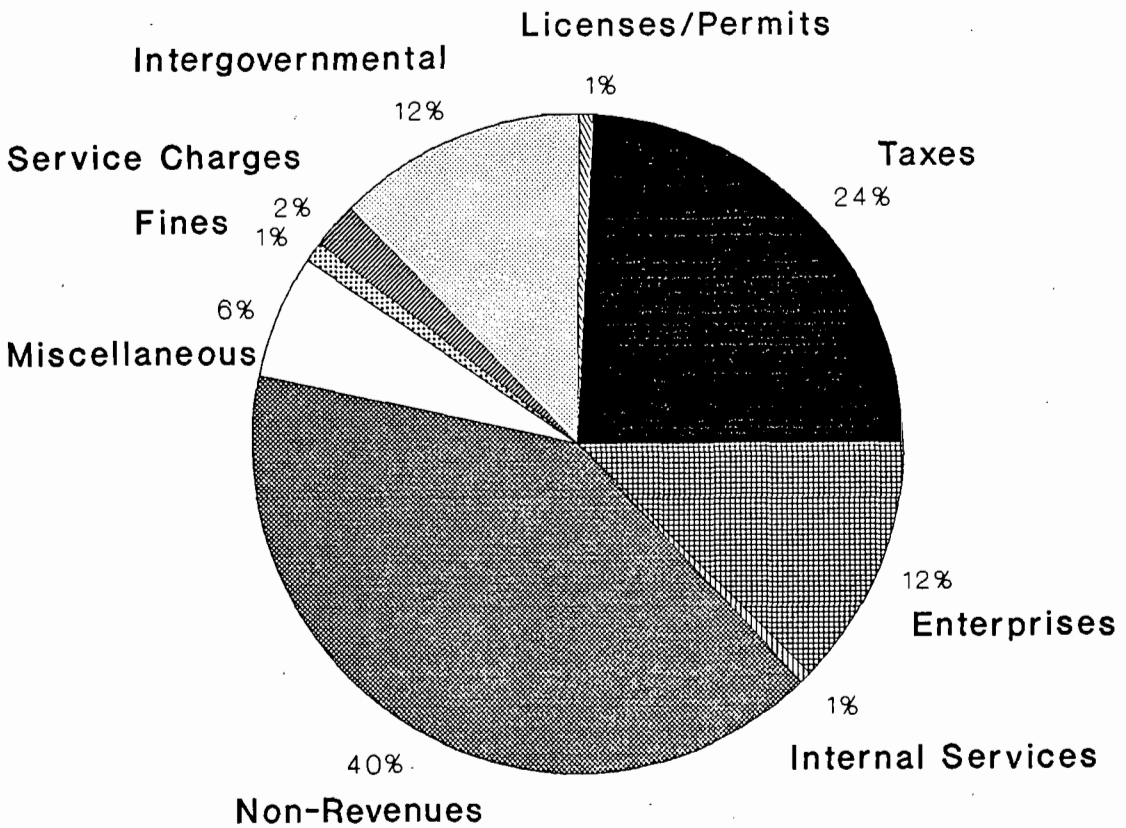


Source: Polk County Office of Management & Budget, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.7-15
POLK COUNTY PER CAPITA EXPENDITURES
1991 THROUGH 1992



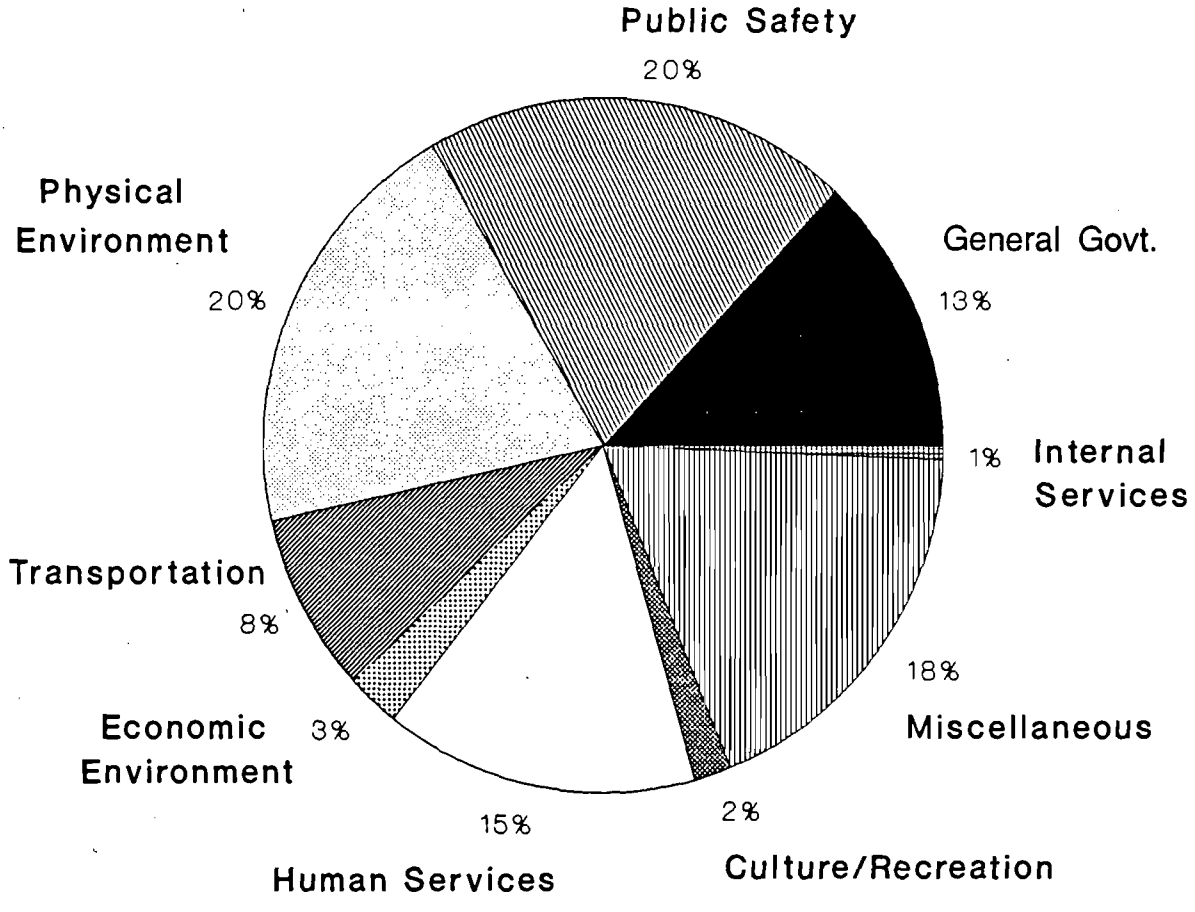
Source: Polk County Office of Management & Budget, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.7-16

MAKE-UP OF POLK COUNTY REVENUES

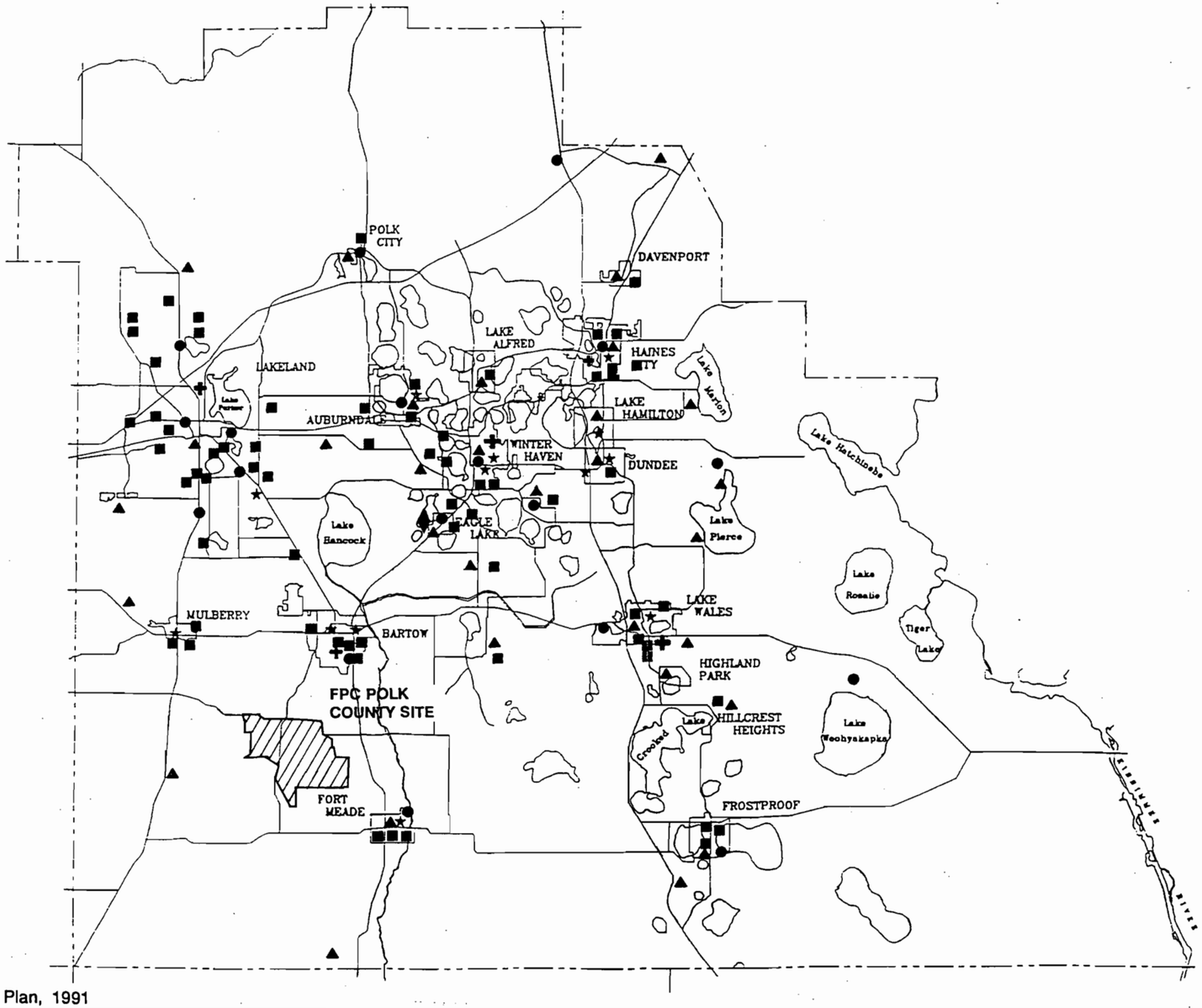


Source: Polk County Office of Management & Budget, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.7-17
MAKE-UP OF POLK COUNTY EXPENDITURES



LEGEND

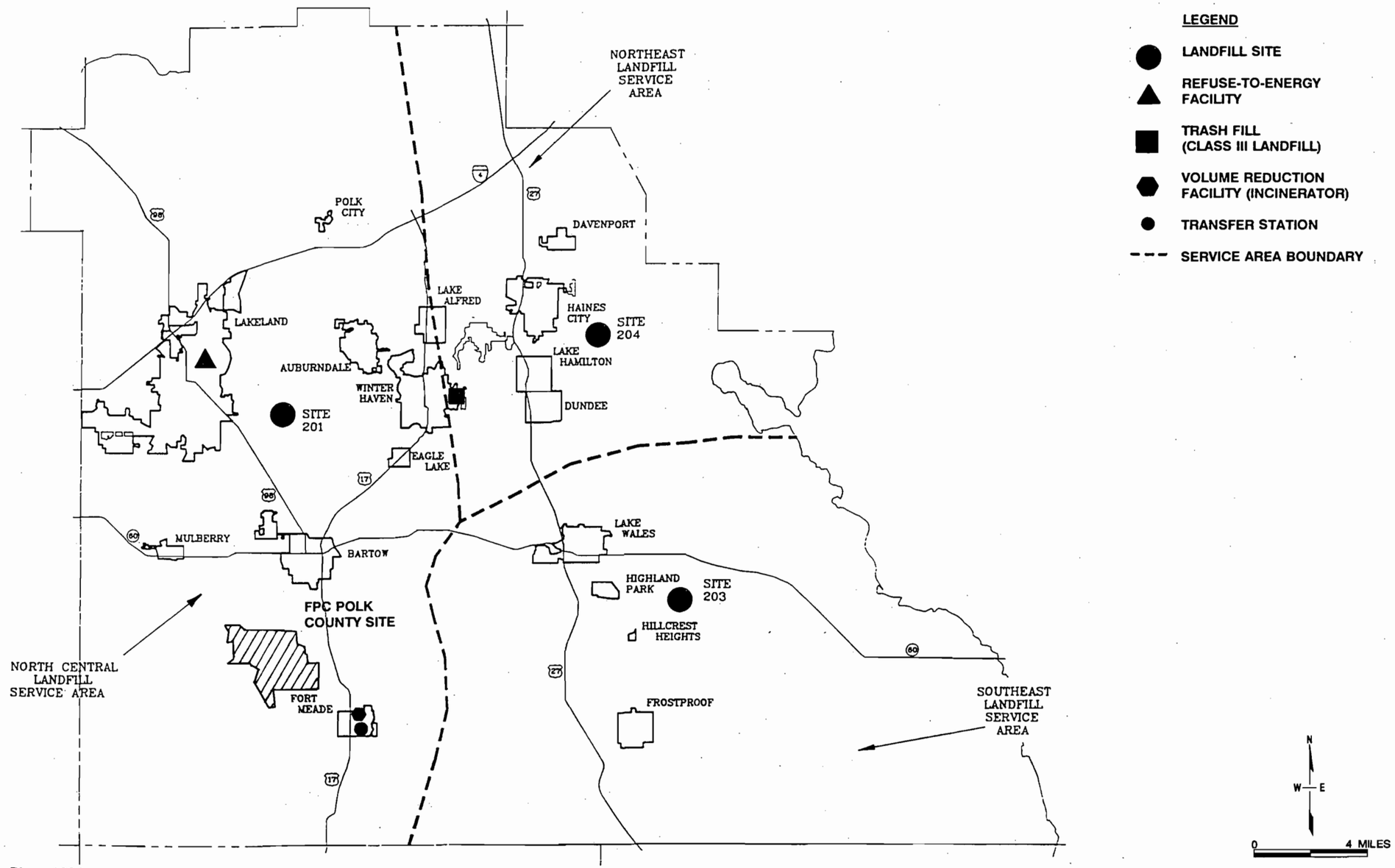
- EMERGENCY MEDICAL SERVICES
- FIRE STATIONS
- HOSPITAL
- LAW ENFORCEMENT
- SCHOOLS
- HAZARDOUS MATERIALS TEAM

Source: Polk County Comprehensive Plan, 1991

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.7-18
LOCATIONS OF PUBLIC SERVICES

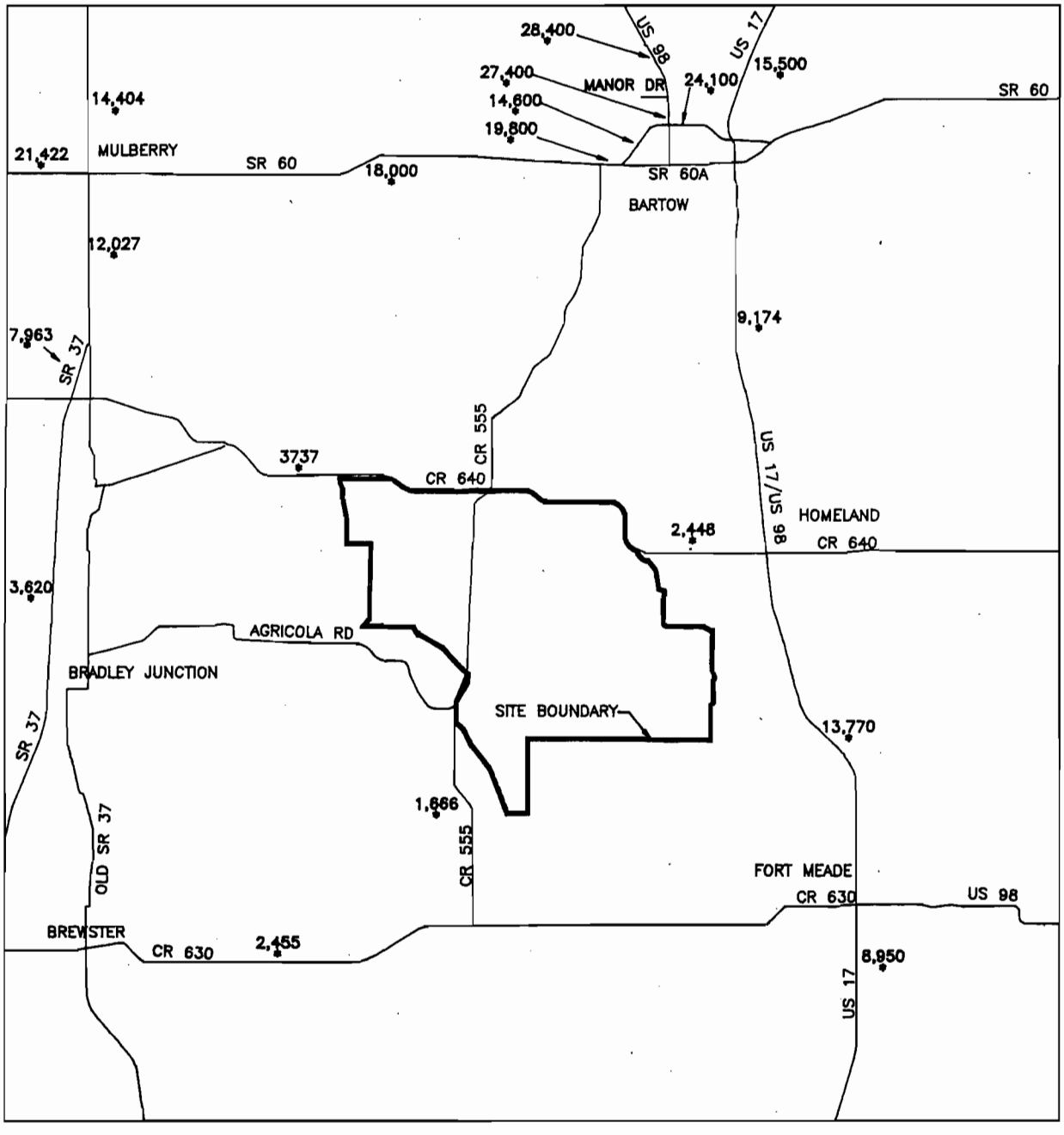


Source: Polk County Comprehensive Plan, 1991

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.7-19
SOLID WASTE FACILITIES AND SERVICE AREA BOUNDARIES



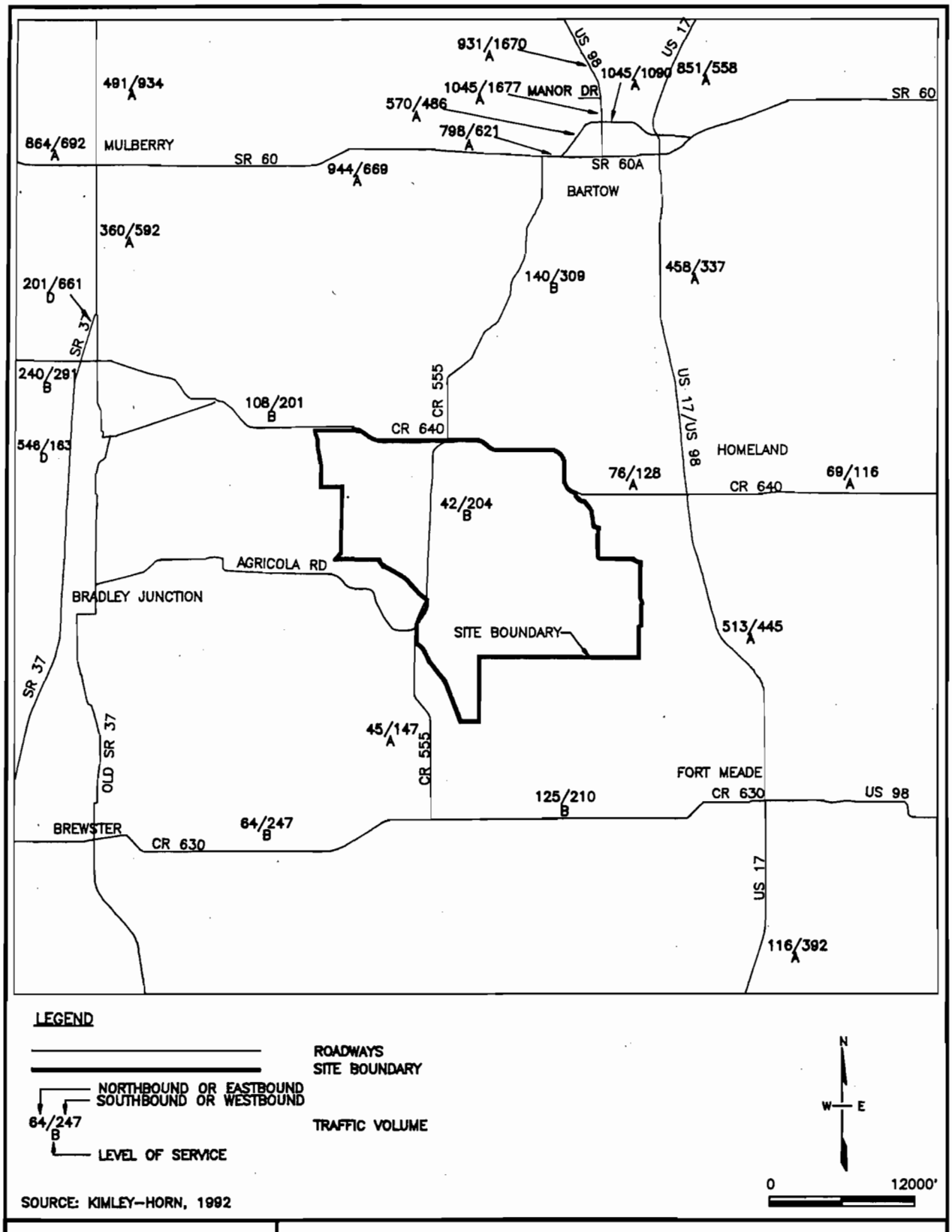
SOURCE: KIMLEY-HORN, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.7-20

EXISTING DAILY TRAFFIC VOLUMES

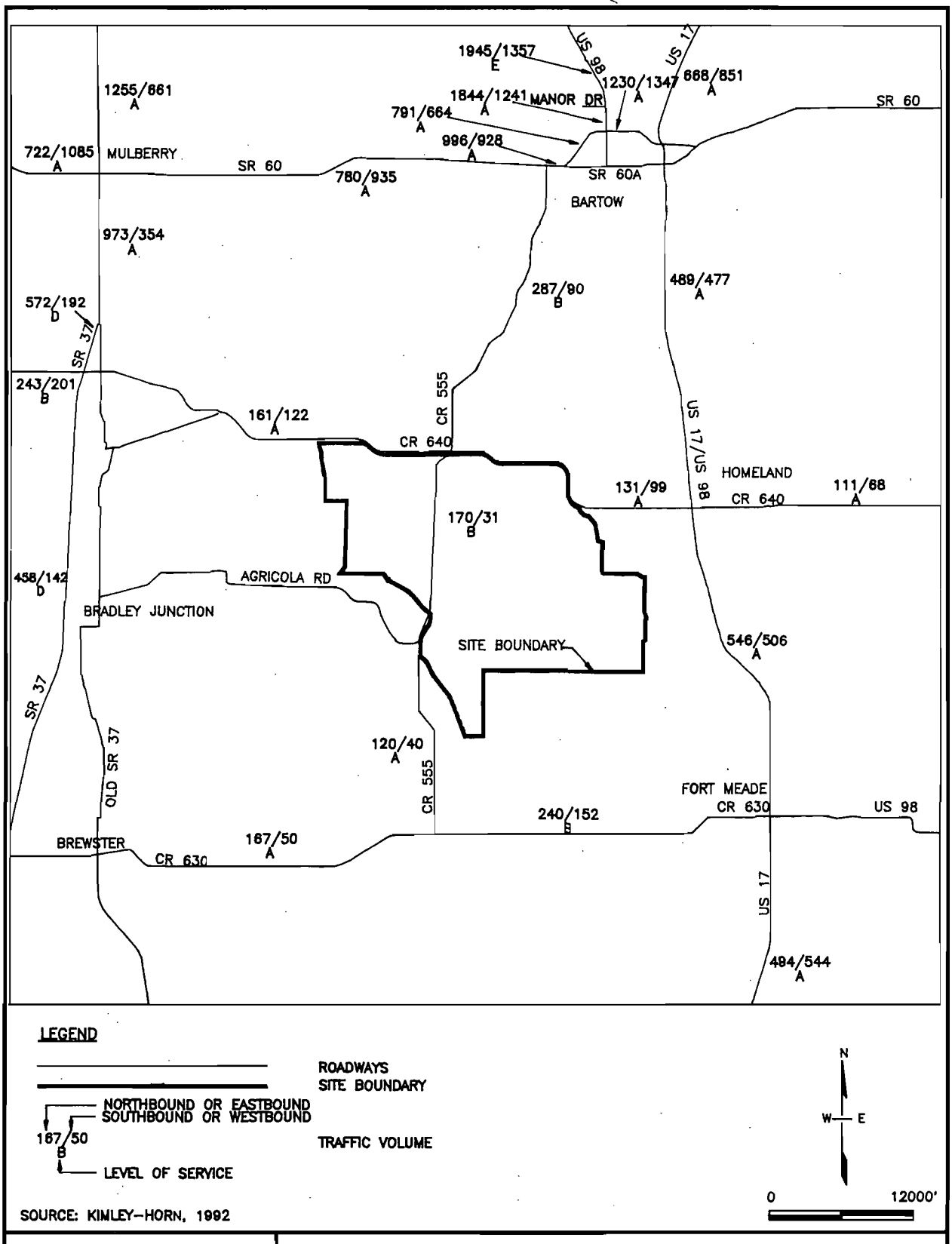


Florida Power CORPORATION

Polk County Site

FIGURE 2.2.7-21

EXISTING PEAK SEASON A.M. PEAK HOUR TRAFFIC VOLUMES

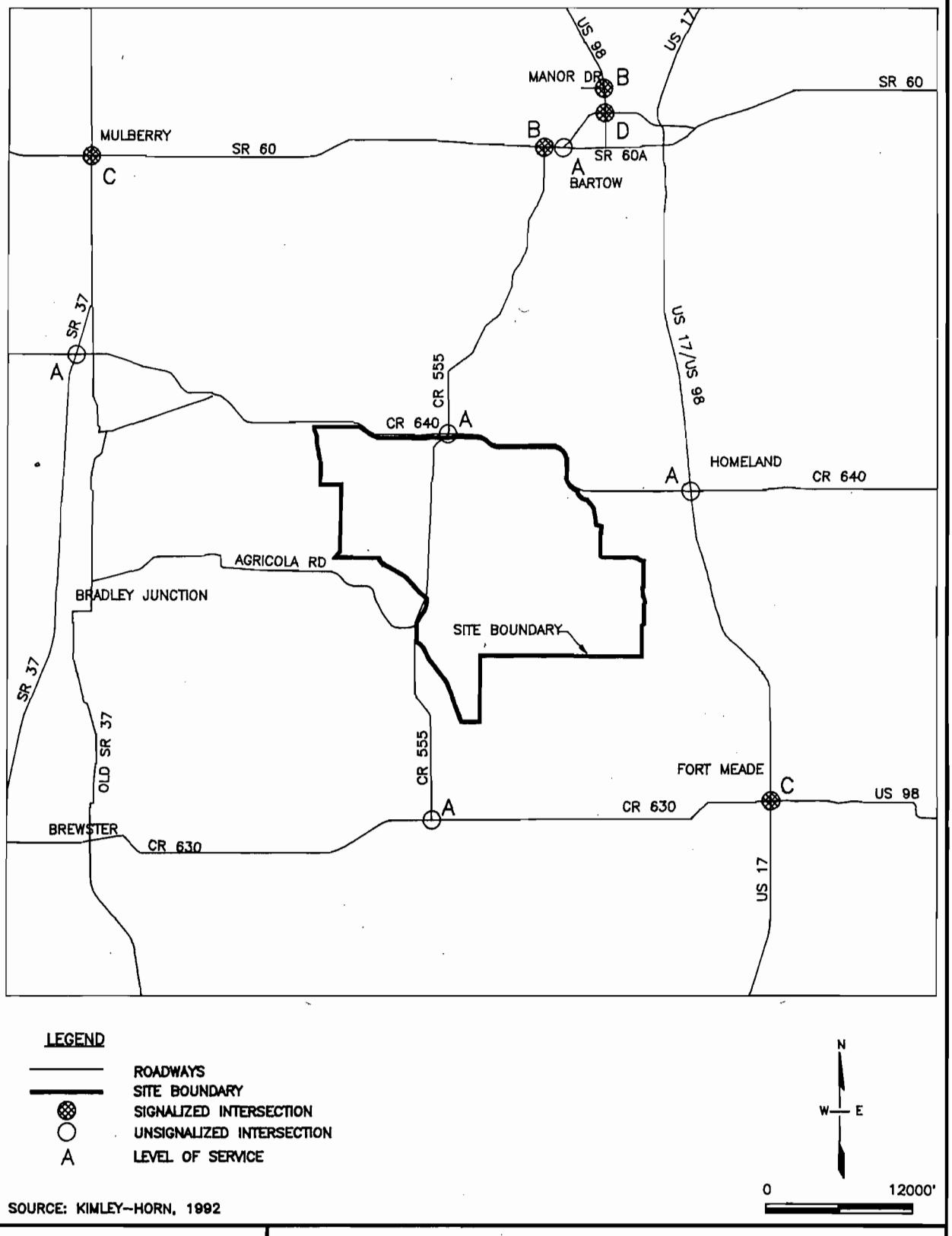


Florida Power CORPORATION

Polk County Site

FIGURE 2.2.7-22

EXISTING PEAK SEASON P.M. PEAK HOUR TRAFFIC VOLUMES



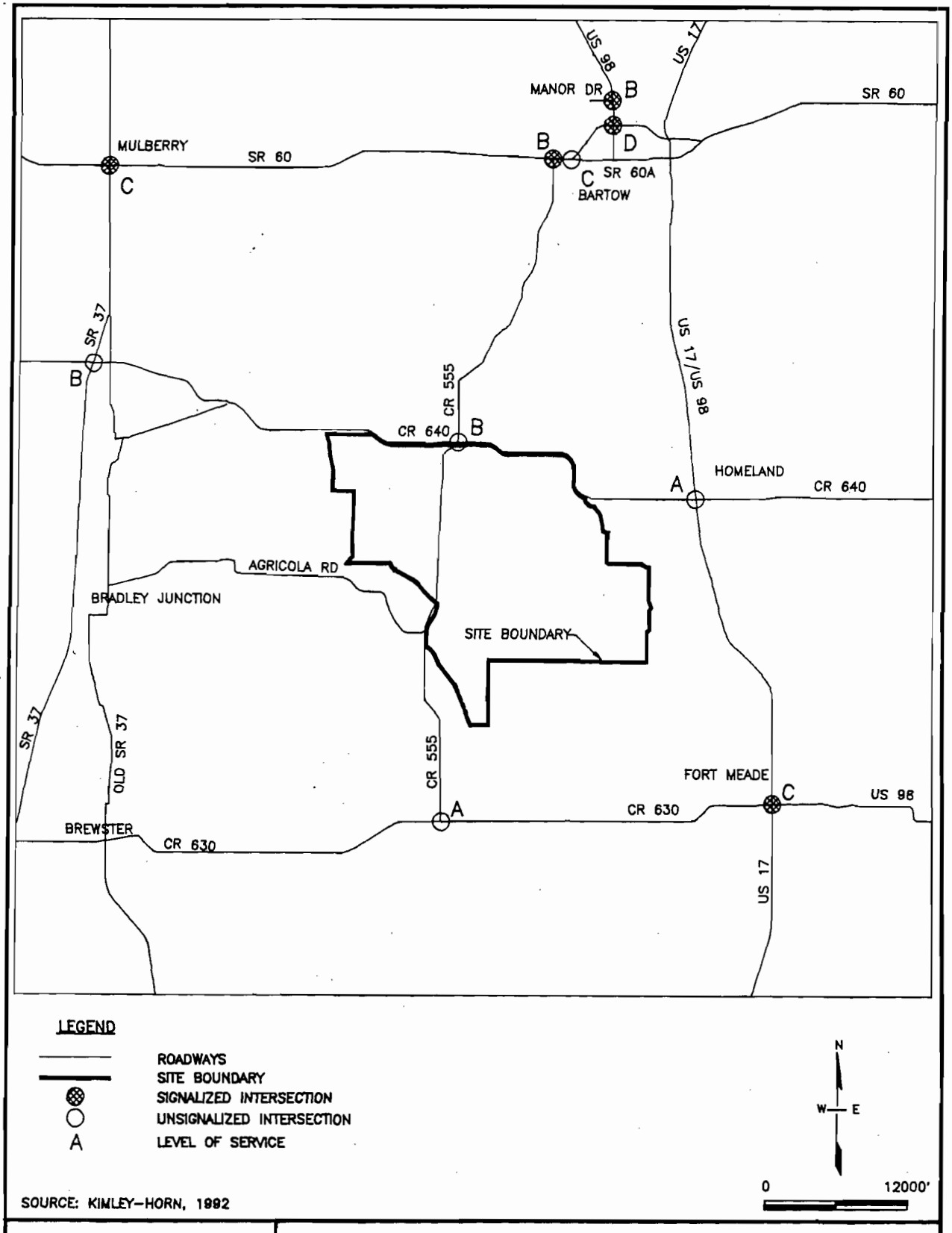
SOURCE: KIMLEY-HORN, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.7-23

EXISTING PEAK SEASON A.M. PEAK HOUR INTERSECTION CONDITIONS



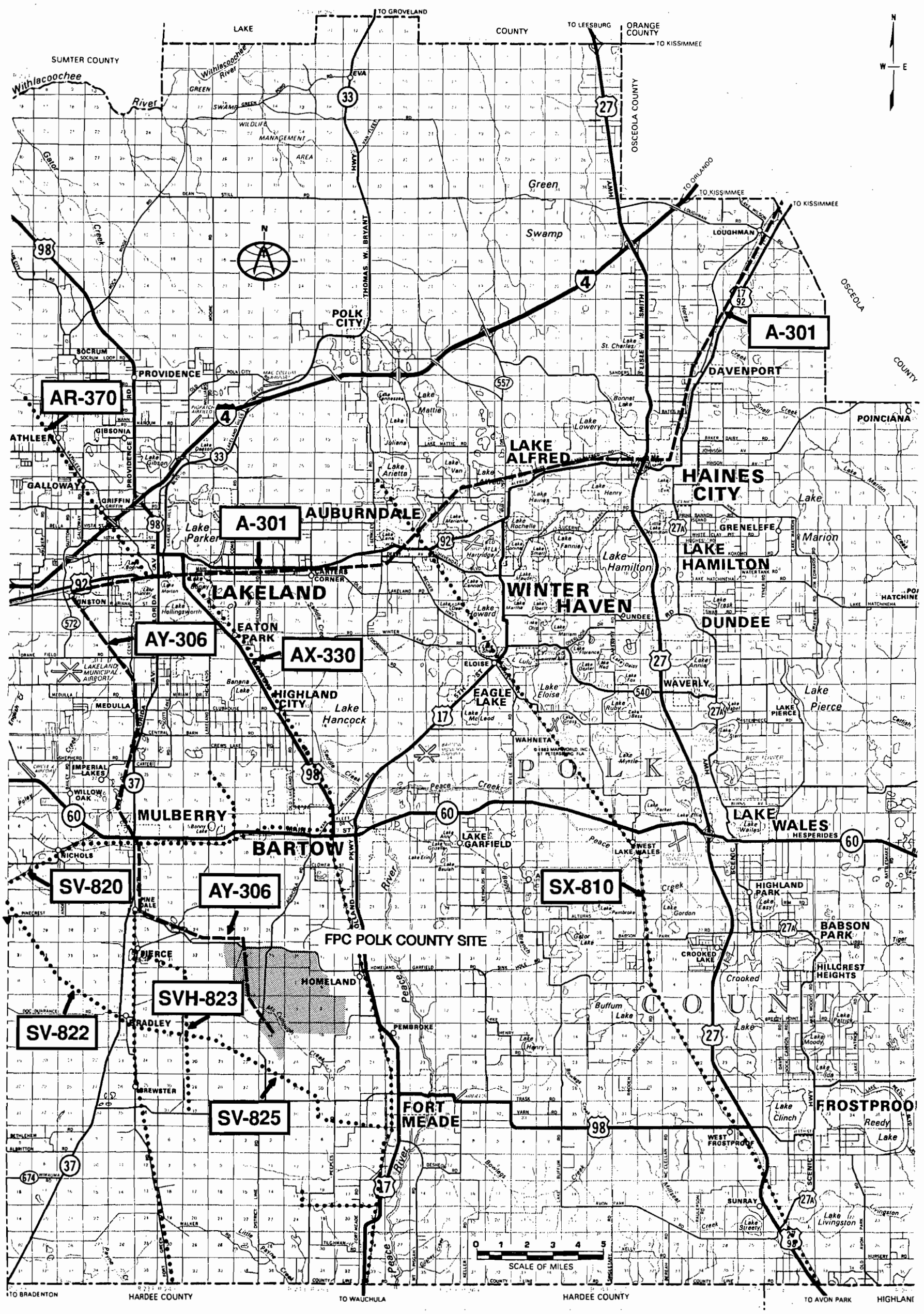
SOURCE: KIMLEY-HORN, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.7-24

EXISTING PEAK SEASON P.M. PEAK HOUR INTERSECTION CONDITIONS



AX-330 ROUTE NUMBER

PROBABLE RAIL ROUTE FOR FPC SITE

OTHER CSX RAIL ROUTES IN POLK COUNTY

SOURCES: RAND McNALLY, 1986;
MOORE/BOWERS, 1992;
FDOT, 1987-1988.

Florida Power CORPORATION

Polk County Site

FIGURE 2.2.7-25

RAIL TRANSPORTATION IN POLK COUNTY

2.3 BIOPHYSICAL ENVIRONMENT

Following are descriptions of the site geology, surface and subsurface hydrology, water budget and area uses, vegetation/land use, ecology, meteorology, ambient air quality, noise, and other environmental features.

2.3.1 Geohydrology

The geohydrology of the FPC Polk County Site prior to mining operations consisted of a shallow Surficial Aquifer of undifferentiated sands, silts and clayey sands typically up to 15 to 20 feet in depth. The Surficial Aquifer system was removed over most of the site by mining operations. The disturbed mined soils are underlain by the Intermediate Aquifer System which includes upper and lower clay silt and sand confining units above the permeable beds of the aquifer. The upper confining unit functions as an aquiclude beneath the site area and is approximately 100 feet thick. The Intermediate Aquifer System is on the order of 225 to 250 feet thick at the site, and is underlain by the Upper Floridan Aquifer, which extends to depths in excess of several hundred feet. The Upper Floridan Aquifer is proposed to provide the majority of makeup water supply requirements for the project.

The entire FPC Polk County Site has been mined, except portions of the Phosphoria area which still remain to be mined, and the western section of the P-2 mine area. The near-surface soil lithology is a product of the various stages of mining and post-mining activities. During mining of the phosphate matrix, the Surficial Aquifer soil deposits of fine sands and silty to clayey fine sands are stripped off by large draglines and stockpiled in adjacent mine cuts. The phosphate matrix is removed, and the excavation is then partially filled with overburden removed from adjacent unmined areas. The depth of the mining activities varies, depending upon the depth and quality of phosphatic matrix. Typically 15 to 25 feet of overburden is removed and 15 to 25 feet of phosphate matrix is mined out. Average mining depths vary, but mining records indicate that most of the site areas were mined to average depths ranging from 30 to 40 feet below the original ground surface. Mining typically extends to the top of the confining unit that separates the Intermediate Aquifer from the Surficial Aquifer. This is the location at which the matrix soils become so clayey that processing costs are prohibitive.

Most of the site areas were designated as clay settling ponds for the disposal of waste phosphatic clays from the beneficiation and ore processing facilities. Impoundment dams and control structures were constructed around these disposal areas. Dams were typically constructed with existing shaped overburden piles supplemented with fill obtained from interior overburden piles. The dams are typically constructed with slopes on the order of 2.5 to 2.75 feet horizontal to 1.0 foot vertical. Construction of the dams at this site occurred during the past 30 to 35 years, and the site includes dams constructed both prior to and after implementation of Florida Administrative Code (F.A.C.) 17-9 (renumbered F.A.C. 17-672) in 1972. The F.A.C. 17-672

regulations imposed regulatory requirements for the design, construction, inspection, surveillance, and maintenance of earthen embankments utilized in phosphate mining and processing operations. Detailed discussions of the site dams are included in Sections 3.5.1.1 and 3.7.1 of this SCA.

The older pre-F.A.C. 17-672 dams typically comprise larger sections of shaped/cast overburden. Post-F.A.C. 17-672 dams usually contain significant portions of compacted fill in the upper embankment sections to meet the design stability requirements of F.A.C. 17-672.

The clay settling areas are filled with the silt and clay component of the mined matrix from several mine areas. The silts and clays are separated at the processing plant washer and pumped by slurry pipeline to the disposal site. Pumped slurry typically contains 3 to 5 percent solids content by weight. The solids are settled out in ponds and clear decanted water is scalped off the pond and returned to the processing plant or other mining operations. The clay settling areas are slowly filled in this manner to maximum elevations of five feet below the impoundment dam crest.

Surface features of the settling ponds are highly variable. Recent settling ponds are shallow ponds with very soft clays near the water surface, while older ponds are relatively flat. These areas usually have a shallow desiccated crust at the surface with desiccation cracks ranging from less than one inch to in excess of 1 foot wide and as deep as 1 to 2 feet. Strength of the surface crust in these ponds varies greatly.

To develop the site for power plant usage, the clay settling areas will be used for the containment and retention of plant cooling water, solid waste disposal, and brine from the water treatment process. Heat dissipation will be accomplished in specified pond areas as described in Section 3.5.1.1. The ponds will utilize the existing impoundment dams with some modifications for the containment of cooling water. In addition, the waste clay deposited in the bottom of these pond areas, in combination with the impermeable undisturbed confining unit soils below the mine pit bottom, will minimize leakage of water from the areas, thereby reducing makeup water requirements. In solid waste disposal areas SA-8, SA-10, P-2, and portions of P-3, the presence of the thick waste clay deposits will function as a natural impermeable soil barrier. Solid waste disposal area designs are described in Section 3.7.1.

The areas proposed for development of the plant island, SA-11, SA-12 and SA-13, consist of partially reclaimed mined-out pits with large amounts of loose overburden material. No phosphatic clays have been deposited in these areas. Fine clean sand tailings occupy a large portion of the north section of SA-13 and a smaller area in the north corner of SA-12.

To evaluate the suitability of the subsurface soil conditions at the site, a program of field investigations and laboratory testing was completed. The field exploration program was divided into the three major component areas of the site: clay settling areas, containment dams, and proposed plant island areas. The site-wide exploration test locations are presented on Figure 2.3.1-1. In addition, deep soil borings were performed to evaluate sinkhole potential at selected locations on the site. The sinkhole study is discussed in detail in Section 2.3.2.2. A laboratory testing program was performed to confirm the field classification of the different lithologic soil units encountered and to define engineering properties of the soils encountered for analysis and design purposes. Appendix 10.5.3 describes the field exploration program conducted to investigate the surficial soil conditions at the site. Detailed lithologic descriptions of the three major component areas of this soil investigation are presented in Section 2.3.1.2.

2.3.1.1 General Geology

This section describes the major geologic aspects of the FPC Polk County Site and discusses these geologic features on a regional setting.

GEOGRAPHIC SETTING

Polk County is divided into nine major physiographic provinces: the Lakeland Ridge, Winter Haven Ridge, Lake Henry Ridge, Lake Wales Ridge, Bombing Range Ridge, Lake Upland, Polk Upland, Osceola Plain, and Western Valley (SWFWMD, 1988). These areas and their topographic relief and sediments are related to higher sea level stands.

The FPC Polk County Site is located within the southern reaches of the Lakeland Ridge, which runs north to south in western Polk County from about 10 miles northwest of Lakeland to the vicinity of Fort Meade. The Ridge ranges in elevation from 150 to 270 ft MSL.

REGIONAL GEOLOGY

Surface and near-surface sediments in Polk County consist of quartz sand, silt, clay, phosphate and limestone. A simplified stratigraphic sequence, from top to bottom, includes unnamed Holocene deposits (predominantly sand), Pleistocene and Pliocene marine sands (some containing phosphate) overlying clays, sandy clays, and phosphatic limestone of the Miocene Hawthorn Group. These overlie a thick sequence of limestone, including the Miocene Tampa Member of the Hawthorn Group, Oligocene Suwannee Limestone, Eocene Ocala Group and Avon Park Formation (SWFWMD, 1988).

Figure 2.3.1-2 shows the generalized lithostratigraphic units and hydrogeologic framework underlying the site area. Figures 2.3.1-3 and 2.3.1-4 show the distribution of these sediments throughout Polk County in two geologic cross-sections.

POST-MIOCENE SURFACE SEDIMENTS

The surface sediments in Polk County consist of post-Miocene deposits of unlithified coastal sand, shell, silts, sand, gravelly sand, and beach and dune sands. In general, the surficial sediments are thinnest in the southwest portion of Polk County, and are thicker to the north and east, and beneath ridges. The thickness of the undifferentiated surficial deposits ranges from less than 10 feet to more than 120 feet. At the site, the surficial deposits were removed by mining operations and were typically 20 feet thick.

MIOCENE HAWTHORN GROUP

The Miocene Hawthorn Group in South Florida includes the Peace River Formation which overlies the Arcadia Formation. The Bone Valley Member, located in the upper portions of the Peace River Formation, is considered to be the top of the Hawthorn Group. The lower portion of the Hawthorn Group consists of silts, clays and limestone of the Arcadia Formation (Scott, 1988). The Peace River Formation is present throughout Polk County with the exception of the northernmost part of the County. The Arcadia Formation ranges in thickness from 0 feet in the north to approximately 300 feet in the southwest corner of the County. In general, these formations dip to the south and southeast. The Peace River Formation includes the Bone Valley Member which consists of yellowish gray to light olive-green interbedded sands, clays and dolomite with variable phosphate content. The Bone Valley Member is defined as phosphorite

pebble or gravel matrix beds with sand-sized phosphorite in a sandy to clayey matrix. At the FPC site, the Bone Valley Member comprises most of the Peace River Formation. The Bone Valley member directly overlies the Arcadia Formation which consists of white to yellowish gray, quartz, sandy, phosphates and clayey dolomites and clay beds. The thickness of the Hawthorn Group is approximately 260 feet in the site vicinity.

OLIGOCENE SUWANNEE LIMESTONE

The Oligocene Suwannee Limestone is present throughout the western portion of Polk County. The Suwannee consists of a white, creamy, tan, variably textured calcarenite to calcilutite, fossiliferous, poor to well indurated to variably recrystallized limestone. The top of the Suwannee Limestone is reported to range from elevation 70 to 80 ft MSL in the north areas of Lakeland to -250 to -300 ft MSL and range in thickness from 100 to 150 feet in the western portions of Polk County (SWFWMD, 1988).

EOCENE OCALA GROUP

Below the Suwannee Limestone lies the Eocene series of the Ocala Group, the Avon Park Formation and the Oldsmar Formation. Essentially all of Polk County is underlain by the Ocala Group. The Ocala Group (consisting of the Crystal River, Williston, and Inglis Formations) ranges in thickness from 75 to 335 feet throughout the County. The top of the Ocala Group is near the surface in the northern portion of the County and dips southward.

The Avon Park Formation is present below the Ocala Group. It is highly fractured, consists of finely crystalline dolomite with some fossiliferous limestone, and ranges up to 700 feet thick. Underlying the Avon Park Formation is the Oldsmar Formation containing gypsum and anhydrite, which degrades the overall water quality.

2.3.1.2 Detailed Site Lithologic Description

Following is a description of site area geology and near-surface soil lithology in the clay settling areas, along the alignment of the clay settling area dams and in the plant island areas, including the results of the field exploration and laboratory testing programs described in Appendix 10.5.3.

A number of previously published soil studies regarding the site subsurface conditions were reviewed and relevant data and information gathered. Pre-mining prospect logs and maps of the area, as well as other records made available by the mining companies, provided information on pre-mining thicknesses of overburden material and matrix. Average pit bottom elevations varied from approximately 110 to 128 ft MSL for the Noralyn (N-series) mining areas and from 130 to 136 ft MSL for the Estech Silver City (SA-series) mining areas.

Dam design reports for mining areas N-15, N-16, SA-8, SA-9, SA-10, P-2 and P-3 were reviewed. Referenced reports are summarized in Section 3.5.1.1 and 3.7.1. Several published documents provided information on properties of the waste phosphatic clays. These include several FIPR publications (Bromwell Engineering, 1982; Ardaman & Associates., Inc., 1982-1989), and mining companies' clay disposal plans and modeling data submitted to SWFWMD and FDNR as part of the permitting process for the clay settling areas.

The mining operations and the various stages of land utilization after mining result in a complex surficial soil lithology that varies from mine area to mine area. Mining has resulted in a severely disturbed, variable surficial soil profile above elevations of 120 to 130 ft MSL, which corresponds to the average elevation of the bottom of the mining pits. Measured pit bottom elevations vary from as low as 106 to as high as 138 ft MSL. Beneath the upper disturbed soils profile, the underlying in-situ soils of the lower Bone Valley Member and upper Hawthorn Group confining unit were encountered in the borings. These soils are typically dense to very dense and have very low permeability.

SITE AREA GEOLOGY

The generalized geology of the site area has been described in the previous section based upon available publications. The purpose of this section is to present site specific data obtained during field activities and correlate site geology to previously described geologic units. This section will describe the lithology from land surface elevation to lithologic units and the thickness of each unit. The geologic framework is limited to the spatial distribution and depth of borings or testing locations. Data obtained by the use of downhole geophysical logging tools, as well as lithologic samples recovered for description were used. The data points were located on the Estech Plant site (west of CR 555), as well as 300 feet deep borings performed near the power block area.

A description of the drilling of boreholes, collection of samples for lithologic description, and results of downhole geophysical logging performed during the aquifer pump test program is provided in Appendix 10.5.8. In addition, hydrogeologic cross-sections were developed from lithology encountered in three 300 feet deep boreholes (SH-1, SH-2, and SH-3) at the site. Generally, the site specific data obtained during the field activities can be correlated to the overall geologic framework as described for Polk County. Figure 2.3.1-5 shows the hydrologic framework of the FPC site as encountered during the field activities. A hydrogeologic cross-section location map from the aquifer pump test at the Estech Plant site is presented on Figure 2.3.1-6. Figures 2.3.1-7 and 2.3.1-8 represent hydrogeological cross-sections A-A' and B-B' in this area. Figure 2.3.1-9 is the cross-section location map for the FPC site. Figures 2.3.1-10 and 2.3.1-11 are hydrogeologic cross-sections underlying the FPC site in relation to the site lithologic data.

As shown in the hydrogeologic cross-sections, the majority of the post-Miocene undifferentiated sands and the Bone Valley Member of the Peace River Formation (the top of the Hawthorn Group) have been removed/disturbed by mining operations. The surficial deposits (overburden) above the Bone Valley Member are typically 15 to 25 feet thick. The Bone Valley Member, typically 15 to 25 feet thick, has been mined to an elevation of approximately 120 to 130 ft MSL.

The Miocene Hawthorne Group below the mined areas consists of clays, silts, sand, and limestone of the Arcadian Formation. The Hawthorn Group, to the bottom of the Arcadian, is approximately 260 feet thick at the Estech Plant site with a base elevation of approximately -110 ft MSL. The bottom of the Hawthorn Group dips downward to the south.

The sandy limestone encountered below the gray silts at the bottom of the Arcadian Formation is most likely the Oligocene age Suwannee Limestone. Limestone of the Early Miocene Tampa Member could not be differentiated, and may or may not be present. The top of the Suwannee Limestone ranges from an elevation of -85 ft MSL to the north at boring SH-1, to an elevation of -110 ft MSL toward the south and southwest.

Below the Suwannee Limestone are the carbonates of the Eocene Ocala Group. The contact between these two could not be identified during the field investigations. However, literature by Ryder (1985) implies the bottom of the Suwannee Limestone is located at about -200 ft MSL in the site area, with a thickness of about 100 feet.

To the extent of the field activities performed, the limestones of the Ocala Group were encountered to the termination depth of well SC-1, which logged lithology to an elevation of -650 ft MSL.

CLAY SETTLING AREAS

Subsurface conditions in the clay settling areas consist of waste phosphatic clays overlying loose cast overburden to the bottom of the mine pit. The approximate location of cross sections through the site is shown on Figure 2.3.1-12, (Cross-Section Location Map). Stratigraphy of the clay pond areas is presented on Figure 2.3.1-13 (Cross-Sections A-A' and E-E'), Figure 2.3.1-14 (Cross-Section B-B', north end), Figure 2.3.1-15 (Cross-Sections C-C' and D-D') and Figure 2.3.1-16, (Cross-Sections F-F' and G-G'). The clay surface elevation varies from as low as 140 ft MSL (in N-16) to as high as 183 ft MSL in N-11B. Clay thicknesses typically range from about 15 feet to 45 feet, as recorded at the boring locations. The smallest clay thickness measured in interior pond areas away from dam slopes during the clay probing performed in the waste disposal areas was approximately 10 feet in pond P-2. Clay probes performed in waste disposal areas are shown in Section 3.7.1. Clay thicknesses greater than 40 feet were measured frequently during the probing operation. Average clay thicknesses were about 30 feet or greater. The thickness and impermeability of the clays will provide a suitable soil liner in proposed waste disposal areas as discussed in detail in Section 3.7.

Solids content profiles generated at the boring locations representing typical conditions are shown on Figures 10.5.3-222 through 10.5.3-262. Some clay pond borings were purposely drilled adjacent to the dams to provide supplemental information for the evaluation of dam stability. These clay borings may not be representative of the typical clay pond conditions in interior pond areas due to their close proximity to the dams and the greater consolidation that occurs near such drainage faces. A wide range of solids content conditions was encountered in the ponds. The average solids content ranged from a low of 29 percent in Boring C-17 in pond N-15, to a high of 47 percent in Boring C-33 in pond P-2. Evidence of stage filling (i.e. intermediate desiccated crusting zones) was observed in a number of the older ponds as evidenced by intermittent layers of solids content measurements in excess of 40 percent to 50 percent.

The overburden material underlying the waste phosphatic clay throughout the site consists typically of clayey and silty fine sand (SC and SM). The material is generally very loose to

loose with erratic distribution throughout the site due to the mining operations and stockpiling of overburden.

The unmined soils immediately underlying the overburden material vary from silty fine sands (SM) to calcareous clayey sandy silt (MH), with occasional limestone fragments. The material is typically dense to very dense or very stiff.

Index and classification tests, including moisture content determination, gradation and Atterberg limits tests, were performed on a large number of samples from the three stratigraphic units. In addition, undisturbed samples were tested to measure their moisture content and dry densities. The results of these tests are shown on the boring logs in Appendix 10.5.3. Plasticity test results for the waste phosphatic clays produced from the various mining operations, are plotted on Figures 2.3.1-17, 2.3.1-18 and 2.3.1-19, respectively. These plots show a wide range in plasticity index, which is an indicator of the variation in the clay mineralogic content of the waste phosphatic clay soils encountered in the various mining areas. The average plasticity index values ranged from 144 percent to 159 percent.

Grain-size distribution curves for two samples of waste phosphatic clay from Borings C-4 and C-18 are shown on Figure 2.3.1-20. The curves are based on the results of hydrometer analysis.

Constant or falling head triaxial permeability tests were performed at the in-situ moisture content on seven samples of phosphatic clays and two samples of the undisturbed material at the bottom of the mine pit (Borings C-46 and C-47) in the N-16 area. The results of these tests are summarized in Table 2.3.1-1.

Table 2.3.1-2 presents porosity and vertical permeability values evaluated from laboratory test results for the three major stratigraphic units encountered in the clay pond borings.

A number of relatively undisturbed samples of the phosphatic clays obtained with the Type-U sampler were selected for consolidation testing. A summary of the consolidation test results (Lambe and Whitman, 1969), including the compressibility (C_c) and recompression (Cr) indices, and the average coefficient of consolidation (C_v), is presented in Table 2.3.1-3.

Triaxial testing was performed on selected clay pond samples obtained with the Type-U sampler. Four Unconsolidated Undrained (UU) tests were performed to supplement the results of the

in-situ vane shear strength tests. The undrained shear strength values obtained from the tests are included in Table 2.3.1-4. The values ranged from 89 to 240 pounds per square foot (psf).

A total of 23 in-situ Field Vane Shear (FVS) tests were completed in 16 of the 47 clay pond borings. The results of these tests are presented in Table 2.3.1-5. The peak strength ranged from 45 to 775 psf while the remolded strength varied from 18 to 258 psf. Sensitivity is a measure of the ratio of the peak to remolded shear strength of the clays, and varied from 1.0 to 3.0 with an average of 2.0.

Clay settling area N-16 is a mine pit with numerous overburden piles which extend above the water surface forming a maze-like series of islands. Water elevation in the pond is about 148 to 150 ft MSL. The pond received a limited amount of clays, which are contained in the northeastern section of the area south of N-13 and west of N-9B. Of the six Standard Penetration Test (SPT) borings drilled in the area, two borings, C-11 and C-12, were drilled in clay areas very close to existing dams to provide information for dam stability assessments. They encountered 3 and 8 feet of phosphatic clay, respectively. The other borings, C-45 through C-48, were drilled in overburden soil areas to obtain samples of the undisturbed material at the bottom of the pond. Boring C-46 encountered three feet of phosphatic clay overlying cast overburden, indicating some spillage of clays from the clay disposal area. The other three borings encountered from 15 to 35 feet of loose overburden material before penetrating the underlying undisturbed ground.

Pond N-11C has been used by the mining company for disposal of sand tailings. Tailings are visible on aerial photographs at the surface along the northern half of the western perimeter and in fingers of varied size and orientation in the northeastern portion. Two borrow source exploratory borings were drilled in the sand tail deposits in the N-11C area. Borings B-1 and B-2 encountered tailings to depths of approximately 60 and 33 feet below existing grade, respectively. There are also sand tailings in the northwestern corner of SA-8, as revealed by borrow source borings B-3 and B-4 which penetrated through 23 and 18 feet of sand tails, respectively. The logs of these borings are presented in Appendix 10.5.3.

Subsurface conditions in the Phosphoria area (excluding P-2 and P-3) are highly variable. Three clay pond borings, C-41 through C-43, were drilled in the area. Borings C-41 and C-42 were drilled in the two lakes between areas P-2 and P-3. Approximately 15 feet of phosphatic clay overlying undisturbed ground were encountered in Boring C-41. Boring C-42 penetrated through

about 26 feet of cast overburden before encountering undisturbed ground. Boring C-43 was drilled in a suspected clay settling area south of the Phosphoria plant and encountered about 5 feet of sand overlying approximately 17 feet of waste phosphatic clay with about 2 feet of organic muck at a depth of 10 feet below existing grade. The waste clay is underlain by undisturbed ground. This area is still an active mine scheduled to be mined out in 1998. The topography and near-surface conditions in this mine will correspondingly be highly altered over the next several years.

DAM ALIGNMENT LITHOLOGY

The exploration program conducted to evaluate the existing dams encountered two primary materials: overburden material used to construct the dams and undisturbed soils which were covered by the overburden material. The overburden material extends from the top of the dams (approximate elevations ranging from 155 ft MSL to 185 ft MSL) to the mine pit bottoms (undisturbed ground) at elevations typically ranging from 115 ft MSL to 135 ft MSL. Typically, this material consists of silty to clayey sand (SM to SC) and was encountered in both the compacted (rolled) and non-compacted (cast) states. The more recent Florida Administrative Code (F.A.C.) 17-672 dams typically contained significantly greater portions of compacted overburden than the earlier dams.

The undisturbed soils beneath the overburden are medium to very dense silty and clayey sands (SM to SC) to stiff to hard calcareous sandy silts and silty clays (MH to CH). These materials extend at least to the boring termination depths at elevations ranging from about 95 ft MSL to 115 ft MSL.

Results of grain-size analyses performed on representative samples of the overburden and undisturbed materials are summarized on Figures 2.3.1-21 and 2.3.1-22, respectively. Porosities, and vertical and horizontal permeabilities as evaluated from appropriate laboratory and field tests are summarized in Table 2.3.1-6.

The results of other index and classification tests are included on the boring logs in Appendix 10.5.3. Shear strength data of the different materials obtained from laboratory triaxial and in-situ dilatometer tests are reported in detail in Section 3.5.1.1.

Descriptions of the subsurface lithologics along dam alignments impounding the various pond locations are provided below. Conceptual cross-sections through N-16, N-15, N-11C and N-11B dams proposed for cooling water retention are presented in Section 3.5.1.1. Cross-sections through dams for waste disposal areas are provided in Section 3.7.1.

N-16 AREA DAMS. The N-16 east dam is the west dam of the N-9B impoundment area with a crest elevation of 165 ft MSL. The north N-16 dam is the south dam of N-13 and the south and southwest dams of N-11B. A small section of the north N-16 dam section is also the south wall of the N-15 dam near the southeast corner of N-15. North N-16 dam crest elevations range from approximately 170 to 175 ft MSL. The south N-16 dam borders Tiger Bay and is constructed to a crest elevation of 155 ft MSL. The west dam is the east dam of SA-8 with a crest elevation of 185 ft MSL.

The subsurface materials encountered by borings along the east, north, and south dams are mainly compacted overburden to depths ranging from 5 to 20 feet, with an average depth of about 10 feet. Cast overburden was typically encountered beneath the compacted material and extended to undisturbed ground at typical elevations ranging from 115 to 135 ft MSL. The natural ground was explored to the boring termination depths at 95 to 115 ft MSL.

Borings along the west dam encountered compacted overburden to depths of about 30 feet underlain by cast or compacted overburden extending to undisturbed ground at elevations of 120 to 125 ft MSL. The deepest boring penetrated to elevation 85 ft MSL.

N-15 AREA DAMS. The N-15 north, west, and south walls are all recent F.A.C. 17-672 dams with a crest elevation of 175 ft MSL. The east N-15 dam, which comprises the west dams of the older N-11C and the N-11B impoundment areas, is also constructed to a crest elevation of 175 ft MSL.

The subsurface materials along the north, west, and south dams are compacted overburden above the exterior undisturbed ground surface at elevations ranging from 148 to 160 ft MSL and are underlain by cast overburden under interior slopes of the dam and by undisturbed ground under exterior dam slopes. These dam sections were built along the edge of the N-15 mining pit area, and were constructed with a 10-foot wide vertical interior seepage collection chimney drain and a 3 foot thick horizontal drainage blanket of clean fine sand tailings.

The east N-15 dams appear to be composed of 5 to 10 feet of compacted overburden underlain by cast overburden extending to the mine pit bottom at elevations ranging from 115 to 125 ft MSL.

NORTH N-11C DAMS. The N-11C north wall is a pre-F.A.C. 17-672 dam with a crest elevation of 175 ft MSL. The subsurface materials along this dam are compacted overburden 5 feet deep near the east end of the dam and about 30 feet deep near the west end of the dam, underlain by cast overburden down to undisturbed ground at elevations ranging from 125 to 130 ft MSL. Finally, a layer of medium stiff sandy clay, 5 to 6 feet thick, was encountered at a depth of 14 feet near the east end of the dam.

EAST N-11C/N-11B DAMS. The east N-11C/N-11B dams are pre-F.A.C. 17-672 dams with crest elevations ranging from 173 ft MSL near the south end of N-11B to 178 ft MSL near the north end of N-11C. These dams were constructed of compacted overburden 5 to 20 feet deep underlain by cast overburden extending down to undisturbed ground at elevations ranging from 115 to 125 ft MSL.

SA-8 DAMS. The SA-8 dams are F.A.C. 17-672 dams with a crest elevation of 185 ft MSL. These dams were constructed of compacted overburden 25 to 30 feet thick underlain by cast overburden or additional compacted overburden extending down to undisturbed ground at elevation 120 to 130 ft MSL.

SA-9 DAMS. The SA-9 dams are F.A.C. 17-672 dams with a crest elevation of 185 ft MSL. The north and east dams are common with the SA-8 area. The northern portion of the west SA-9 dam consists of compacted overburden 25 to 35 feet thick underlain by cast or compacted overburden down to undisturbed ground at elevation 130 to 135 ft MSL. Borings along the southern portion of the west SA-9 embankment indicate compacted overburden directly overlying undisturbed ground at about elevation 130 ft MSL.

PLANT ISLAND LITHOLOGY

The proposed plant island areas SA-11, SA-12 and SA-13 are mine pits presently undergoing reclamation. Water surface elevation and the average water depth obtained from a bathymetric study for area SA-11 are approximately 160 ft MSL and 4 feet, respectively. Similarly, the water surface elevation for SA-12 is approximately 158 ft MSL with an average depth of 3 feet.

A bathymetric study was not performed in SA-13 because it consisted of three smaller isolated pits and two sand tail-filled sections in the northwest portion of the area. The water depths at the three boring locations drilled in SA-13 ranged from 7.5 to 11.9 feet. Generally, water depths for all the lakes varied greatly because of the undulating overburden piles that form the pit bottoms.

The plant island areas consist of partially leveled, loose overburden placed on the undisturbed mine pit bottom. Cross-Section B-B' on Figure 2.3.1-14 and Cross-Section G-G' on Figure 2.3.1.2-16 provide graphical representation of the subsurface stratigraphy in the plant island areas. Overburden thickness ranges from 22 to 30 feet and typically extends down to elevation 130 to 133 ft MSL in SA-11, and 120 to 130 ft MSL in SA-12 with elevations trending lower to the south. The results of laboratory testing of selected samples are shown on the boring logs. Grain-size distribution data are presented in Section 2.3.1.4. Typically, the overburden soil is classified as either silty or clayey sand (SM or SC) with gradation curves in the range shown on Figure 2.3.1-25.

The underlying undisturbed ground to the termination depth of the plant island area borings typically consist of silty to clayey calcareous sands (SM) to clayey, sandy calcareous silts (MH). These soils are typically dense to very dense with occasional limestone fragments.

Borings P-1 and P-2 were drilled in the sand tails areas in northern SA-13 where the surface elevation is highly variable and encountered 6.5 to 14 feet, respectively, of sand tails overlying overburden material. Soil samples taken at the sand tail/overburden interface presented a slight hydrocarbon odor. The soils are suspected to contain flotation agents and perhaps other hydrocarbons from the matrix separation process at the beneficiation plant. Sand tails were not encountered in any of the remaining borings in the eastern area of SA-13.

An apparent localized area of black organic clay (OH) with organic debris was encountered in Boring P-20 in the northeast area of SA-12 from 2 to 14 feet below the ground surface. This led to further exploration of the area with Borings P-28 to P-31 in an attempt to identify roughly the extent of this material. The organic soil was encountered in Boring P-29 at a depth of 7 to 14 feet. The pocket of organic material is believed to be a disposal site for organic mucks and trees which existed in local areas prior to mining. No indication of a depressed or weakened undisturbed ground profile was found by the boring beneath these soils as is often the case in central Florida, where local organic deposits develop in surface depressions related to sinkholes.

2.3.1.3 Geologic Maps

Descriptions of the general area geology and major geologic aspects of the site are provided in Section 2.3.1.1. Descriptions of the site geology and lithology are presented in Section 2.3.1.2. Clay soils which can be used to attenuate contaminants from leachate or runoff are briefly described in Section 2.3.1.2. Clay soils in cooling pond areas are discussed in detail in Section 3.5.1.1 and in solid waste/brine disposal areas in Section 3.7.1.

2.3.1.4 Bearing Strength

Power generation and related facilities will be constructed in the SA-11, SA-12, and SA-13 mining areas. These areas contain flooded, partially-levelled overburden piles which remain from original mining activities at an average elevation of 156 ft MSL. To provide a plant grade of 163 ft MSL, the areas must be filled. The overburden soils consist of very loose to loose, silty to clayey fine sands that, in their present condition, will not adequately support the proposed structures and foundations from a bearing capacity and settlement standpoint. However, if adequately densified, these soils will provide suitable support for the power generating and associated facilities on shallow foundations. Alternately, a deep foundation system could be utilized for the foundation support of structures. The undisturbed soils below the mine pit bottom are dense to very dense and well suited for supporting structures on deep foundations.

Fill will consist of overburden obtained from the retention pond area in the south end of SA-12 and from overburden piles in interior areas of N-16. Based on data from pit take-up maps, mining depths typically varied from 30 to 40 feet in the power block areas. Corresponding bottom of mine elevations typically vary between 120 and 135 ft MSL with an average pit elevation of approximately 132 ft MSL in SA-11, and 128 ft MSL in SA-12.

SHALLOW FOUNDATION SUPPORT

Figures 2.3.1-23 and 2.3.1-24 provide schematics of potential foundation support alternatives for shallow and deep foundations, respectively. For shallow foundation support, the following densification alternatives are considered feasible for the existing overburden and fill soils.

EXCAVATE, REPLACE AND COMPACT. For design efficiency, shallow foundations must be capable of developing allowable foundation bearing pressures up to 8,000 pounds per square foot (psf) with tolerable settlements. To provide adequate support for these foundation pressures, the existing overburden must be densified. Two primary densification alternatives are considered feasible: 1) excavate, replace, and compact; and 2) densification by deep dynamic compaction. Based on review and analysis of the subsurface boring data and laboratory test results for the overburden materials, the excavate, replace, and compact alternative is the most desirable from a technical and economic viewpoint.

Excavation, replacement, and compaction requires that the mine areas be dewatered using standard reclamation techniques. A small portion of the mine areas will be excavated and the overburden stockpiled in an immediately adjacent area. Due to the deficiency of overburden soil quantities in the SA-11, SA-12, and SA-13 areas, the volume of excavated area available to be filled will increase as the overburden is placed and compacted in structural filling areas. Fill will be placed under controlled conditions relative to lift thickness, borrow material moisture conditions and equipment suitability and operation. Lifts will be densified by mechanical compacting equipment to densities in excess of 95 percent of Modified Proctor Density (ASTM D-1557). Moisture - density relationships from typical samples obtained from the plant island borings are shown in Table 2.3.1-7. The excavate, replace, and compact construction sequence will proceed across the power block areas needed for the structural support. Due to the arrangement of building areas, SA-11, the southern section of SA-13, and the approximate eastern one-third of SA-12 area north of the retention pond will require complete excavation, replacement, and compaction. Approximately 11,000,000 cubic yards of existing overburden soils will be reworked in the power block area and 8,200,000 cubic yards of borrow will be imported from N-16 to achieve the desired final plant grade. The result of the excavate, replace, and compact procedure will be a structurally compacted power block area capable of supporting shallow foundations at bearing pressures up to 8,000 psf.

The excavate, replace, and compact alternative has the advantage of exposing all of the fill soils beneath the proposed power block area for inspection and testing. This ensures good quality fill is incorporated into the final product and that the fill is well compacted and documented by quality control inspection and testing during construction.

DEEP DYNAMIC COMPACTION. As an option under the shallow foundation alternative, densification of the existing overburden by the dynamic compaction technique was considered.

Dynamic compaction densifies the overburden soils in-place by applying compaction energy to the surface of a levelled prepared area. Energy is applied by dropping a heavy weight from a height on a grid-type pattern over the prepared area. The shock and the applied energy of the weight impacting the ground surface causes the underlying soils to densify, with the degree of compaction varying with depth.

The suitability of soils for densification by dynamic compaction is illustrated on Figure 2.3.1-25 which shows zone groupings of soils based on grain-size distribution (FHA, 1986). Granular soils with little or no fines are the soil types best suited for dynamic compaction. Figure 2.3.1-25 also shows the plot of the gradation band for 15 sieve and 8 hydrometer grain-size analyses performed on overburden samples obtained from the plant island borings. The sieve analyses band indicates that, while the coarser sand fraction of the overburden would generally be suitable for dynamic compaction, the voids of the sands are filled with the finer silt and clay-size fractions. The data indicate that the overburden soils would likely perform as a Zone 2, semi-impervious soil. Figure 2.3.1-26 presents the applied energy requirements for dynamic compaction of these soils (Mayne, 1985). Table 2.3.1-8 presents the n-factors which can be assigned to the various soil types and zone designations. For the overburden soils at this site, an n-factor of 0.35 to 0.4 was assigned. This range of n-factors requires that between 550 to 900 ton-meters of impact energy be applied by each drop of the weight to the ground surface for a desired depth of compaction of 9 to 10 meters (28 to 32 feet). The site survey data show that approximately 22 to 26 feet of overburden would have to be compacted by this technique. Adequate densification of the full overburden thickness is required as the anticipated size and depth of the structural building foundations will stress the overburden soils below the bottom of the mine areas. The analysis of dynamic compaction indicates that the technique is feasible for densification of the overburden soils. However, the required application energies will likely require equipment capable of dropping up to 30 ton (metric) weights from heights up to 30 meters (100± feet).

Dynamic compaction has the advantage that it requires somewhat less dewatering and construction schedules can be more readily accommodated or accelerated by adding or decreasing the number of working rigs. Dynamic compaction has the disadvantage that the quality of overburden being compacted cannot be directly inspected. Quality control verification of fill densification requires extensive use of the ECPT test described in Appendix 10.5.3 to measure and assess the degree of improvement and compactness. Dynamically compacted overburden soils must present ECPT values of 125 tons per square foot (TSF) or greater to be

considered acceptable from a quality assurance perspective. Any deleterious materials found in the overburden (such as localized pockets of organics) that cannot be adequately densified would have to be excavated and replaced if located below structural building areas.

The assessment of the site development scenarios described above concludes that the excavate, replace and compact alternative is the more desirable option for the shallow foundation support of structures.

DEEP FOUNDATION SUPPORT

The second alternative for the foundation support of structures is to fill the plant area to final grade with loose, uncompacted overburden fill, but to support the structures by deep foundations, such as driven piles, augercast piles, drilled shafts or vibroreplacement stone columns installed to the undisturbed soils below the mine pit bottom. Use of the deep foundation alternative would require that a 10-foot surcharge be rolled across the site to remove potential settlement of the overburden due to light surface loaded areas, and fill areas for roadways. The surcharge fill would also reduce the potential for the development of negative downdrag loads to the deep foundations caused when the soil surrounding the foundation settles more than the foundation element.

PILE FOUNDATIONS. Deep piling foundation support can be provided by either driven precast, prestressed concrete piles or augercast pressure grouted piles installed into the dense to very dense soils beneath the mine pit bottom. Precast, prestressed concrete piles 14, 16, and 18 inches square should be capable of achieving respective maximum permissible pile loads of 120, 160, and 200 tons (5,000 psi concrete) at depths of 40 to 60 feet. The piles would perform as end-bearing piles and should achieve design capacities at relatively shallow depths of embedments into the dense to very dense undisturbed soils below the mine pit bottom. Augered pressure-grouted piles, 14, 16, and 18 inches in diameter, should achieve maximum permissible pile loads by code of 95 tons, 125 tons, and 160 tons, respectively, at depths of 40 to 60 feet.

VIBROCOMPACTION STONE COLUMNS. As an alternative to piles, deep foundation support may also be provided by vibroreplacement stone columns (VSC). Soils suitable for vibroreplacement/compaction are shown on Figure 2.3.1-27. A vibratory VSC probe is inserted into the ground at a specified spacing typically on a grid pattern. The probe is advanced into the soil to the desired depth using high-pressure washing jets at the tip of the probe. The

vibrating energy of the probe densifies the soil in an area around the probe resulting in localized settlement at the ground surface. The depressed surface area around the probe is filled with soil during insertion and as the probe is being extracted.

The type of fill soil used to backfill the probe area is dependent upon local availability of fill, installation costs and the intended use of the area after completion of the densification operations. To provide adequate support for the heavily loaded power block structures on shallow spread footings, it would be necessary that the probe area be backfilled with a select granular, coarse-graded stone. Such select material is necessary to provide a compact densified soil column of adequate stiffness beneath the foundations to support the heavy loads of the structures without excessive settlement. Due to the lack of immediate availability of large quantities of such select material, it is likely that the cost of importing such material combined with installation costs would be prohibitive compared to other foundation systems. This foundation system, however, is technically feasible considering the material characteristics of the overburden soils and could be used at the site. Shallow spread footing foundations would be constructed over the areas after densification was complete.

DRILLED SHAFTS. Foundations such as deep drilled shafts could be used to support the proposed structures. Deep drilled shafts would be required to be cased through the very loose to loose overburden to provide for shaft stability during excavation. Deep drilled shafts would be founded well into the underlying, undisturbed ground at depths of 40 to 60 feet below plant grade. Depending on the size of the shaft, very high foundation capacities up to several hundred tons per shaft could be achieved. The foundation system, however, is technically feasible considering subsurface conditions at the site, and such systems could be employed for structural foundation support particularly for very heavily loaded structures.

COAL STORAGE AREAS

In the area of the coal storage piles, surcharge soils will be placed to reduce settlements of the underlying, overburden soils under the weight of the stockpiled coal. The excavate, replace, and compact option is not proposed for this area. Structural support of conveyor systems or other heavily loaded localized areas, such as the rotary car dumper, will be by deep foundations either driven or augercast piles or VSC. Alternately, localized dynamic compaction may be considered for isolated foundation support by shallow spread footings.

2.3.1.5 References

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TABLE 2.3.1-1
SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

POND AREA	BORING NUMBER	DEPTH (ft)	LIQUID LIMIT (%)	PLAST. INDEX (%)	DRY UNIT WEIGHT (pcf)	COEFF. OF PERMEAB. (cm/sec)
SA-9	C-24	6.5	-	-	17.0	2.0×10^{-7}
SA-9	C-24	9.0	300	244	-	-
SA-9	C-24	15.8	174.0	126.1	25.0	5.0×10^{-7}
SA-8	C-28	5.8	133.0	104.0	-	1.2×10^{-6}
SA-8	C-28	6.5	-	-	28.3	-
SA-10	C-30	8.2	-	-	41.0	3.5×10^{-7}
P-2	C-34	3.5	214.0	174.7	29.9	1.8×10^{-7}
P-2	C-35	10.3	-	-	21.0	1.8×10^{-7}
P-3	C-37	1.0	231.5	188.7	-	1.4×10^{-6}
N-16	C-46[1]	25.5	58.5	29.2	65.3	1.0×10^{-6}
N-16	C-46[1]	25.5	95.6	49.0	69.6	1.3×10^{-6}

Notes: [1] Samples of undisturbed ground
- No data

Source: Dames & Moore, 1992

TABLE 2.3.1-2
SUMMARY OF POROSITY AND PERMEABILITY VALUES
CLAY POND AREAS

MATERIAL	POROSITY (%)			PERMEABILITY (cm/sec)		
	Min	Max	Avg	Min	Max	Avg
Phosphatic Clay	55	93	83	1.8×10^{-7}	1.4×10^{-6}	5.7×10^{-7}
Overburden Material	30	74	44	(1) ---	(1) ---	(1) ---
Undisturbed Ground	51	70	60	1.0×10^{-6}	1.1×10^{-5}	4.5×10^{-6}

(1) See Table 2.3.1-6 for representative soil properties.

Source: Dames & Moore, 1992

TABLE 2.3.1-3
SUMMARY OF CONSOLIDATION TEST RESULTS

POND AREA	BORING NO.	DEPTH (ft)	LIQUID LIMIT (%)	PLAST. INDEX (%)	Cc	Cr	Cv (ft^2/day)
N-11A	C-2	5.3	----	----	1.4	0.10	1.13×10^{-2}
N-11A	C-3	15.8	178.0	128.9	2.2	0.06	2.06×10^{-2}
N-13	C-4	10.8	174.5	130.3	2.1	0.14	1.52×10^{-2}
N-13	C-6	13.3	196.0	136.1	2.2	0.33	2.48×10^{-2}
N-9B	C-8	5.8	208.0	159.7	1.5	0.17	1.49×10^{-2}
N-11B	C-13	5.7	282.0	211.1	2.6	0.39	1.53×10^{-2}
N-11B	C-14	25.5	130.0	106.1	2.5	0.29	1.44×10^{-2}
N-11C	C-16	15.8	235.0	174.3	2.2	0.15	2.26×10^{-2}
SA-8	C-20	10.8	163.0	115.0	2.9	0.22	7.29×10^{-3}
SA-8	C-22	8.3	131.5	89.4	1.9	0.19	1.99×10^{-2}
SA-8	C-22	33.3	204.0	161.3	2.0	0.19	1.27×10^{-2}
SA-9	C-23	3.2	245.0	197.1	5.3	0.28	2.05×10^{-2}
SA-9	C-25	16.0	157.0	109.6	1.9	0.22	1.81×10^{-2}
SA-10	C-29	13.3	176.0	135.0	2.1	0.17	1.05×10^{-2}
P-2	C-32	5.5	205.0	169.6	1.9	0.10	7.86×10^{-3}
P-3	C-38	0.5	225.5	168.4	1.8	0.24	6.17×10^{-2}

Notes: ---- no data

Source: Dames & Moore, 1992

TABLE 2.3.1-4
SUMMARY OF TRIAXIAL UU TEST RESULTS

MINE AREA	BORING NO.	DEPTH (ft)	DRY UNIT WEIGHT (pcf)	CELL PRESSURE (psf)	SHEAR STRENGTH (psf)
N-11A	C-2	6.0	32.8	1,440	150
N-13	C-6	14.0	27.6	1,152	89
N-11C	C-16	6.5	28.6	1,440	240
P-2	C-32	3.0	33.1	720	227

Source: Dames & Moore, 1992

TABLE 2.3.1-5
RESULTS OF IN-SITU VANE SHEAR TESTS

MINE AREA	BORING NO.	TEST DEPTH (ft)	PEAK STRENGTH (psf)	REMOLDED STRENGTH (psf)	SENSITIVITY
N-11A	C-2	8.65	517.0	258.5	2.0
N-11A	C-3	8.25	144.8	67.9	2.1
N-13	C-6	8.25	64.8	38.9	1.7
N-13	C-7	7.75	64.8	31.1	2.1
N-13	C-7	9.00	67.9	31.7	2.1
N-11B	C-13	8.25	155.4	77.7	2.0
SA-8	C-21	9.25	361.9	129.3	2.8
SA-9	C-23	9.25	63.4	40.7	1.6
SA-9	C-25	9.25	63.4	36.2	1.8
SA-8	C-26	5.25	67.9	45.3	1.5
SA-10	C-29	5.25	45.3	27.2	1.7
SA-10	C-30	0.75	45.3	18.1	2.5
P-2	C-31	0.25	388.5	194.3	2.0
P-2	C-31	5.25	90.5	63.4	1.4
P-2	C-31	10.25	81.5	45.3	1.8
P-2	C-34	0.25	775.5	258.5	3.0
P-2	C-34	5.25	45.3	22.6	2.0
P-2	C-35	0.25	646.3	258.5	2.5
P-2	C-35	5.50	67.9	22.6	3.0
P-3	C-37	0.50	45.3	22.6	2.0
P-3	C-37	5.50	36.2	22.6	1.6
P-3	C-39	0.50	113.1	45.3	2.5
P-3	C-39	5.50	22.6	22.6	1.0

Source: Dames & Moore, 1992

TABLE 2.3.1-6
SUMMARY OF REPRESENTATIVE SOIL PROPERTIES
DAM AREAS

MATERIAL	POROSITY (%)			PERMEABILITY (cm/sec)					
				Horizontal			Vertical		
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Overburden									
Rolled	40	26	34	----	----	9.0×10^{-6}	1.1×10^{-5}	3.7×10^{-7}	5.7×10^{-6}
Cast	75	28	40	2.0×10^{-5}	1.0×10^{-5}	1.3×10^{-5}	----	----	5.0×10^{-5}
Undisturbed Ground	62	38	49	----	----	----	1.1×10^{-5}	1.1×10^{-6}	4.5×10^{-6}

Note: ---- no data

Source: Dames & Moore, 1992

TABLE 2.3.1-7
SUMMARY OF LABORATORY PROCTOR TEST RESULTS*

BORING NUMBER	BULK SAMPLE DEPTH (ft)	USCS SYMBOL	OPTIMUM MOISTURE CONTENT (%)	MAXIMUM DRY DENSITY (pcf)
B-13	0.4 - 1.2	SM	13.9	112.6
B-14	0.4 - 1.0	SC	11.0	121.0
B-15	0.0 - 1.6	SM	9.0	118.2
B-20	0.5 - 1.0	SC	10.5	123.5
B-21	0.6 - 1.0	SM	15.2	110.5

* ASTM D-1557

Source: Dames & Moore, 1992

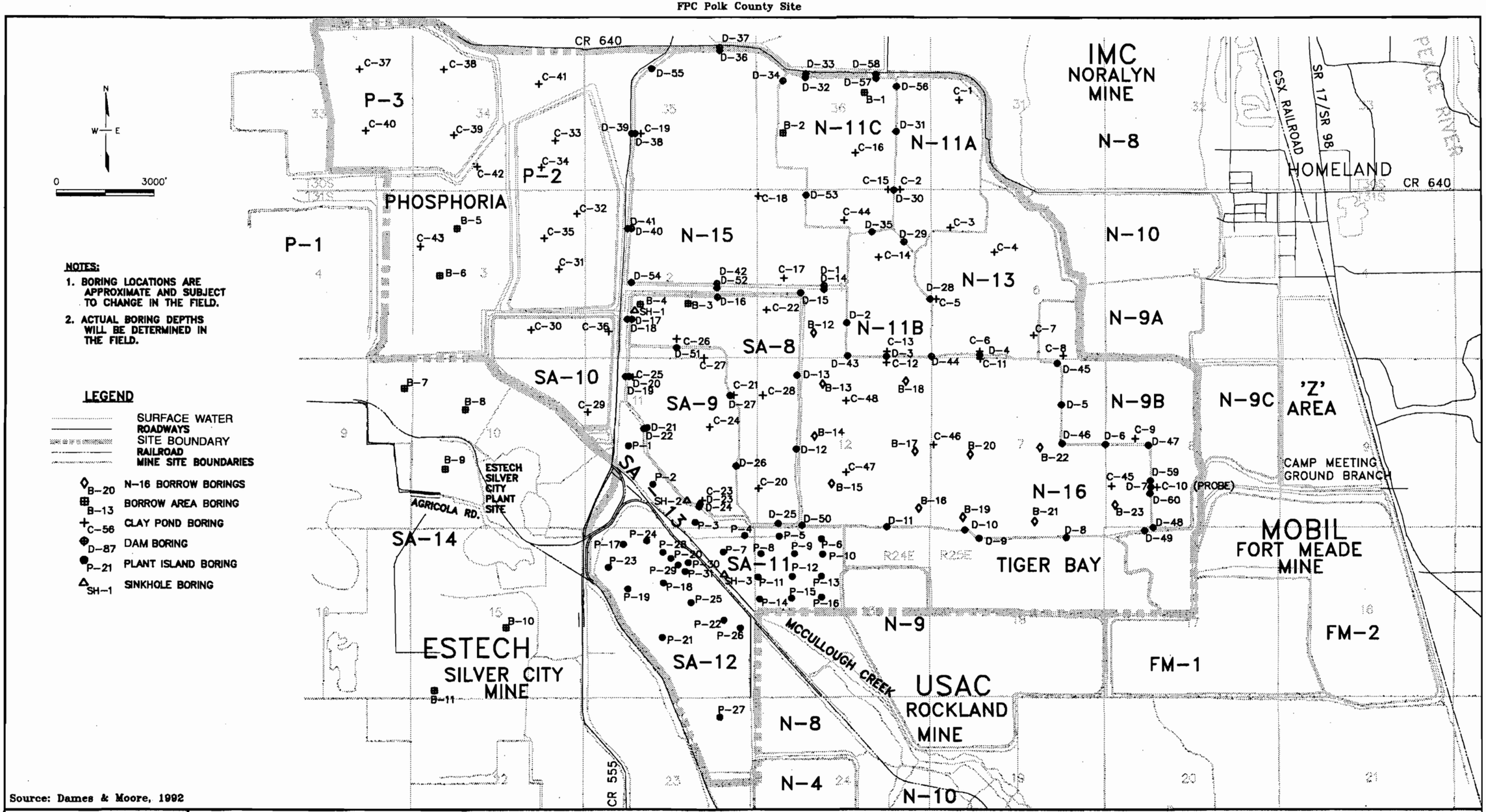
TABLE 2.3.1-8
RECOMMENDED *n* VALUE FOR DIFFERENT SOIL TYPES

Soil Type	Degree of Saturation	Recommended *n* Value
A. Pervious Soil Deposits - Granular Soils - Zone 1	High	0.5
	Low	0.5 to 0.6
B. Semi-Pervious Soil Deposits, Primarily Silts with P.I. <8 - Zone 2	High	0.35 to 0.4
	Low	0.4 to 0.5
C. Impervious Deposits Primarily Clayey Soils with P.1 >8 - Zone 3	High	Not recommended
	Low	.35 to 0.40
		Soils should be at a water content less than the plastic limit

Notes: 1) n value represents correction factor used in equation to calculate depth of compaction (See Figure 2.3.1-26)

2) Recommended n values for an applied energy of 34 to 100 ton-ft/ft^2 (100 to 300 ton-m/m^2) and for a weight dropped using a single cable with a free spool drum.

Source: FHWA, 1986

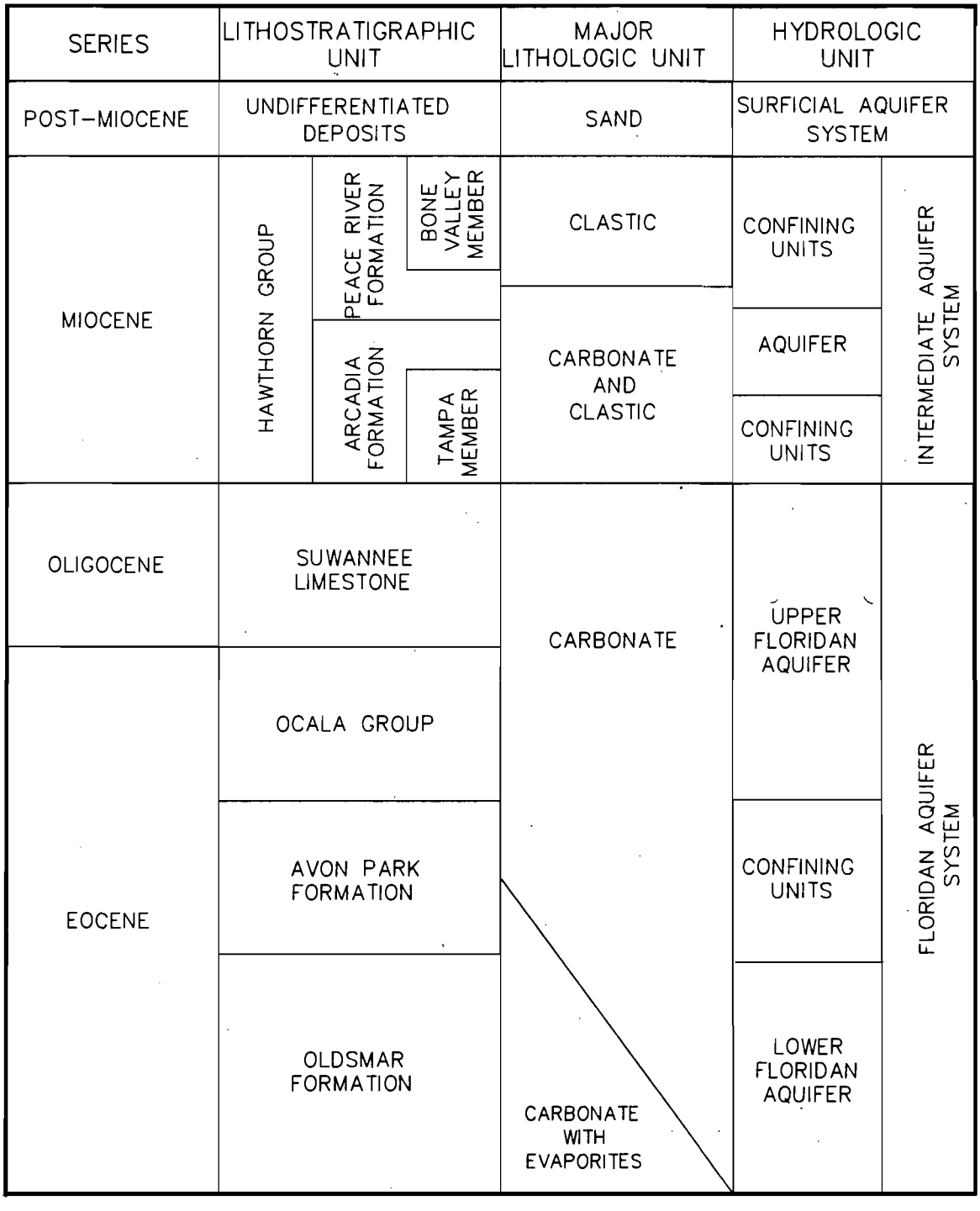


Source: Dames & Moore, 1992

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Polk County Site

FIGURE 2.3.1-1
SUBSURFACE INVESTIGATION PLAN
GENERAL SITE AREA

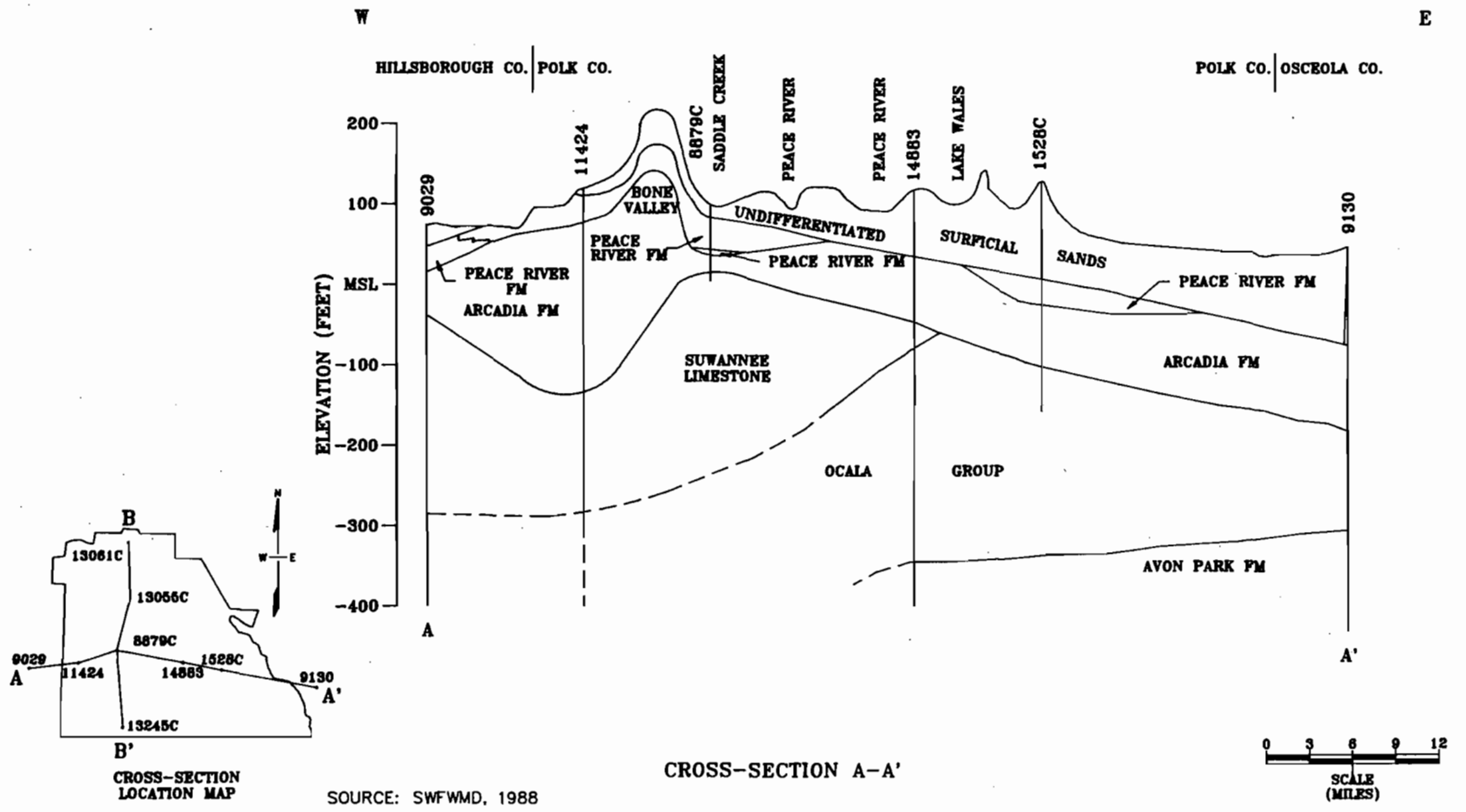


SOURCE: SWFWMD, 1988

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Polk County Site

FIGURE 2.3.1-2
GENERALIZED LITHOSTRATIGRAPHIC AND HYDROGEOLOGIC FRAMEWORK POLK COUNTY AREA

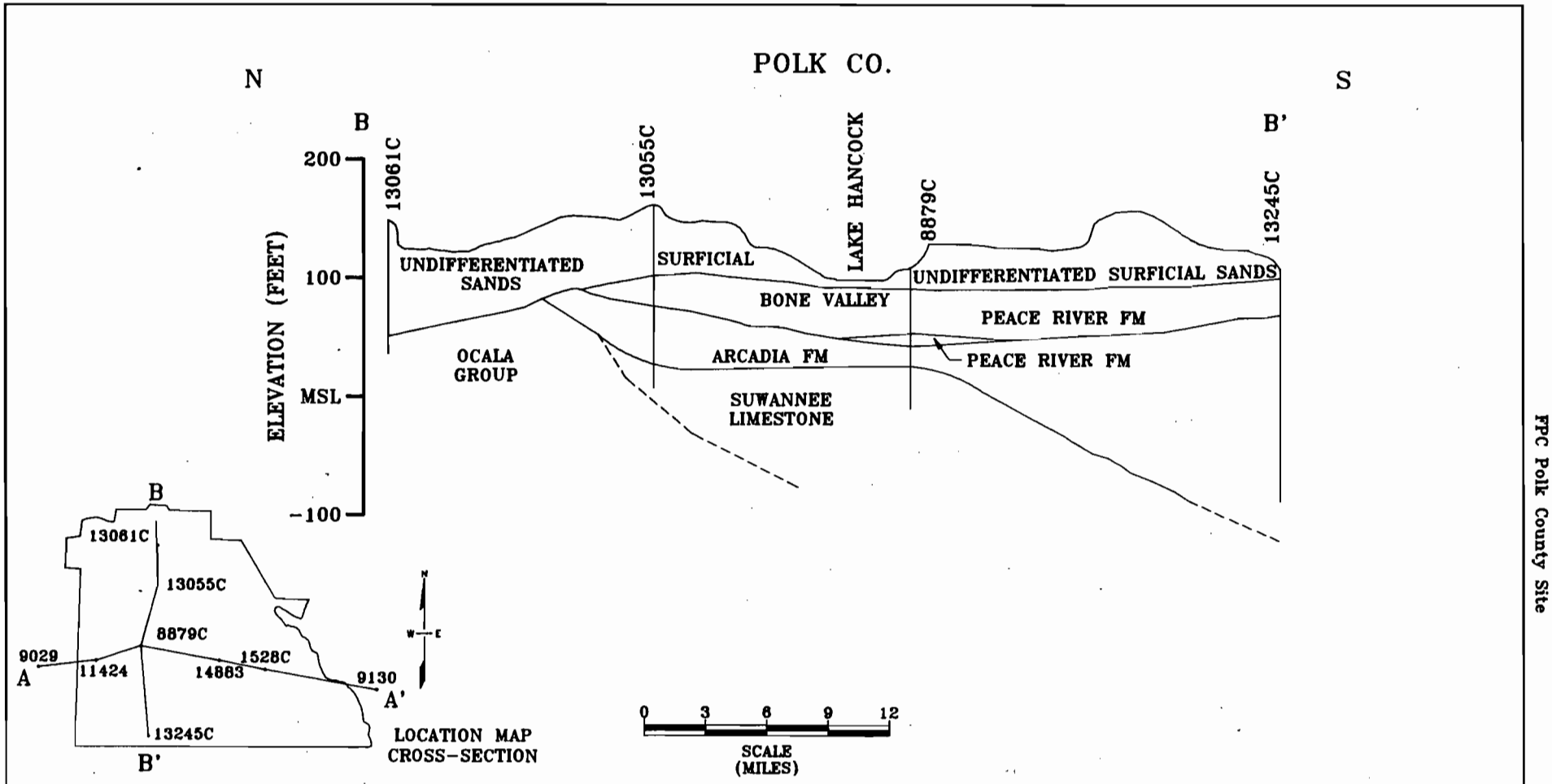


SOURCE: SWFWMD, 1988

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Polk County Site

FIGURE 2.3.1-3
GENERALIZED GEOLOGICAL SECTION OF POLK COUNTY (EAST-WEST)

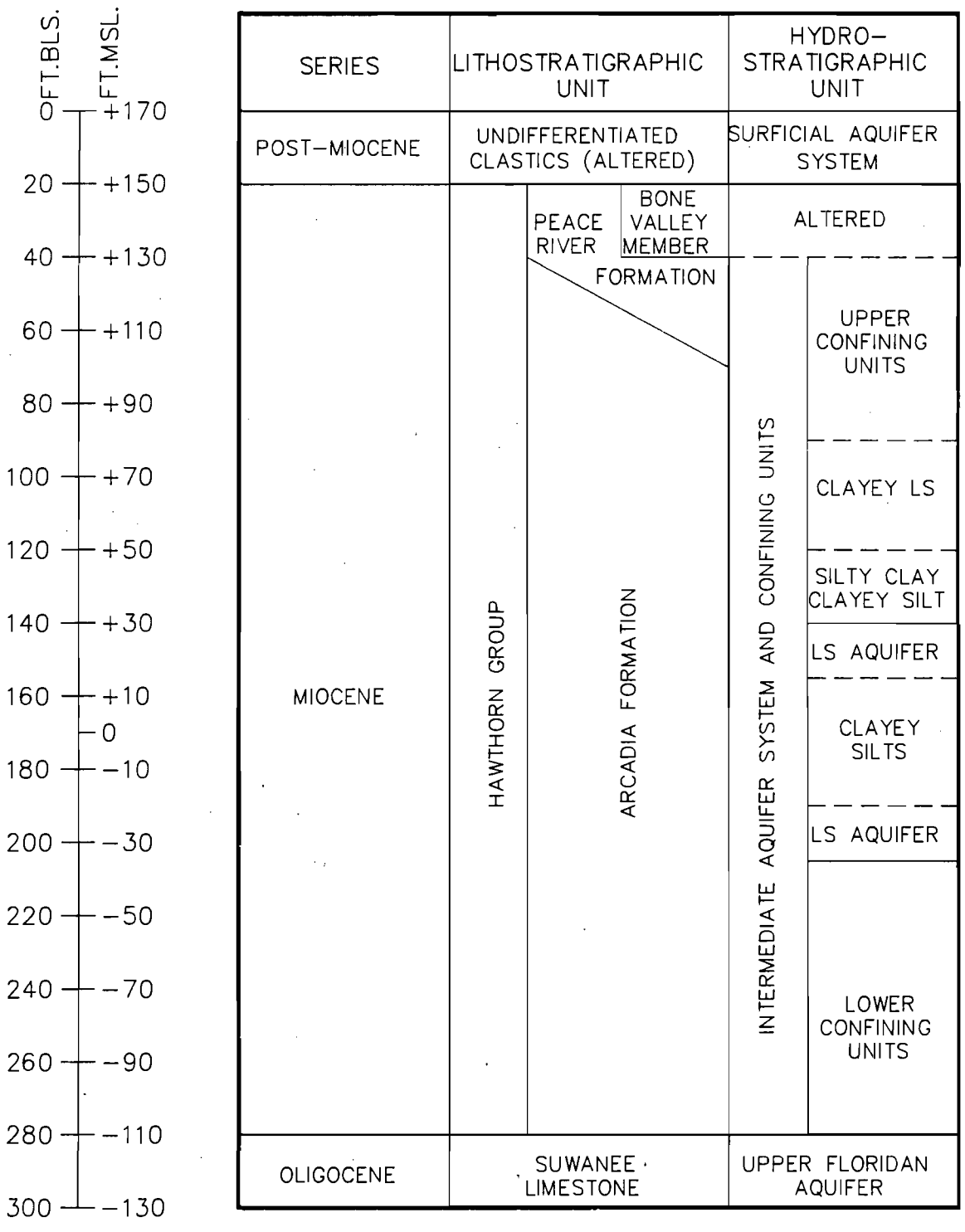


SOURCE: SWFWMD, 1988

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Polk County Site

FIGURE 2.3.1-4
GENERALIZED GEOLOGICAL SECTION OF POLK COUNTY (NORTH-SOUTH)



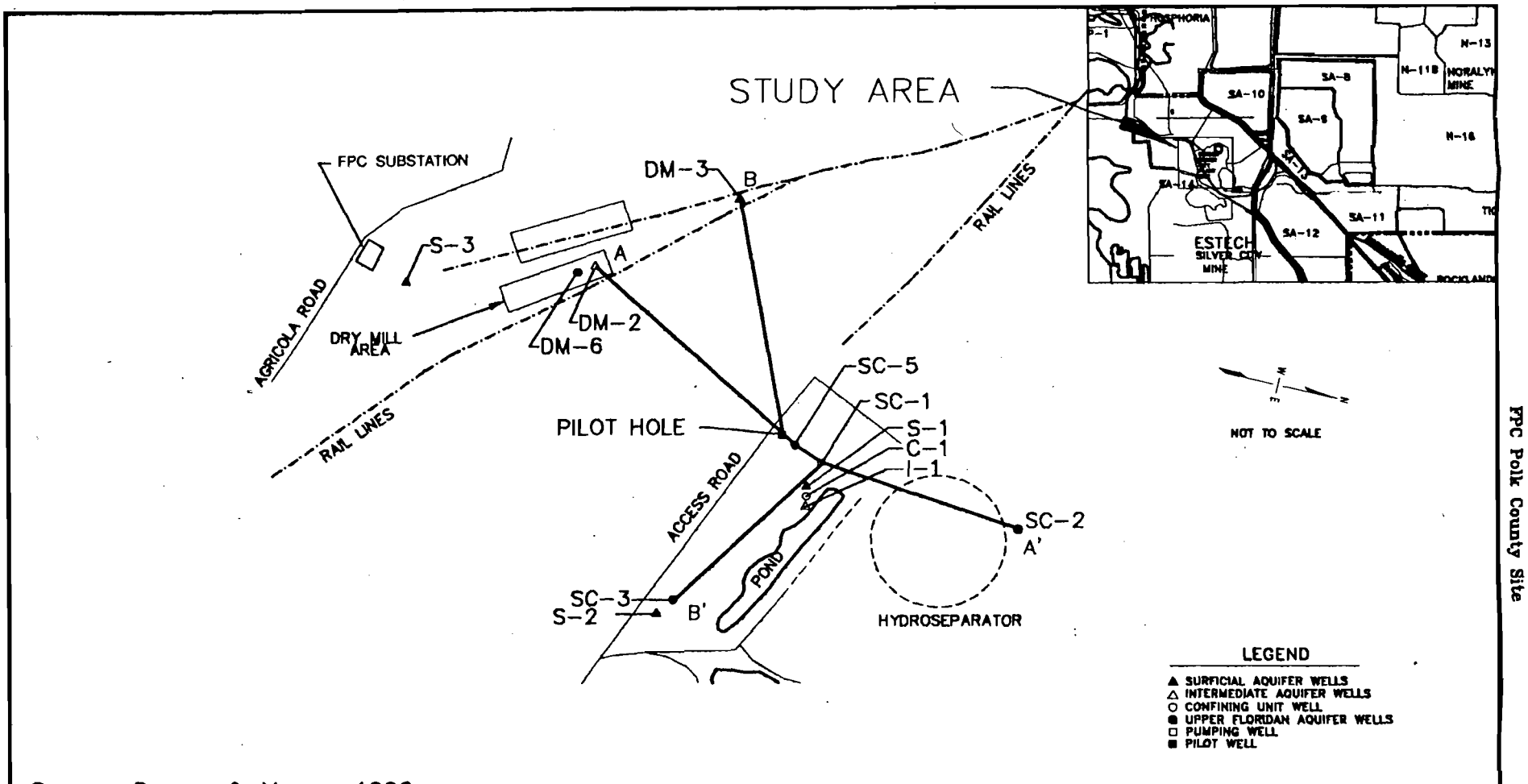
LEGEND:
FT. BLS: FEET BELOW LAND SURFACE
FT. MSL: FEET MEAN SEA LEVEL

SOURCE: DAMES & MOORE, 1992

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Polk County Site

FIGURE 2.3.1-5
HYDROGEOLOGIC FRAMEWORK
FPC SITE AREA

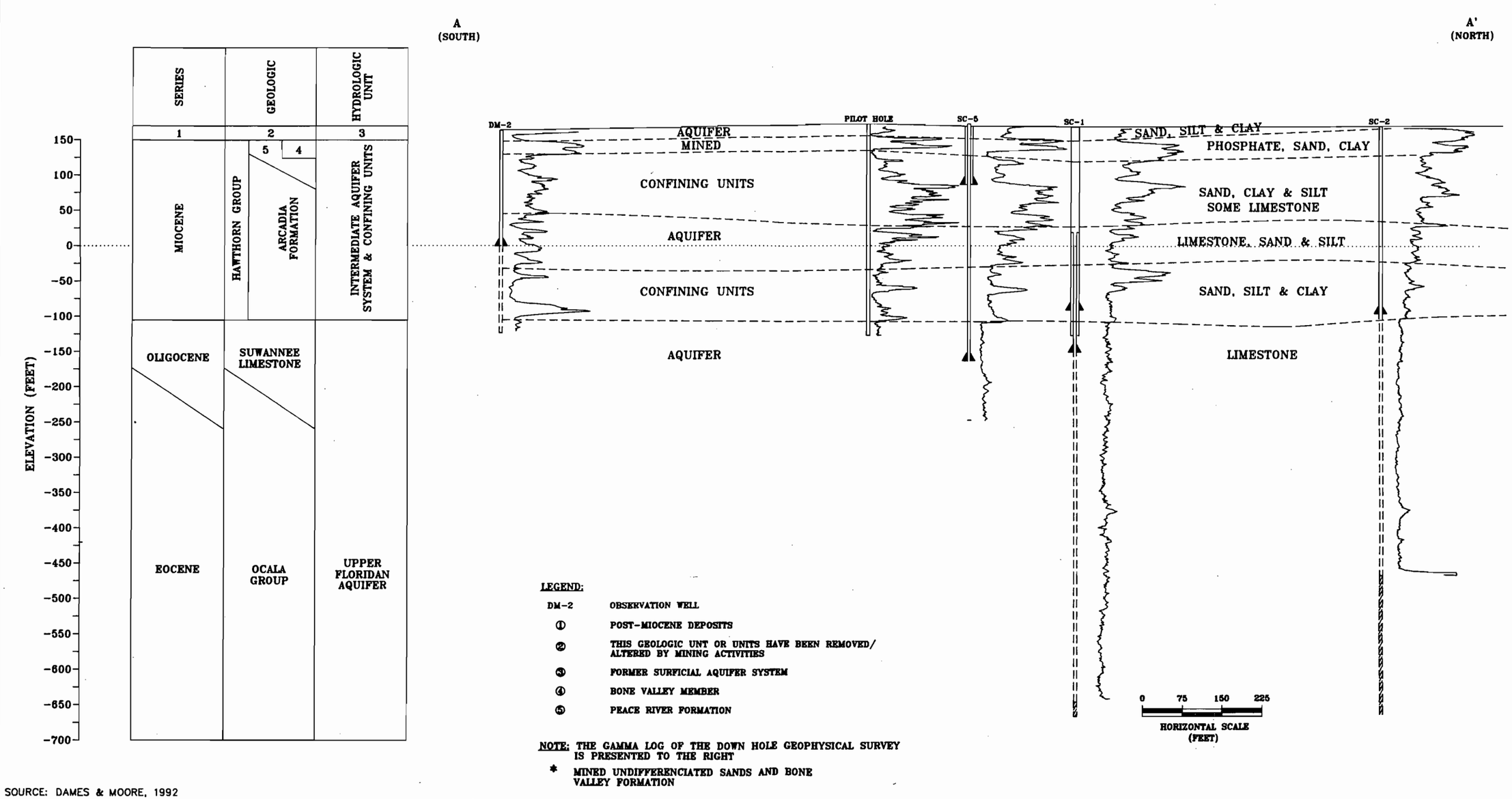


Source: Dames & Moore, 1992

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FIGURE 2.3.1-6
HYDROGEOLOGIC CROSS-SECTION LOCATION MAP
ESTECH PLANT SITE



LEGEND:

DM-2	OBSERVATION WELL
①	POST-MIOCENE DEPOSITS
②	THIS GEOLOGIC UNT OR UNITS HAVE BEEN REMOVED/ ALTERED BY MINING ACTIVITIES
③	FORMER SURFICIAL AQUIFER SYSTEM
④	BONE VALLEY MEMBER
⑤	PEACE RIVER FORMATION

NOTE: THE GAMMA LOG OF THE DOWN HOLE GEOPHYSICAL SURVEY IS PRESENTED TO THE RIGHT

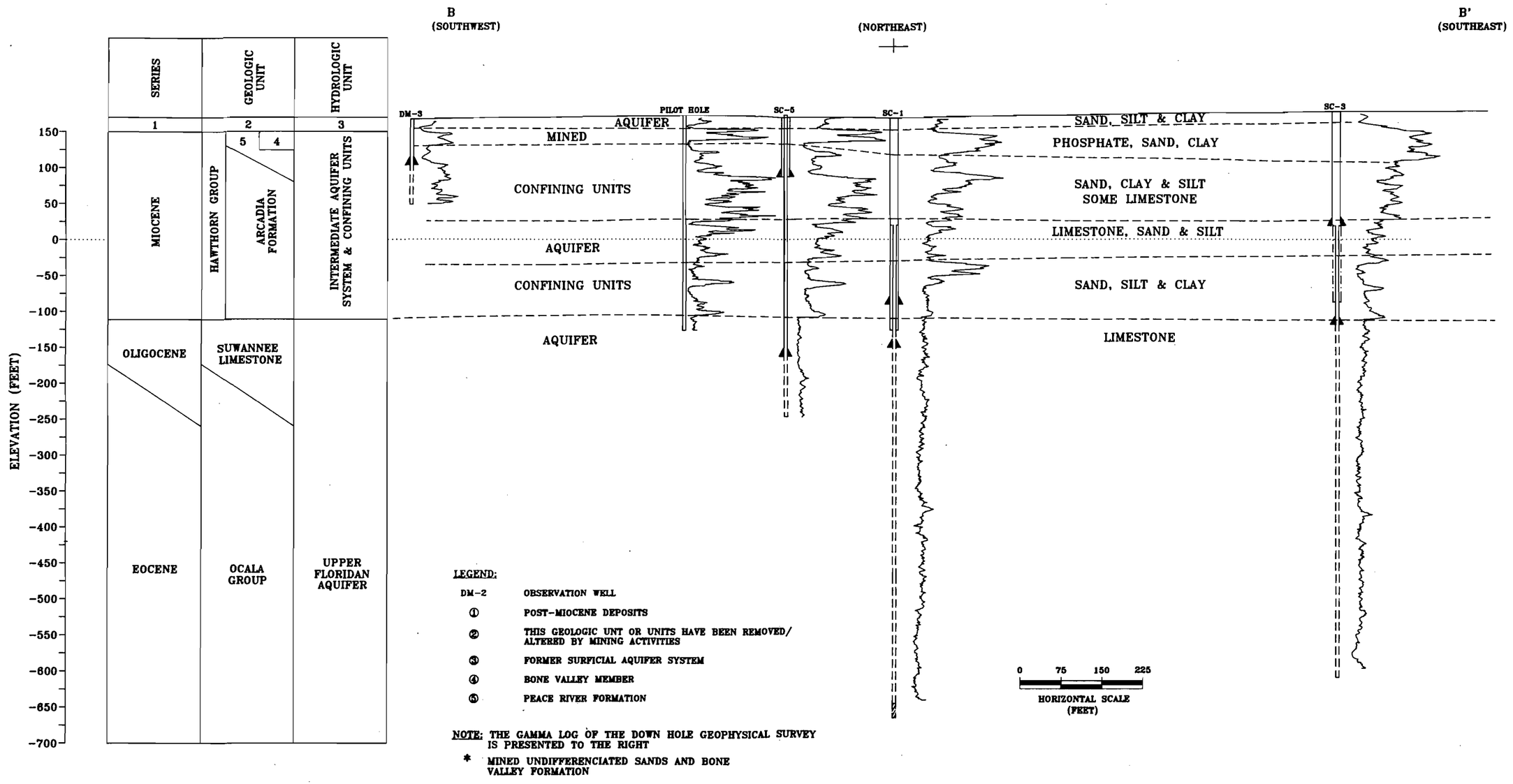
* MINED UNDIFFERENCIATED SANDS AND BONE VALLEY FORMATION

SOURCE: DAMES & MOORE, 1992

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Polk County Site

FIGURE 2.3.1-7
HYDROGEOLOGIC CROSS-SECTION A-A' ESTECH PLANT SITE
DECEMBER 1991



LEGEND:

DM-2	OBSERVATION WELL
①	POST-MIOCENE DEPOSITS
②	THIS GEOLOGIC UNT OR UNITS HAVE BEEN REMOVED/ ALTERED BY MINING ACTIVITIES
③	FORMER SURFICIAL AQUIFER SYSTEM
④	BONE VALLEY MEMBER
⑤	PEACE RIVER FORMATION

NOTE: THE GAMMA LOG OF THE DOWN HOLE GEOPHYSICAL SURVEY IS PRESENTED TO THE RIGHT

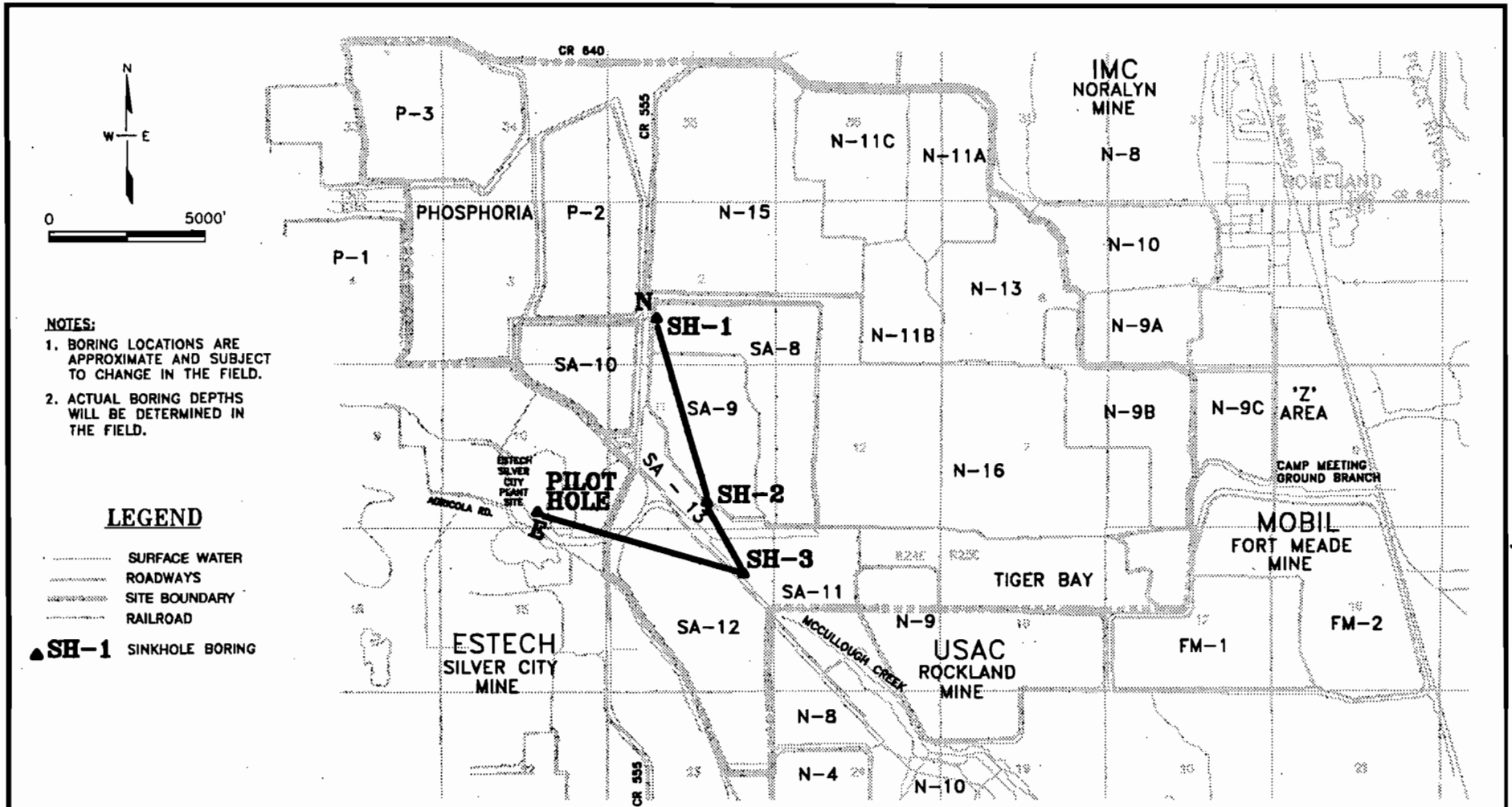
* MINED UNDIFFERENCIATED SANDS AND BONE VALLEY FORMATION

SOURCE: DAMES & MOORE, 1992

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Polk County Site

FIGURE 2.3.1-8
HYDROGEOLOGIC CROSS-SECTION B-B' ESTECH PLANT SITE
DECEMBER 1991

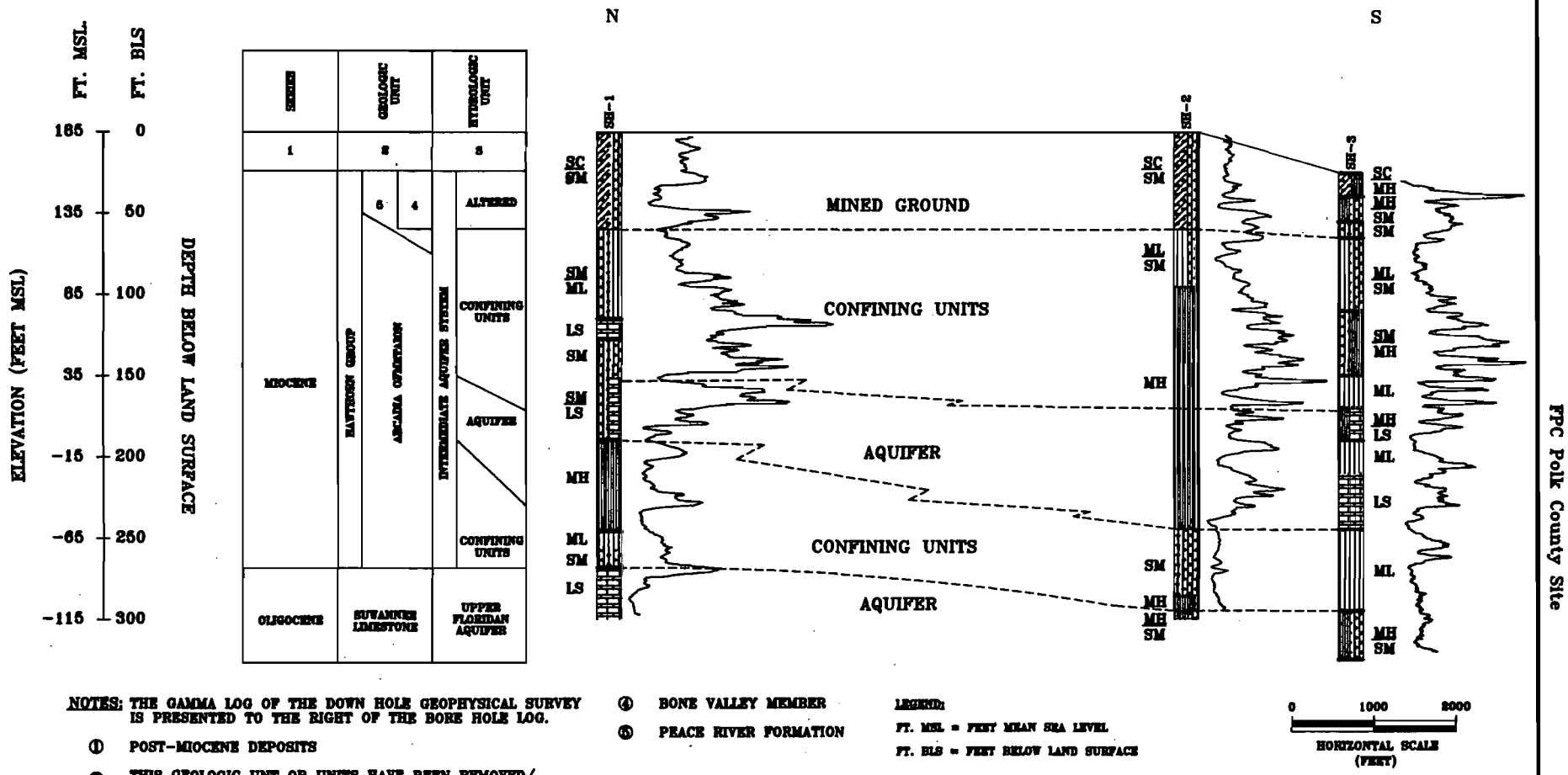


SOURCE: DAMES & MOORE, 1992

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Polk County Site

FIGURE 2.3.1-9
HYDROGEOLOGIC CROSS-SECTION LOCATION MAP
FPC SITE AREA



NOTES: THE GAMMA LOG OF THE DOWN HOLE GEOPHYSICAL SURVEY IS PRESENTED TO THE RIGHT OF THE BORE HOLE LOG.

① POST-MIOCENE DEPOSITS

② THIS GEOLOGIC UNT OR UNITS HAVE BEEN REMOVED/ ALTERED BY MINING ACTIVITIES

③ FORMER SURFICIAL AQUIFER SYSTEM

④ BONE VALLEY MEMBER

⑤ PEACE RIVER FORMATION

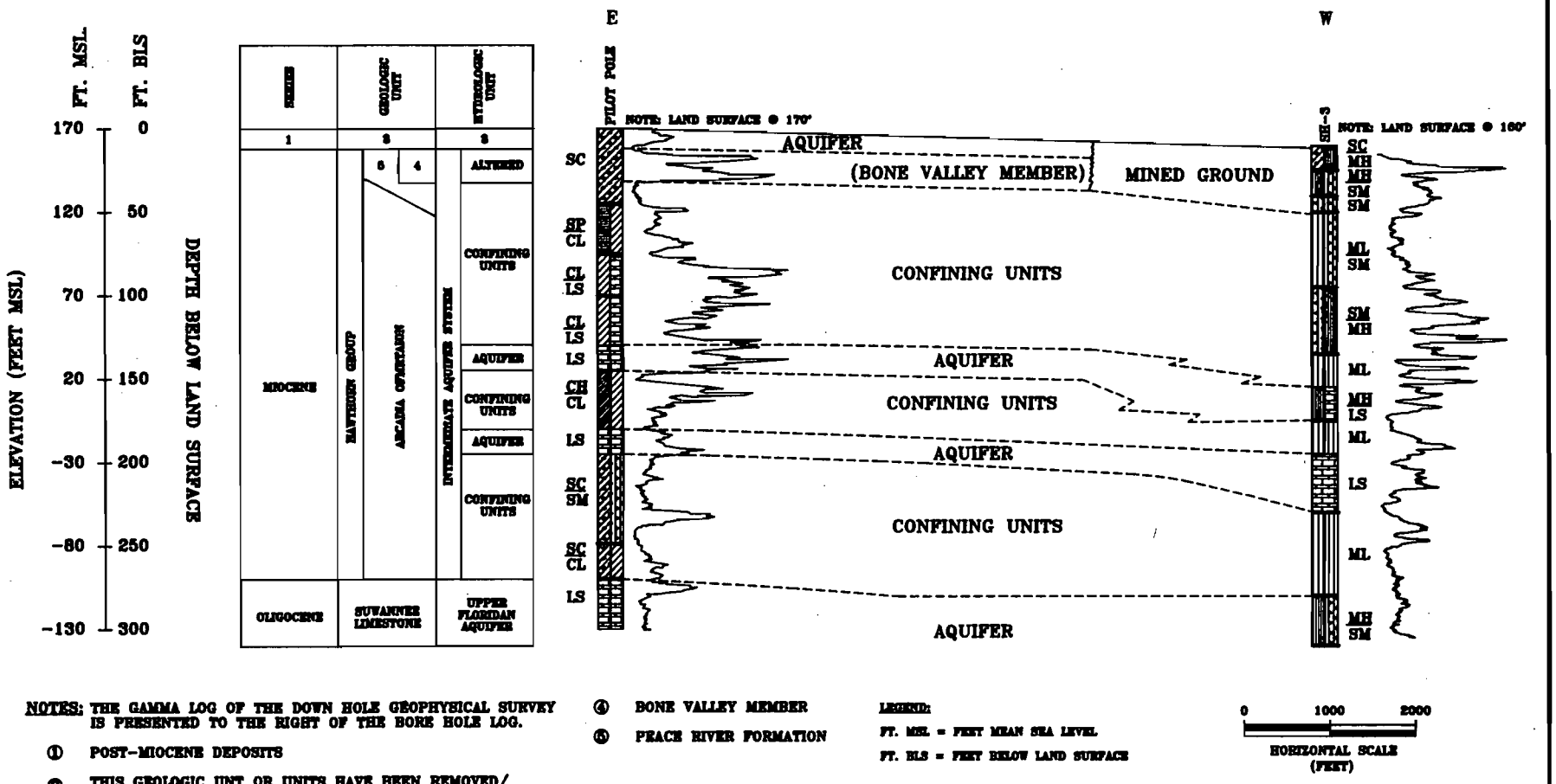
LEGEND:
FT. MSL = FEET MEAN SEA LEVEL
FT. BLS = FEET BELOW LAND SURFACE

SOURCE: DAMES & MOORE, 1992

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Polk County Site

FIGURE 2.3.1-10
HYDROGEOLOGIC CROSS-SECTION N-S ESTECH PLANT SITE, DECEMBER 1991



NOTES: THE GAMMA LOG OF THE DOWN HOLE GEOPHYSICAL SURVEY IS PRESENTED TO THE RIGHT OF THE BORE HOLE LOG.

① POST-MIOCENE DEPOSITS

② THIS GEOLOGIC UNT OR UNITS HAVE BEEN REMOVED/ ALTERED BY MINING ACTIVITIES

③ FORMER SURFICIAL AQUIFER SYSTEM

④ BONE VALLEY MEMBER

⑤ PEACE RIVER FORMATION

LEGEND:
FT. MSL = FEET MEAN SEA LEVEL
FT. BLS = FEET BELOW LAND SURFACE

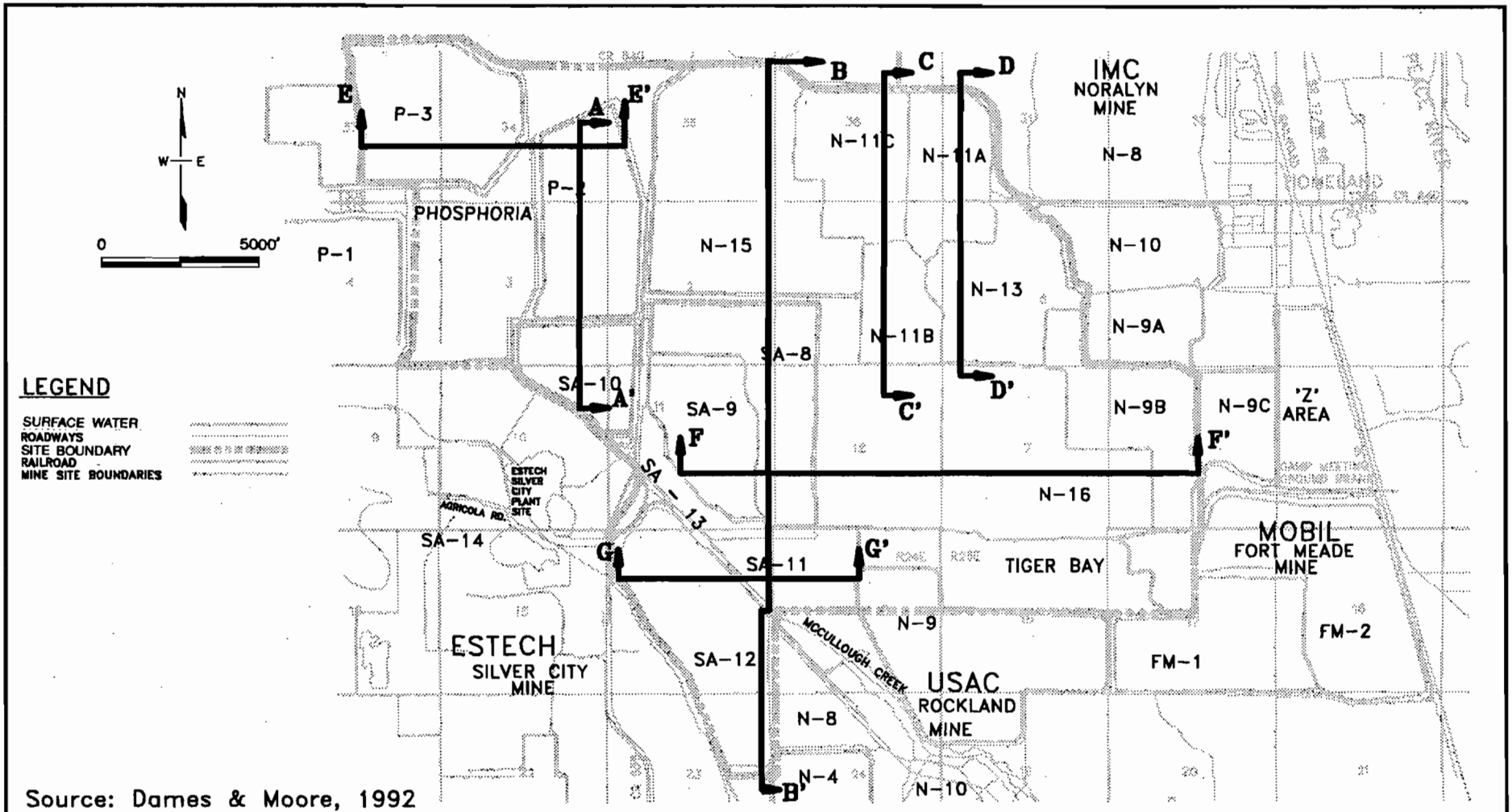
0 1000 2000
HORIZONTAL SCALE (FEET)

SOURCE: DAMES & MOORE, 1992

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FIGURE 2.3.1-11
HYDROGEOLOGIC CROSS-SECTION E-W
ESTECH PLANT SITE, DECEMBER 1991

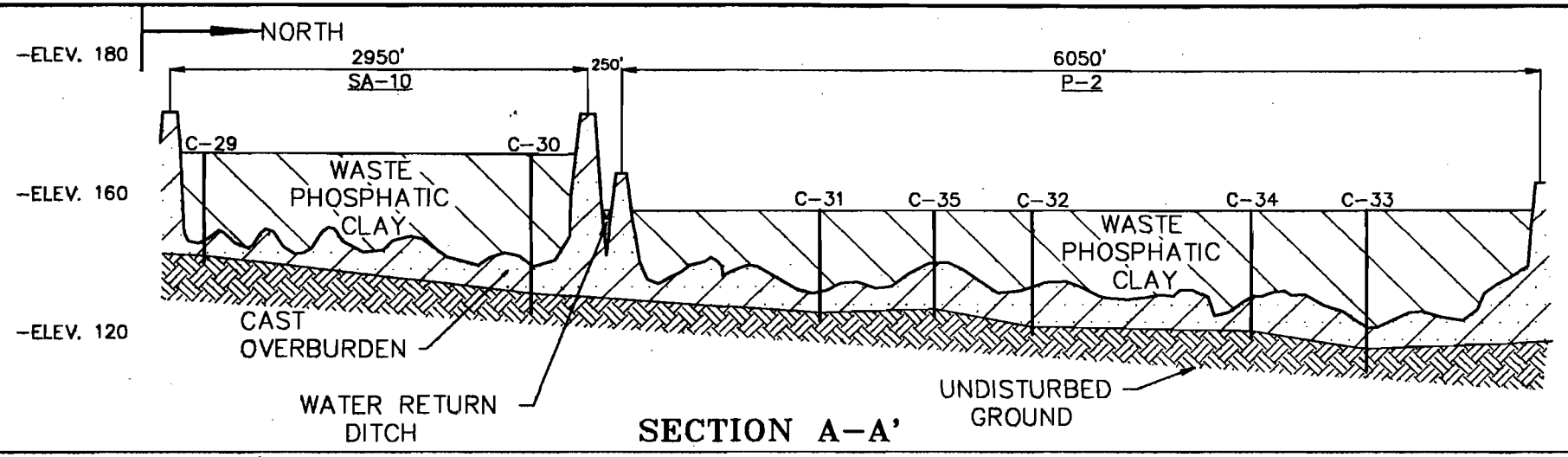


Source: Dames & Moore, 1992

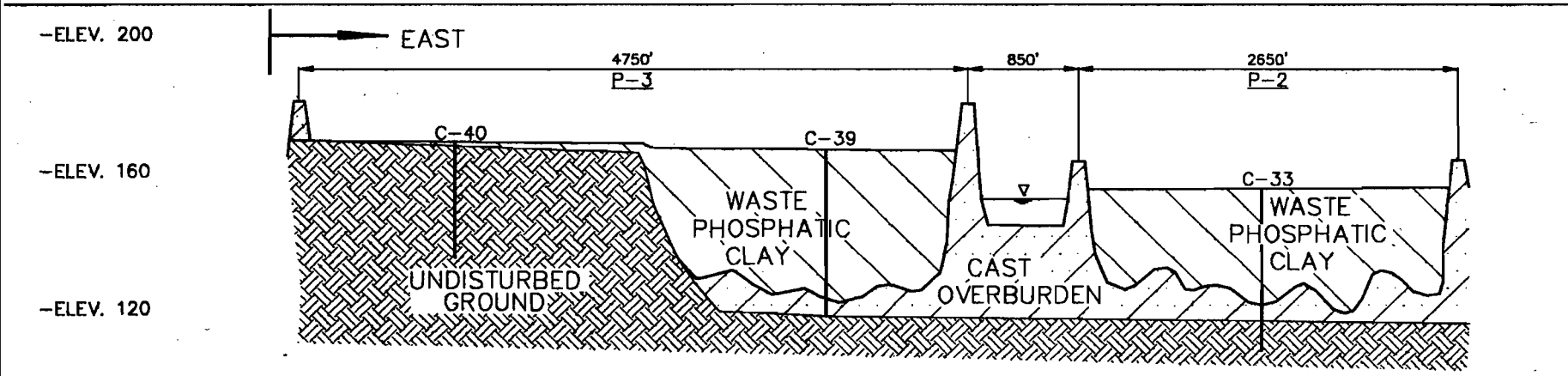
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FIGURE 2.3.1-12
CROSS-SECTION LOCATION MAP



SECTION A–A'



SECTION E–E'

Source: Dames & Moore, 1992

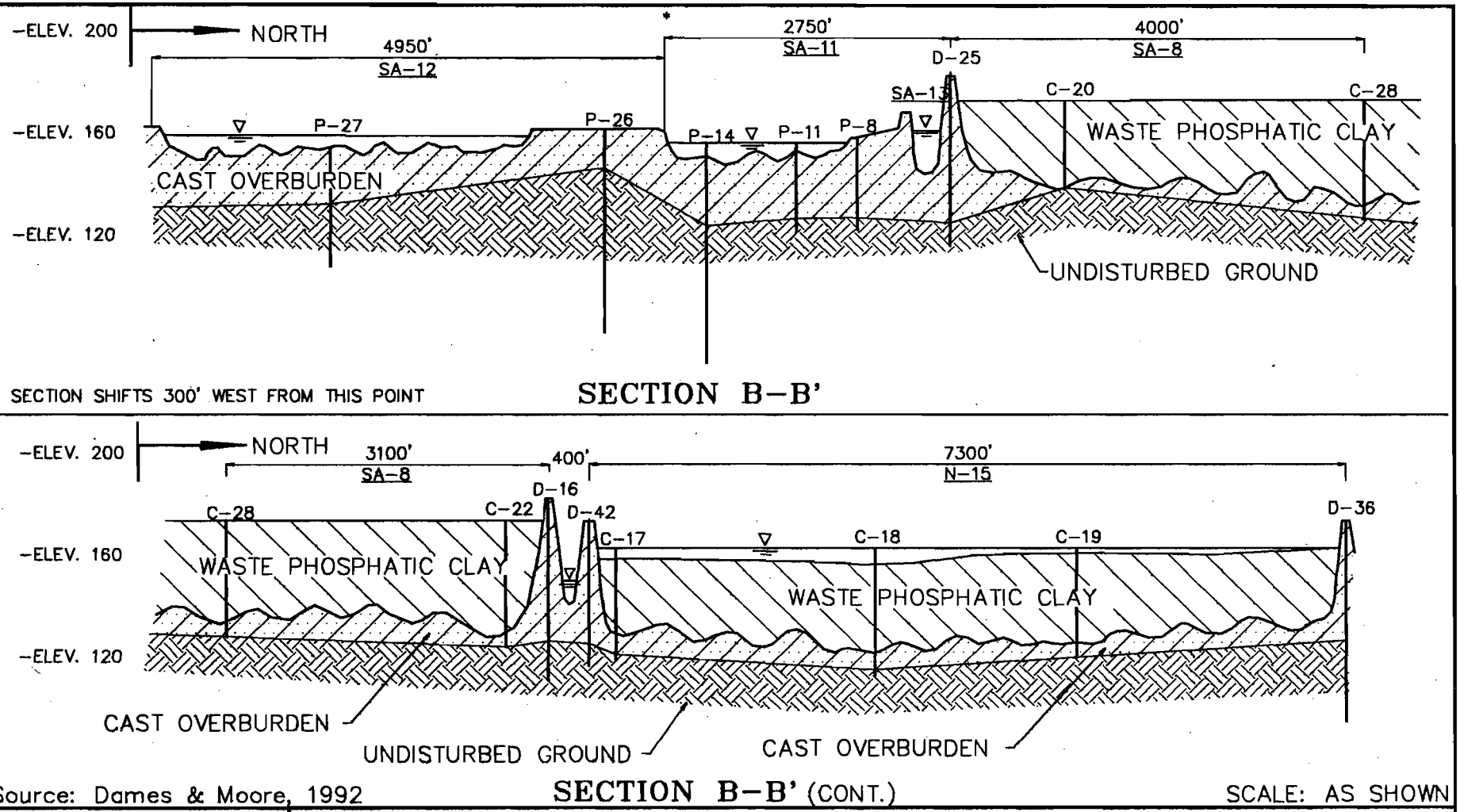
SCALE: AS SHOWN

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FIGURE 2.3.1-13

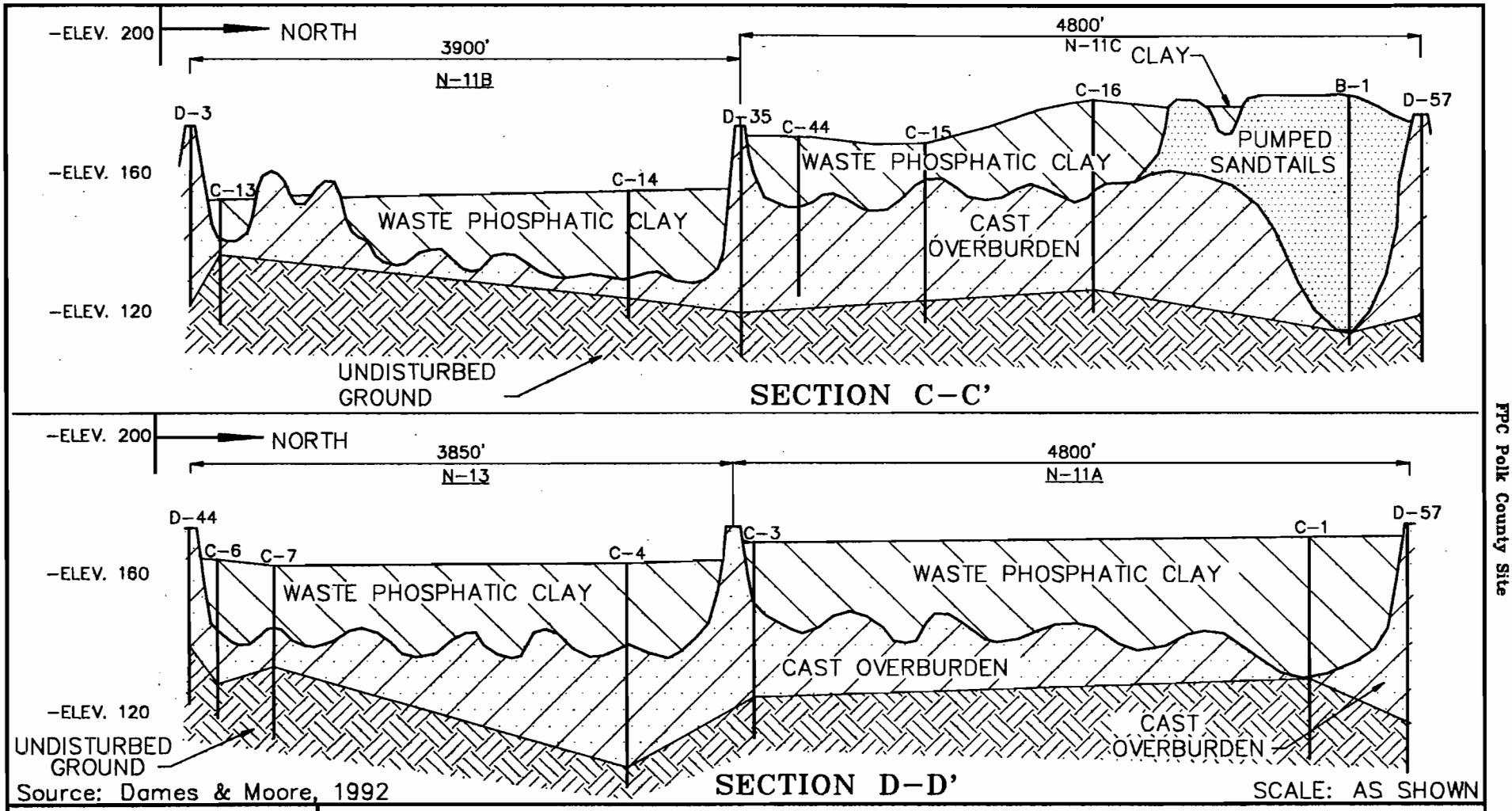
CROSS-SECTIONS A-A' AND E-E'



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FIGURE 2.3.1-14
CROSS-SECTION B-B'



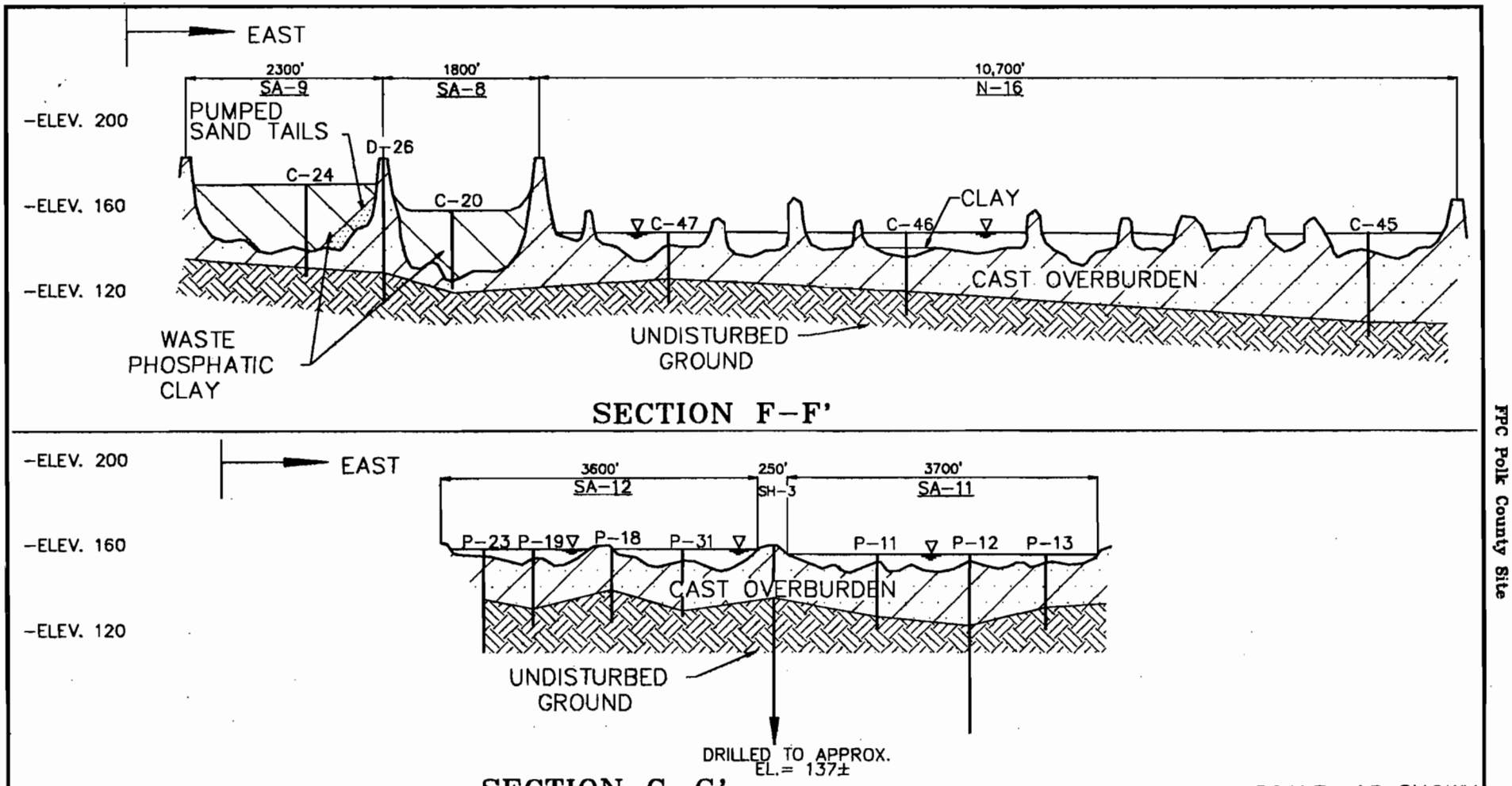
Source: Dames & Moore, 1992

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FIGURE 2.3.1-15

CROSS-SECTIONS C-C' AND D-D'



Source: Dames & Moore, 1992

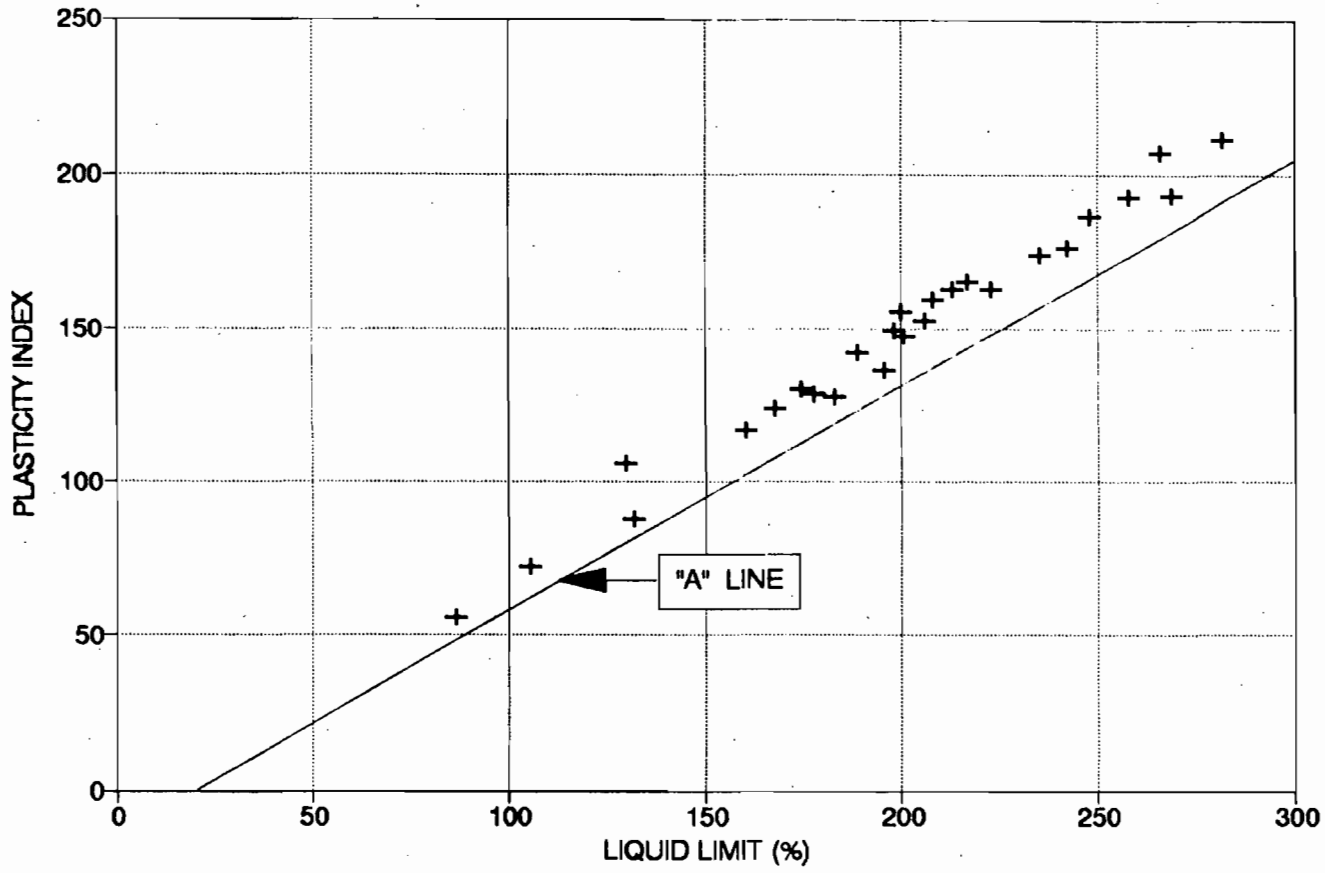
SCALE: AS SHOWN

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Polk County Site

FIGURE 2.3.1-16

CROSS-SECTIONS F-F' AND G-G'

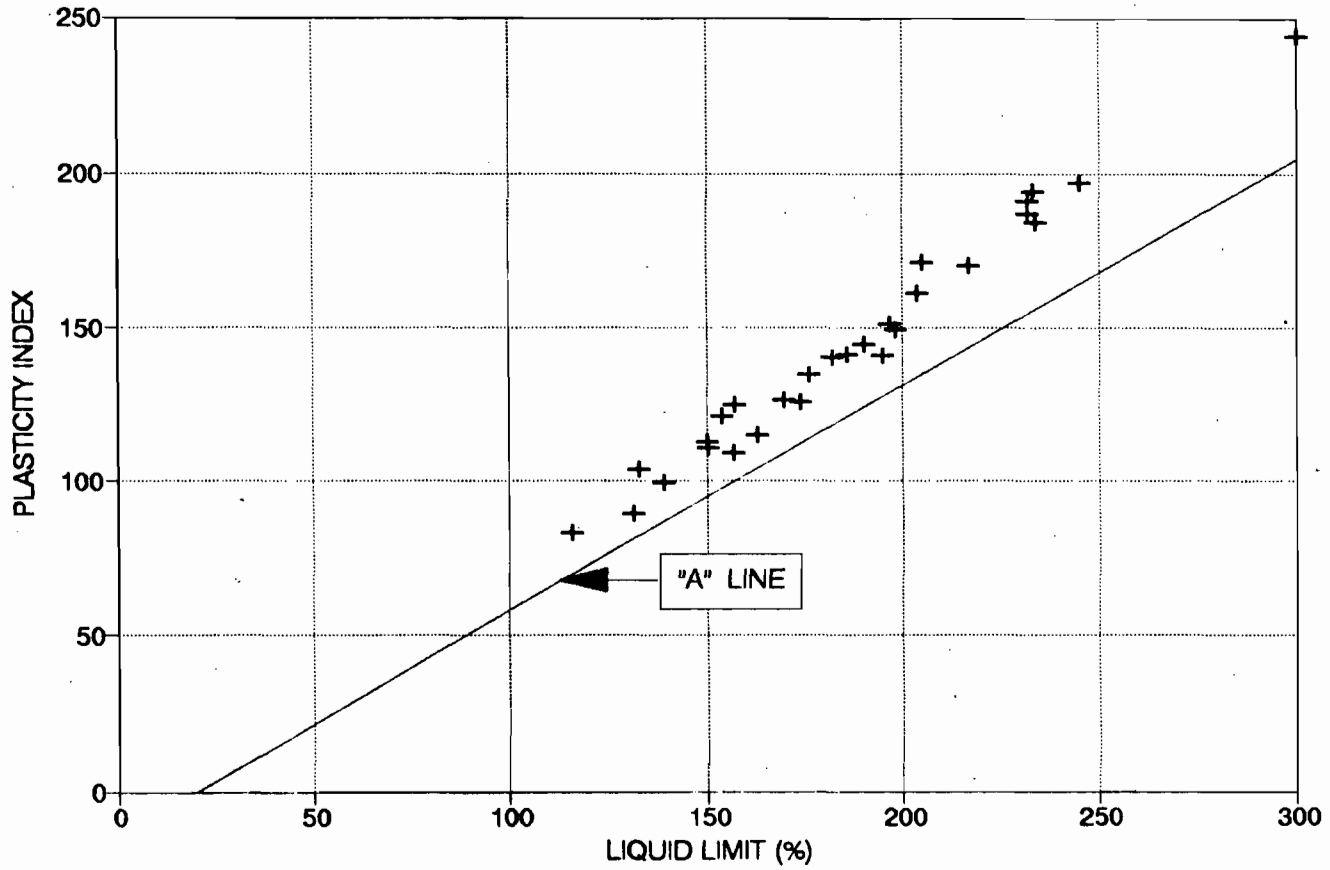


Source: Dames & Moore, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.1-17
ATTERBERG LIMITS
POND AREAS
N-9B, N-11A, N-11B, N-11C, N-13, AND N-15

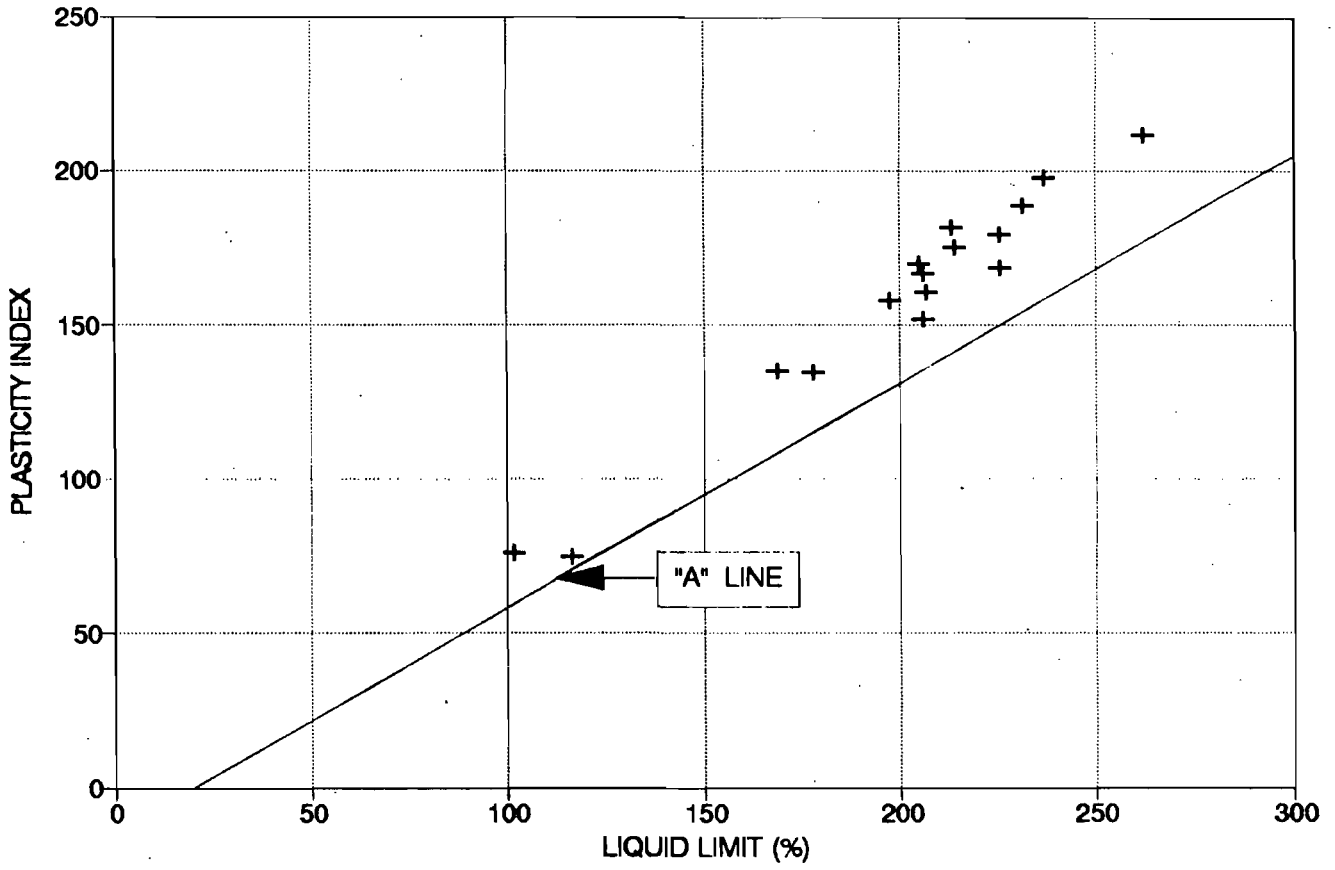


Source: Dames & Moore, 1992

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Polk County Site

FIGURE 2.3.1-18
ATTERBERG LIMITS
POND AREAS
SA-8, SA-9, AND SA-10

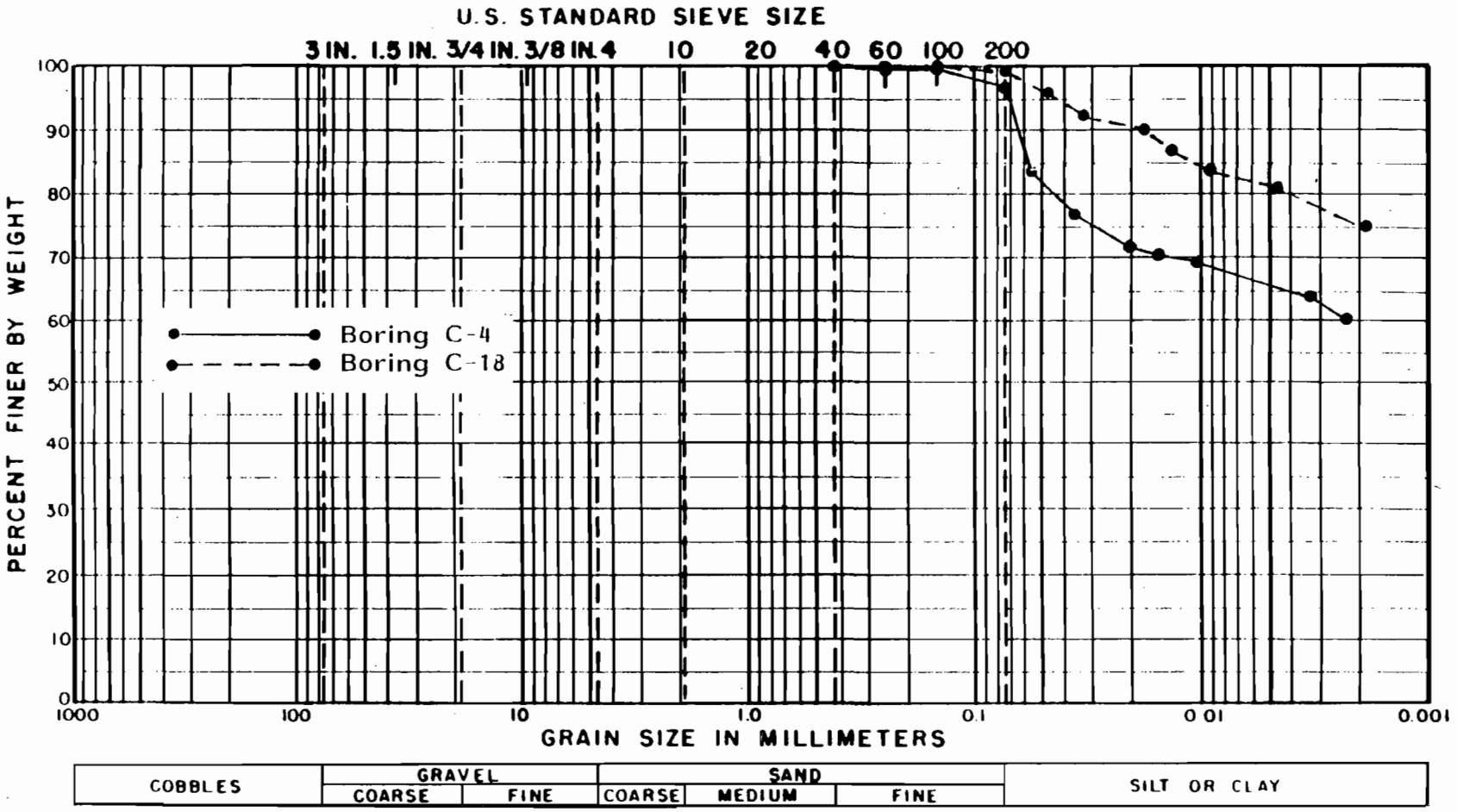


Source: Dames & Moore, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.1-19
ATTERBERG LIMITS
POND AREAS
P-2 AND P-3

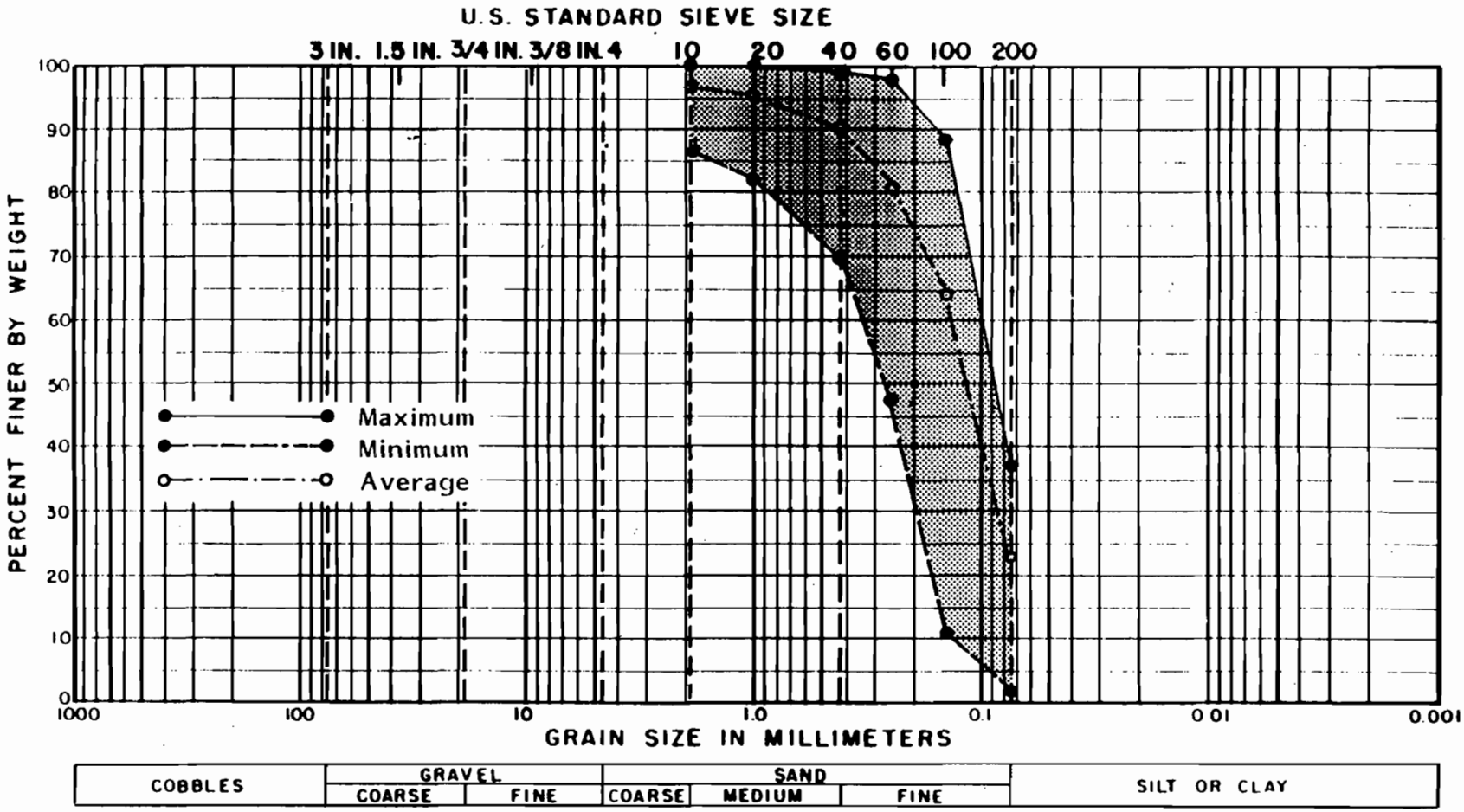


Source: Dames & Moore, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.1-20
WASTE PHOSPHATIC CLAY
GRAIN SIZE DISTRIBUTION

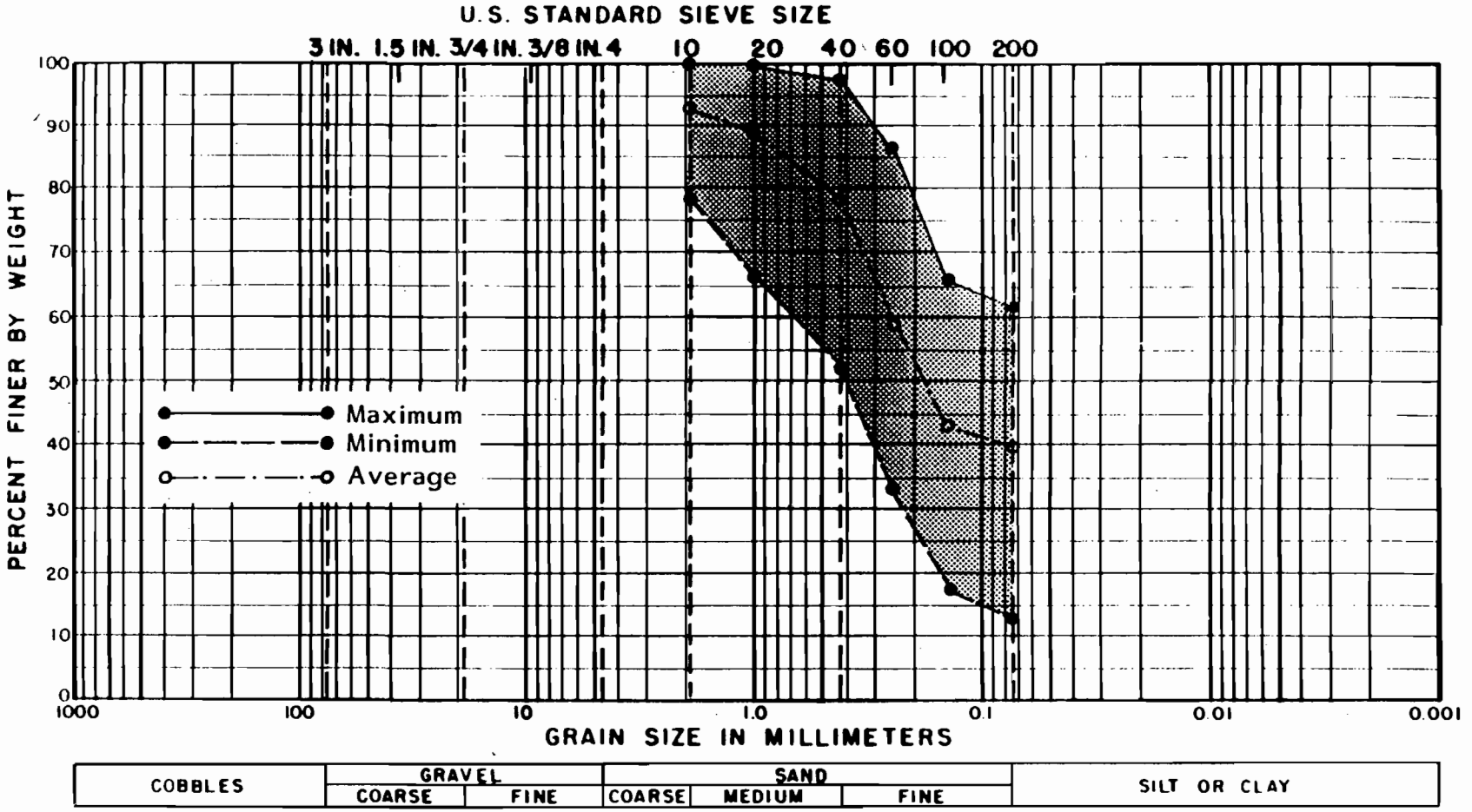


Source: Dames & Moore, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.1-21
EMBANKMENT OVERBURDEN MATERIAL GRAIN SIZE DISTRIBUTION

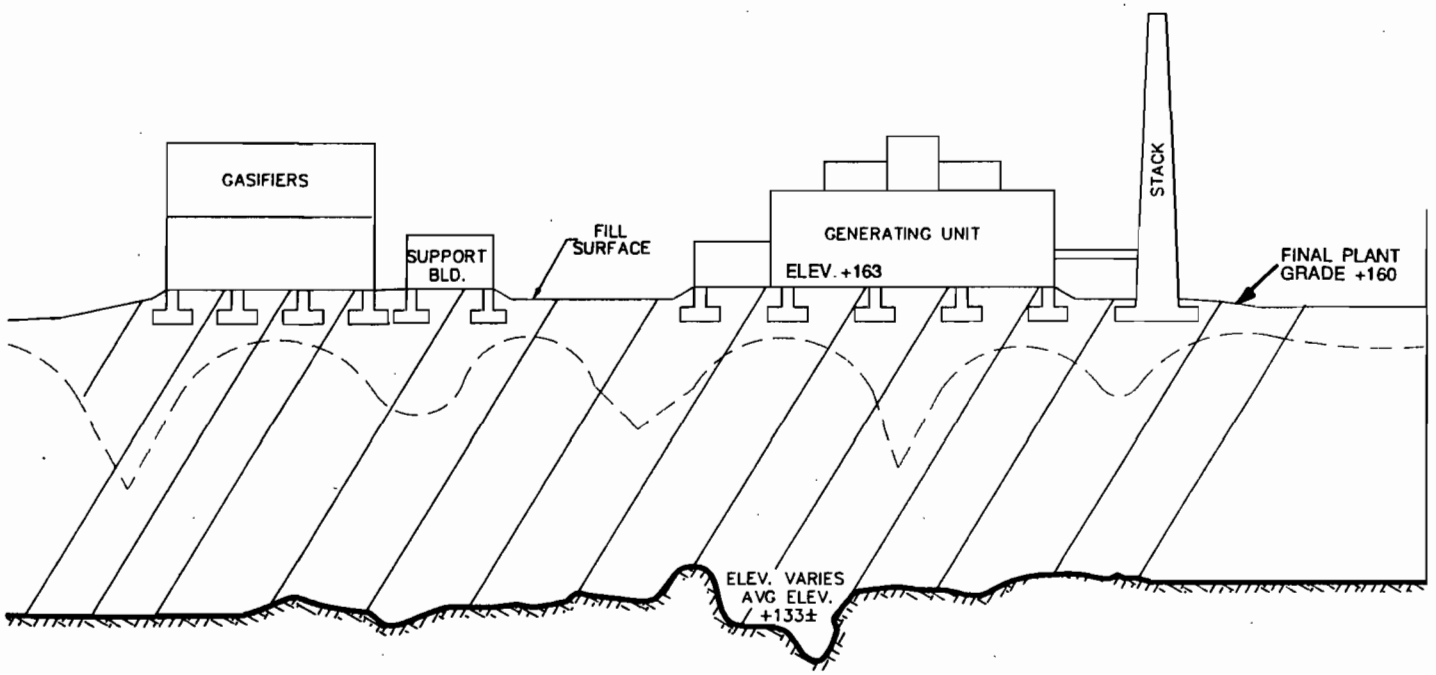


Source: Dames & Moore, 1992

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Polk County Site

FIGURE 2.3.1-22
UNDISTURBED GROUND
GRAIN SIZE DISTRIBUTION



LEGEND:

OVERBURDEN PILES
STRUCTURAL COMPACTED FILL
ORIGINAL UNDISTURBED GROUND

DRAWING FOR ILLUSTRATION PURPOSES ONLY

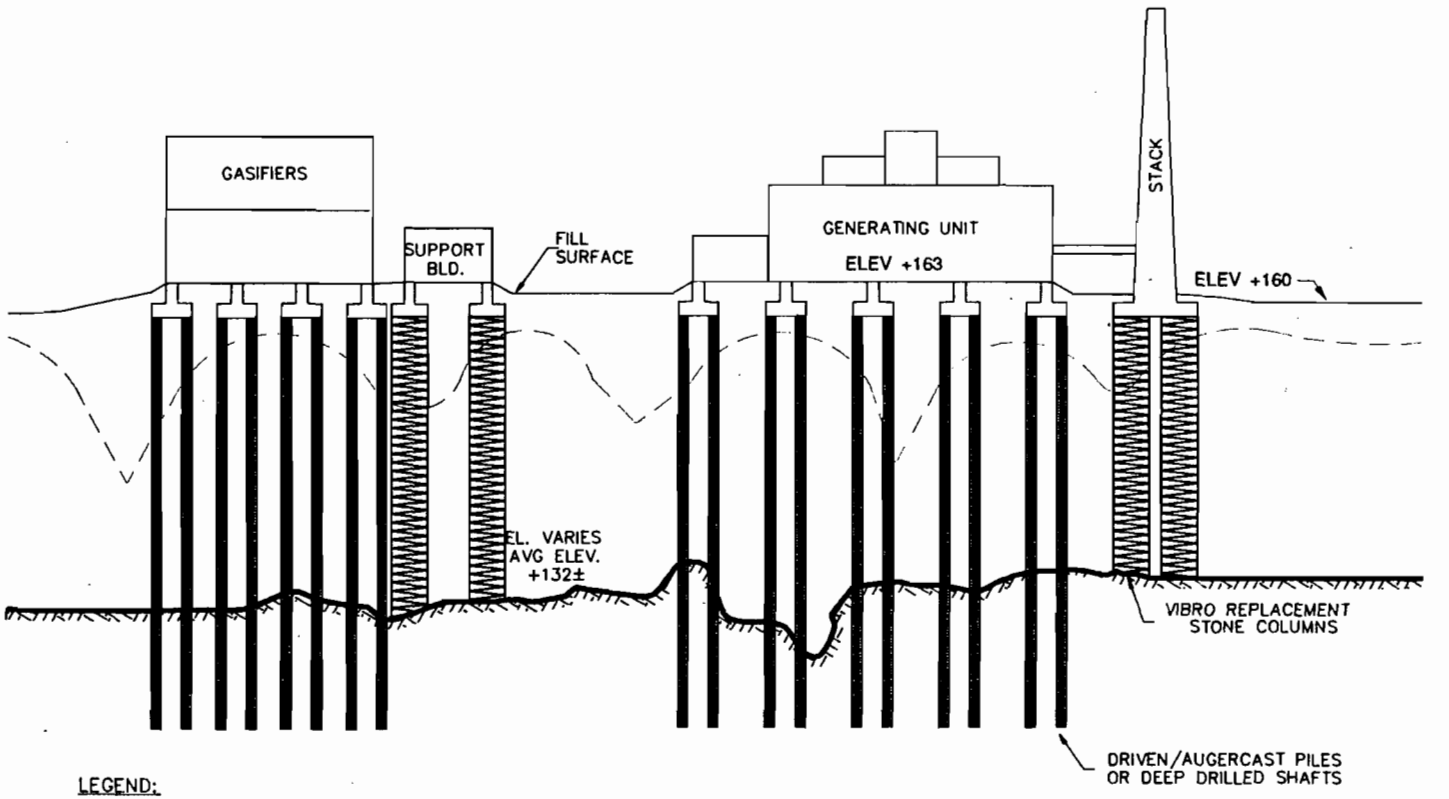
NOT TO SCALE

SOURCE: DAMES & MOORE, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.1-23
SCHEMATIC OF SHALLOW FOUNDATION SUPPORT ALTERNATIVES FOR CONSTRUCTION

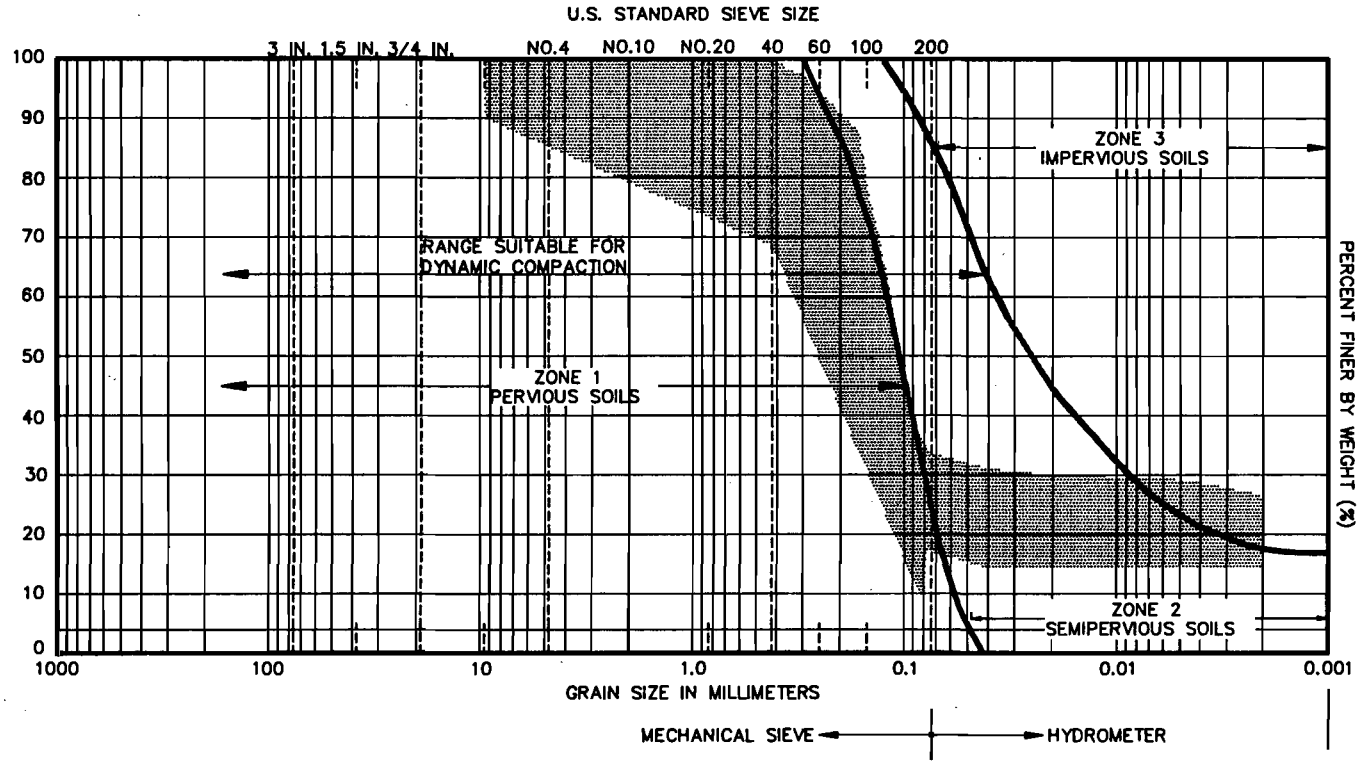


SOURCE: DAMES & MOORE, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.1-24
SCHEMATIC OF DEEP FOUNDATION SUPPORT ALTERNATIVES FOR CONSTRUCTION

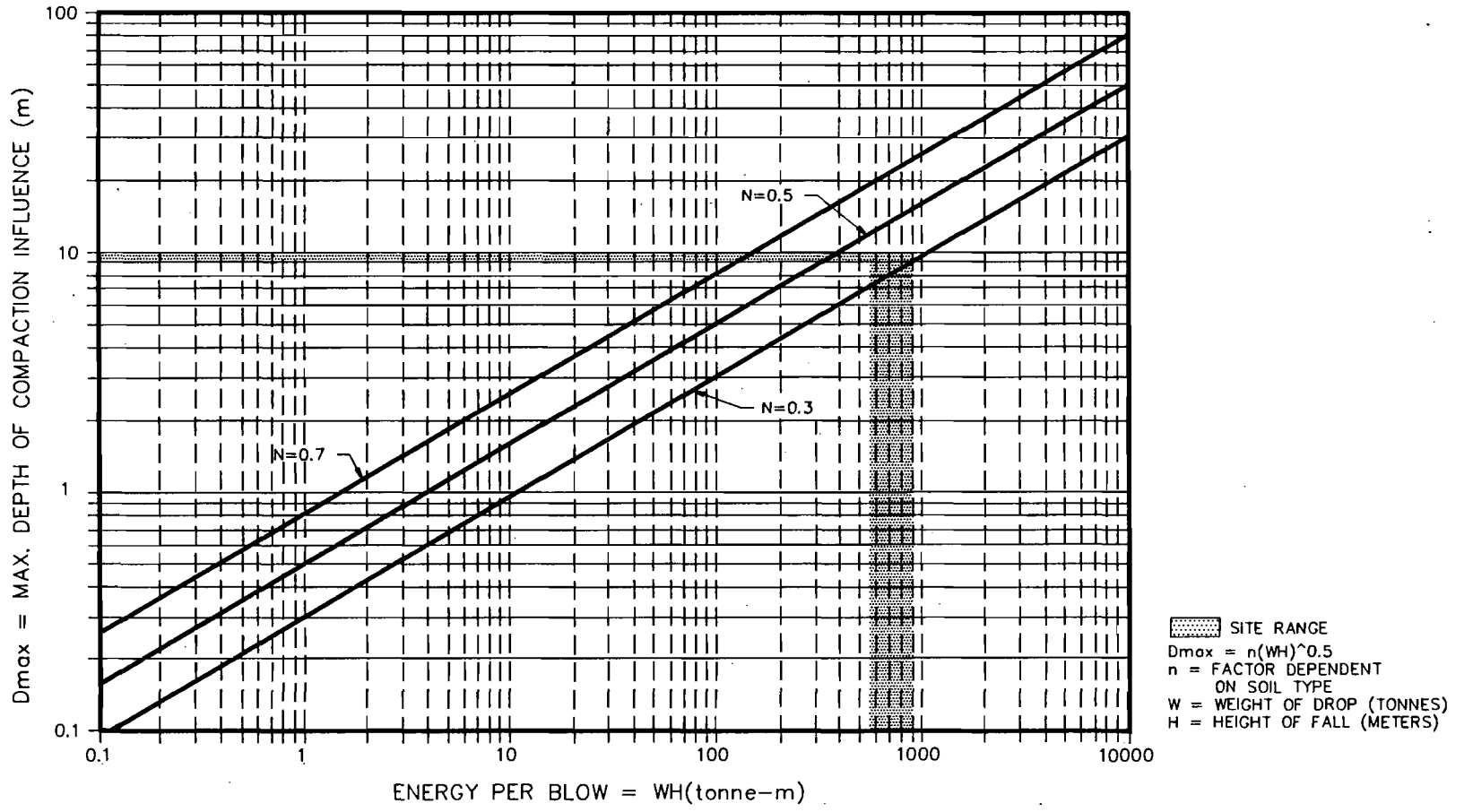


SOURCE: DAMES & MOORE, 1992 / FHWA, 1986

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.1-25
GRAIN SIZE SUITABILITY FOR DYNAMIC COMPACTION

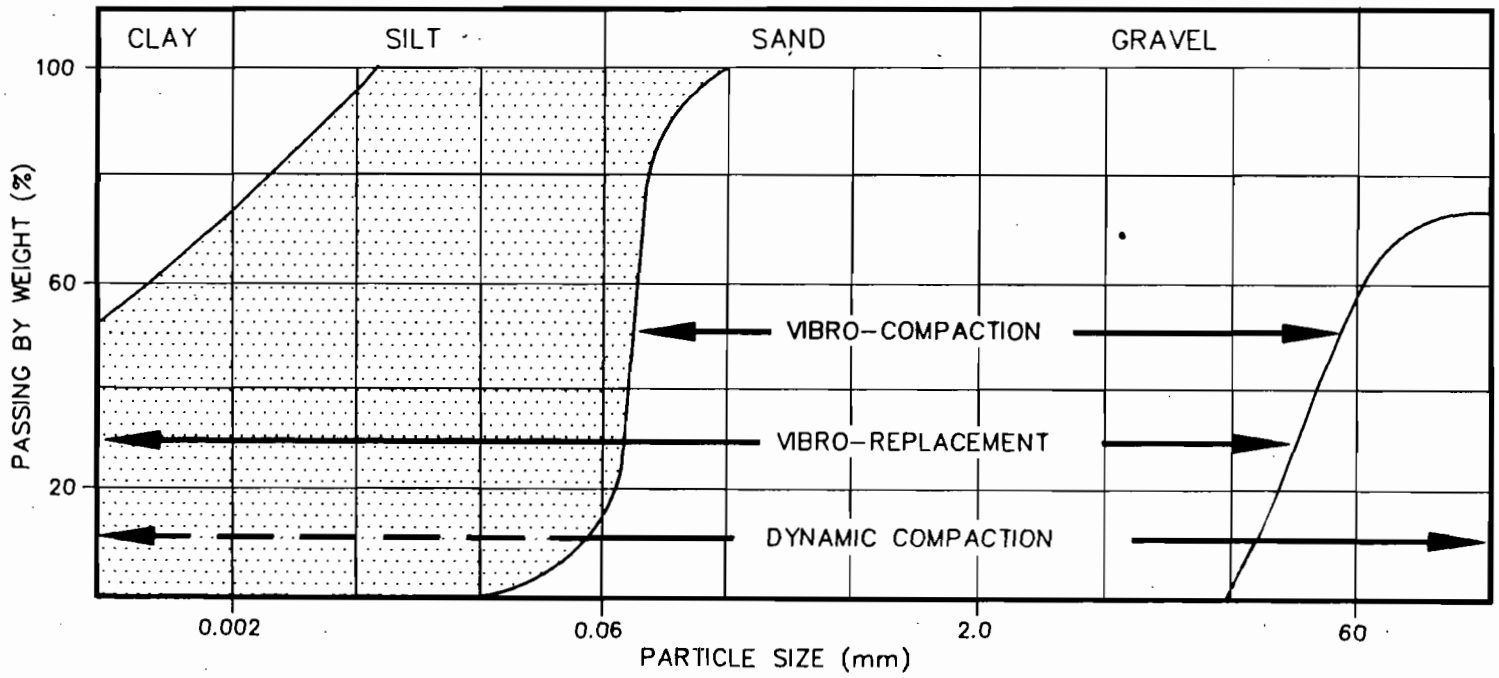


SOURCE: DAMES & MOORE, 1992/FHWA 1986

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.1-26
TREND BETWEEN APPARENT MAXIMUM DEPTH OF COMPACTION INFLUENCE AND ENERGY PER BLOW



GRADING OF SOILS WHERE GROUND IMPROVEMENT TECHNIQUES MAY BE USED

SOURCE: DAMES & MOORE, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.1-27
SUITABILITY OF SOILS FOR VARIOUS GROUND IMPROVEMENT TECHNIQUES

2.3.2 Subsurface Hydrology

2.3.2.1 Subsurface Hydrological Data For Site Area

Generally, the site area is underlain by three hydrostratigraphic units: the Surficial Aquifer (removed/altered); the Intermediate Aquifer which includes upper and lower confining units; and the Floridan Aquifer. This section provides background water quality data for each unit; aquifer characteristics; historical water level contour maps; and unit thicknesses. The discussion of aquifer definitions and the relationship of aquifers to geologic units is referenced to the publications by SWFWMD (1988) and Ryder (1985).

Background water quality data for the Surficial, Intermediate, and Upper Floridan Aquifers were tabulated from the U.S. Geological Survey (USGS), Water Quality Data Printout dated May 29, 1991. Additional water quality data for the Surficial Aquifer were obtained from Hutchinson (1978).

Historical water level data used to develop contour maps for the Surficial Aquifer are referenced from Hutchinson (1978). Potentiometric contour maps for the Intermediate and Upper Floridan Aquifers are referenced from USGS water resources data reports (USGS, 1980-91).

SURFICIAL AQUIFER SYSTEM

A majority of the materials which comprise the Surficial Aquifer have been altered, or removed, due to mining activities at the Polk County Site. Where it occurs and before being removed by mining at the site, the Surficial Aquifer system typically consists of clastic deposits of sands, silty sands, and clays of eolian and marine origins. In Polk County, the Surficial Aquifer is utilized primarily for domestic and low volume irrigation uses. It ranges in thickness from a few inches in lowlands to 250 feet in ridge areas. As defined by Southwest Florida Water Management District (SWFWMD) (1988), the base of the Surficial Aquifer system is the clayey, less permeable beds of the Hawthorn Group. As shown previously on Figures 2.3.1-11 through 2.3.1-17, the top of the Hawthorn Group (the Bone Valley Member of the Peace River Formation) is laterally continuous across the site at an elevation of approximately 150 ft MSL. The bottom of the Surficial Aquifer, to an elevation of about 150 ft MSL, has been removed/altered during mining operations.

The elevation of the land surface, at boring locations SH-1, SH-2 and SH-3 and at the Estech Plant site, ranged from 185 to 160 ft MSL. Where it exists, such as at the Estech Plant site and beneath county roads, the Surficial Aquifer ranges in thickness from about 10 to 35 feet.

During the field activities at the Estech Plant site in November and December, 1991, the elevation of the water table of the Surficial Aquifer in an adjacent unmined area was measured to range from 153 to 163 ft MSL. As reported in the Aquifer Characteristics Program (ACP) Summary Report (Appendix 10.5.8), the groundwater flow direction at the Estech Plant site is to the southwest. Water level measurements were not collected at the FPC site itself, because of the lack of aquifer thickness or continuity. However, published data by Hutchinson (1978) provided water table elevations for the Surficial Aquifer in September 1975. Figure 2.3.2-1 is a generalized water table contour map of the Surficial Aquifer in the site area prior to mining. These data indicate water level elevations of 150 ft MSL in the vicinity of the FPC site with a groundwater flow direction to the east along the east half of the FPC site, and to the southwest along the west half of the site. However, it is noted that these water levels are no longer indicative of present day flow conditions due to the extensive mining operations in the site area. This information is provided solely as historical data on pre-mining groundwater flow and elevation.

The hydraulic properties of the Surficial Aquifer were not measured. However, as reported by Hutchinson (1978), the Surficial Aquifer, where it exists and has been tested, has an average transmissivity of 1,900 ft^2/day and a specific yield of 0.29.

The background water quality of the Surficial Aquifer System in the vicinity of the FPC site is tabulated from published data by the USGS (1991). The Surficial Aquifer baseline water quality data sampling locations are shown on Figure 2.3.2-2. Water quality data at nine sampling locations near the FPC site are provided in Table 10.5.3-3. The minimum, maximum, and mean Surficial Aquifer water quality data are presented in Table 10.5.3-4.

INTERMEDIATE AQUIFER SYSTEM

As shown in the hydrogeological cross-sections on Figures 2.3.1-11 through 2.3.1-17, the Intermediate Aquifer System is present in the Arcadia and Peace River Formations of the Miocene Age Hawthorn Group. The Intermediate Aquifer System includes all water bearing units and confining units between the overlying Surficial Aquifer System and the underlying

Upper Floridan Aquifer System (SWFWMD, 1988). The Intermediate Aquifer System includes the upper confining units below the Surficial Aquifer, the middle units of limestone and clayey silts, and the lower confining units above the Suwannee Limestone, which corresponds to the upper sections of the Upper Floridan Aquifer. Water withdrawals from the middle units of the Intermediate Aquifer System are used primarily for domestic supply in Polk County. Large diameter wells (6 inches or larger) open to the Intermediate Aquifer System generally can provide yields of 200 gpm or more. The Aquifer is most productive in the central and southern parts of Polk County. The upper confining layers of the Intermediate Aquifer System consist of the clayey and silty sediments of the Bone Valley Member of the Peace River Formation. Mining activities have removed/altered the sediments of the Bone Valley Member, which were typically 15 to 25 feet thick. The geophysical logs (see ACP Summary Report, Appendix 10.5.8) indicate the bottom of the Bone Valley Member to be approximately 130 ft MSL. Therefore, the remaining upper confining units of the Arcadia Formation are about 100 feet thick, beginning at approximately 130 ft MSL and extending downward to the first production zones, consisting of limestone at an elevation of 30 ft MSL. The lithologic data obtained from the drilling of the 300-foot deep pilot hole at the Estech Plant site and the three 300-foot deep borings near the plant island area at the Polk County Site show two limestone aquifer zones in the Arcadia Formation. As shown in the hydrogeologic cross-section and framework, the aquifer zones of the Intermediate Aquifer range in elevation from 30 ft MSL at the top to about -30 ft MSL at the bottom. The units appear to be laterally extensive throughout the site area as extrapolated from the boring locations.

The lower confining units of the Intermediate Aquifer consist of grey clayey silts of the Arcadia Formation. The lower confining units are approximately 75 feet thick with the bottom at an elevation ranging from -110 ft MSL at the Estech pilot hole, to -85 ft MSL at SH-1, and to -115 ft MSL at SH-3.

During October to December 1991, the potentiometric surface of this aquifer ranged from 79 ft MSL at the south of the site to 75 ft MSL to the north at the Estech Plant site. As shown in the Appendix 10.5.8, the potentiometric surface contours suggest a northwest groundwater flow direction.

Historical potentiometric surface contour maps of the Intermediate Aquifer during wet and dry seasons were developed from USGS data files as shown on Figures 2.3.2-3 through 2.3.2-8 during the months of May and September, for the years 1989, 1990 and 1991. The

potentiometric maps indicate variable flow directions which are influenced by pumping from water wells in Bartow, Fort Meade, and Homeland. The potentiometric level in the site area ranged from approximately 60 ft MSL to 75 ft MSL during the May measurements with groundwater flow to the southeast to east, and 75 ft MSL to 90 ft MSL during the September measurements with groundwater flow to the east.

The hydraulic properties of the Intermediate Aquifer system are provided by Hutchinson (1978). The transmissivity for the Intermediate Aquifer averaged 5,185 ft^2/day for six tests conducted in Polk County, and storage coefficients ranged between $1.0x10^{-4}$ and $4.2x10^{-5}$ for seven tests. One leakance coefficient value of $2.x10^{-4}$ feet per day per foot (ft/dy/ft) was reported (SWFWMD, 1988). Model-derived leakance values of the lowermost intermediate confining beds are estimated to range from $3x10^{-5}$ to $7x10^{-5}$ ft/dy/ft (Ryder, 1985). A leakance value for the lower confining units evaluated from data generated during the aquifer performance testing at the Estech Plant site (Appendix 10.5.8) was calculated to be $2.4x10^{-4}$ gallons per day per cubic foot (gpd/ft^3). The leakance values are greatly affected by the variability in thickness of the confining beds, which is most likely the main reason for the observed differences.

The background water quality of the Intermediate Aquifer is provided by data published by the USGS. The Intermediate Aquifer baseline water quality data sampling locations are shown on Figure 2.3.2-9. Water quality data at six locations near the Polk County Site are provided in Table 10.5.3-5. The minimum, maximum, and mean values of the water quality data are presented in Table 10.5.3-6. In general, the water quality of the Intermediate Aquifer System in Polk County is within FDER primary and secondary drinking water standards (SWFWMD, 1988).

FLORIDAN AQUIFER SYSTEM

As shown in the generalized lithostratographic and hydrogeologic framework (Figure 2.3.1-8), the Floridan Aquifer System in the vicinity of the site consists of vertically persistent permeable carbonates of the Avon Park Formation, the Ocala Group, and the Suwannee Limestone.

As shown in the hydrogeological cross-sections (Figures 2.3.1-11 through 2.3.1-17), the Upper Floridan Aquifer begins at the encounter of the sandy carbonates of the Suwannee Limestone, followed by the limestones of the Ocala Group and consists of units below the bottom of the clayey silts of the Arcadia Formation of the Hawthorn Group, from which the majority of

potable water supply is provided. The contact between the Suwannee Limestone and the Ocala Group could not be identified from the field activities performed at the Estech Plant site; however, the bottom of the Suwannee is estimated to be at approximately -200 ft MSL (Ryder, 1985).

The 300-foot deep pilot hole at the Estech Plant site and the three 300-foot borings (SH-1, 2, and 3) at the FPC Polk County Site indicate the top of the Upper Floridan Aquifer to range from -85 ft MSL (SH-1) to -115 ft MSL (SH-3). The top of the Upper Floridan dips generally to the south-southeast, and southwest in Polk County. Estimates of the aquifer's base elevation range from higher than -1,000 ft MSL in central Polk County to deeper than -1,200 ft MSL in southern Polk County (SWFWMD, 1988). The deepest well from which downhole geophysical data were obtained on the Estech Plant site was SC-1, to a bottom elevation of approximately -650 ft MSL.

During the field activities at the Estech Plant site, between October and December 1991, the potentiometric level of the Upper Floridan ranged in elevation from +57 ft MSL to +58 ft MSL (See ACP Summary Report, Appendix 10.5.8).

Historical water level data from USGS files led to the potentiometric surface contour maps for the Upper Floridan during the wet and dry seasons shown on Figures 2.3.2-10 through 2.3.2-15 during the months of May and September for the years 1989, 1990, and 1991. At the site area, the potentiometric levels ranged from 40 ft MSL to 50 ft MSL during the May measurements, and 55 ft MSL to 65 ft MSL during the September measurements. Based on USGS data, the groundwater flow direction of the Upper Floridan Aquifer is toward the southwest.

The hydraulic properties of the Upper Floridan Aquifer are documented throughout Polk County. The areal variation in the Upper Floridan transmissivity is controlled primarily by the occurrence of solution features and fractures. The aquifer storage coefficient is controlled by thickness, and confining bed lithology and thickness control leakance (SWFWMD, 1988). Transmissivity values from four aquifer performance tests performed in the vicinity of the FPC Polk County Site ranged from 119,000 gpd/ft to 69,800,000 gpd/ft. (See Table 1 of ACP Summary Report, Appendix 10.5.8). The upper range was reported for a well that most probably encountered a fracture system (SWFWMD, 1987). Storage coefficients ranged from 1.0×10^{-4} to 4.4×10^{-4}. An average transmissivity value of 552,000 gpd/ft was measured during the aquifer performance test performed on well SC-1 at the Estech Plant site (see Table 6, ACP Summary Report, Appendix

10.5.3-8). The average storage coefficient was found to be 7.92×10^{-3} for the test at the Estech Plant site.

Background water quality data of the Upper Floridan Aquifer was provided by the USGS. The Upper Floridan Aquifer baseline water quality data sampling locations are shown on Figure 2.3.2-16. Water quality data for thirteen locations near the FPC Polk County Site are provided in Table 10.5.3-7. The minimum, maximum, and mean values of the water quality data are presented in Table 10.5.3-8.

RECHARGE TO AQUIFER SYSTEMS

The recharge and discharge to the Upper Floridan Aquifer in Polk County are controlled primarily by vertical hydraulic conductivity and thickness of confining units. These variables have been used to calculate recharge rates to the Upper Floridan Aquifer. Stewart (1980) reports that no recharge occurs along the Kissimmee River area of eastern Polk County. Areas of very low recharge (0 to 2 inches) occur in the southwest portions of the County. Very low to moderate areas of recharge (less than 2 inches to as much as 10 inches per year) are found in the northern Green Swamp area of Polk County.

The highest values of recharge occur in a linear band directly associated with the upland sandy ridge areas, where recharge rates are estimated between 10 and 20 inches per year (SWFWMD, 1988). Estimates of recharge by SWFWMD (1988), Ryder (1985), and Stewart (1989), near the FPC Polk County Site area range from no recharge to 2 inches, 3 to 6 inches, and 0 to 2 inches per year, respectively.

Recharge rates to the Intermediate Aquifer System were evaluated by SWFWMD (1988). This publication indicates a very low to moderate recharge rate to the Intermediate Aquifer for September 1986 and May 1987, ranging from 0 to 10 inches per year at the FPC site area.

2.3.2.2 Karst Hydrogeology

The karst hydrogeology review and site sinkhole evaluation included: (1) a study of topographic maps and aerial photographs (both pre-mining and post-mining) of the site and vicinity; (2) a review of the available literature on the geology of the region of Polk County; (3) a review of USGS and Florida Geological Survey (FGS) documents related to sinkhole occurrences as

reported by the Florida Sinkhole Research Institute (FSRI) and SWFWMD; (4) a review of available newspaper articles regarding reported sinkholes in the Polk County area; (5) a surficial lineament analysis to evaluate the regional potential for sinkhole solution activity, and (6) a field investigation program consisting of deep borings in three depressed areas identified on pre-mining aerial photographs. Borings were drilled to a depth of 300 feet from the ground surface and were geophysically logged as described in Section 2.3.1.

PHYSIOGRAPHY

The FPC Polk County Site is contained entirely within the Polk Upland subdivision of the Central Highlands region of the mid-peninsular physiographic zone (White, 1970). The Central Highlands physiographic region is characterized by discontinuous highlands, or ridges, which generally align sub-parallel with the axis of the peninsula. These highland areas are separated by broad valleys or by lower elevation upland regions with only local relief. The ridges appear to be linear marine terrace features resulting from the recession of ancient sea level stands. The ridges are dissected by surface streams and are being lowered by surface erosion and sinkhole (solution) activity. Sinkhole and solution activity appear to be less visible within the Polk Upland region than in the rest of the highland regions. Surface streams which dissect the Polk Upland form the headwaters of the Peace, Manatee, Little Manatee and Alafia Rivers and are typified by widely branching tributaries.

In areas which have not been mined, the Polk Uplands region is characterized by gently sloping terrains containing pasture lands and orange groves. Some pine and hardwood regions are also present within the region. The surface of the Polk Uplands contains numerous shallow, saucer shaped depressions which appear to be either recessional shoreline features, the consolidation of thicker near-surface sandy clay soils, or potentially doline type features.

Detailed descriptions of the general site geology are provided in Section 2.3.1.1.

SINKHOLE DEVELOPMENT

Limestone formations exhibit porosity from both primary and secondary features. Primary porosity results from internal voids which may or may not be interconnected. Secondary porosity results from fractures or joints. Fracture or joint features may result from bedding and shrinkage during lithification, or from regional tectonic or geomechanical forces.

Limestone which exists at or near ground surface is exposed to seepage from rainfall and other surficial water. Such water can often be slightly acidic due to its contact with organic matter, dissolved atmospheric gases, and other sources. When these lightly acidic waters come in contact with the limestone, the water reacts with, and slowly dissolves, the calcium carbonate, which is typically the major constituent of limestone. The flow of water across, or through, a limestone formation can slowly dissolve the calcium carbonate components of the rock, forming channels. This solution activity may be concentrated along the more highly permeable joints, fractures and bedding planes in the limestone. The most severe solution and weathering action usually occurs at the intersections of joints or fracture planes. Solution activity enlarges the secondary porosity in the limerock, forming channels and voids of various sizes in the upper limestone strata. The voids and channels produced in the limestone can result in surficial expressions in the terrain overlying the bedrock, creating features such as rolling hills, numerous shallow surface depressions, and steep-sided circular depressions. The name "karst" is used to characterize the geomorphic terrain underlain by carbonate bedrock which has undergone significant solution activity that is manifested at the surface by these topographic shapes.

A sinkhole forms when significant, usually rapid, ground surface subsidence occurs within a confined area. In karst areas, the formation of the depression may be due to subsidence from solution activity, or it may result from erosion of surficial soils into existing voids and channels in the limestone bedrock. There are three basic types of sinkholes which predominate in Florida: cover-subsidence sinkholes, cover-collapse sinkholes, and solution sinkholes. These sinkhole types result from their characteristics of formation which are controlled by both the geology and hydrogeology of a given region.

The most common type of sinkhole in the central Florida region is the cover-subsidence sinkhole which results from the erosion of noncohesive, unconsolidated, and permeable near-surface soils into voids or cavities in the underlying limestone. The voids are usually open at the surface of the limestone underlying the pervious deposit. The following conditions must be present for this type of sinkhole to occur:

- The cavernous limestone must be overlain by relatively pervious, noncohesive, unconsolidated sediments.

- The water table in the overlying surficial aquifer must be at a higher elevation (head) than the water level in the underlying limestone aquifer (potentiometric surface).

- An open conduit must exist within the limestone connecting to the cavernous zone creating a point of high recharge to the limestone aquifer.

Where these conditions are present, water moving down into the limestone may take large amounts of sediments into the cavity system which creates a void in the overlying sediment. The soils can "hourglass" down into the rock cavity, causing a surface depression to form gradually, or a void can migrate up into the soil (roof ravelling) resulting in a localized depression of the ground surface. This latter occurs when the void in the sediment reaches the diameter where its roof is no longer stable and the overburden sloughs into the void, eventually exiting at the surface to form the sinkhole. In areas where the overlying sand cover is 50 to 100 feet in thickness, these types of sinkholes are only a few feet in diameter and depth.

In the region of the site, the potentiometric level of the permeable beds of the Intermediate Aquifer System is significantly (approximately 80 feet) lower than that of the original Surficial Aquifer removed by mining operations. Although this head differential is present, and tends to induce downward groundwater flow, the possibility of a cover subsidence-type sink occurring on the subject property is significantly reduced, due to the thick sequence of very dense, consolidated cohesive soils in the lower Peace River Formation and the very dense consolidated nature of the upper underlying Arcadia Formation. Beggs (1984) found that, in areas directly underlain by the Floridan Aquifer System, the frequency of sink occurrence decreases with increased depth to rock. According to this study, the probability of sinkhole occurrence is very small when the depth to limestone is 100 feet or greater. At the FPC site, the depth to the solution prone limestone is in excess of 260 feet.

The second type of sinkhole, which occurs far less frequently than the above described cover-subsidence type, is the cover-collapse type sinkhole. This sinkhole occurs when a cavity enlarges to such an extent that its roof can no longer support the load of the overlying soil and rock. This type of sinkhole results in a sudden collapse of the roof and overlying soils and is usually quite large. Collapse sinkholes generally occur in areas where the limestone is relatively close to the land surface and the limestone aquifer is under water table conditions. Collapse type sinkholes are generally less likely to occur in areas where the cavernous limestone is at a significant depth below land surface. The depth to the thick sequence of solution prone limestone and dolomite in the Upper Floridan Aquifer is approximately 280 to 310 feet below land surface at the site.

Based on the type of cover and general thickness of soils which overlie the limestone bedrock, four distinct areas of sinkhole occurrence have been mapped within the state of Florida. Figure 2.3.2-17 illustrates these four separate areas as defined by the USGS Map Series No. 110 (Sinclair and Stuart 1985). As shown, the Polk County site is located near the northern limits of Area IV. This area is defined as typical of cover-collapse sinkholes to occur and is typified as having more than 200 feet of cover material thickness. The cover material is described as generally being cohesive sediments with interlayered carbonate beds. Although cover-collapse sinkholes are present in Area IV, sinkhole occurrences are few.

Other studies by the USGS have evaluated the sinkhole potential in the state of Florida in the region of the site (Beck and Sinclair 1985, Sinclair and Stewart 1985, and Sinclair, et al. 1985). Their research has concluded that areas where the cover is as much as 200 feet thick are essentially free of sinkhole development. Mapping of sinkhole occurrences by the Polk County Department of Public Safety has shown that the sinkholes are concentrated along the east flank of the uplifted Lakeland Ridge (Sinclair, et al. 1985). Fractures and fault traces on either side of the uplifted ridge have greatly accelerated the occurrence of sinkholes.

Due to the thickness, denseness, and consolidated, cohesive nature of the underlying Arcadia Formation and the lower portion of the Bone Valley Formation, the likelihood for cover-collapse sinkholes to occur at this site is greatly reduced. This is substantiated by the review of historic aerial mapping within the area of the site prior to mining. The review did not identify any large cover collapse-type sinkholes on the site, however, a few sinkholes have occurred within a 5-mile radius of the site. Cover-collapse sinkhole occurrences were primarily observable to the north and east of the site, east of the Peace River, and along the Peace River bed. The hydrologic and geologic conditions east of the Peace River that have resulted in the cover-collapse sinkhole formation are dissimilar to the conditions existing in the immediate vicinity of the site. East of the Peace River the solution prone limestones are closer to the ground surface.

The third type of sinkhole is called a solution (doline) sinkhole. These sinkholes normally occur where limestone bedrock is at the land surface or is covered only by a relatively thin layer of permeable, unconsolidated soil. In this type of sinkhole, subsidence results from the gradual lowering of the surface by the slow dissolution of calcium carbonate from the calcareous soil and rock which exist beneath the ground. Solution activity is concentrated along joints, fractures or other discontinuities in the limestone and the dissolved calcium carbonate is removed by the ground water. No large voids are formed from the solution of the limestone, however, the

surface of the limestone slowly moves downward resulting in the formation of a shallow surface depressional feature. These shallow depressions may collect surface runoff resulting in the formation of a marsh or lake. The topography which results from this type of solution activity is common throughout Florida.

As estimated by the USGS, the doline solution of limestone resulting from normal recharge would result in the formation of a 1-foot deep depression in 33,000 years (Sinclair et. al., 1985). This gradual subsidence would result in an approximate elevation change of 3 to 5 feet in the area of the site from the time that the surficial sandy soils were initially deposited (approximately 100,000 years ago).

Since groundwater flow is concentrated in faults and fractures, recharge and dissolution would also be concentrated in these areas. If a 10-fold increase in dissolution in limestone were to occur due to the increased recharge at the joints and fractures, it can be estimated that a 1-foot deep cavity would develop in about 3,300 years resulting in the subsidence of the ground surface of as much as 30 feet in 100,000 years. Shallow depressions would be formed at the ground surface in areas overlying the intersections of fractures and joints in the underlying limestone from solutioning, which is concentrated at these intersections. Shallow surface depressions noted in the review of historic aerial photographs of the site and surrounding region appear to be concentrated along inferred lineaments and fracture traces. Subsurface investigations of three depressed surface areas were performed as part of the site sinkhole assessment which is subsequently discussed.

COMPILATION OF SINKHOLE OCCURRENCES. To develop an understanding and appreciation of the nature of sinkhole development, the geologic and hydrologic factors affecting their development, and to determine which areas are most susceptible to sinkhole damage, it is necessary to investigate the inventory of sinkhole occurrences in the area of study. Records regarding recorded sinkhole occurrences have been individually maintained by several federal, state and county agencies and as a result, there had been no complete and comprehensive data base compiled for such research. The FSRI was formed to develop the data base and to rectify the lack of information. The FSRI compiled all available reports regarding sinkhole occurrences within the central Florida region and stored the information in both manual and computer-based files. The sinkhole inventory was prepared in a format designed to include physical information regarding the circumstances of each sinkhole occurrence as well as the pertinent hydrogeologic background data.

Figure 2.3.2-18 is a map of the site vicinity which shows the approximate locations of the recorded sinkholes as compiled by the FSRI. The record dates back from 1956 through June 6, 1991. Since 1991, the FSRI has no longer been funded and is, therefore, in the process of being closed. Figure 2.3.2-19 shows the location of reported sinkholes within 5 miles of the site. The existence of sinkholes 16-704, 16-705, and 16-707 could not be verified as the FSRI listed coordinates and location description of the sinkhole do not match the locations shown on Figure 2.3.2-19.

The review of the FSRI sinkhole inventory mapping substantiates the findings from the review of historic, pre-mining aerial photographs. The FSRI data indicates that sinkhole occurrences are concentrated in areas to the north of the site, between Bartow and Lakeland, Florida. According to the FSRI data, only three sinkholes have been reported within a 5-mile radius of the site. The closest reported sinkhole is approximately 2.9 miles south of the perimeter of the site, approximately 1.9 miles west of Fort Meade.

The area of the proposed power plant has no record of cover-subsidence or cover-collapse sinkhole activity. Available information does indicate that the area adjacent to the Peace River to the east, and particularly to the northeast of the site, is active. This area coincides with the mapped fracture zones areas located along the flanks of the uplifted ridges where accelerated sinkhole development has occurred. There are open sinkholes in the bottom of the Peace River in this region and some old clay settling areas on both sides of the River north of and in the IMC Clear Springs Mine, had to be abandoned due to the occurrence of sinkholes. As a result of these problems, several extensive geologic studies by various consultants were conducted on a number of Clear Springs Mine settling areas with evidence of karst geology and problems. One settling area, CS-10, was the site of a large sinkhole that formed in about 1971, called the Kincade Dairy Sink. The conclusion of an evaluation of this sink was that the CS-10 settling area could be built without significant risk of future sinkhole development if proper site development procedures were utilized. However, one recent sink in the CS-10 mining area developed in December of 1991. The sink formed under the interior embankment slope of the impounding embankment near the southwest corner. The clay settling area is presently being abandoned. The CS-10 mining area is located along the east side of the Peace River approximately 3.8 miles north of Homeland.

In addition to the FSRI records, local news agencies were also contacted to review news articles of reported sinks. The *Tampa Tribune* and the Lakeland *Ledger* provided records and newspaper

articles related to five separately reported sinkhole occurrences. The locations of these sinkholes were not specifically identified. However, their general locations were identified as Frostproof, Mulberry, Lakeland, Winter Haven and Bartow. The Bartow sinkhole reportedly occurred in a citrus grove in Bartow on July 4, 1989. One article stated that more than 200 sinkholes have been mapped by the Civil Defense office in Bartow in the last 30 years. The pattern suggested by the article showed that the Civil Defense mapped sinkhole occurrences have not occurred within the area of the site and are generally located northwest to east of Bartow.

WELL LOGS IN THE VICINITY OF THE SITE. Well logs can provide valuable information on solution features that potentially may induce sinkhole development. An FGS report (Stewart, 1966) contains well drilling information for the Polk County area, including solutional features penetrated by wells. Table 2.3.2-1 summarizes available data on solution features in the vicinity of the site obtained from this report. These data suggest that the amount of solutioning that has occurred in the limestone formations in the vicinity of the site is relatively small. The majority of the solution features found were reported in the Avon Park Formation, at depths on the order of 600 feet. As shown on Table 2.3.2-1, 15 of the 22 (approximately 70 percent) recorded solution features were within the Avon Park Formation at elevations below -600 ft MSL. Three solution features (approximately 10 percent) were recorded at elevations between -220 and -300 ft MSL and the remaining four solution features (approximately 20 percent) were recorded at elevations less than -200 ft MSL. It was noted that three of the shallow features were encountered in wells located to the east of Fort Meade in the Peace River Valley. One well at the Estech Plant site, USGS Number 747-153-2, reported a solution feature at a depth of -97 to -113 ft MSL . The feature is reported to be a cavern filled with green shale and sand. Records obtained from SWFWMD were reviewed for the subject well (FGS Number Wgi-1006). The FGS well number is different than FGS Well Number Wgi-1008 reported by Stewart (1966). Based on data supplied by the SWFWMD, the lower number is the correct well corresponding to the USGS well number. The well drillers logs did not specifically state that a cavern was encountered. It appears that the reported existence of the solution feature may be a subjective evaluation of the soil profile as provided by Stewart (1966). The Estech Plant site was operational during the 1960s to the 1990s. Long-term pumping from several wells in the plant site area occurred during this period, with no reported incidents of sinkhole development.

OBSERVATIONS DURING MINING ACTIVITIES. Available information provided by the mining companies resulting from observations while mining was progressing indicates that the mine area pits were generally dry, and that the soils below the matrix were very dense and consolidated,

exhibiting little structure in the way of fissures or joints. No open cavities or other karst features were reported during mining. During the geotechnical investigation of the N-15 mine area embankments, the soils consultant (Pittsburgh Testing Laboratory, 1973) reported the potential existence of a sinkhole along the south N-15 embankment near the northwest corner. The reported potential sink was the result of a circular depressed area along the proposed dam centerline evident in the pre-mining aerial photograph. The depressed area was reported to have been inspected during mining activities, and the feature was concluded not to be a sinkhole feature. The south N-15 embankment was constructed across the depressed area after removal of shallow surficial organic material. The embankment section has performed well as a clay settling area since the 1970s without any reported problems under full hydrostatic pressures of the filling of the N-15 area with waste phosphatic clays.

Several other engineering studies have been performed for the design and construction of dams for other site settling areas. These studies also reviewed the potential for site sinkhole development. Sinkhole assessments were made for the SA-8, SA-9, and SA-10 settling areas (Ardaman 1978, 1979, and 1981). The conclusion of these studies was that there was little potential for sinkhole development at the site.

LINEAMENT ANALYSES. A typical method of evaluating the relationship, if any, of geologic structure of an area with karst activity is the lineament analysis. A lineament is a mappable, simple or composite linear feature, whose parts are aligned in a rectilinear or slightly curvilinear relationship which differs distinctly from the patterns of adjacent features and presumably reflects a subsurface phenomenon (O'Leary et. al. 1976). The lineaments, therefore, represent large-scale features that may be more than a mile long that are composed of smaller scale, fracture zones or joints. Structurally controlled lineaments may comprise fracture zones perhaps 0.5 mile wide. Fracture trace features are much smaller (less than 50 feet in width) and shorter.

Joints and bedding planes resulting from the deposition and lithification in limestone rock tend to lie along roughly orthogonal axes. Tectonic stresses, faulting, and other geologic forces have induced additional fractures along orthogonal axes which usually have different orientations. The geomechanics of local compressional forces produce lineament patterns in the Florida limestones that tend to run roughly northwest to southeast and northeast to southwest. However, the predominant pattern of fracture at any location will vary depending on the relative influence of deposition and regional stresses on the limestone stratum. Lineaments and fracture trace

patterns in Florida have been mapped by several researchers. Figure 2.3.2-20 illustrates the fracture pattern mapping as developed in the site area (Vernon 1951).

Due to the extensive strip mining operations in the area of the Polk County Site, the surface topography has been extensively disturbed and modified so that few surficial features other than adjacent property stream locations can be identified by recent aerial photography. It was necessary, therefore, to obtain pre-mining aerial photographs of the site and surrounding region in order to perform the lineament analyses. A number of governmental agencies were contacted in the Bartow, Florida, area to obtain the historic aerials, but only one source was able to provide early photographs. The United States Department of Agriculture (USDA), Soil Conservation Service (SCS) made available approximately 50 photographs, at a scale of 1 inch to 1,320 feet, dated 1952. The area of coverage extended beyond the proposed FPC site boundaries for a minimum distance of 5 miles.

The review of the pre-mining aerial photography obtained for this study indicates that the site, prior to mining, contained numerous shallow ground surface depressions located predominately in the western half of the site, typically in the plant island area. No large-scale solution features or sinkholes were noted. The shallow surface depressions appear to be typical of lowered ground surface areas which have infilled with shallow surface organic deposits. These areas are typified by darker colors indicative of higher moisture contents and different vegetative patterns on the aerial photographs. The lineament analysis indicates that these depressed areas correspond to a large-scale lineament feature that transects the site. The northwest-southeast trending lineament transects the site in a broad band comprised of several shorter fracture zones or traces. The lineament has been mapped and is shown on the FGS Fracture Trace Map, (Figure 2.3.2-20).

The likely fracture traces and lineaments determined for the area surrounding the subject site are shown on the Lineament Feature Rose, Figure 2.3.2-21 (Vernon, 1951) . The lines represent the most likely fracture angles in the underlying limestone within the general site area. These fracture traces and lineaments represent areas of potential solution activity. The intersections of such features indicate the areas of highest probable solution activity. It should be understood, however, that major fracture systems are not the only source of limestone porosity. Local conditions, unrelated to regional geologic structure, may result in sinkholes which cannot be predicted by lineament or other analyses. Figure 2.3.2-22 is a computer aided drafting (CAD) drawing which depicts the plant island area and delineates surface features and depressions which

were identified during the review of the pre-mining aerial mapping. Some orthogonally oriented fracture traces and/or lineaments could also be mapped in the general east-west direction. However, the predominant direction of the fracture trace is oriented northwest-southeast. Several of the fracture traces are seen to intersect at a number of locations, and these areas are considered to have the highest potential for sinkhole activity within the site. Two of these areas were selected for investigation by deep subsurface borings.

Based on the lineament and fracture trace analysis, there appears to be a minor potential for further doline solution activity within the site. However, due to the thick dense consolidated soil sequences underlying the site, the solution activity will manifest itself as doline or solution type subsidence with little likelihood of catastrophic occurrences. The deep well log data previously discussed also suggests that solution activity is minor within the upper portions (above -200 feet MSL) of the formations underlying the site. Although some solution activity was noted as caverns or porous zones within the limestone formations, the majority of these solution features were reported in the Avon Park Formation, at depths greater than 800 feet below land surface (below -600 feet MSL).

SUBSURFACE EXPLORATIONS. To further evaluate areas of potential sinkhole and solution activity as inferred from the lineament and fracture trace analysis, a limited subsurface drilling and geophysical logging program was initiated at the site. This drilling program consisted of the three deep Standard Penetration Test (SPT) borings. Borings SH-1, SH-2, and SH-3 were drilled to depths of 300 feet at the locations of three separate depressions along apparent fracture trace lineament features and/or intersections. The locations of the borings are shown on Figure 10.5.3-218. The lithology of the borings was logged in the field. Detailed logs of each boring are provided on Figures 10.5.3-219A through 10.5.3-221E. Each of the soil borings were geophysically logged utilizing caliper, gamma, and resistivity methods. The results of the gamma geophysical logs are contained on Figure 2.3.1-16.

Below the bottom of the surficial mined soils (typically 120 to 130 ft MSL) the subsurface borings typically encountered dense to very dense, moderately to well cemented carbonate sandy silts (dolosilts), and clayey silts of the lower Bone Valley and upper Arcadia Formations of the Hawthorn Group. These soils contain occasional thin layers of fragmented limestone, phosphatic sands, and clayey sands to elevations of about 25 ft MSL. These soils constitute the upper confining unit to the Intermediate Aquifer. Below these upper confining unit soils, silty to phosphatic fine sands and carbonate silts interbedded with fragmented limestone layers were

encountered to approximate elevations of -0.5 to -4.5 ft MSL. A porous limestone layer was encountered below elevation -5 ft MSL as drilling fluid was temporarily lost in the boreholes during penetration of a 15 to 20-feet thick limestone layer below this elevation. Caliper logging of the boreholes did not identify any caverns in this limestone layer and no drop in the drill rods was observed. The loss of circulation was considered the result of higher secondary porosity in the limestone layer encountered. This limestone layer was also reported by Estech to be the layer selected for dewatering wells during mining (SA-11, SA-12, and SA-13) operations. Water was drained from the pre-mining Surficial Aquifer to this layer which has a potentiometric level approximately 80 feet lower than the Surficial Aquifer. The dewatering wells were reported to have been sealed with bentonite and lean cement.

Beneath this porous limestone layer, the borings encountered very dense, weakly to well cemented clayey silts to silty fine sands to depths greater than 295 feet below the ground surface. These lower fine-grained soils constitute the lower confining unit between the Intermediate Aquifer and the underlying Upper Floridan Aquifer System. Only one deep boring (SH-1) is believed to have tagged the top of the Floridan Aquifer at a depth of 295 feet. This depth corresponds to an elevation of -110 ft MSL.

Caliper, gamma ray and electric (16 inches and 64 inches normal, single point, and spontaneous potential) logs were performed in borings SH-1, SH-2, and SH-3. The caliper logs indicated fairly cohesive or consolidated/cemented material with only a few small cavities 6 to 7 inches in diameter in limestone zones corresponding to the lost circulation zones. The gamma ray logs indicated highly variable clay and/or phosphate content with depth and generally impure limestone zones, not indicative of sinkhole activity. The electric logs generally indicated variable clay content. The normal logs indicated that the small cavities shown in the caliper logs were concentrated in the vicinity of the boreholes, and were not connected to any large caverns within the formation.

The subsurface conditions encountered in the borings did not reveal the existence of any subsurface anomalies suggestive of on-going sinkhole development. Some zones of drill fluid circulation loss were recorded at depths ranging from 180 to 200 feet in the borings. However, no significant voids were recorded within these lost circulation zones. Loss of circulation was attributed to higher secondary porosity and lower phreatic surface in the Intermediate Aquifer limestone layer.

The subsurface borings and geophysical logging did not provide any indication of existing sinkhole activity such as depressed soil layers, loosened soil conditions, or the presence of cavernous zones, either devoid of soil or infilled with loose soils from raveling or sloughing. The soil conditions encountered were typically very consolidated and very dense, or weakly to well cemented in nature. The compactness and nature of these soils are not readily susceptible to cover subsidence or, cover collapse sinkhole type development.

SINKHOLE ASSESSMENT

The results of this study on sinkhole potential can be summarized as follows:

- The overall assessment of sinkhole potential at the FPC site is that the occurrence of a catastrophic sinkhole is highly unlikely.

- Sinkhole activity, although relatively high in Polk County, tends to concentrate in areas to the north and northeast of the site. Only three sinkholes have occurred within 5 miles of the perimeter of the site. Two are north and east of Homeland, approximately 5 miles from the site, and one is south of the site, just south of CR 630 and west of CR 555, approximately 5 miles from the site.

- Solution-prone limestone formations of the Suwannee Formation, Ocala Group, and Avon Park Formation deepen to the south in Polk County, with depths on the order of 280 feet or greater in the area of the site. Evaluation of sinkhole potential for areas directly underlain by the Floridan Aquifer System have shown that the frequency of sinkhole occurrence decreases with increased depth to limestone according to a probability function (Beggs 1984). Sinkhole potential at the site is estimated to be of very low probability.

- The lower Bone Valley Formation and the Arcadia Formation act as a confining layer to the Upper Floridan Aquifer beneath the site. These formations are relatively thick, dense, well consolidated and weakly to well cemented in the project area; the upper Arcadia Formation sediments are clayey with few fissures or joints. These confining units will act to prevent the development of sinkholes by restricting the vertical flow of water and soil to the solution prone limestones of the Floridan Aquifer.

- There was no evidence of historic sinkholes at the site, and no reported incidents of sinkhole problems during mining operations.

- The Estech Plant area has been extensively pumped for 20 to 30 years during the operation of the Estech Mine with no reported incident of sinkhole development.

A 16-foot soil filled cavern was reported (Stewart, 1966) in a deep well at the Estech Plant site at a maximum depth of 264 feet. The presence of the cavern was not verified based on the review of drillers logs provided by the SWFWMD.

- The site is located near the northern limits of Area IV where cover-collapse sinkholes dominate (Sinclair and Stewart, 1985). There is no historic evidence of cover-collapse sinkholes occurring in the area of the site.

- Shallow depressions visible on the western portion of the site in the 1952 aerial photographs appear to be part of a large lineament feature extending northwest-southwest. The depressions appear to be the result of recessional shoreline features, or consolidation of thicker clay strata, which developed during earlier geologic settings and which, subsequently, have infilled to shallow depths with organic matter. The site borings data and geophysical logging did not identify any indication of solution activities at boring locations.

2.3.2.3 References

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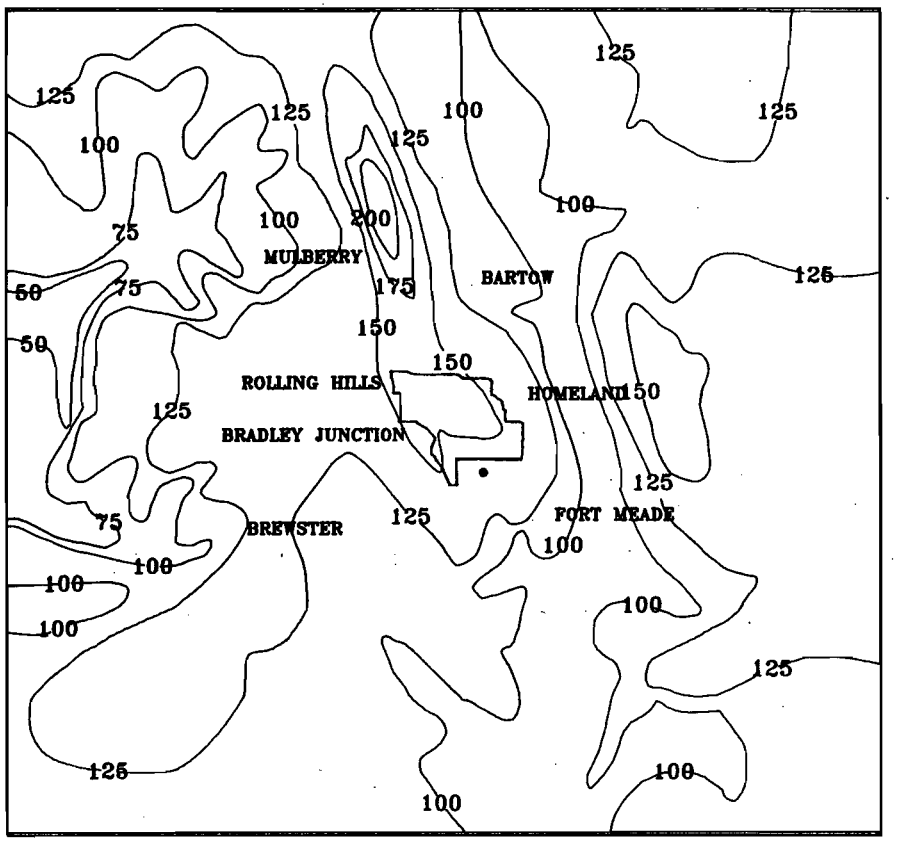
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TABLE 2.3.2-1
SOLUTIONAL FEATURES FROM WELL DATA

USGS WELL NO.	GROUND SURFACE ELEVATION (FT MSL)	BOTTOM OF FEATURE ELEVATION (FT MSL)	APPARENT HEIGHT OF FEATURE (FT)	TYPE OF FEATURE	PROBABLE GEOLOGIC UNIT	REMARKS
745-148-3	138	76 -689	2 2	Cavern Cavern	Tampa Avon Park	North of Fort Meade
745-147-1	129	-114 -108	1.5 5	Cavern Cavern	Hawthorn Hawthorn	East of U.S. 17
746-150-1	153	-677	3	Cavern	Avon Park	South of site
746-148-1	149	-691	5	Cavern	Avon Park	North Fort Meade
747-153-2	167	-113 -639 -646	16 24 7	Cavern fill Porous zone Porous zone	Suwannee Avon Park Avon Park	Estech Plant
748-148-1	110	-277	3	Porous zone	Crystal River	East of U.S. 17
748-148-4	110	-618 -630 -637	2 4 7	Cavern Cavern Honeycomb	Avon Park Avon Park Avon Park	East of U.S. 17
748-148-5	115	-643 -669 -680	4 4 10	Cavern Cavern Cavern	Avon Park Avon Park Avon Park	East of U.S. 17
749-149-1	126	-243 -292	3 1	Porous Zone Porous Zone	Hawthorn Hawthorn	North of Homeland
750-151-3	136	-641	2	Cavern	Avon Park	North of site
750-148-1	85	-665 -2447 -4455	24 62 37	Cavern fill Honeycomb Cavity filled	Avon Park Oldsmar Lawson	N.E. of site

Source: Stewart, 1966

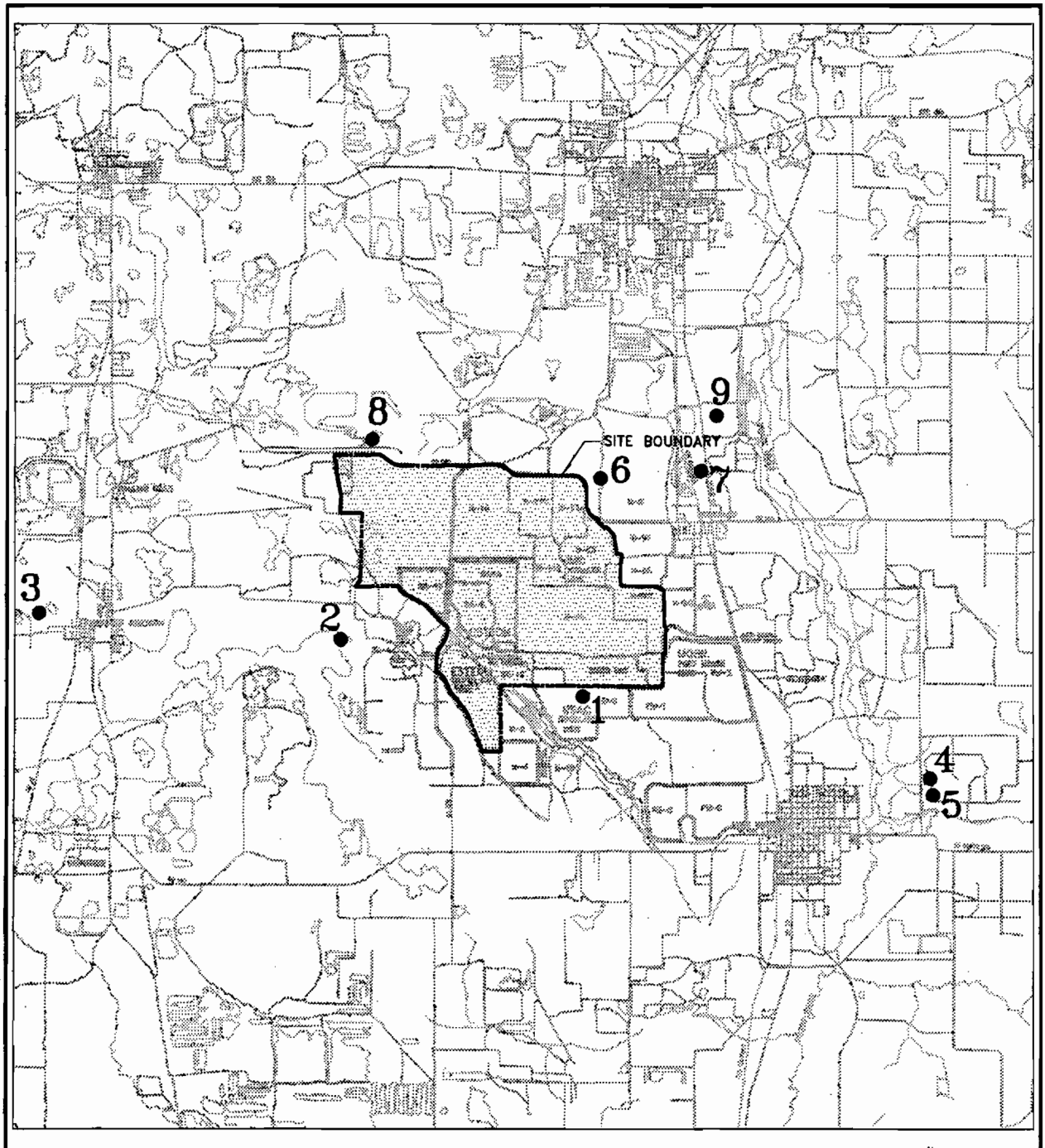


SOURCE: HUTCHINSON, 1978

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-1
GENERALIZED WATER TABLE CONTOUR MAP SURFICIAL AQUIFER SEPTEMBER 1975



LEGEND

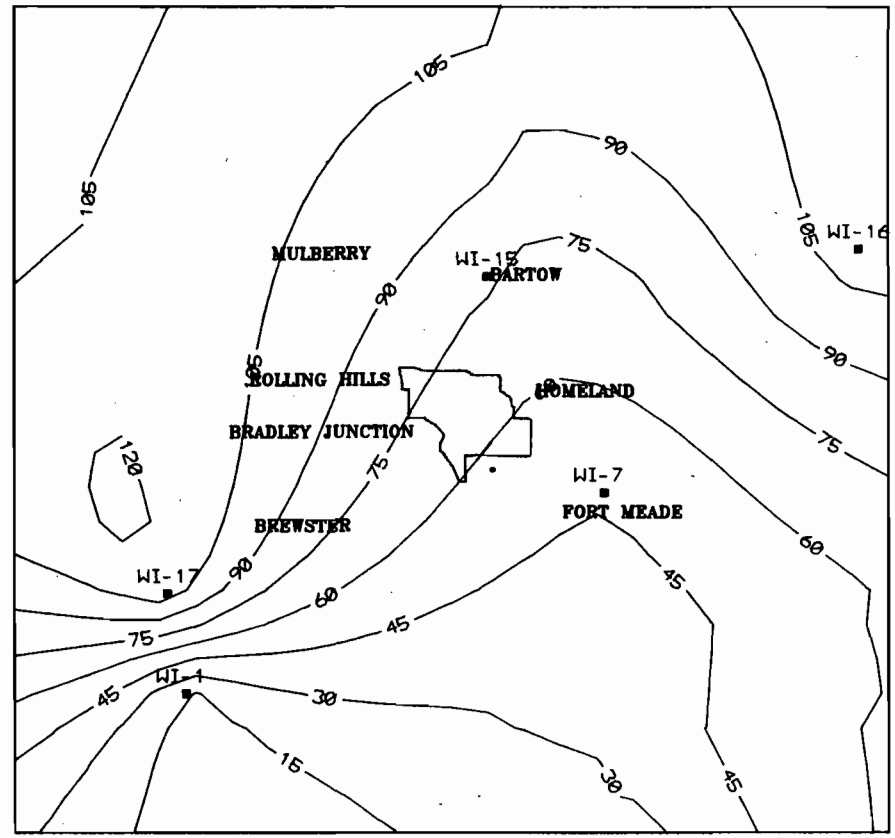
● 1 SAMPLING POINT

Source: Dames & Moore, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-2
SURFICIAL AQUIFER BASELINE WATER QUALITY DATA SAMPLING LOCATION MAP



CONTOUR INTERVAL = 15 FEET (NGVD)

N
W E

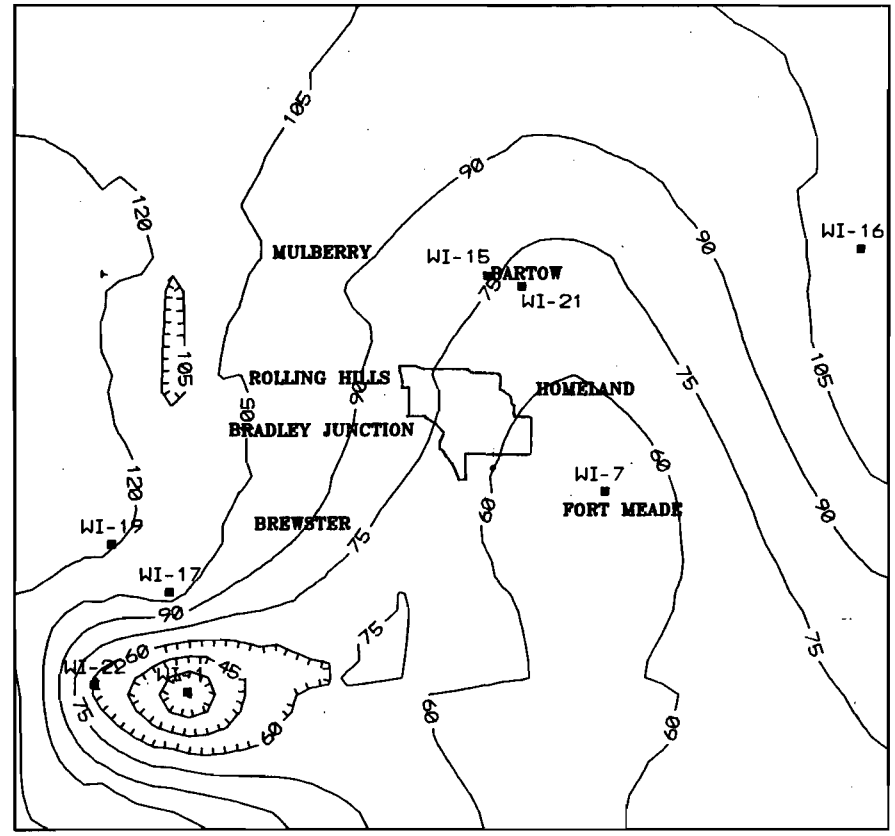
0 20000 40000 FEET
0 1 2 3 4 5 6 7 MILES
(APPROXIMATE SCALE)

SOURCE: USGS, 1990

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-3
POTENTIOMETRIC SURFACE INTERMEDIATE AQUIFER
MAY 1989



CONTOUR INTERVAL = 15 FEET (NGVD)

N
W E

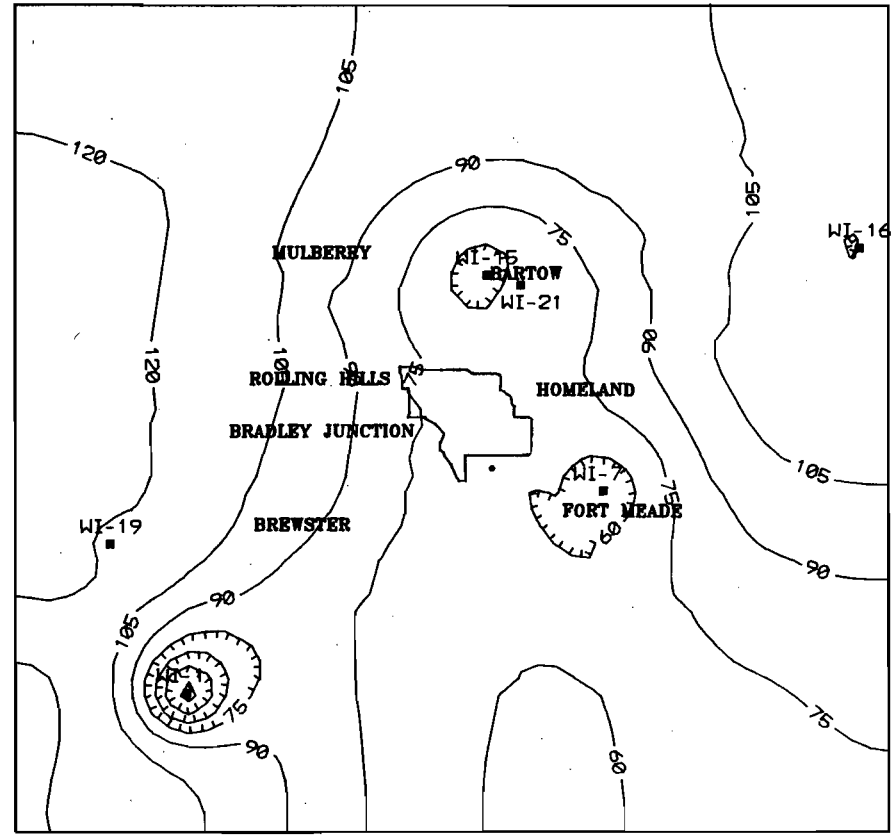
0 20000 40000 FEET
0 1 2 3 4 5 6 7 MILES
(APPROXIMATE SCALE)

SOURCE: USGS, 1991

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-4
POTENTIOMETRIC SURFACE INTERMEDIATE AQUIFER
MAY 1990

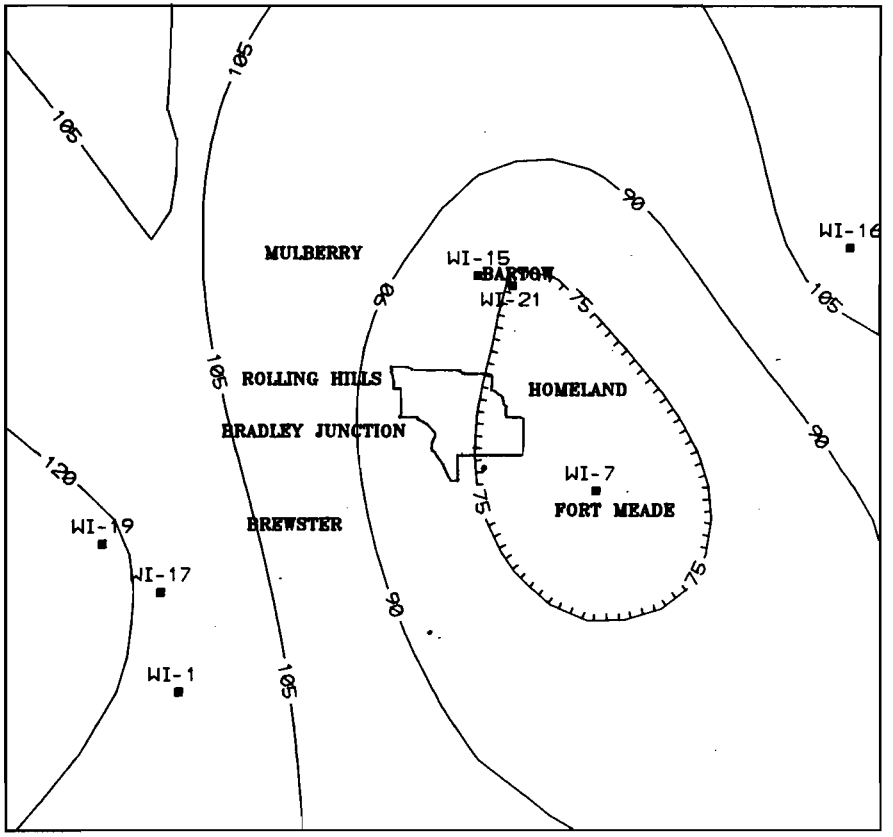


SOURCE: USGS, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-5
POTENTIOMETRIC SURFACE INTERMEDIATE AQUIFER
MAY 1991



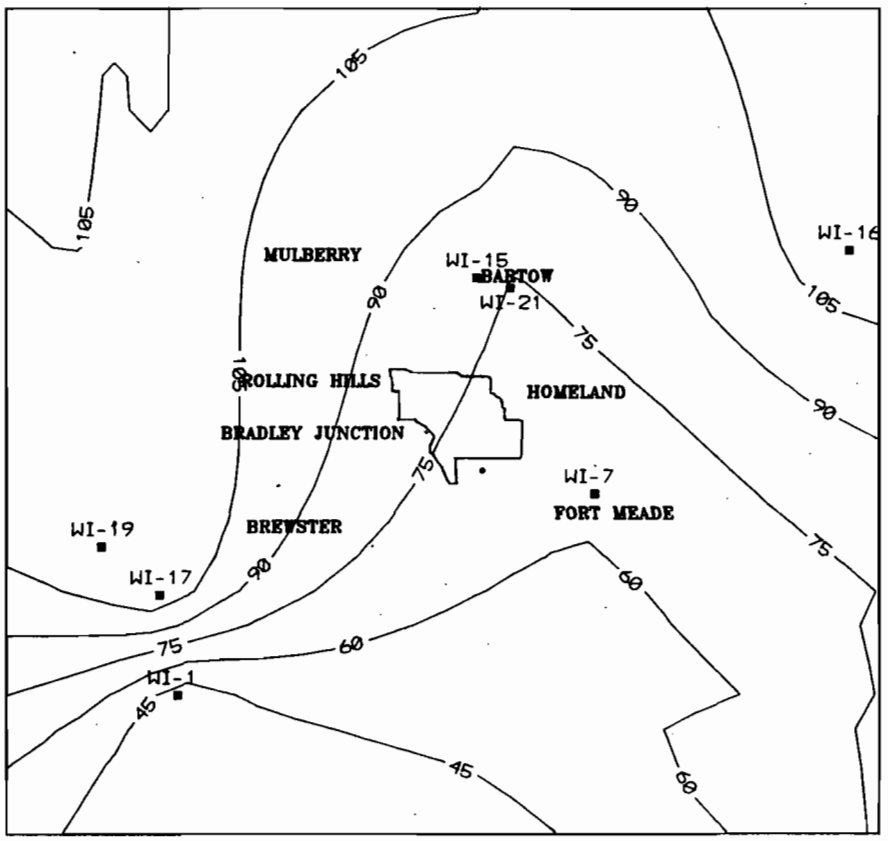
CONTOUR INTERVAL = 15 FEET (NGVD)

SOURCE: USGS, 1990

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-6
POTENTIOMETRIC SURFACE INTERMEDIATE AQUIFER SEPTEMBER 1989



CONTOUR INTERVAL = 15 FEET (NGVD)

N
W E

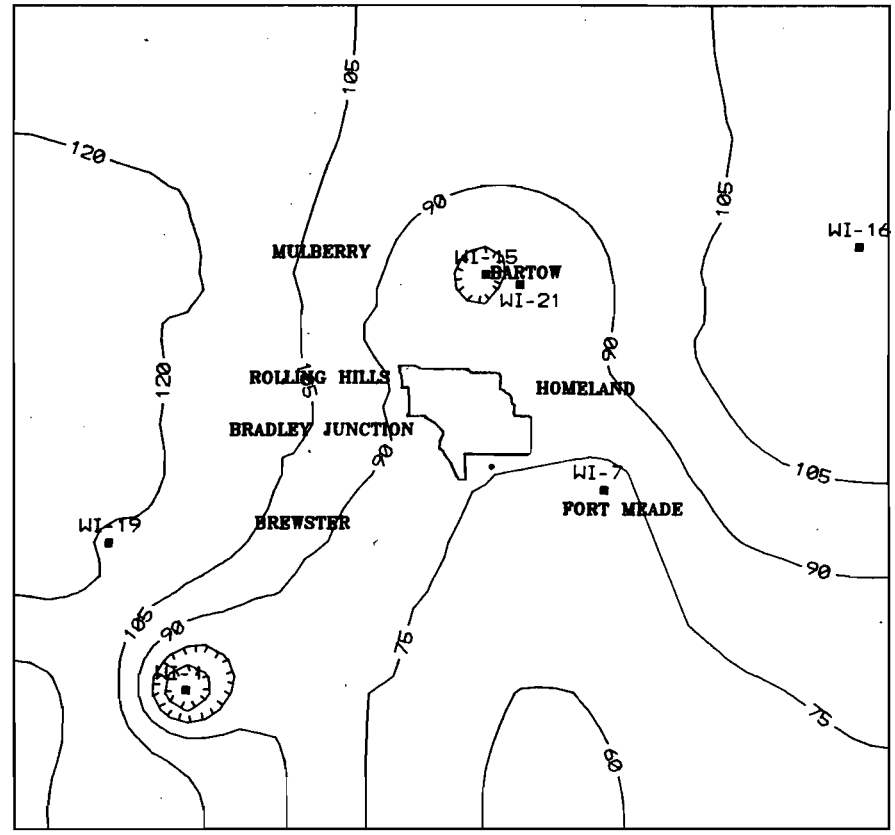
0 20000 40000 FEET
0 1 2 3 4 5 6 7 MILES
(APPROXIMATE SCALE)

SOURCE: USGS, 1991

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-7
POTENTIOMETRIC SURFACE INTERMEDIATE AQUIFER SEPTEMBER 1990



CONTOUR INTERVAL = 15 FEET (NGVD)

N
W — E

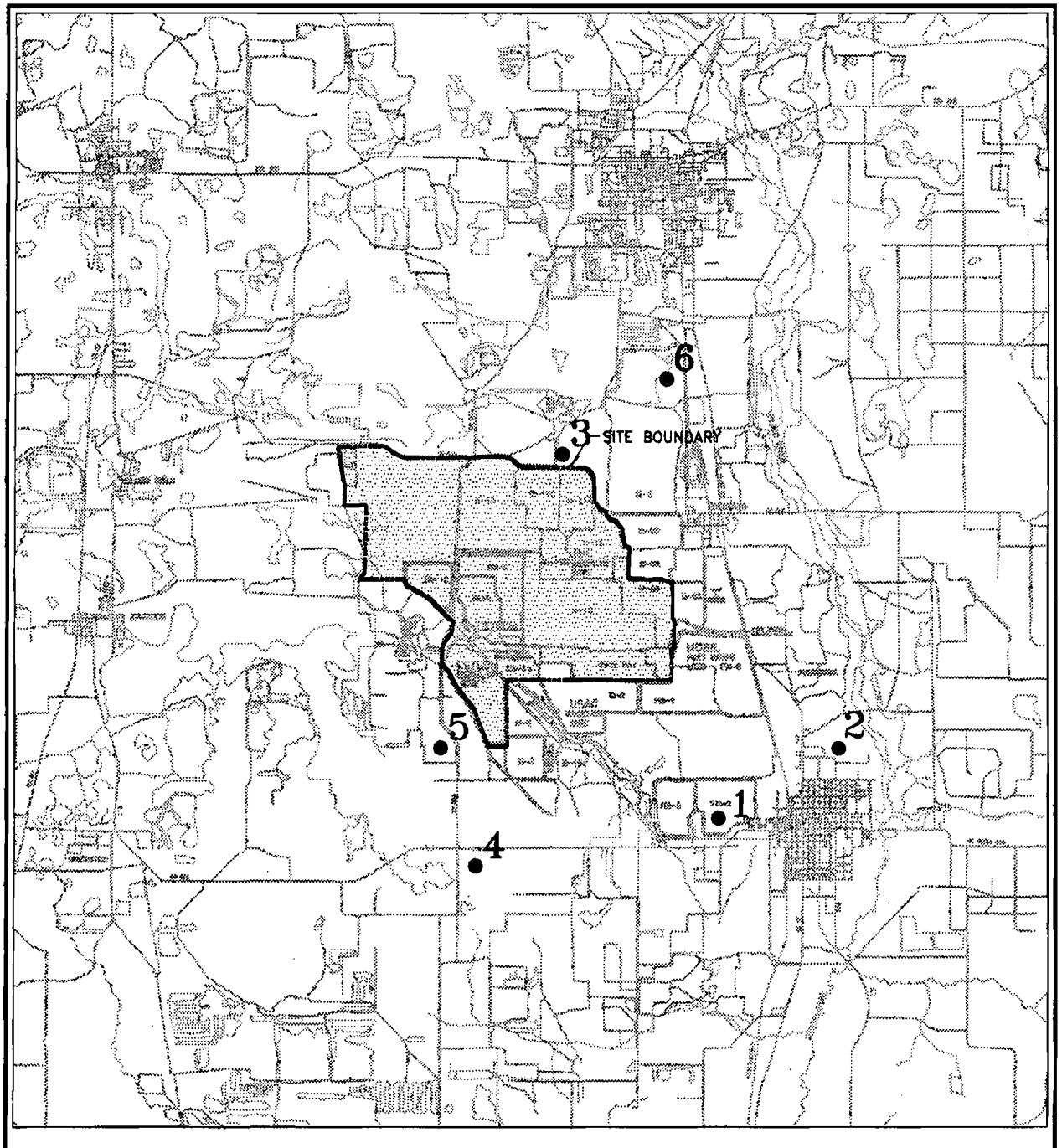
0 20000 40000 FEET
0 1 2 3 4 5 6 7 MILES
(APPROXIMATE SCALE)

SOURCE: USGS, 1991

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-8
POTENTIOMETRIC SURFACE INTERMEDIATE AQUIFER SEPTEMBER 1991



LEGEND

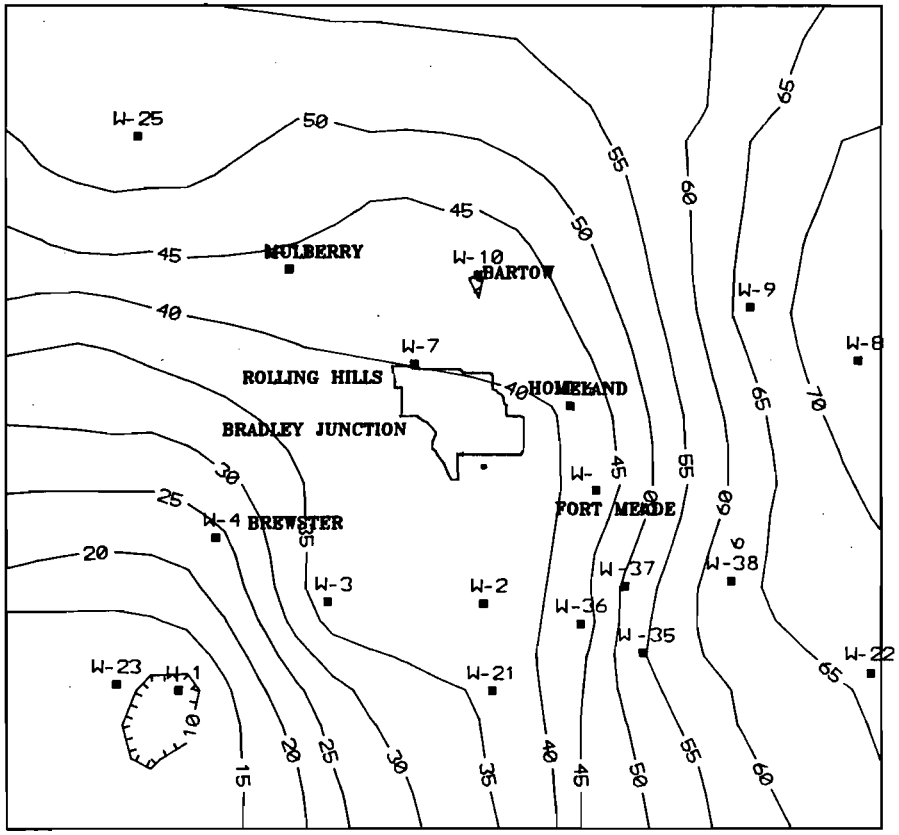
● 1 SAMPLING POINT

Source: Dames & Moore, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-9
INTERMEDIATE AQUIFER BASELINE WATER QUALITY DATA SAMPLING LOCATION MAP

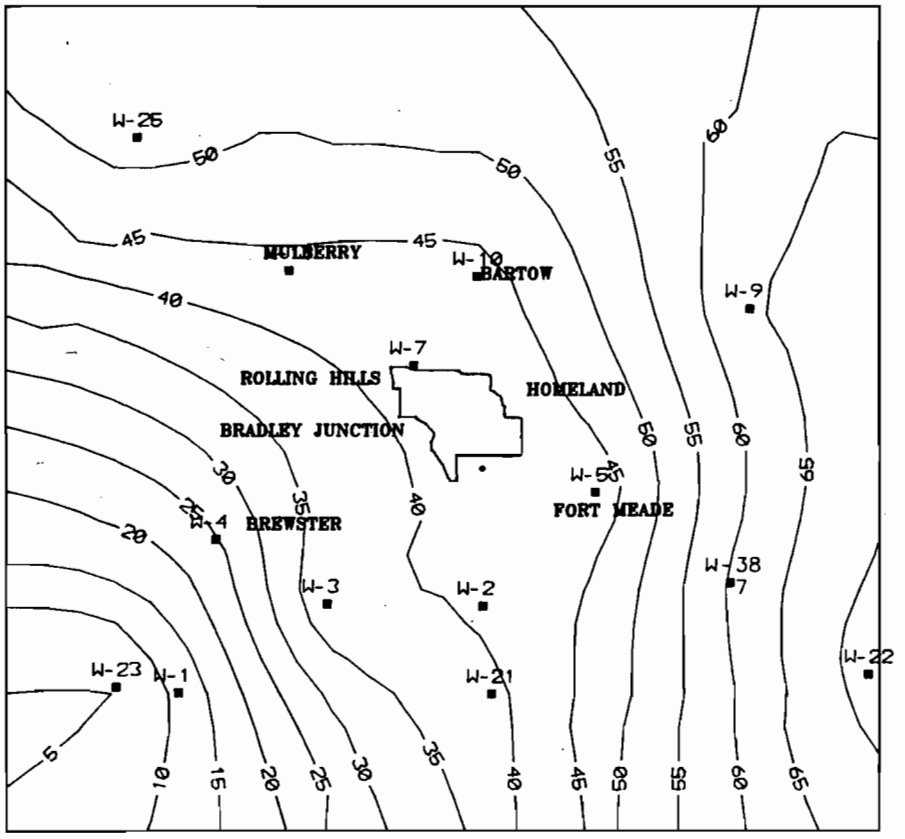


SOURCE: USGS, 1990

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-10
POTENTIOMETRIC SURFACE UPPER FLORIDAN AQUIFER
MAY 1989



CONTOUR INTERVAL = 5 FEET (NGVD)

N
W — E

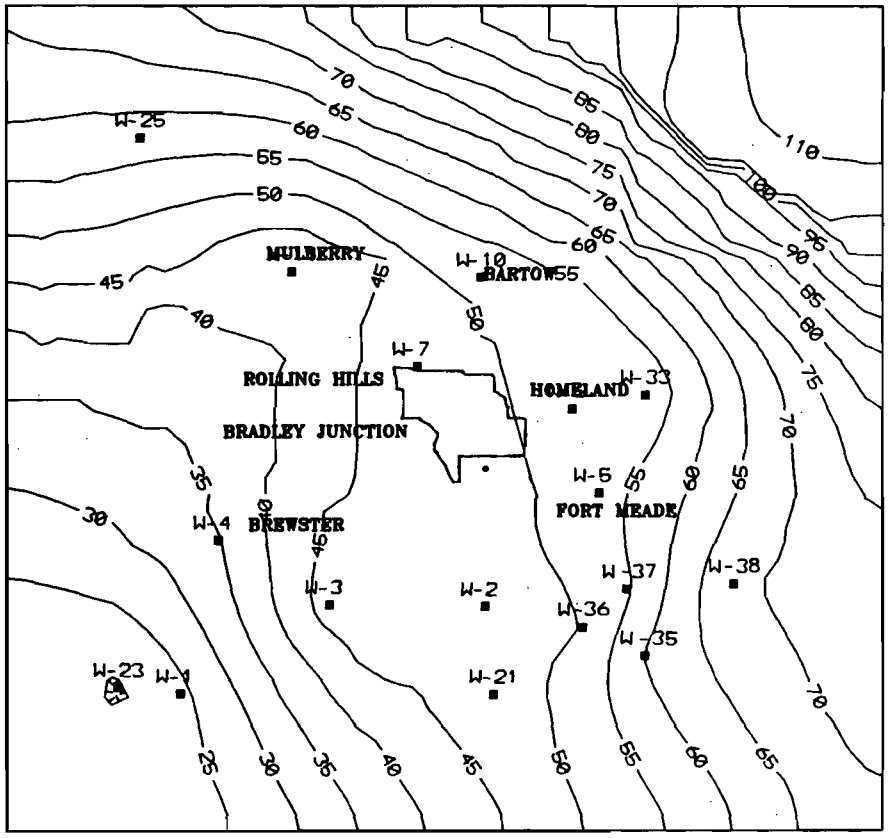
0 20000 40000 FEET
0 1 2 3 4 5 6 7 MILES
(APPROXIMATE SCALE)

SOURCE: USGS, 1991

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-11
POTENTIOMETRIC SURFACE UPPER FLORIDAN AQUIFER
MAY 1990



CONTOUR INTERVAL = 5 FEET (NGVD)

N
W E

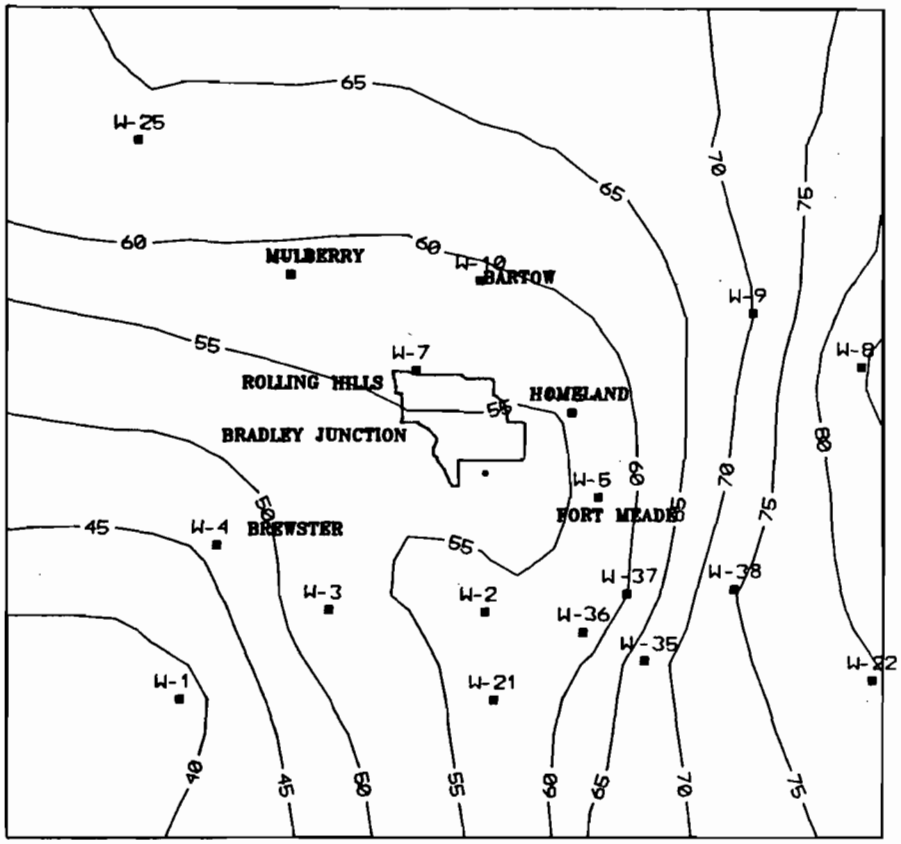
0 20000 40000 FEET
0 1 2 3 4 5 6 7 MILES
(APPROXIMATE SCALE)

SOURCE: USGS, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-12
POTENTIOMETRIC SURFACE UPPER FLORIDAN AQUIFER
MAY 1991



CONTOUR INTERVAL = 5 FEET (NGVD)

N
W E

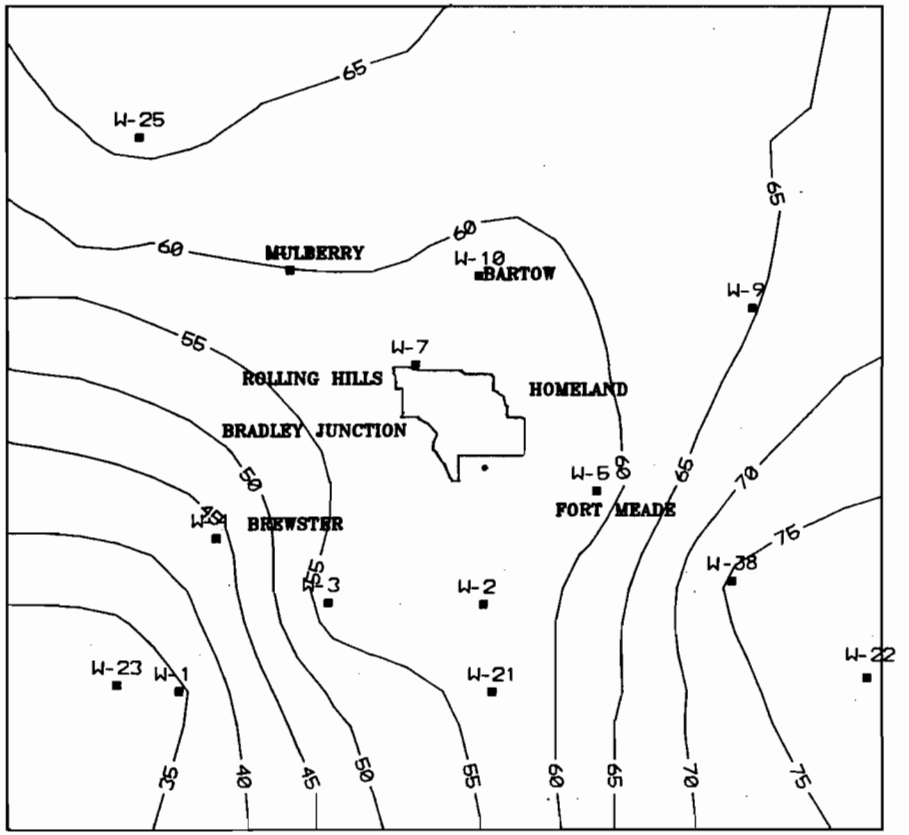
0 20000 40000 FEET
0 1 2 3 4 5 6 7 MILES
(APPROXIMATE SCALE)

SOURCE: USGS, 1990

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-13
POTENTIOMETRIC SURFACE UPPER FLORIDAN AQUIFER SEPTEMBER 1989



CONTOUR INTERVAL = 5 FEET (NGVD)

N
W — E

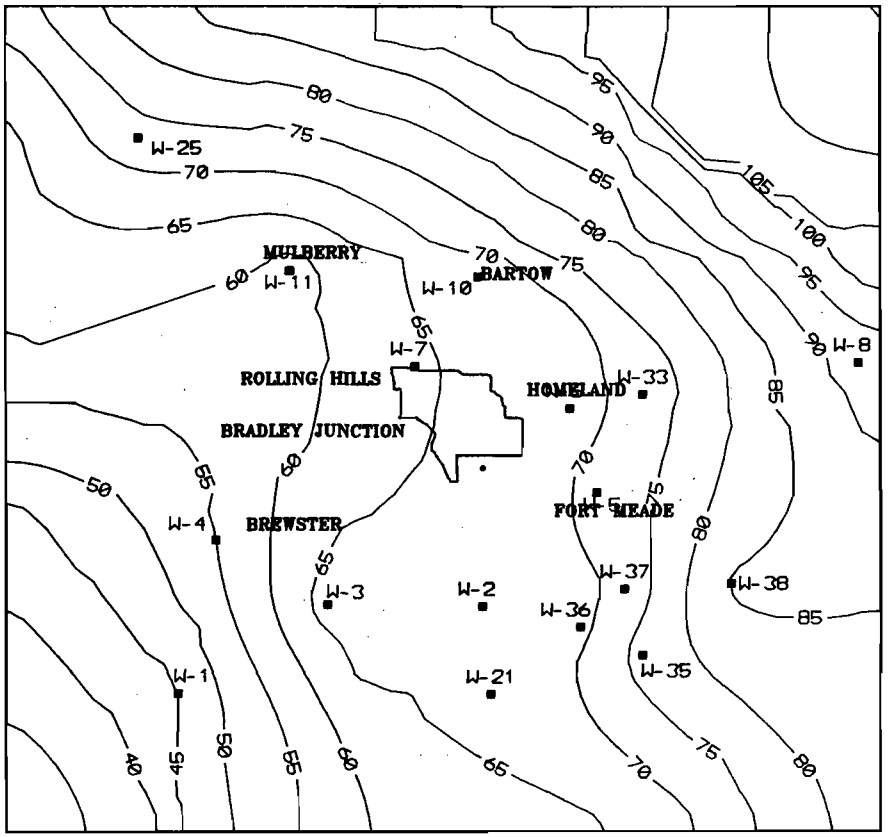
0 20000 40000 FEET
0 1 2 3 4 5 6 7 MILES
(APPROXIMATE SCALE)

SOURCE: USGS, 1991

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-14
POTENTIOMETRIC SURFACE UPPER FLORIDAN AQUIFER SEPTEMBER 1990



CONTOUR INTERVAL = 5 FEET (NGVD)

N
W — E

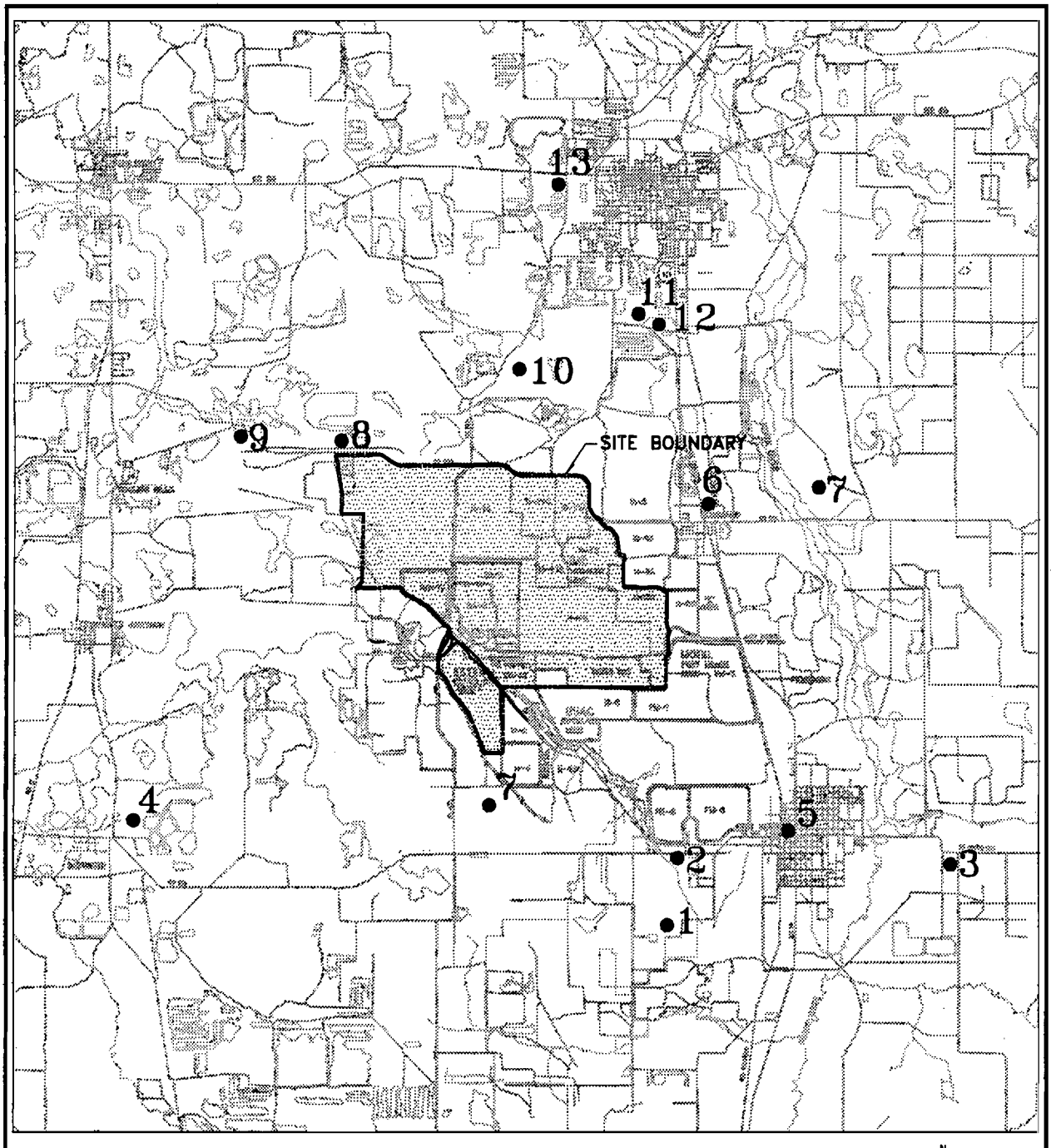
0 20000 40000 FEET
0 1 2 3 4 5 6 7 MILES
(APPROXIMATE SCALE)

SOURCE: USGS, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-15
POTENTIOMETRIC SURFACE UPPER FLORIDAN AQUIFER SEPTEMBER 1991



LEGEND

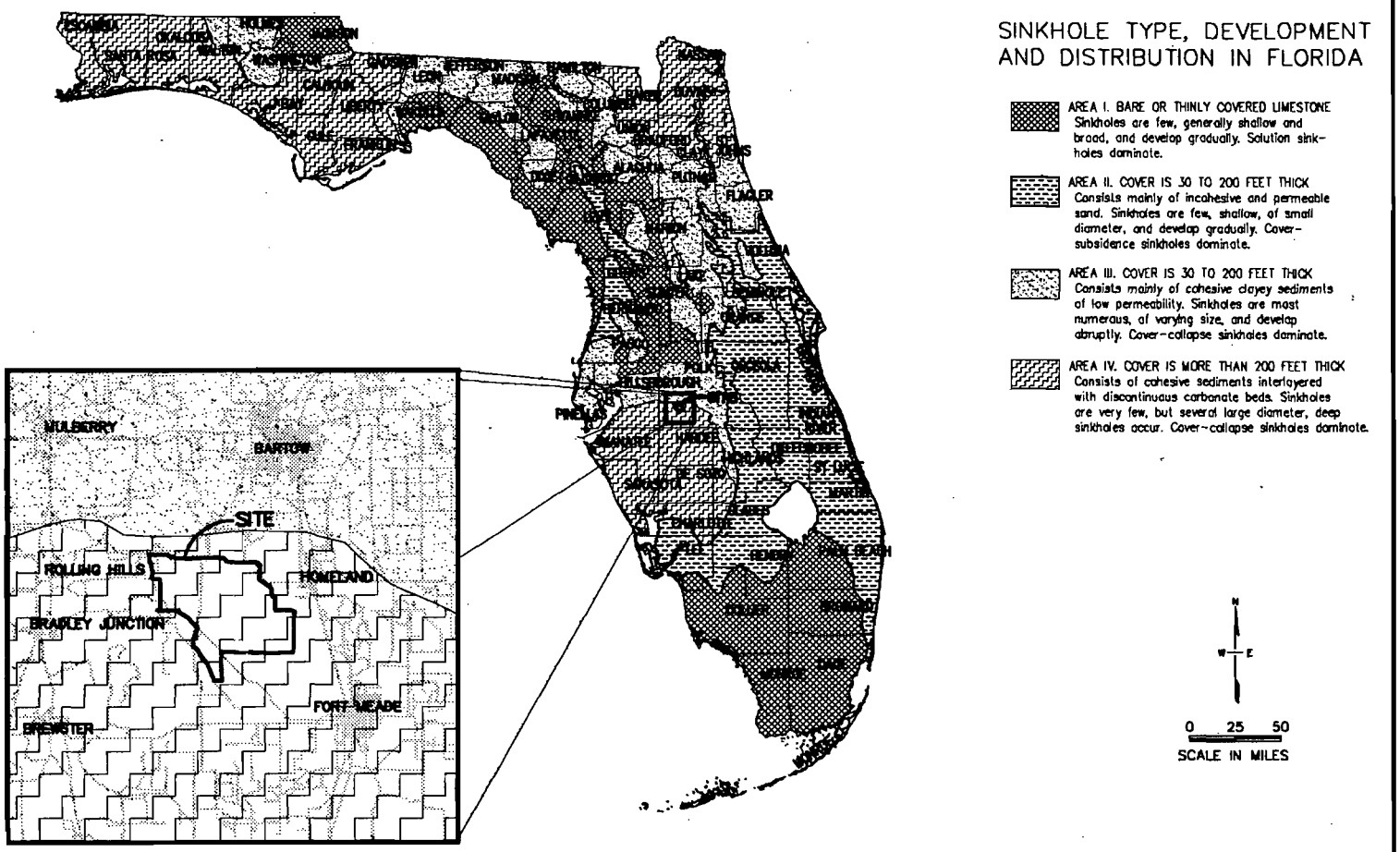
● 1 SAMPLING POINT

Source: Dames & Moore, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-16
UPPER FLORIDAN AQUIFER BASELINE WATER QUALITY DATA SAMPLING LOCATION MAP

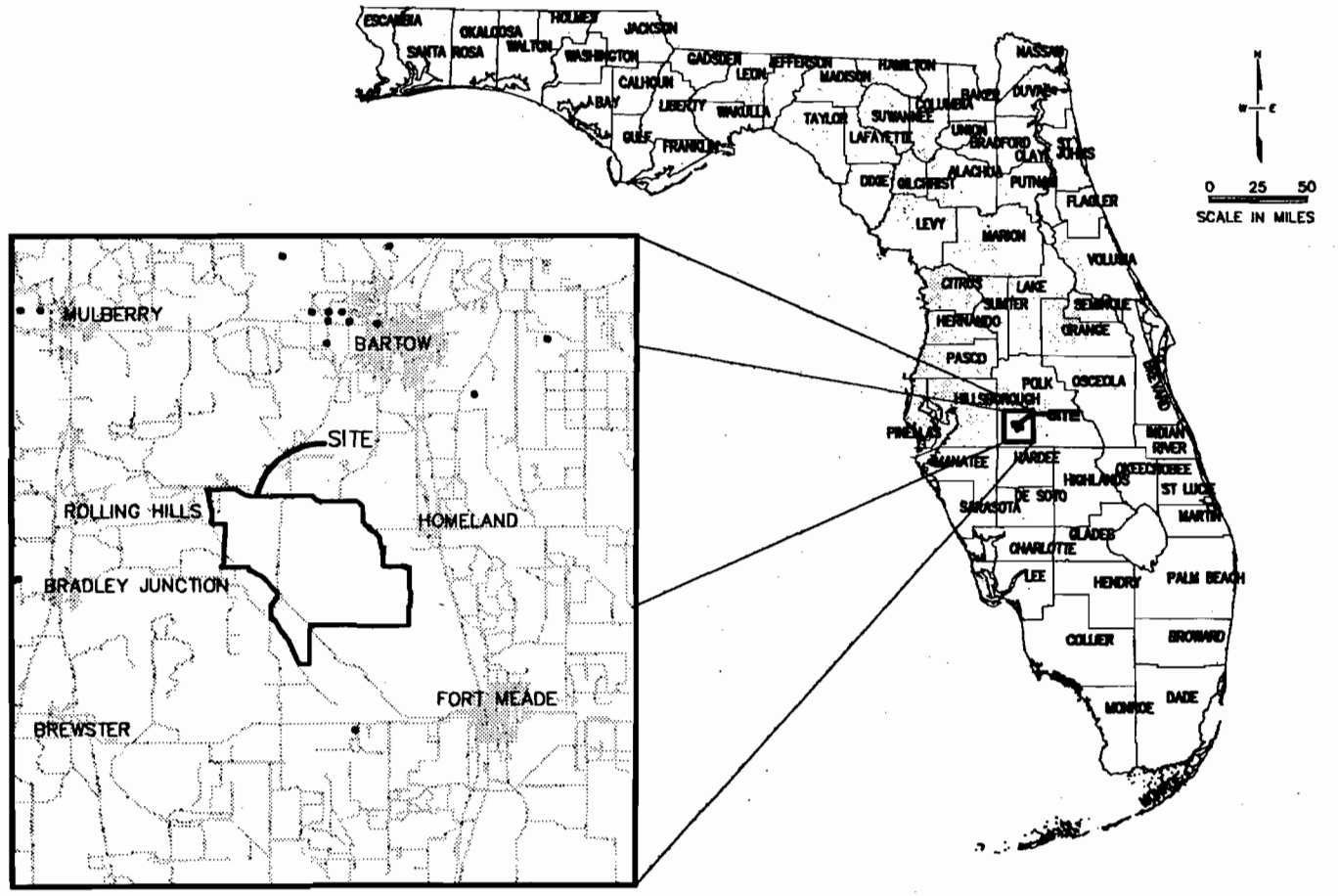


SOURCE:
SINCLAIR, W. C., AND STEWART, J. W., 1985,
SINKHOLE TYPE, DEVELOPMENT, AND DISTRIBUTION IN
FLORIDA: U. S. GEOLOGICAL SURVEY, MAP SERIES NO. 110.

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-17
AREAS OF SINKHOLE OCCURRENCE IN FLORIDA

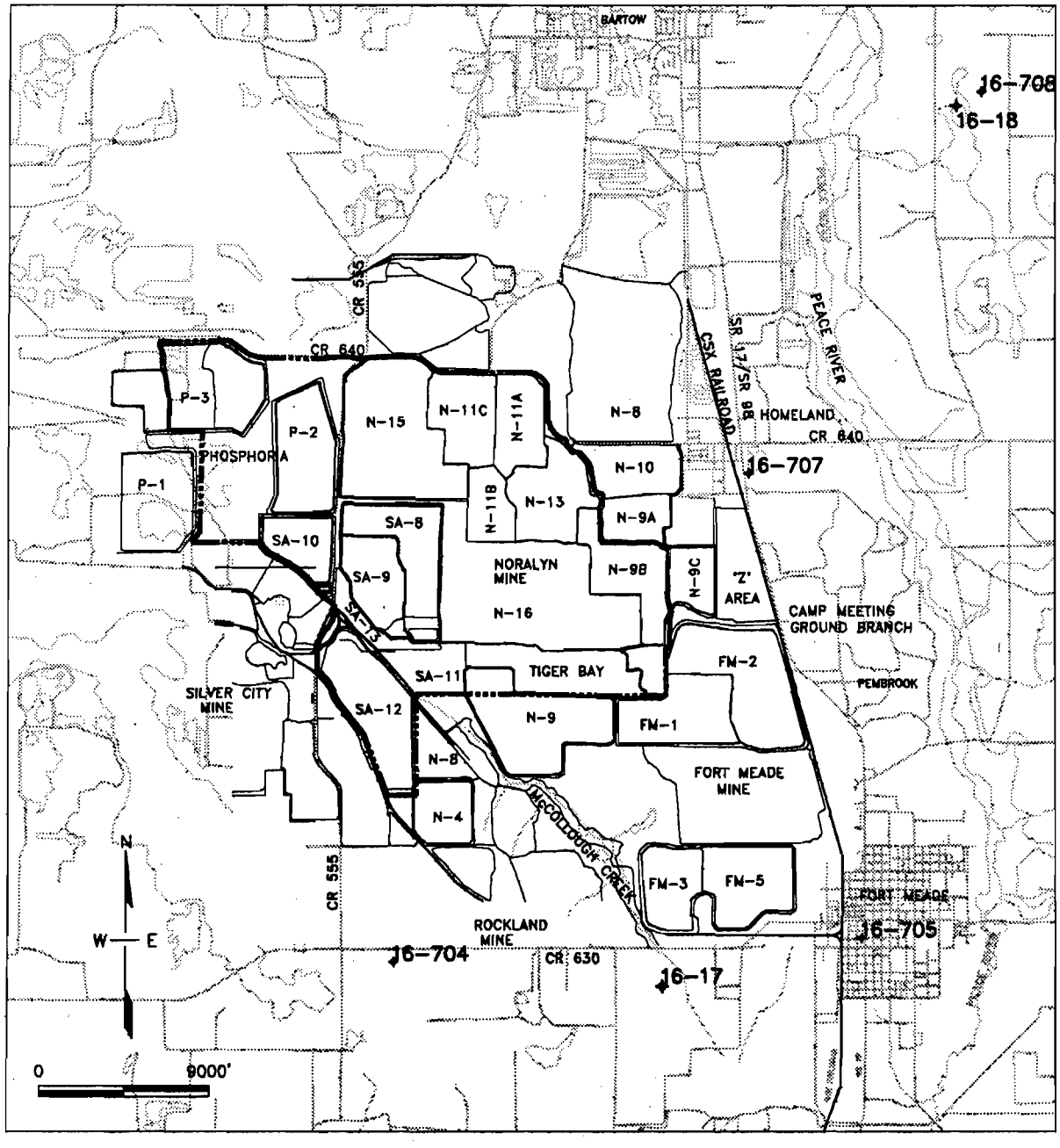


SOURCE:
SINCLAIR, W. C., AND STEWART, J. W., 1985.

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-18
SINKHOLE LOCATIONS IN VICINITY OF SITE

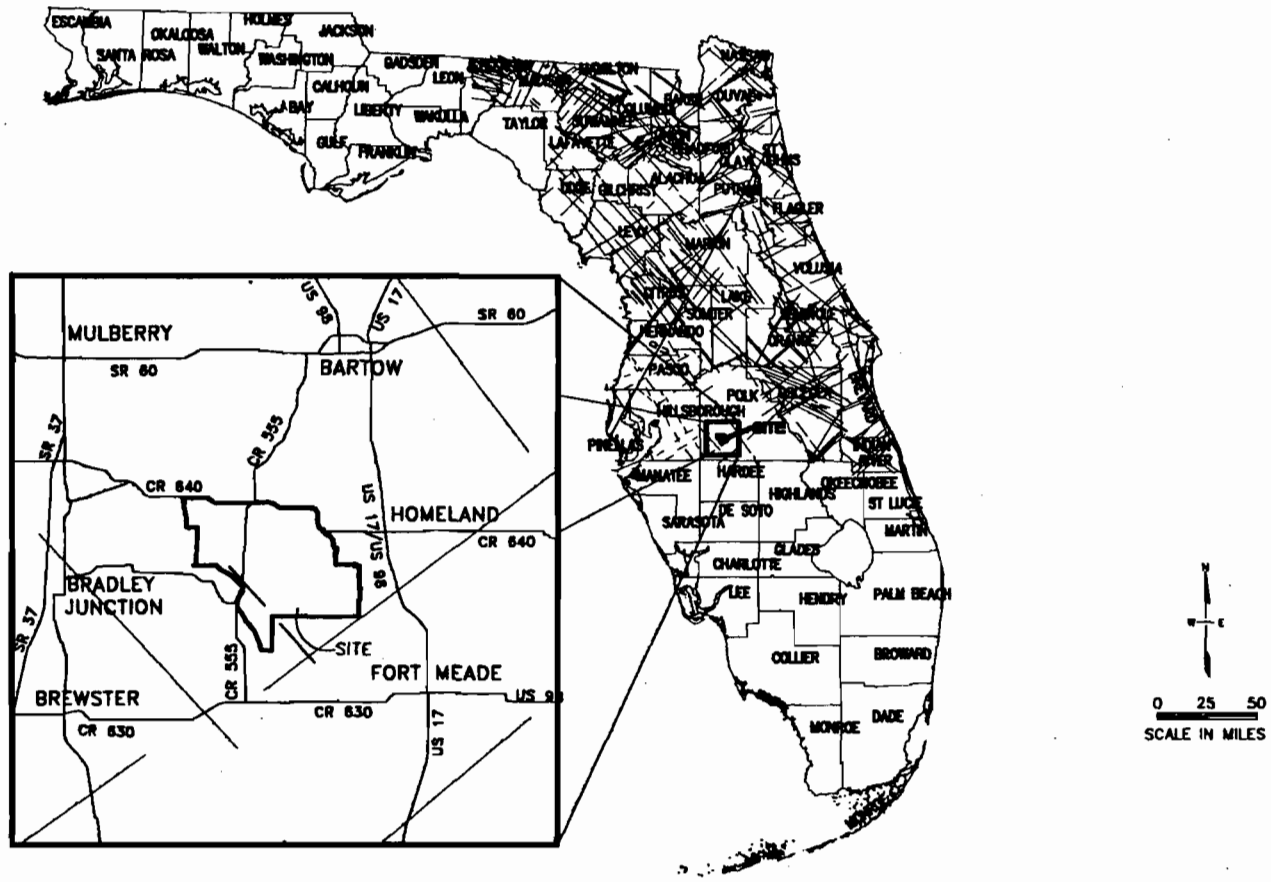


SOURCE: FLORIDA SINKHOLE RESEARCH INSTITUTE

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-19
REPORTED SINKHOLES WITHIN FIVE MILES OF SITE



LEGEND:

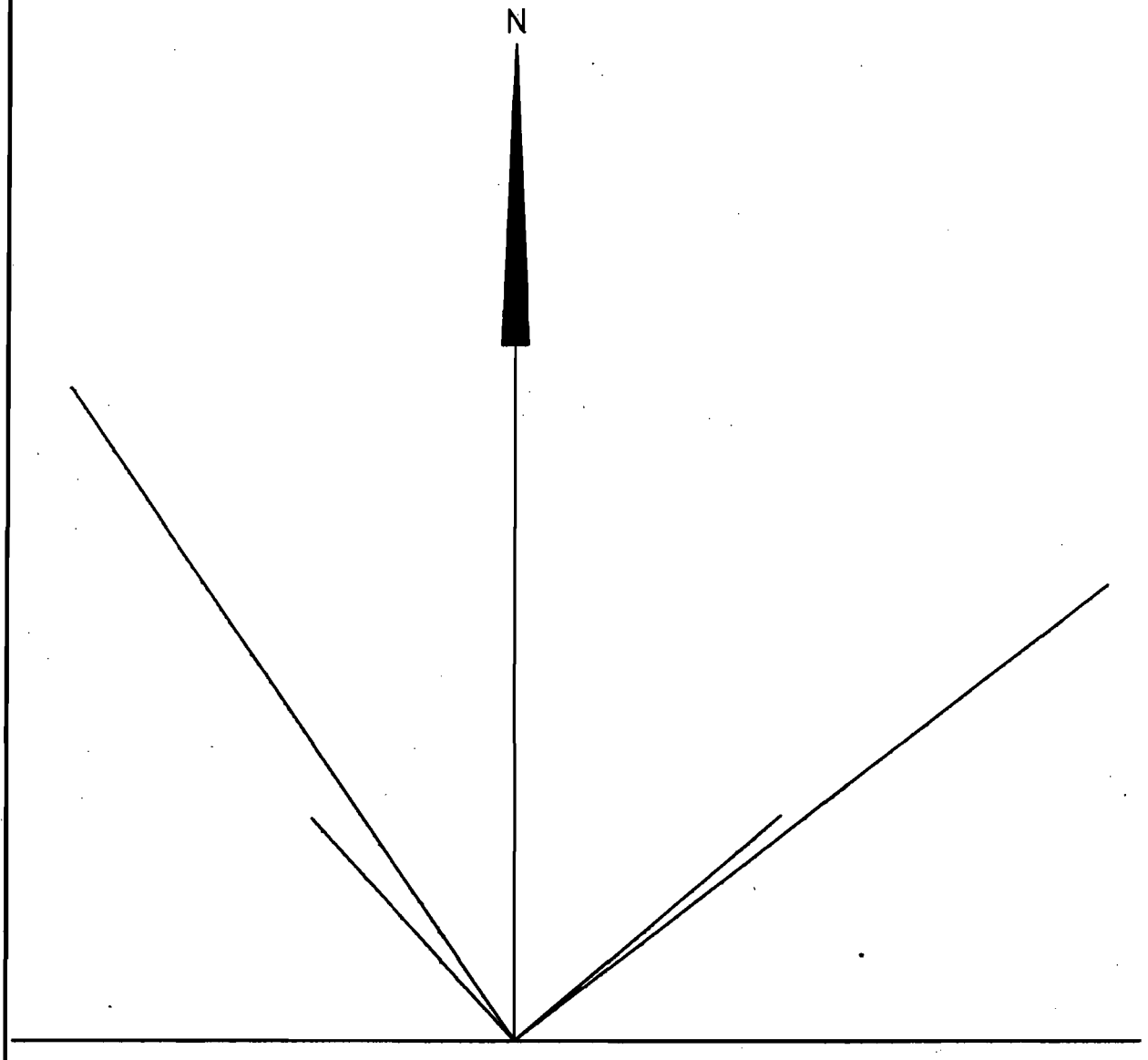
- JOINTS AND POSSIBLE FAULTING
- ADDED FRACTURE TRACE
- POSSIBLE POST-PALEOZOIC GRABEN FAULT BOUNDARY (AFTER PAUL APPLIN).

SOURCE:
FLORIDA GEOLIGICAL SURVEY GEOLOGICAL BULLETIN NO. 33, FIGURE 11.

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-20
FRACTURE TRACE MAP



NOTE: LINEAMENT LENGTHS SHOWN ARE PROPORTIONED TO INDICATE RELATIVE FREQUENCY OF OCCURRENCE WITHIN AN APPROXIMATE 20-MILE RADIUS OF DEVELOPMENT SITE.

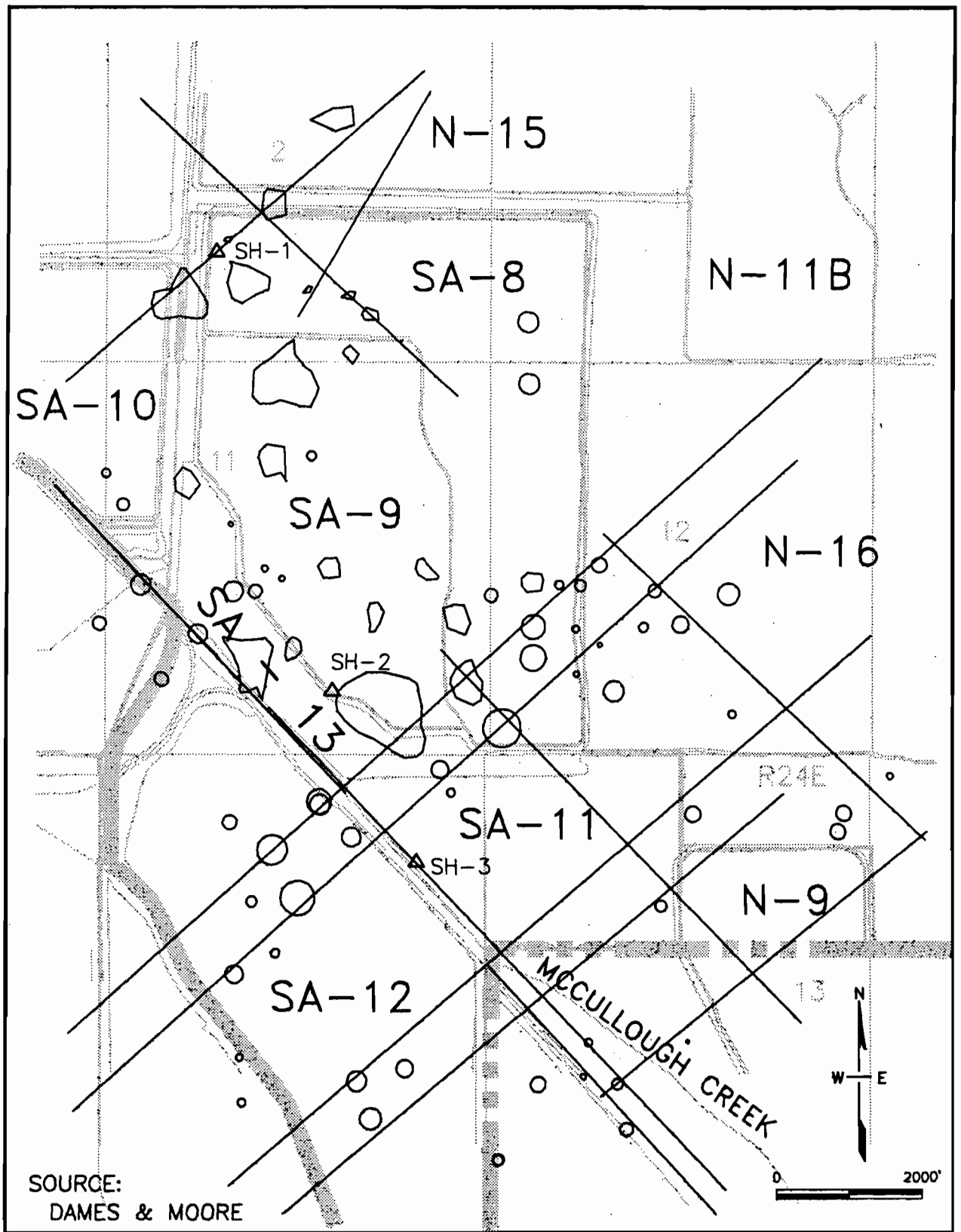
BASED ON: FRACTURE PATTERN IN THE NORTHERN PORTION OF THE FLORIDA PENINSULA, FLORIDA GEOLOGICAL SURVEY, GEOLOGICAL BULLETIN NO. 33, FIGURE 11.

SOURCE:
DAMES & MOORE

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-21
LINEAMENT FEATURE ROSE



Florida Power CORPORATION

Polk County Site

FIGURE 2.3.2-22
PLANT ISLAND AREA PRE-MINING SURFACE FEATURES AND DEPRESSIONS

2.3.3 Site Water Budget and Area Uses

This section of the SCA presents a summary of the sources of water available and the principle water users in the vicinity of the Polk County Site. In the absence of sophisticated in-place monitoring systems, it is impossible to determine precisely the total amount of precipitation on and adjacent to an area the size of the Polk County Site, the total amount of surface water flowing through or adjacent to the site, or the amount of ground water flowing through the aquifers underlying the site and adjacent areas. In addition, water use permits reflect maximum amounts available for use, and no means are available to account for actual amounts of water withdrawn from wells or surface water sources. Therefore, this is not meant to be a "budget" in the accounting sense, where inputs precisely equal outputs, but is meant to be a reasonable characterization and approximation of the sources and uses of surface and ground water in the vicinity of the Polk County Site, based upon available representative data.

2.3.3.1 Site Water Budget

CLIMATOLOGY AND METEOROLOGY

The Polk County Site is located in the south central Florida peninsula, which has a climate characterized as subtropical. The two National Weather Service stations nearest the Polk County Site with long-term (30-year) periods of record are located at Bartow and Wauchula, Florida. Bartow lies approximately 6 miles north-northeast of the site and Wauchula is approximately 19 miles south-southeast of the site. As shown in Table 2.3.3-1, temperatures in the vicinity of the Polk County Site, as measured at Bartow and Wauchula, range from a combined average low of 61.2°F in January to a combined average high of 82.0°F in August, with an annual combined average of about 72.4°F. The highest temperature recorded nearby was 103°F and the lowest was 18°F, both recorded at the Bartow National Weather Service Station. The temperatures shown in Table 2.3.3-1 represent 30-year averages compiled by Gale Research from National Oceanic and Atmospheric Administration (NOAA) records spanning the time period from 1951 to 1980. Average total annual rainfall measured at Bartow and Wauchula as shown in Table 2.3.3-2 is 53.43 inches, with normal monthly averages ranging from 2.00 inches in December to 8.42 inches in July. Generally, the period of the year with the heaviest rainfall in southwest central Florida is May to September.

No direct measurements of evaporation and evapotranspiration in the vicinity of the Polk County Site are available. However, pan evaporation data has been recorded monthly by NOAA since 1965 at Lake Alfred, which is located approximately 23.5 miles north-northeast of the site. SWFWMD analyzed NOAA measurements of pan evaporation data at Lake Alfred for each month of the year (Keller, 1988). The SWFWMD report also discusses the rationale for the method used to convert pan evaporation data to estimated evapotranspiration rates.

Table 2.3.3-3 presents measured precipitation and pan evaporation data along with calculated evapotranspiration, runoff and recharge rates for the site area. Average yearly precipitation is approximately 53.43 inches and average annual pan evaporation is 71.29 inches. Pan evaporation was converted to an estimated evapotranspiration rate using SWFWMD's formula (Keller, 1988), which multiplies pan evaporation by a factor of 60 percent for an annual total evapotranspiration of 42.78 inches. This method consisted of adding the monthly totals from three nearby USGS streamflow measurement stations located on rivers which received runoff from the site (Peace River near Fort Meade, North Prong Alafia River, and South Prong Alafia River) and dividing this sum by a factor of three in order to estimate the local runoff value. This resulted in an estimated yearly average runoff of 7.86 inches. Runoff data for the three streamflow measuring stations used in this analysis were reported by the USGS (1980 to 1990). Recharge is defined as precipitation minus the sum of evapotranspiration and runoff. Average annual recharge for the site and vicinity is thus estimated as 2.79 inches.

GROUNDWATER RESOURCES

There are three major aquifers in Polk County. The non-artesian Shallow Aquifer lies between land surface and approximately 50 feet below land surface and is recharged directly by rainfall throughout Polk County. A small amount of recharge to the Shallow Aquifer may also result from seepage of water used for agricultural irrigation and water held in retention areas or ponds. The Intermediate Aquifer System, which is present primarily in southwestern Polk County, may be recharged by downward seepage from the Surficial Aquifer through the upper confining unit. The Intermediate Aquifer System is underlain by the Upper Floridan Aquifer System and is recharged principally by upward movement of water from the lower Floridan Aquifer System. The Floridan is recharged throughout central and northeastern Polk County by downward percolation of rainfall through the overlying sediments. In the immediate vicinity of the site, clayey strata present in the Peace River and Arcadia Formations minimize the amount of local recharge to both the Intermediate and the Floridan Aquifer Systems.

SURFACE WATER RESOURCES

The Polk County Site lies in an area whose drainage is divided into two main basins and several smaller drainage basins. The main basins are the Alafia River basin to the west and the Peace River basin to the east and south. Discharge records for the Alafia River are measured by the USGS on the North Prong of the Alafia River near Mulberry and on the South Prong near Bradley Junction. Discharge in the Peace River is measured at several locations, the closest point to the site with daily measurements being Fort Meade.

Much of the Polk County Site area and environs are covered by a series of manmade surface water ponds and retention areas which are used for clay settling and storage during phosphate mining, beneficiation, and reclamation processes which are active throughout the area.

2.3.3.2 Area Uses

Surface water and groundwater use in the vicinity of the Polk County Site are regulated by SWFWMD by the issuance of consumptive water use and well construction permits. Information gathered primarily from SWFWMD permit records was used as the basis of this summary of water uses near the Polk County Site. Polk County does not maintain any separate records of surface and groundwater use or well construction. The unincorporated community of Homeland lies approximately one mile northeast of the site, and its residents rely on individual private wells for drinking water. These small users do not require consumptive use permits and, therefore, these wells are not permitted by SWFWMD. FPC estimates that approximately 1,000 such wells exist in Homeland and that, as a group, they withdraw approximately 200,000 gpd. It should be noted that there is a possibility that other unreported and unpermitted wells are also in existence in the vicinity of the Polk County Site.

As shown in Table 2.3.3-4, SWFWMD has issued 34 consumptive use permits for surface and groundwater withdrawals within a 5-mile radius of the power block. Ground water is withdrawn from the Surficial, Intermediate, and Floridan Aquifer Systems for four principal purposes: phosphate mining and related operations; chemical manufacturing and processing; citrus or other irrigation; and public supply. Essentially, all of the largest users rely on water withdrawn from the Floridan Aquifer System. However, some public supply and citrus irrigation water is supplied by wells which produce from the Intermediate and Surficial Aquifer Systems. There is only one surface water permit listed and that is for the withdrawal of water from a mining pit.

Table 2.3.3-4 provides details on each consumptive use permit within 5 miles of the Polk County Site power block including the ownership, area of the property permitted, number of wells, source (aquifer or surface water), use, and permitted capacity. SWFWMD records indicate that a total of 637 wells have been constructed within the 5 mile radius of the power block, however, many of these wells are plugged or used strictly for observation or monitoring and thus do not have consumptive use permits associated with them. Figure 2.3.3-1 depicts graphically the approximate locations of all known permitted consumptive uses of surface or ground water within 5 miles of the power block.

Based on SWFWMD well construction permits, Table 2.3.3-5 lists 141 wells which have been constructed within 1 mile of the site. Some of these wells are included in the existing consumptive use permits listed in Table 2.3.3-4. However, the majority are small users and thus do not require consumptive use permits. Table 2.3.3-5 lists all the known wells identified in SWFWMD well construction permit files within one mile of the site boundary. Additionally, this table lists the ownership, location, well depth, diameter, and use of each well. Of the 141 known wells within one mile of the site boundary, 94 are listed as domestic use, 25 industrial use, 12 public supply, and 10 irrigation or livestock. None of these wells produces from the Surficial Aquifer System and many produce completely or partially from the Intermediate Aquifer System. However, the majority produce from the upper portion of the Floridan Aquifer System. Since most of these wells are not required to file consumptive use permits with SWFWMD, it is reasonable to assume that their overall usage requirements remain low.

2.3.3.3 References

Campbell, Kenneth M. 1986. Geology of Polk County, Florida. Open file Report 13. Florida Geological Survey. Tallahassee, Florida.

Gale Research Center. 1985. NOAA Data Summary (1951-1980).

Heath, Richard C. 1961. Surface Water Resources of Polk County, Florida. Information Circular No. 25. Prepared by U.S. Geological Survey, in cooperation with the Florida Geological Survey. Tallahassee, Florida.

Keller, Kevin K. Distribution of Evapotranspiration Within the Southwest Florida Water Management District. January 1988. SWFWMD. Brooksville, Florida.

SWFWMD. Well Construction and Permitting Section. 1992. Computer Records. SWFWMD. Brooksville, Florida.

USGS. 1980-1990. Water Resources Data - Florida, Southwest Florida Surface Water. USGS. Tampa, Florida.

TABLE 2.3.3-1
MONTHLY TEMPERATURE MEANS AND EXTREMES, 1951-1980
BARTOW AND WAUCHULA, FLORIDA

Month	Highest Recorded Temp (°F)		Lowest Recorded Temp (°F)		Monthly Average Temp (°F)		Combined Average
	Bartow	Wauchula	Bartow	Wauchula	Bartow	Wauchula	
January	87	88	22	21	60.9	61.5	61.2
February	91	93	23	26	62.9	62.5	62.7
March	93	94	23	23	67.5	67.4	67.4
April	96	97	39	36	72.3	71.8	72.1
May	101	101	49	46	77.4	76.8	77.1
June	103	99	59	56	80.7	80.1	80.4
July	101	98	64	57	82.1	81.5	81.8
August	99	98	62	62	82.2	81.7	82.0
September	97	99	57	55	80.6	80.4	80.5
October	96	95	41	39	74.6	74.5	74.5
November	93	90	25	26	67.3	67.6	67.5
December	90	92	18	21	62.0	62.4	62.2
Annual Extreme	103	101	18	21	---	---	---
Annual Average	---	---	--	--	72.5	72.4	72.4

Note: The Bartow station is approximately 6 miles NNE of the Polk County Site and the Wauchula station is approximately 19 miles SSE of the site.

Source: Gale Research, 1985 (Compilation of NOAA collected data).

TABLE 2.3.3-2
MONTHLY PRECIPITATION MEANS, 1951-1980
BARTOW AND WAUCHULA, FLORIDA

	Monthly Means		
Month	Bartow	Wauchula	Combined Average
January	2.52	2.40	2.46
February	3.37	3.01	3.19
March	3.32	3.02	3.17
April	2.59	2.46	2.53
May	5.35	4.94	5.15
June	7.18	8.33	7.76
July	8.33	8.50	8.42
August	7.46	6.87	7.17
September	6.68	7.03	6.86
October	2.76	2.88	2.82
November	2.03	1.76	1.90
December	2.10	1.89	2.00
Total Annual	53.69	53.09	53.43

Note: Data in inches

Source: Gale Research, 1985 (Compilation of NOAA collected data)

TABLE 2.3.3-3
ESTIMATED ANNUAL EVAPOTRANSPIRATION, RUNOFF, AND RECHARGE

Month	Precipitation [1] (in.)	Pan Evaporation [2] (in.)	Estimated Evapotranspiration [3] (in.)	Est. Total Runoff [4] (in.)	Recharge [5] (in.)
January	2.46	3.45	2.07	0.52	-0.13
February	3.19	4.16	2.50	0.63	0.06
March	3.17	6.26	3.76	0.75	-1.34
April	2.53	7.56	4.54	0.46	-2.47
May	5.15	8.53	5.12	0.30	-0.27
June	7.76	7.69	4.61	0.49	2.66
July	8.42	7.63	4.58	0.82	3.02
August	7.17	7.06	4.24	1.05	1.88
September	6.86	6.24	3.74	1.32	1.80
October	2.82	5.60	3.36	0.65	-1.19
November	1.90	3.94	2.36	0.42	-0.88
December	2.00	3.17	1.90	0.45	-0.35
Total Annual	53.43	71.29	42.78	7.86	2.79

Notes:
1. Average Total Monthly Precipitation for Bartow and Wauchula Stations, NOAA data 1951-1980
2. Rate estimated by SWFWMD, based on NOAA data for Lake Alfred, January 1988
3. Pan Evaporation x (0.6), SWFWMD 1988
4. Sum of Peace River (Fort Meade), N. Prong Alafia River, and S. Prong Alafia River Stations ÷ 3 - Data Source USGS, 1980-1990, Water Resources Data Florida, Southwest Florida Surface Water, Tampa, Florida
5. Precipitation minus Estimated Evapotranspiration + Runoff

Sources: As noted above.

TABLE 2.3.3-4
CONSUMPTIVE USE PERMITS WITHIN A FIVE MILE RADIUS OF THE POLK COUNTY SITE POWER BLOCK

Consumptive Use Permit No.	Owner	Location*			# Wells	Source Aquifer	Use	Gallons Per Day (GPD)	
		S	T	R				Max Permit	Daily Average
00678-02	Agrico Chemical Co.	20,29,30	31	24	7	Floridan	Mining/Industrial	2,760,000	1,750,000
00678-02	Agrico Chemical Co.	20,29,30	31	24	N/A	Mining Pit	Mining/Industrial	5,400,000	70,000
01477-04	U.S. Agri-Chemicals	13,23-26,35-36	31	24	16	Floridan/Intermediate	Citrus/Mining	15,300,000	281,000
		18-19,29-33,	31	25					
		1,2,11,14,23-26,35,36	32	24					
		1-3,11-12	33	24					
03841-04	Estech, Inc.	1-3,9-16,21-25	31	24	16	Floridan	Irrigation/Industrial	17,460,000	N/A
03049-04	IMC Fertilizer, Inc.	12-17,20-36	30	24	78	Floridan/Surficial	Mining/Public Supply	27,000,000	N/A
		1-3,9-36	30	25					
		1-9,12-13	31	24					
00029-05	Seminole Fertilizer Corp.	7-9,16-19,21,22	31	24	18	Floridan/Surficial	Mining/Observation	7,200,000	N/A
		27,28,30-34	31	24					
		3-10,16-18	32	24					
00781-03	IMC Fertilizer	30,31	31	24	2	Floridan	Mining/Observation	18,600,000	N/A
06685-01	Barnett J.C. & J.R.	34	31	24	1	Floridan	Citrus Irrigation	277,000	N/A
06794-01	Shirley H.M	34	31	24	1	Floridan	Citrus Irrigation	251,000	18,000
09836-00	Barnett J.C.	33	31	24	2	Floridan	Citrus Irrigation	165,000	N/A
01255-01	Snell M.	5	31	25	1	Intermediate	Irrigation	30,500	4,332
02596-01	Rhymes J.E.	4	31	25	1	Intermediate	Irrigation	120,000	3,320
08615-00	Snell R.R.	4	31	25	1	Floridan	Citrus Irrigation	84,000	8,520
01467-01	Goochland Nurseries	15	31	25	3	Floridan	Irrigation	1,722,000	50,106
02318-03	Mobil Mining & Minerals	1-4,8-34	31	25	19	Floridan	Reclamation/ Irrigation	N/A	1,360,000
		3-4	32	25					
07226-01	Pembroke Laboratories	15	31	25	1	Floridan	Chemical Mfg.	96,000	7,900
00261-02	Aluminum Co. of America	30	31	25	2	Floridan	Chemical Mfg.	N/A	200,000

TABLE 2.3.3-4
CONSUMPTIVE USE PERMITS WITHIN A FIVE MILE RADIUS OF THE POLK COUNTY SITE POWER BLOCK

Consumptive Use Permit No.	Owner	Location*			# Wells	Source Aquifer	Use	Gallons Per Day (GPD)	
		S	T	R				Max Permit	Daily Average
00438-02	U.S. Agri-Chemicals	31	31	25	3	Floridan	Chemical Processing	12,000,000	8,580,000
		6	32	25					
08586-00	Barnett J.C.	31	31	25	2	Floridan	Citrus Irrigation	477,000	13,300
08594-00	Sheffield C.	29	31	25	1	Floridan	Citrus Irrigation	288,000	10,550
09637-00	Barnett J.C.	28	31	25	1	Floridan	Citrus Irrigation	576,000	9,000
00341-02	Bartow, City of	12-13,23-24	30	24	1	Floridan	Public Supply	6,250,000	3,330,000
		4-9,16-18	30	25					
00610-03	CF Industries	8-9,13,17-20,24-25,30	30	24	10	Floridan	Industrial/Public	18,500,000	7,430,000
01539-02	Farmland Hydro L.P.	28,30	30	24	5	Floridan	Supply	15,000,000	N/A
06747-01	IMC Development Corp.	33	30	24	1	Floridan	Industrial	240,000	N/A
08751-00	Polk County	33	30	24	1	Floridan	Irrigation	360,000	61,440
10035-00	UNC Reclamation	30	30	24	1	Floridan	Irrigation	N/A	30,000
01140-01	Agrico Chemical Co.	3	32	24	1	Floridan	Industrial	450,000	15,800
00548-02	Baker, Gerald E.	31,33	30	25	1	Floridan	Citrus Irrigation	504,000	N/A
00713-01	Fussell I.	30	30	25	1	Intermediate	Citrus Irrigation	144,000	10,250
01602-01	Weyland G.	31	30	25	1	Surficial	Citrus Irrigation	90,000	2,780
02407-03	Kaplan Industries	28-29,31,33	30	25	2	Floridan	Citrus Irrigation	N/A	1,000,000
02597-01	Wilson V.	30 .	30	25	1	Floridan	Industrial/Irrigation	546,000	23,910
03555-01	Smith B.W.	33	30	25	1	Floridan	Citrus Irrigation	189,000	17,580
10011-00	Heartland Supply Co.	33	30	25	2	Floridan/Surficial	Citrus Irrigation Public Supply	0	1,500

*Location:
S = Section
T = Township
R = Range

Source: SWFWMD, 1992.

TABLE 2.3.3-5
WELLS WITHIN ONE MILE OF THE POLK COUNTY SITE

Well Owner	Location* S	T	R	Well Diameter (inches)	Casing Depth (ft)	Well Depth (ft)	Well Usage
R. Kaplan	29	30	25	12	82	885	Industrial
K. Planfeed	29	30	25	4	95	185	Livestock
IMC	29	30	25	8	62	250	Industrial
IMC	29	30	25	8	105	300	"
IMC	31	30	25	8	83	126	"
Alcoa	32	30	25	10	397	823	"
Alcoa	32	30	25	10	390	835	"
P. Wilson	32	30	25	4	63	110	Domestic
R. Helms Sr.	32	30	25	4	–	–	"
P. Goss	32	30	25	4	63	155	"
H. Gray	32	30	25	4	105	182	"
L. Leach	32	30	25	4	83	180	"
T. Jarosek	32	30	25	4	–	–	"
W. M. Lanier	32	30	25	4	86	163	"
T. Jarosek	32	30	25	4	60	120	"
L. Sellers	32	30	25	4	84	180	"
R. Bordeen	32	30	25	4	50	125	"
T. Hembrott	32	30	25	4	66	160	"
H. C. Davis	32	30	25	4	147	245	Public Supply
E. Peterman	32	30	25	4	59	137	Domestic
I. Lawhorn	32	30	25	4	60	90	"
D. Kauffman	32	30	25	4	54	185	"
J. Moon	32	30	25	4	54	98	"
A. Smith	32	31	24	4	83	200	"
S. Haney	32	31	24	4	81	201	"
Portable Dredging Corp.	32	31	24	4	84	160	"
IMC	12	31	24	8	65	250	Industrial
Estech Inc.	14	31	24	6	188	822	Public Supply
Swift & Co.	14	31	24	8	325	795	Industrial
Estech Inc.	15	31	24	4	333	822	Public Supply
US Agri-Chemicals	23	31	24	8	70	174	Industrial
Swift Agricultural Chemicals	23	31	24	6	181	230	Industrial
Estech Inc.	23	31	24	6	178	307	Irrigation
Pacemaster Oil Co.	4	31	25	4	73	150	Public Supply
No Name	4	31	25	4	85	165	Domestic
C. Walker	4	31	25	4	64	159	"
J. P. Registea	4	31	25	4	42	88	"
M. Mooneyham	4	31	25	4	42	90	"
J. Howard	4	31	25	4	85	127	"
L. Kilcreast	4	31	25	4	42	90	"
R. R. Snell	4	31	25	6	88	400	Irrigation
W. Arnson	4	31	25	4	63	160	Domestic
R. Snell	4	31	25	4	63	195	"
J. Snell	4	31	25	4	53	198	"
H. Barefoot	4	31	25	4	80	150	"
L. Parker	4	31	25	4	104	185	"
A. Aycock	4	31	25	4	108	185	"

TABLE 2.3.3-5
WELLS WITHIN ONE MILE OF THE POLK COUNTY SITE

Well Owner	Location* S	T	R	Well Diameter (inches)	Casing Depth (ft)	Well Depth (ft)	Well Usage
J. A. Belcher	4	31	25	4	84	200	"
M. Corwin	4	31	25	4	85	160	"
B. W. Smith	4	31	25	4	221	356	Irrigation
W. Roland	4	31	25	4	–	200	Domestic
J. E. Rhymes	4	31	25	4	82	180	Irrigation
J. Barefoot	4	31	25	4	–	–	Domestic
A. H. Girtman	4	31	25	4	50	150	"
P. D. Crum	4	31	25	4	180	192	"
O. G. Page	4	31	25	4	71	190	"
L. T. Wynns	4	31	25	4	58	174	"
L. T. Wynns	4	31	25	4	105	195	Irrigation
J. Barefoot	4	31	25	4	115	192	Domestic
R. R. Snell	4	31	25	6	105	206	"
S. Monroe	4	31	25	4	40	85	"
G. Whidden	4	31	25	4	–	325	"
A. L. Henderson	4	31	25	4	84	196	"
R. R. Snell	4	31	25	4	212	405	"
R. Snell	4	31	25	4	273	420	"
No Name	5	31	25	4	63	130	"
C. E. Kiggin	5	31	25	4	87	140	"
J. M. Snell	5	31	25	6	80	285	Irrigation
I. A. Willis	5	31	25	4	73	160	Domestic
R. O. Lowery	5	31	25	4	97	183	"
W. Lester	5	31	25	4	84	142	"
A. Smith	5	31	25	4	62	180	"
J. Kilcrease	5	31	25	4	61	177	"
G. C. Ross	5	31	25	4	63	200	"
W. V. Tucker	5	31	25	4	96	258	"
V. Hancock	5	31	25	4	84	180	"
H. T. Siler	5	31	25	4	101	191	"
General Baptist Church	5	31	25	4	273	400	Public Supply
D. M. Kinsler	5	31	25	4	86	152	Domestic
Polk County Parks & Rec.	5	31	25	4	396	396	Public Supply
E. M. Bass	9	31	25	4	105	270	Public Supply
E. M. Bass	9	31	25	4	84	168	Domestic
R. Jackson	6	31	25	4	60	180	Domestic
J. Eldred	6	31	25	2	63	84	"
Stedem Ford	16	31	25	4	106	147	Public Supply
J. Armbruster	20	31	25	4	150	390	Domestic
IMC	25	30	24	–	43	125	Industrial
Intl. Min. Church	25	30	24	8	136	291	Irrigation
IMC	25	30	24	12	80	512	Industrial
IMC	25	30	24	12	85	85	"
IMC	25	30	24	4	80	130	"
IMC	25	30	24	4	84	183	"
IMC	25	30	24	8	90	200	"
IMC	25	30	24	10	120	350	"

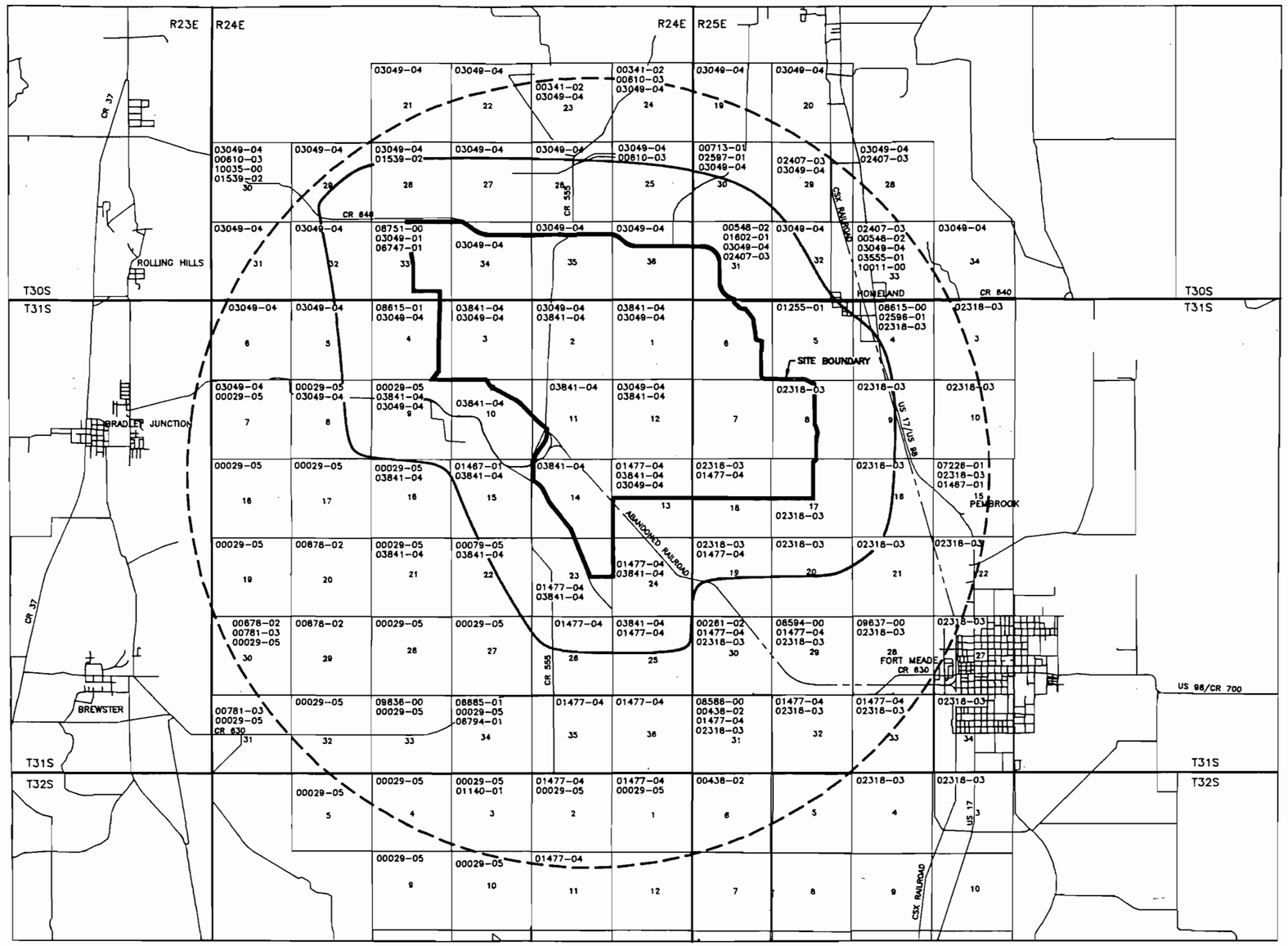
TABLE 2.3.3-5
WELLS WITHIN ONE MILE OF THE POLK COUNTY SITE

Well Owner	Location* S	T	R	Well Diameter (inches)	Casing Depth (ft)	Well Depth (ft)	Well Usage
L. Mason	26	30	24	3	7	18	Livestock
Polk City En.	26	30	24	6	98	375	Essential Services
IMC	26	30	24	8	72	340	Industrial
IMC	27	30	24	4	84	150	Domestic
Farmland Inc.	28	30	24	4	247	260	Industrial
G. M. Hrebec	28	30	24	4	126	450	Domestic
J. A. Prine	29	30	24	4	93	170	Domestic
T. G. Brooke	29	30	24	4	168	325	Domestic
Public Interest Corp.	31	30	24	4	84	165	Irrigation
A. Crum	32	30	24	3	72	122	Domestic
T. Mathis	32	30	24	6	95	200	Irrigation
G. Law	32	30	24	4	84	160	Domestic
J. Bradshaw	32	30	24	4	126	280	"
J. Hayes	32	30	24	2	–	–	"
J. Hayes	32	30	24	2	58	100	"
J. E. Mims	32	30	24	4	250	351	"
M. L. Watson	32	30	24	4	160	355	"
B. Thomas	33	30	24	3	88	275	"
IMC	33	30	24	4	84	460	"
Bartow Bd of City Commissioners	33	30	24	4	273	400	Public Supply
Bartow Bd of City Commissioners	33	30	24	10	40	780	"
J. Douglas	34	30	24	8	–	–	Domestic
C. Whitaker	35	30	24	4	52	151	"
W. R. Broderi	35	30	24	4	42	142	"
W. Geohagan	35	30	24	4	50	145	"
I. Stricklan	35	30	24	4	96	142	"
D. G. Haag	35	30	24	4	120	157	"
R. M. Spivey	35	30	24	4	84	135	"
D. Gay	35	30	24	4	67	135	"
B. Register	35	30	24	4	126	220	"
IMC	35	30	24	8	126	205	Industrial
IMC	35	30	24	4	–	–	Domestic
J. Desmidt	35	30	24	2	90	100	"
D. G. Haag	35	30	24	4	105	195	"
IMC	35	30	24	8	126	300	"
IMC	36	30	24	4	42	90	Public Supply
IMC	4	31	24	4	105	178	"
IMC	4	31	24	34	314	790	Industrial
IMC	4	31	24	36	310	870	"
IMC	4	31	24	8	64	308	"
IMC	22	31	24	8	70	390	"
S. E. Woods	22	31	24	3	125	227	Domestic
T. Drine	25	31	24	4	101	119	Irrigation
IMC	25	31	24	8	85	351	Industrial
IMC	25	31	24	12	129	378	Domestic
US Agri Chemicals	26	31	24	4	74	13	"

*Location:
S = Section
T = Township
R = Range

Note: – Not reported

Source: SWFWMD Well Construction Permit Files, 1992.



SOURCE: SWFWMD,1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.3-1

WATER USE IN SITE VICINITY

2.3.4 Surficial Hydrology

2.3.4.1 Hydrologic Characterization

GENERAL DESCRIPTION

The Polk County Site is located in the Southwest Florida Water Management District, along the divide between the Peace River Basin and the Alafia River Basin (see Figure 2.3.4-1).

Polk County is on the topographic high of peninsular Florida, from which water flows in all directions. Water from the eastern 35 percent of the County drains eastward and southward into the Kissimmee River and from the south-central 35 percent into the Peace River. Along the western boundary, water from 8 percent of the County drains into the Alafia River and water from 4 percent drains into the Hillsborough River. On the north, water from about 15 percent drains northwestward into the Withlacoochee River, and drainage from about 3 percent moves northward into the headwaters of the Oklawaha River, a tributary to the St. Johns River (USGS, 1961).

In the high, rolling, sandy lands of the Peace River basin, channels tend to be somewhat well defined, although many of the natural passages between lakes are more accurately described as long, narrow, wooded swamps than as well defined streams. In many places, these natural drains have been improved by channelizing. In this part of Polk County, lakes are more numerous, although smaller, than in the Kissimmee Valley section. Many of the lakes have no surface outlet and outward drainage may take place through the ground. In several areas, lakes that had no surface connections or were imperfectly joined have been connected by canals and made into full fledged drainage systems.

Along the western side of the county, in the Alafia River and Hillsborough River basins, the land is flat and fairly high. Lakes are few and small. Although the few streams in this area are small, most of them have well defined channels.

Streamflow in Polk County does not fluctuate as rapidly or as much as in many other counties in Florida because of the buffer effect of the many lakes in the County. The lakes store water in times of rainfall excess, thus reducing flood peaks. Conversely, they release water to streams in times of deficiency and thereby sustain streamflow. Each stream is stabilized by lakes to a

greater or lesser extent, depending upon the size and number of lakes to which it may be connected. This factor, as well as climatic and geologic factors, causes flow characteristics to be different from stream to stream and even from place to place on the same stream.

PEACE RIVER BASIN. The drainage area of the Peace River is about 2,180 square miles. From its source in northern Polk County, the River flows southward through Hardee and De Soto counties into the tidewater of Charlotte Harbor in Charlotte County. The River has many tributary streams, some of them having large drainage areas.

The topography of the valley rises from tidewater near the estuary to about 200 feet above sea level on the upper western side of the valley and about 250 feet on the upper eastern side. The highlands and flatwoods areas of the valley were originally heavily timbered with pine but most of this has been cut and replaced with citrus groves and pastures. Cypress swamp extends generally throughout the River floodplain to tidewater.

The Peace River originally received more of the drainage from Green Swamp than it has since the construction of the Atlantic Coast Line Railroad and Highway U.S. 17-92. The original natural divide was nearer the old Polk City-Haines City road.

The main stem of the Peace River is a narrow and shallow watercourse above tidewater in relation to the area it serves as a flood outlet. The floodplain is relatively narrow with a steep slope. This offers little opportunity for flood storage to reduce flood peaks. At the present time, flood waters quickly spread beyond the banks of the natural stream, overflowing the densely wooded floodplain. As the River nears tidewater, extreme floods extend beyond the normal floodplain, inundating large areas of adjacent flat lands.

The River channel has headwaters in three lakes or lake systems: Lake Hancock, normally less than 98 feet above sea level; the Winter Haven chain of lakes, normally about 131 feet above sea level; and Lake Hamilton, normally about 121 feet above sea level. All of these lake outlets converge about 1 mile above Bartow. The distance from the point of convergence to the zone of tidewater influence is about 87 miles along the stream.

ALAFIA RIVER BASIN. The Alafia River drains approximately 460 square miles of Hillsborough and western Polk Counties. The USGS streamflow gaging station above Lithia Springs measures flow from approximately 72 percent of the drainage basin (SWFWMD, 1991).

The Alafia River is notable for the extensive phosphate mining and chemical processing in its basin. Water quality conditions in the River were at their worst during the 1950s and 1960s, but pollution abatement practices applied in the 1970s and 1980s have resulted in improved water quality. Concentrations of several water quality parameters, such as phosphorus and nitrogen species, fluoride, specific conductance, sulfate, and coliform bacteria remain very high (SWFWMD, 1991). Water quality has consistently been impacted most in the North Prong of the river as a result of the high density of phosphate mines and chemical processing plants nearby. Water quality has typically been best in the South Prong of the river and is of intermediate quality in the main stem downstream of the confluence of the two prongs.

WATER BODIES NEAR THE SITE. Figure 2.3.4-2 shows the pre-mining drainage basin divides. All of the streams mentioned, except the South Prong Alafia River, are within the drainage basin of the Peace River. Table 2.3.4-1 indicates what percentage of the site was formerly within each of the sub-basins.

The portion of the site which, prior to the start of mining activities, was within the drainage basin of the Alafia River, represented approximately 0.14 percent of Alafia River's pre-mining drainage basin. The three existing parcels that fell within this pre-mining basin are: a small portion of land at the north-west corner of the Estech SA-12 parcel, and the western portions (approximately one-half) of the IMC Phosphoria parcel and the IMC P-3 parcel. These areas were altered by mining pre-1971, pre-1984, and during 1974 respectively. Neither the existing (pre-1992) reclamation plans submitted by the mining companies and approved by FDNR, or the proposed reclamation plans currently under review by FDNR, propose to restore these areas to the Alafia River basin. Since these ares have not contributed to the Alafia River basin since the start of mining and are not be restored to that basin as part of the approved reclamation programs in the future, no further discussion of the Alafia River basin will be presented in this section.

MORPHOMETRY, BATHYMETRY, AND STAGES

PEACE RIVER. Figure 2.3.4-3 shows the profile of the Peace River, from Punta Gorda to Lake Hancock. The bridge on SR 60 at Bartow, 105 miles upstream from the mouth of the River (USGS, 1990), is shown at Milepost 101 on Figure 2.3.4-3. Figure 2.3.4-4 shows the USGS flow and water quality monitoring stations on the Peace River in the vicinity of the FPC Polk

County Site. The Peace River station near Homeland is 97 miles upstream from the mouth, or at Milepost 93 on Figure 2.3.4-3, and the Peace River station at Fort Meade is at Milepost 88.

Morphometry and bathymetry for the Peace River were not measured. However, USGS maintains gaging stations at Bartow, Homeland, and Fort Meade. During the dry season, river widths are typically 20 to 50 feet at each of these stations, with maximum depths on the order of 1.5 to 4 feet. During the wet season, river widths are more typically 200 to 600 feet, and maximum depth ranges from 4 to 8 feet. The stage-discharge curve for the Bartow gaging station indicates a flow of 3,000 cfs would occur at a depth (gage height) of about 7.5 feet. The same depth at the Fort Meade station would coincide with a flow of under 1,000 cfs. The maximum high water surface stages shown on Figure 2.3.4-3 were estimated for a design storm of 9.6 inches over a 5-day period (Johnson, 1960). This storm has a recurrence interval of about 15 years. Maximum and minimum stages, and the associated flows, are presented in Table 2.3.4-2 for the Peace River USGS stations in the vicinity of the site (USGS, 1990). The peak stage at Fort Meade of 78.12 feet coincides with a stage of 85 feet at Bartow. Flow records for that event (September 29, 1979) indicate that the flow was essentially identical at Bartow and at Fort Meade (daily flows of 1,340 and 1,310 cfs, respectively). The 100-year flood stages at Bartow, Homeland, and Fort Meade are reported to be about 99.0, 90.6, and 85.1 ft MSL, respectively (FEMA, 1983). The Federal Emergency Management Agency (FEMA) Flood Insurance Rate maps are included in Chapter 4 as Figure 4.1.3-1.

McCULLOUGH CREEK. McCullough Creek presently arises from a small lake (approximately 10 acres), which is shown on Figure 3.2.1-3 as an existing lake just south of the FPC Polk County Site property line. The Creek runs approximately south-southeast for about 5 miles and then empties into Whidden Creek. In the upper reaches, the Creek bank elevation is about 150 ft MSL. At the Whidden Creek confluence, the McCullough Creek bank elevations are on the order of 50 feet. The 100-year flood stage, which is not expected to be within 3 miles of the site, extends upstream only to about CR 630. Presently, the only permitted discharge from the proposed site to McCullough Creek is the Estech NPDES outfall from SA-11. Under the existing approved (pre-1992) reclamation plan topography, this discharge would be eliminated. The only release from the Estech property then would be the rare overflow (less than once in 500 years) from SA-12 to the USAC N-8 area.

Except for a 200 feet wide and about 7,000 feet long strip in the upper reaches, all of McCullough Creek has been mined for phosphate (Partney, et al, 1990). As of 1990, mining

of the basin has ceased, and only USAC and IMC are actively disposing of waste clay and sand tailings. These disposal areas include IMC's N-16 (no longer receiving waste clays) and USAC's N-9 (the ninth Rockland Mine waste clay pond north of CR 630).

The pre-mining drainage basin for McCullough Creek was 14.5 square miles (Partney, et al, 1990), while in 1990 FDNR reported it contained 16.6 square miles at that time (see Figure 2.3.4-5). The increase in area is a result of phosphate mining changes to the topography. The area within the site which was in the pre-mining drainage basin is estimated at 1,526 acres, or about 2.4 square miles.

CAMP MEETING GROUND BRANCH. At the present time, the source of the Camp Meeting Ground Branch is the outfall serial number (OSN) 003 of the IMC Noralyn Mine (NPDES Permit No. FL 0000230 and FDER Permit No. I053-97271). This location is approximately 0.5 mile east of the site's eastern-most property line. From this point, the Branch continues eastward about 3,500 feet and crosses under U.S. Highway 17. In 1971, the Branch traveled generally northward about a mile and then joined a ditch which entered the Peace River, as shown on Figure 2.3.4-6 (EPA, 1985). Since that time, the portion of the Branch east of U.S. Highway 17 has been mined. Its actual channel location is still more or less as described. A determination of total drainage area of the Branch has not been made.

SIX-MILE CREEK AND BARBER BRANCH. Six-Mile Creek (with tributaries Sweet Water Branch and Cedar Branch) and Barber Branch are former streams which drained the bulk of the site to the north and eventually discharged to the Peace River. Virtually no traces of these streams are left as a result of mining activities.

FLOWS

PEACE RIVER. As described in the FPC Polk County Site Plan of Study, historical records of flows exist only for the Peace River. Figure 2.3.4-5 shows the three Peace River USGS monitoring locations: Bartow, near Homeland, and Fort Meade. Only at Bartow and Fort Meade are flows recorded daily, since 1939 and 1974 respectively.

The Peace River Valley Water Conservation and Drainage District developed a unit hydrograph for the Peace River at Bartow in 1960 (Johnson, 1960). It is reproduced in this SCA as Figure 2.3.4-7, and it shows a peak of about 1,150 cfs at 3.5 hours with a duration of about 15 days.

The maximum discharge recorded at the Bartow station was 4,140 cfs on September 24, 1947. The average discharge over 51 years (1939 to 1990) was 229 cfs. The maximum discharge recorded at Fort Meade since 1974 is 1,360 cfs on September 27, 1979. However, the USGS (1961) reports the extreme high flow ever measured was 1,600 cfs on June 19, 1947. On that date the daily flow at Bartow was 1,290 cfs. The minimum daily discharges recorded are 1.1 cfs at Bartow (April 27, 1968) and 0.22 cfs at Fort Meade (June 6, 1985).

Heath and Wimberly (USGS, 1971) calculated the 7 consecutive day 10-year low flow (7Q10) from October 1939 through September 1964 for the Peace River at Bartow was 11.1 cfs, and the average flow was 308 cfs. Based on the period 1966 through 1991, the 7Q10 has dropped to about 3.0 cfs. Based on the full period of record (water years 1940 to 1991), the 7Q10 is 4.6 cfs. Based on the period from 1974 to 1991, the 7Q10 is 3.3 cfs at Bartow, and only 0.9 cfs at Fort Meade.

The average flow at Fort Meade was 155 cfs (water years 1975 to 1990); for the same period at Bartow, the average was 133 cfs. The USGS (1990) hypothesized that a significant water loss to ground water occurs from the Peace River between Bartow and Fort Meade. The limited data at Homeland indicate that the water loss occurs between Bartow and Homeland.

OTHER STREAMS. Heath (USGS, 1961) calculated peak flood relationships for Polk County streams, as shown on Figures 2.3.4-8 and 2.3.4-9. Based on this data, McCullough Creek would have an annual flood peak of about 500 cfs, a 10-year peak of about 1,100 cfs, a 25-year peak of about 1,700 cfs, and a 50-year peak of about 1,900 cfs. However, Partney (1990) indicates that the contributing area of a drainage basin is typically reduced by at least 50 percent when an area is mined for phosphate and then reclaimed.

If Figures 2.3.4-8 and 2.3.4-9 are used to estimate the peak 50-year flood on the Peace River at Bartow (drainage area of 390 square miles), the estimate is on the order of 6,840 cfs. Since the actual peak for 51 years of record was only 4,140, it appears that Heath's method (USGS, 1961) would overestimate peak flows by a factor of about 65 percent.

TEMPERATURE

Heath (USGS, 1981) reports an average annual temperature range of streams in south-central and south-western Florida of 72 to 76° F. All of the USGS data for the Peace River at Bartow,

near Homeland, and at Fort Meade have been plotted over the period of temperature record, and are shown on Figures 2.3.4-10 through 2.3.4-12, respectively, and the tabulated data are presented in Appendix 10.5.4-4. Based on the USGS data, water temperatures in the Peace River in the site vicinity range from a low of 50°F in the winter to a high of 94.1°F in the summer. There are no published temperature data for other water bodies in the site vicinity.

As part of the surface water hydrology studies in support of this application (see Section 2.3.4.2), water quality data were monitored at seven surface water locations during both the wet and dry season (see Figure 2.3.4-13). These monitoring results are tabulated in Table 2.3.4-3. They indicate that the temperatures in McCullough Creek and Camp Meeting Ground Branch are, for all practical purposes, the same as in the Peace River. For SA-11, N-15, and N-16, which are part of the active mining operations, water temperatures during the wet season (June to September) were 3 to 6° F higher than those in McCullough Creek, Camp Meeting Ground Branch, and the Peace River, but were indistinguishable from them in the dry season (October to May). The one area on-site which is not part of mining operations is Tiger Bay, which has been reclaimed and released by FDNR. Water temperatures measured in Tiger Bay were similar to those measured in the on-site clay settling areas.

WATER QUALITY

As was the case with temperature, historical water quality data are available for the Peace River at the three locations shown on Figure 2.3.4-4.

Water quality data have been taken continuously at the Bartow station since October 1963; at the Homeland station since October 1980; and at the Fort Meade Station from October 1964 through September 1969, and since 1972 (USGS, 1990). All of these data are presented in Appendix 10.5.4 in both tabular and graphic form. The following general discussion is based in part on that data.

As part of baseline surficial hydrology studies (see Section 2.3.4.2), water quality samples were taken during the wet (September 1991) and dry (February 1992) seasons at seven locations (see Figure 2.3.4-13). The complete results of that monitoring program are shown in Table 2.3.4-4. Table 2.3.4-5 presents the results of that monitoring program showing only those constituents which were detected.

Heath and Conover (USGS, 1981) indicate that streams in southwest Polk County are of the calcium and magnesium sulfate type (see Figures 2.3.4-14 and 2.3.4-15). This information indicates that the dominant cations for streams in the site vicinity are calcium, magnesium, and sodium, and the dominant anions are sulfate, bicarbonate, and chloride.

Based on Rule 17-302.600 (3) (b) 53, F.A.C., Classified Waters, all surface waters of the state that are in Polk County are Class III Waters (Recreation, Propagation and Maintenance of a Health, Well-Balanced Population of Fish and Wildlife). The standards applicable to Class III Waters are presented in Table 2.3.4-6. As indicated in Table 2.3.4-6, Class III water quality standards were exceeded for iron in Camp Meeting Ground Branch; nickel in the Peace River; pH in N-15, N-16, Tiger Bay, SA-11 and the Peace River; turbidity in N-15, N-16 and SA-11; and gross alpha radioactivity in N-15. It should be noted that Tiger Bay is the only on-site water body which might be considered subject to regulatory water quality restrictions.

Additional water quality sampling was performed to supplement the ecological studies. The sampling locations are shown on Figure 2.3.4-16. Monitoring results are presented in Tables 2.3.4-7 and 2.3.4-8.

ON-SITE WATER BODIES. There is one parcel on the FPC Polk County Site which contains surface water bodies and is not part of ongoing mining and related operations. This is the Tiger Bay area at the southern end of the site, which includes a remnant of Camp Meeting Ground Branch on the east side of Tiger Bay. Tiger Bay consists of about 417 acres of reclaimed land and lakes and presently includes a stressed and degenerating wetland area. The Camp Meeting Ground Branch remnant, hereafter referred to as Tiger Bay East, is about 102 acres. Water levels in Tiger Bay and Camp Meeting Ground Branch are artificially maintained by a weir on Camp Meeting Ground Branch.

Based on the results of the groundwater modeling (see Section 4.3), the current circulation of water through Tiger Bay is estimated to be about 10,000 gallons per day (gpd), or 0.02 cfs, virtually all of which is seepage from N-16. The property to the south (N-9) is presently full of relatively dense clay and surrounded by a seepage collection/return system. Seepage from SA-11 is considered negligible. The existing approved (pre-1992) reclamation plan for N-16 will remove the 10,000 gpd of seepage on the inflow side, and the removal of the IMC NPDES OSN 003 weir will lower the water table on the outflow side. The net result will be the drying out

of the wet areas, which will ultimately result in a drastically altered and ecologically diminished Tiger Bay ecosystem.

The remaining on-site parcels are part of phosphate mining operations. Table 2.3.4-9 summarizes the history and present status of each parcel. The only parcels which would have on-site lakes according to the baseline (presently approved pre-1992 reclamation plans for mandatory areas, and most likely reclamation for nonmandatory areas) are Estech SA-11 and SA-12. The lakes are shown as FLUCCS Code 520 on Figure 2.1.2-2B. They total 641 acres of which about three-fourths are in SA-12 and one fourth are in SA-11. Information about wetlands which would be created under the baseline is presented in Section 2.3.5.

SITE DRAINAGE. All present site drainage is either utilized in mining operations or released through NPDES permitted mine discharges. There are four mine water recirculation systems located on the Polk County Site:

- IMC Noralyn Mine system
- IMC Phosphoria Mine system
- Estech Silver City Mine system
- USAC Rockland Mine system

The two IMC systems are integrated and act as one system.

When storms require the mine systems to release water, they do so by discharging via their NPDES outfalls. Figure 2.3.4-17 shows the outfall location for the IMC system, Figure 2.3.4-18 shows those for the Estech system, and Figure 2.3.4-19 shows the USAC N-9 outfall location. The three NPDES permits are presented in Appendix 10.1.2.

2.3.4.2 Measurement Programs

A full description of the surface water hydrology measurement program is provided in Appendix 10.5.4.6, in the document entitled Surface Water Hydrology Technical Procedures Manual. The procedures were conducted in full compliance with the Quality Assurance Project Plan (QAPP) approved by FDER for this project.

2.3.4.3 References

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TABLE 2.3.4-1
PRE-MINING DRAINAGE BASINS

Pre-mining Basin	% of Site Acreage
PEACE RIVER BASIN	
McCullough Creek	18.5%
Six Mile Creek	52.4%
Barber Branch	11.5%
Camp Meeting Ground Branch	12.3%
Peace River Basin Subtotal	94.7%
ALAFIA RIVER BASIN	
in SA-12	0.6%
in Phosphoria	2.5%
in P-3	2.1%
Alafia River Basin Subtotal	5.2%

TABLE 2.3.4-2
MAXIMUM AND MINIMUM STAGES - PEACE RIVER

Station Location	At Bartow	Near Homeland	At Ft. Meade
Years of Complete Stage Record	51	10	16
Peak Stage ft MSL	98.57	NA	78.12
Flow at Peak Stage, cfs	3,460	NA	1,360

N/A = Not Available

Source: U.S.G.S., Water Resources Data, Florida, Water Year 1990

TABLE 2.3.4-3
MEASURED WATER TEMPERATURES

Location	Wet Season	Dry Season
N-15	86.7	71.2
N-16	89.4	71.8
SA-11	86.0	72.1
Tiger Bay	87.1	72.5
Camp Meeting Ground Branch	82.4	71.6
McCullough Creek	83.7	69.6
Peace River	83.3	70.3

Note: Temperatures expressed in °F.

Source: Ebasco Environmental, 1992

TABLE 2.3.4-4
SURFACE WATER MONITORING DATA - POLK COUNTY SITE

Parameter (mg/l unless noted otherwise)	FPC-001 (N-15) 09/91	FPC-009 (N-15) 02/92	FPC-002 (N-16) 09/91	FPC-010 (N-16) 02/92	FPC-003 (Tiger Bay) 09/91	FPC-011 (Tiger Bay) 02/92	FPC-004 (CMGB) 09/91	FPC-015 (CMGB) 02/92	FPC-005 (SA-11) 09/91
Alkalinity (as $CaCO_3$)	89	75.5	119	133	82.5	93.2	139	151	95.5
Aluminum	0.36	0.52	0.31	0.32	< 0.1	< 0.1	1.2	0.67	0.26
Ammonia, as N	< 0.1	< 0.1	< 0.1	0.14	< 0.1	< 0.1	0.27	0.36	0.15
Antimony	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Arsenic	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Barium	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Beryllium	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bicarbonate	< 78.2	< 48.3	109	123	82.5	92.2	139	151	73.9
Boron	< 0.1	< 0.05	< 0.1	< 0.05	< 0.1	< 0.05	< 0.1	< 0.05	< 0.1
Cadmium	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Calcium	49	62	56	60	15	20	58	58	82
Carbonate	13	26.8	8.56	10.2	< 2	< 2	< 2	< 2	21.4
Chloride	16.1	17.9	17.6	19.9	8.04	11.1	17.1	19.1	42.2
Chromium	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Color (PCU)	40	100	50	70	30	20	40	40	50
Copper	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Cyanides (total)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Dissolved Oxygen	8.8	**	9.7	**	5.8	**	3.9	**	6.7
Fecal Coliform Bacteria (Cfu/100 ml)	< 1	6	6	5	18	18	< 1	100	< 1
Fluoride	2.84	2.55	2.38	2.51	1.99	1.93	2.24	2.33	2.53
Gross Alpha (pCi/l)	9.5	15.8	3.2	6.9	< 0.5	0.6	4.2	6.9	8.9

TABLE 2.3.4-4
SURFACE WATER MONITORING DATA - POLK COUNTY SITE

Parameter (mg/l unless noted otherwise)	FPC-001 (N-15) 09/91	FPC-009 (N-15) 02/92	FPC-002 (N-16) 09/91	FPC-010 (N-16) 02/92	FPC-003 (Tiger Bay) 09/91	FPC-011 (Tiger Bay) 02/92	FPC-004 (CMGB) 09/91	FPC-015 (CMGB) 02/92	FPC-005 (SA-11) 09/91
Iron	< 0.1	0.28	< 0.1	0.11	0.19	0.23	1.1	0.79	< 0.1
Lead	< 0.01	< 0.005	< 0.01	< 0.005	< 0.01	< 0.005	< 0.01	< 0.005	< 0.01
Magnesium	22	22	24	26	11	14	27	27	41
Manganese	< 0.03	0.033	< 0.03	< 0.03	< 0.03	< 0.03	0.052	0.049	< 0.03
Mercury	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Molybdenum	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel	< 0.01	< 0.04	< 0.01	< 0.04	< 0.01	< 0.04	< 0.1	< 0.04	< 0.01
Nitrate, as N	0.04	0.07	< 0.03	0.07	< 0.03	0.05	0.133	0.31	< 0.03
Nitrite, as N	< 0.03	0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Oil & Grease, Grav.	4.2	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
pH, Field	8.87	9.18	9.06	7.08	7.48	8.52	7.38	7.16	9.3
Phenolics	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Potassium	3.6	2.5	3.4	3	< 1	< 1	4.2	2.5	3.3
Radium 226 (pCi/l)	0.3	1.1	1.1	0.6	< 0.2	< 0.2	1.3	1.7	1.1
Radium 228 (pCi/l)	0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.07
Selenium	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Silica-Dissolved	5.41	< 0.5	4.21	< 0.5	3.83	< 0.5	2.1	3.1	< 0.5
Silver	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Sodium	47	50	42	47	7.1	8.9	41	42	41
Specific Conductance (umho/cm)	670	620	645	620	205	220	677	600	978
Strontium	0.2	0.13	0.1	0.11	< 0.1	< 0.05	0.13	0.12	0.19

TABLE 2.3.4-4
SURFACE WATER MONITORING DATA - POLK COUNTY SITE

Parameter (mg/l unless noted otherwise)	FPC-001 (N-15) 09/91	FPC-009 (N-15) 02/92	FPC-002 (N-16) 09/91	FPC-010 (N-16) 02-92	FPC-003 (Tiger Bay) 09/91	FPC-011 (Tiger Bay) 02/92	FPC-004 (CMGB) 09/91	FPC-015 (CMGB) 09/91	FPC-005 (SA-11) 09/91
Strontium 90 (pCi/l)	0.2	0.3	7	0.5	0	0.1	0	0	0
Sulfate	213	254	132	195	< 1	< 1	143	160	289
Surfactants	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TDS	428	444	400	412	122	114	416	398	660
Total Coliform (Cfu/100 ml)	10/H	100/H	*	100/H	*	*	< 1/H	1200/H	*
Total Hardness (as $CaCO_3$)	235	250	239	260	110	110	167	260	374
Total Phosphorus	0.741	1.12	0.543	1.06	0.102	0.09	0.895	2.81	0.344
Total Sulfide	0.11	0.32	0.11	0.2	< 0.1	< 0.1	< 0.1	< 0.1	0.12
Tritium (pCi/l)	0	36	0.1	0	2	43	26	12	60
TSS	12.5	32.5	13.5	19.5	< 5	8.5	14	18.5	11.5
Turbidity, Field (NTU)	42	81	44	12	12	0.8	0.34	6.2	0.24
Vanadium	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Zinc	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

TABLE 2.3.4-4
SURFACE WATER MONITORING DATA - POLK COUNTY SITE

Parameter (mg/l unless noted otherwise)	FPC-001 (N-15) 09/91	FPC-009 (N-15) 02/92	FPC-002 (N-16) 09/91	FPC-010 (N-16) 02-92	FPC-003 (Tiger Bay) 09/91	FPC-011 (Tiger Bay) 02/92	FPC-004 (CMGB) 09/91	FPC-015 (CMGB) 09/91	FPC-005 (SA-11) 09/91
Organics									
Benzene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Detergents	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
1,2 - Dichloroethane	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Ethylene dibromide	< 0.00002	< .00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Oil and Grease	4.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
PCBs	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Phthalate Esters	< 0.01	< 0.1	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Tetrachloroethane	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
1,1,1 - Trichloroethane	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Total Trihalomethanes	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Vinyl Chloride	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

TABLE 2.3.4-4
SURFACE WATER MONITORING DATA - POLK COUNTY SITE

Parameter (mg/l unless noted otherwise)	FPC-001 (N-15) 09/91	FPC-009 (N-15) 02/92	FPC-002 (N-16) 09/91	FPC-010 (N-16) 02-92	FPC-003 (Tiger Bay) 09/91	FPC-011 (Tiger Bay) 02/92	FPC-004 (CMGB) 09/91	FPC-015 (CMGB) 09/91	FPC-005 (SA-11) 09/91
Pesticides									
Aldrin plus Dieldrin	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0001	< 0.0001	<0.0001	< 0.0001	< 0.0001
Chlordane	<0.0005	<0.0005	<0.0005	<0.0005	< 0.0005	< 0.0005	<0.0005	< 0.0005	< 0.0005
2,4-D	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.006	< 0.002
2,4,5 - TP	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.003	< 0.001
Demeton	< 0.001	< .001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Endosulfan	<0.0001	<0.0001	<0.0001	<0.0001	< 0.0001	< 0.0001	<0.0001	< 0.0001	< 0.0001
Endrin	<0.0001	< 0.0001	<0.0001	<0.0001	< 0.0001	< 0.0001	<0.0001	< 0.0001	< 0.0001
Guthion	< 0.002	< 0.001	< 0.002	< 0.001	< 0.002	< 0.001	< 0.002	< 0.001	< 0.002
Heptachlor	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Lindane	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Malathion	***	< 0.001	***	< 0.001	***	< 0.001	< 0.001	< 0.001	< 0.001
Methoxychlor	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Myrex	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Parathion	***	< 0.001	***	< 0.001	***	< 0.001	< 0.001	< 0.001	< 0.001
Toxaphene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

TABLE 2.3.4-4
SURFACE WATER MONITORING DATA - POLK COUNTY SITE

Parameter (mg/l unless noted otherwise)	FPC-006 (SA-11) 09/91	FPC-012 (SA-11) 02/92	FPC-007 (Peace Riv) 09/91	FPC-014 (Peace Riv) 02/92	FPC-008 (McC Crk) 09/91	FPC-016 (McC Crk) 09/91	FPC-017 (McC Crk) 02/92	FPC-013 (Sewage Pit) 02/92
Alkalinity (as $CaCO_3$)	82.5	107	58.8	117	81.1	114	104	133
Aluminum	0.24	0.51	< 0.1	< 0.1	0.97	0.72	0.75	2.4
Ammonia, as N	< 0.1	< 0.1	0.13	0.2	0.31	< 0.1	< 0.1	14.9
Antimony	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Arsenic	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Barium	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Beryllium	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bicarbonate	69.6	97.6	58.8	117	81.1	114	104	133
Boron	< 0.1	< 0.05	< 0.1	< 0.05	< 0.1	< 0.05	< 0.1	0.15
Cadmium	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Calcium	86	94	65	60	86	87	90	79
Carbonate	12.8	9.2	< 2	< 2	< 2	< 2	< 2	< 2
Chloride	41.2	46.9	20.1	18.1	42.2	46.4	46.1	139
Chromium	< 0.01	< 0.01	0.041	< 0.01	< 0.01	< 0.01	< 0.01	0.038
Color (PCU)	50	40	150	30	80	40	40	60
Copper	< 0.01	< 0.01	0.014	< 0.01	< 0.01	< 0.01	< 0.01	0.052
Cyanides (total)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.011
Dissolved Oxygen	6.7	**	3.5	**	2.8	2.8	**	**
Fecal Coliform Bact. (Cfu/100 ml)	10	3	70	100	40	540	490	> 20000
Fluoride	2.58	2.8	0.822	1.84	2.54	2.69	2.7	0.264
Gross Alpha (pCi/l)	4.6	11.4	< 0.5	6.3	6.1	5.5	14.8	3.7

TABLE 2.3.4-4
SURFACE WATER MONITORING DATA - POLK COUNTY SITE

Parameter (mg/l unless noted otherwise)	FPC-006 (SA-11) 09/91	FPC-012 (SA-11) 02/92	FPC-007 (Peace Riv) 09/91	FPC-014 (Peace Riv) 02/92	FPC-008 (McC Crk) 09/91	FPC-016 (McC Crk) 09/91	FPC-017 (McC Crk) 02/92	FPC-013 (Sewage Pit) 02/92
Iron	< 0.1	< 0.1	< 0.1	0.15	< 0.1	< 0.1	< 0.1	0.28
Lead	< 0.01	< 0.005	< 0.01	< 0.005	< 0.01	< 0.005	< 0.01	< 0.005
Magnesium	43	46	8.1	24	43	42	43	21
Manganese	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.037
Mercury	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Molybdenum	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel	< 0.01	< 0.04	0.1	< 0.04	< 0.01	< 0.04	< 0.01	< 0.04
Nitrate, as N	< 0.03	0.05	0.273	0.43	< 0.03	0.06	0.05	1.46
Nitrite, as N	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Oil & Grease, Grav.	< 1	< 1	1.1	< 1	< 1	< 1	< 1	5.8
pH, Field	9.3	9.02	7.27	5.18	7.5	7.16	7.16	6.92
Phenolics	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.008
Potassium	3.2	2.3	39	1.9	3.5	3.2	2.9	8.5
Radium 226 (pCi/l)	1	0.7	1.2	< 0.2	1.7	0.9	< 0.2	< 0.2
Radium 228 (pCi/l)	< 0.7	1.1	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Selenium	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Silica-Dissolved	< 0.5	< 0.5	6.5	4.4	< 0.5	< 1	< 1	19.2
Silver	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Sodium	43	46	24	35	42	42	44	95
Specific Conductance (umho/cm)	939	890	313	580	886	820		1100
Strontium	0.21	0.25	0.14	0.37	0.2	0.21	0.22	1.7

TABLE 2.3.4-4
SURFACE WATER MONITORING DATA - POLK COUNTY SITE

Parameter (mg/l unless noted otherwise)	FPC-006 (SA-11) 09/91	FPC-012 (SA-11) 02/92	FPC-007 (Peace River) 09/91	FPC-014 (Peace River) 02/92	FPC-008 (McC Crk) 09/91	FPC-016 (McC Crk) 09/91	FPC-017 (McC Crk) 02/92	FPC-013 (Sewage Pit) 02/92
Strontium 90 (pCi/l)	0	0	0	0	0	0	0	0
Sulfate	247	303	42.3	192	308	356	352	240
Surfactants	< 0.1	< 0.1	0.111	< 0.1	0.125	< 0.01	< 0.1	2.64
TDS	644	616	204	380	668	604	614	652
Total Coliform (Cfu/100 ml)	*	200/H	*	900/H	*	3,200/H	3,400/H	*
Total Hardness (as $CaCo_3$)	389	420	195	250	392	390	400	290
Total Phosphorus	0.322	0.56	1.16	0.71	0.498	0.75	0.71	1.01
Total Sulfide	0.11	0.13	0.16	< 0.1	0.12	< 0.1	0.11	0.17
Tritium (pCi/l)	0	50	0.4	0	12	19	17	7
TSS	11.5	16.5	38.9	5	18	11	10.5	15.5
Turbidity, Field (NTU)	0.24	42	0.22	1.8	0.32	4.4	4.4	12
Vanadium	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Zinc	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.065

TABLE 2.3.4-4
SURFACE WATER MONITORING DATA - POLK COUNTY SITE

Parameter (mg/l unless noted otherwise)	FPC-006 (SA-11) 09/91	FPC-002 (SA-11) 02/92	FPC-007 (Peace River) 09/91	FPC-014 (Peace River) 02-92	FPC-008 (McCullough Creek) 09/91	FPC-016 (McCullough Creek) 02/92	FPC-017 (McCullough Creek) 09/91	FPC-013 (Sewage Plant) 09/91
Pesticides								
Aldrin plus Dieldrin	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0001
Chlordane	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	<0.0005
2,4-D	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.006
2,4,5 - TP	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.003
Demeton	< 0.001	< .001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Endosulfan	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0001
Endrin	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	<0.0001
Guthion	< 0.002	< 0.001	< 0.002	< 0.001	< 0.002	< 0.001	< 0.002	< 0.001
Heptachlor	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	<0.00005
Lindane	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	<0.00005
Malathion	< 0.00005	< 0.001	< 0.00005	< 0.001	< 0.00005	< 0.001	< 0.001	< 0.001
Methoxychlor	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	<0.00005
Myrex	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	<0.00005
Parathion	< .001	< 0.001	***	< 0.001	***	< 0.001	< 0.001	< 0.001
Toxaphene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

TABLE 2.3.4-4
SURFACE WATER MONITORING DATA - POLK COUNTY SITE

Parameter (mg/l unless noted otherwise)	FPC-006 (SA-11) 09/91	FPC-012 (SA-11) 02/92	FPC-007 (Peace River) 09/91	FPC-014 (Peace River) 02-92	FPC-008 (McCullough Creek) 09/91	FPC-016 (McCullough Creek) 02/92	FPC-017 (McCullough Creek) 09/91	FPC-013 (Sewage Plant) 09/91
Organics								
Benzene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Detergents	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
1,2 - Dichloroethane	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Ethylene dibromide	< 0.00002	< .00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Oil and Grease	4.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
PCBs	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Phthalate Esters	< 0.01	< 0.1	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01
Tetrachloroethane	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
1,1,1 - Trichloroethane	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Total Trihalomethanes	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Vinyl Chloride	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

* matrix interference
** not measured due to equipment malfunction
*** inadvertently not tested
Source: Ebasco Environmental, 1992

TABLE 2.3.4-5
DETECTED WATER QUALITY MONITORING DATA

Parameter (mg/l unless otherwise noted)	FPC-001 (N-15) 09/91	FPC-009 (N-15) 02/92	FPC-002 (N-16) 09/91	FPC-010 (N-16) 02/92	FPC-003 (Tiger Bay) 09/91	FPC-011 (Tiger Bay) 02/92	FPC-004 (CMGB) 09/91	FPC-015 (CMGB) 02/92	FPC-005 (SA-11) 09/91
Alkalinity (as $CaCO_3$)	89	75.5	119	133	82.5	93.2	139	151	95.5
Aluminum	0.36	0.52	0.31	0.32			1.2	0.67	0.26
Ammonia, as N				0.14			0.27	0.36	0.15
Bicarbonate	78.2	48.3	109	123	82.5	92.2	139	151	73.9
Boron									
Calcium	49	62	56	60	15	20	58	58	82
Carbonate	13	26.8	8.56	10.2					21.4
Chloride	16.1	17.9	17.6	19.9	8.04	11.1	17.1	19.1	42.2
Chromium									
Color (PCU)	40	100	50	70	30	20	40	40	50
Copper									
Cyanides (total)									
Fecal Coliform Bact. (Cfu/100 ml)		6	6	5	18	18		100	
Fluoride	2.84	2.55	2.38	2.51	1.99	1.93	2.24	2.33	2.53
Gross Alpha (pCi/l)	9.5	15.8	3.2	6.9		0.6	4.2	6.9	8.9
Iron		0.28		0.11	0.19	0.23	1.1	0.79	
Magnesium	22	22	24	26	11	14	27	27	41
Manganese		0.033					0.052	0.049	
Nickel									
Nitrate, as N	0.04	0.07		0.07		0.05	0.133	0.31	
Nitrite, as N		0.03							

TABLE 2.3.4-5
DETECTED WATER QUALITY MONITORING DATA

Parameter (mg/l unless otherwise noted)	FPC-001 (N-15) 02/92	FPC-009 (N-15) 02/92	FPC-002 (N-16) 09/91	FPC-010 (N-16) 02/92	FPC-003 (Tiger Bay) 09/91	FPC-011 (Tiger Bay) 02/92	FPC-004 (CMGB) 09/91	FPC-015 (CMGB) 02/92	FPC-005 (SA-11) 09/91
Oil & Grease, Grav.	4.2								
pH, Field	8.87	9.18	9.06	7.08	7.48	8.52	7.38	7.16	9.3
Potassium	3.6	2.5	3.4	3			4.2	2.5	3.3
Radium 226 (pCi/l)	0.3	1.1	1.1	0.6			1.3	1.7	1.1
Radium 228 (pCi/l)	0.7								
Silica-Dissolved	5.41		4.21		3.83		2.1	3.1	
Sodium	47	50	42	47	7.1	8.9	41	42	41
Specific Conductance (umho/cm)	670	620	645	620	205	220	677	600	978
Strontium	0.2	0.13	0.1	0.11			0.13	0.12	0.19
Strontium 90 (pCi/l)	0.2	0.3	7	0.5	0	0.1	0	0	0
Sulfate	213	254	132	195			143	160	289
Surfactants									
TDS	428	444	400	412	122	114	416	398	660
Total Coliform (Cfu/100 ml)	10/H	100/H	*	100/H	*	*	*	1200/H	*
Total Hardness (as $CaCO_3$)	235	250	239	260	110	110	167	260	374
Total Phosphorus	0.741	1.12	0.543	1.06	0.102	0.09	0.895	2.81	0.344
Total Sulfide	0.11	0.32	0.11	0.2					0.12
Tritium (pCi/l)	0	36	0.1	0	2	43	26	12	60
TSS	12.5	32.5	13.5	19.5		8.5	14	18.5	11.5
Turbidity, Field (NTU)	42	81	44	12	12	0.8	0.34	6.2	0.24
Zinc									

TABLE 2.3.4-5
DETECTED WATER QUALITY MONITORING DATA

Parameter (mg/l unless otherwise noted)	FPC-006 (SA-11) 09/91	FPC-012 (SA-11) 02/92	FPC-007 (Peace Riv) 09/91	FPC-014 (Peace Riv) 02/92	FPC-008 (McC Crk) 09/91	FPC-016 (McC Crk) 09/91	FPC-017 (McC Crk) 02/92	FPC-013 (Sewage Pit) 02/92
Alkalinity (as $CaCO_3$)	82.5	107	58.8	117	81.1	114	104	133
Aluminum	0.24	0.51			0.97	0.72	0.75	2.4
Ammonia, as N			0.13	0.2	0.31			14.9
Bicarbonate	69.6	97.6	58.8	117	81.1	114	104	133
Boron						0.05		0.15
Calcium	86	94	65	60	86	87	90	79
Carbonate	12.8	9.2						
Chloride	41.2	46.9	20.1	18.1	42.2	46.4	46.1	139
Chromium			0.041					0.038
Color (PCU)	50	40	150	30	80	40	40	60
Copper			0.014					0.052
Cyanides (total)								0.011
Fecal Coliform Bact. (Cfu/100 ml)	10	3	70	100	40	540	490	> 20000
Fluoride	2.58	2.8	0.822	1.84	2.54	2.69	2.7	0.264
Gross Alpha (pCi/l)	4.6	11.4		6.3	6.1	5.5	14.8	3.7
Iron				0.15				0.28
Magnesium	43	46	8.1	24	43	42	43	21
Manganese				0.03				0.037
Nickel			0.01					
Nitrate, as N		0.05	0.273	0.43		0.06	0.05	1.46
Nitrite, as N								

TABLE 2.3.4-5
DETECTED WATER QUALITY MONITORING DATA

Parameter (mg/l unless otherwise noted)	FPC-006 (SA-11) 09/91	FPC-012 (SA-11) 02/92	FPC-007 (Peace Riv) 09/91	FPC-014 (Peace Riv) 02/92	FPC-008 (McC Crk) 09/91	FPC-016 (McC Crk) 09/91	FPC-017 (McC Crk) 02/92	FPC-013 (Sewage Pit) 02/92
Oil & Grease, Grav.			1.1					5.8
pH, Field		9.02	7.27	5.18	7.5	7.16		6.92
Potassium	3.2	2.3	39	1.9	3.5	3.2	2.9	8.5
Radium 226 (pCi/l)	1	0.7	1.2		1.7	0.9		
Radium 228 (pCi/l)		1.1						
Silica-Dissolved			6.5	4.4				19.2
Sodium	43	46	24	35	42	42	44	95
Specific Conductance (umho/cm)	939	890	313	580	886	820		1,100
Strontium	0.21	0.25	0.14	0.37	0.2	0.21	0.22	1.7
Strontium 90 (pCi/l)	0	0	0	0	0	0	0	0
Sulfate	247	303	42.3	192	308	356	352	240
Surfactants			0.111		0.125			2.64
TDS	644	616	204	380	668	604	614	652
Total Coliform (Cfu/100 ml)	*	200/H	*	900/H	*	3,200/H	3,400/H	*
Total Hardness (as $CaCO_3$)	389	420	195	250	392	390	400	290
Total Phosphorus	0.322	0.56	1.16	0.71	0.498	0.75	0.71	1.01
Total Sulfide	0.11	0.13	0.16		0.12		0.11	0.17
Tritium (pCi/l)	0	50	0.4	0	12	19	17	7
TSS	11.5	16.5	38.9	5	18	11	10.5	15.5
Turbidity, Field (NTU)		42	0.22	1.8	0.32	4.4		12
Zinc								

* matrix interference
** not measured due to equipment malfunction

TABLE 2.3.4-6
STANDARDS APPLICABLE TO CLASS III WATERS

General		Class III	
Arsenic	0.05 mg/l	Ammonia	0.02 mg/l*
Chlorides	shall not be increased more than 10% above b.g.	Beryllium	0.011 mg/l
		Bromine	0.1 mg/l
Chromium	0.05 mg/l after mixing	Cadmium	0.8 μ/l
Detergents	0.5 mg/l	Chlorine	0.01 mg/l
Fluorides	10 mg/l	Copper	0.03 mg/l
Lead	0.05 mg/l	Cyanide	5.0 μg/l
O&G	5.0 mg/l	D.O.	5 mg/l (min)
pH	6 - 8.5	Iron	1.0 mg/l
Phenols	1 μ/l	Lead	0.03 mg/l
Radium 226 + Radium 228	5 pCi/l	Mercury	0.2 μg/l
		Nickel	0.1 mg/l
		Pesticides	extensive list
Alpha Radioactivity	15 pCi/l	pH	6.0 - 8.5
Specific Conductance	1,275 μmho/cm	Phthalate Esters	3.0 μg/l
Turbidity	29 NTU	PCBs	0.001 μg/l
Zinc	1 mg/l	Selenium	0.025 mg/l
		Silver	0.07 μg/l
		Zinc	0.03 mg/l

* un-ionized

Source: Rule 17-302.560, F.A.C.

TABLE 2.3.4-7
DRY SEASON SUPPLEMENTAL WATER QUALITY MONITORING DATA

Constituent (mg/l unless noted otherwise)	Location			
	Tiger Bay East	Tiger Bay West	Camp Meeting Ground Branch	McCullough Creek
BOD5	36.3	33.3	39.3	48.3
Fecal Coliform (Cfu/100ml)	140	5	18	250
Ammonia Nitrogen	<.10	<.10	0.47	0.57
Nitrate Nitrogen	<.03	<.03	0.28	<.03
Nitrite Nitrogen	<.03	<.03	<.03	<.03
Ortho Phosphate	<.05	<.05	0.88	0.26
Total Dissolved Solids	106	142	476	774
Total Kjeldahl Nitrogen	3.34	0.74	1.60	2.56
Total Alkalinity (as CaCO3)	79.4	101	156	116
Total Coliform (Cfu/100ml)	200/H	<10/H	1,000/H	<100/H
Total Phosphorus	0.73	0.07	1.32	0.49

Notes: H = greater than 200 background colonies
Cfu = colony forming units

Source: Ebasco Environmental, 1992

TABLE 2.3.4-8
WET SEASON SUPPLEMENTAL WATER QUALITY MONITORING DATA

Constituent (mg/l unless noted otherwise)	Location			
	Tiger Bay East	Tiger Bay West	Camp Meeting Ground Branch	McCullough Creek
BOD5	3.57	3.26	<3.0	8.49
Fecal Coliform (Cfu/100ml)	40	17	290	14
Ammonia Nitrogen	<0.10	<0.010	0.17	0.15
Chlorophyll A	<1.0	<1.0	<1.0	<1.0
Nitrate Nitrogen	<0.03	<0.03	0.09	<0.03
Nitrite Nitrogen	<0.03	<0.03	<0.03	<0.03
Ortho Phosphate	<0.05	<0.03	0.75	0.14
Total Dissolved Solids	104	128	310	544
Total Kjeldahl Nitrogen	0.82	0.55	0.96	2.64
Total Alkalinity (as CaCO3)	83.5	99.5	145	73.7
Total Coliform (Cfu/100ml)	10/H	100/H	1100/H	400/H
Total Phosphorus	<0.05	<0.05	1.02	0.28

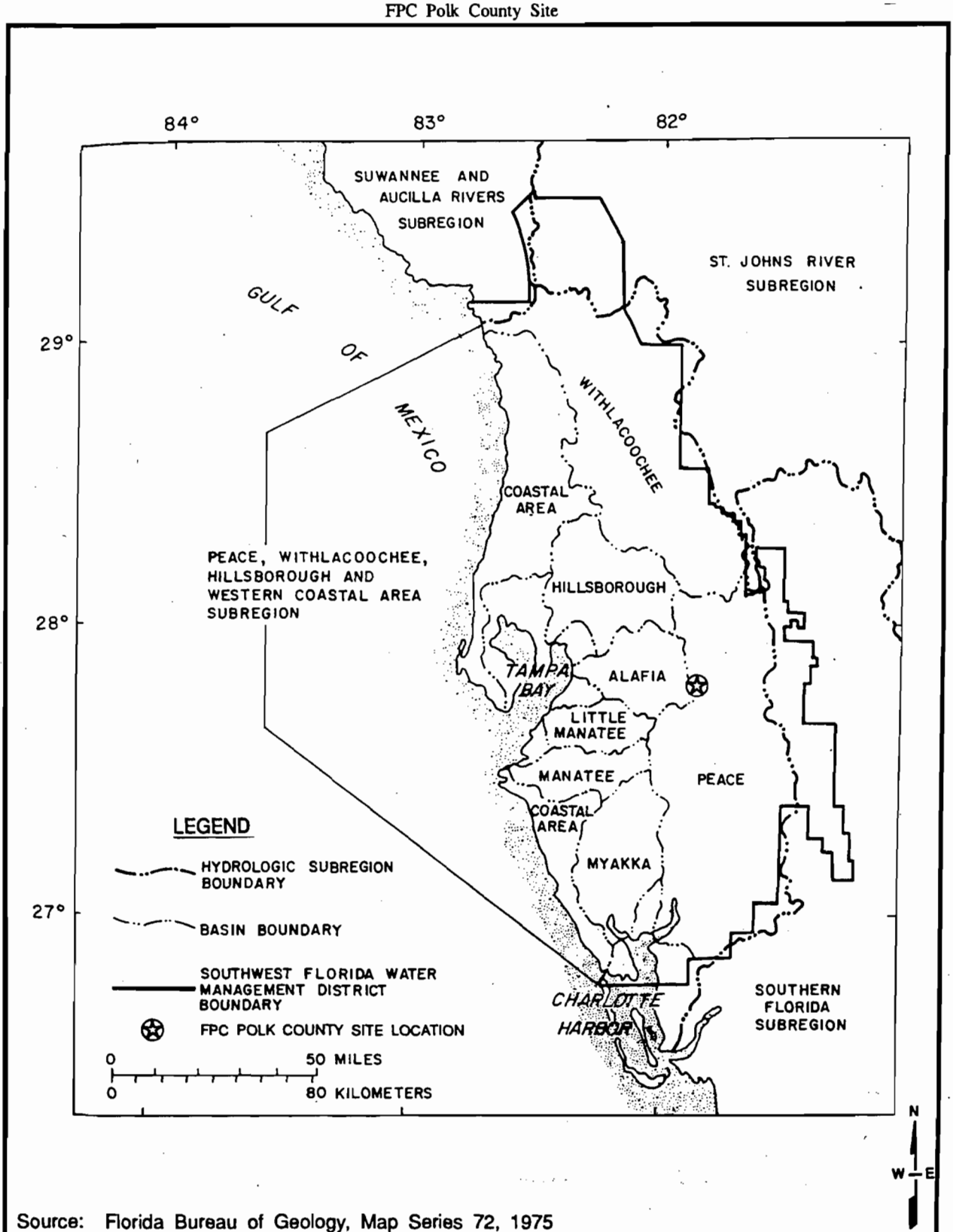
Notes: H = greater than 200 background colonies
Cfu = colony forming units

Source: Ebasco Environmental, 1992

TABLE 2.3.4-9
HISTORY OF MINING OPERATIONS ON POLK COUNTY SITE

Mining Company	Area	Start of Mining	End of Mining	Start Clay Pumping	End Clay Pumping/Status	Start Reclamation	End Reclamation
IMC	N-9	1954	1960	1961	1992	N/A	N/A
IMC	N-11A	1957	1963	1963	1973	N/A	N/A
IMC	N-11B	1961	1963	1964	Active	N/A	N/A
IMC	N-11C	1962	1965	1965	1984	N/A	N/A
IMC	N-13	1968	1969	1969	1984	N/A	N/A
IMC	N-15	1969	1974	1975	Active	N/A	N/A
IMC	N-16	1970	1980	1982	Active	N/A	N/A
IMC	TIGER BAY	1975	1978	N/A	N/A	1978	1982
ESTECH	SA-8	1972	1975	1976	1990	1990	Active
ESTECH	SA-9	1976	1977	1977	1990	1990	Active
ESTECH	SA-10	1977	1980	1981	1990	1990	Active
ESTECH	SA-11	1980	1982	N/A	N/A	1990	1991
ESTECH	SA-12	1981	1988	1965	1972	1990	Active
ESTECH	SA-13	1988	1990	N/A	N/A	1990	Active
IMC	P-2	unknown	1978	1979	1985	1990	Active
IMC	P-3	1974	1979	1980	1986	1990	Active
IMC	Phosphoria	unknown	1984	1984	Active	N/A	N/A
IMC	Triangle Lakes	unknown	1977	N/A	N/A	1977	1979
USAC	N-9	1980	1987	1987	Active	N/A	N/A

NOTES: The above table is based on available documents from the mining companies, and FDNR, as well as from interpretation of aerial photographs. Dates are approximates only.
N/A - not applicable
(1) A portion of Phosphoria has not yet been mined.
Source: Dames & Moore, 1992

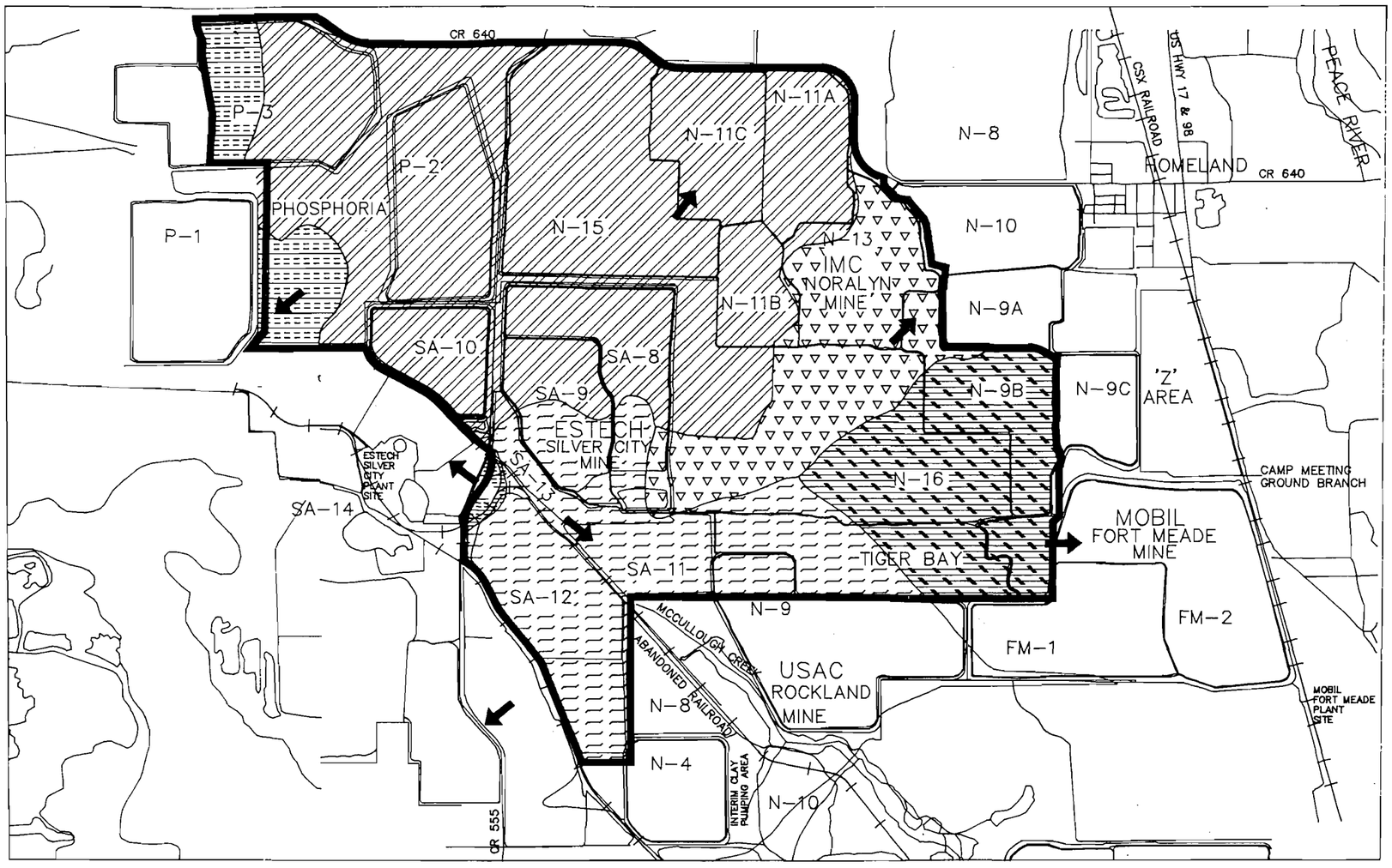


Source: Florida Bureau of Geology, Map Series 72, 1975

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Polk County Site

FIGURE 2.3.4-1
MAJOR RIVER BASINS IN VICINITY OF SITE

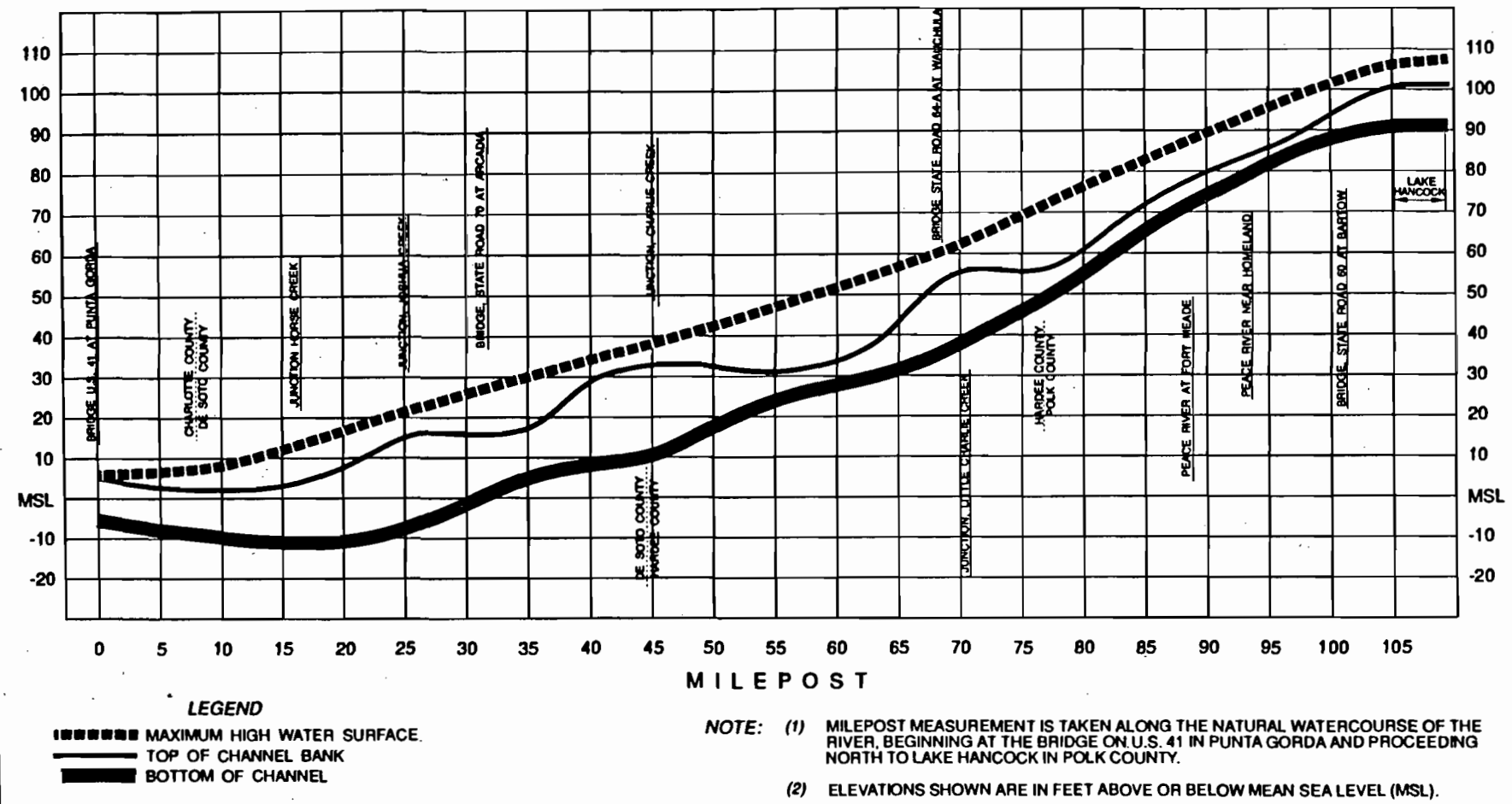


SOURCE: DAMES & MOORE, 1992

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Polk County Site

FIGURE 2.3.4-2
PRE-MINING DRAINAGE BASIN BOUNDARIES



NOTE: *(1)* MILEPOST MEASUREMENT IS TAKEN ALONG THE NATURAL WATERCOURSE OF THE RIVER, BEGINNING AT THE BRIDGE ON U.S. 41 IN PUNTA GORDA AND PROCEEDING NORTH TO LAKE HANCOCK IN POLK COUNTY.

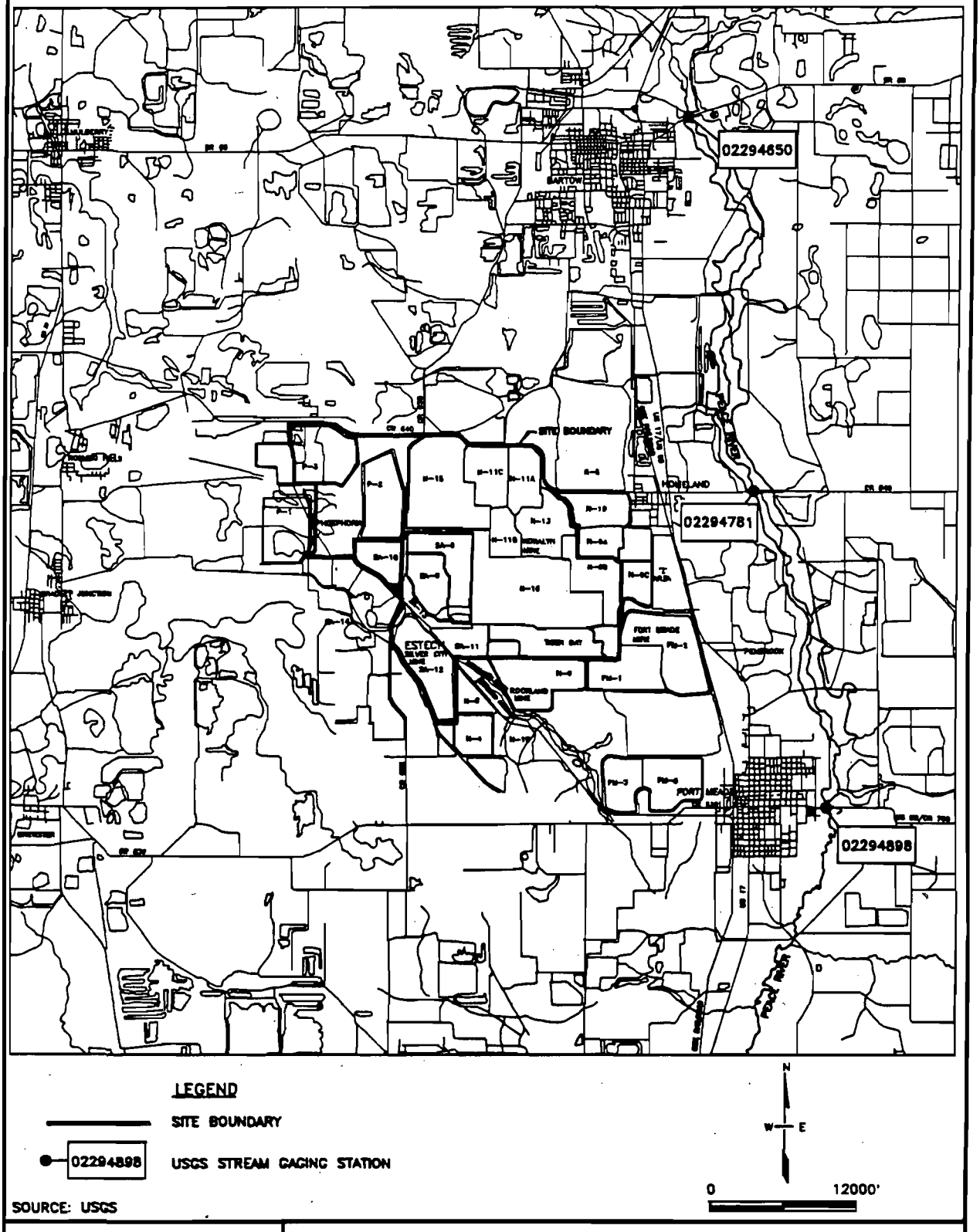
(2) ELEVATIONS SHOWN ARE IN FEET ABOVE OR BELOW MEAN SEA LEVEL (MSL).

Source: Peace River Valley Water Conservation and Drainage District, 1960

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Polk County Site

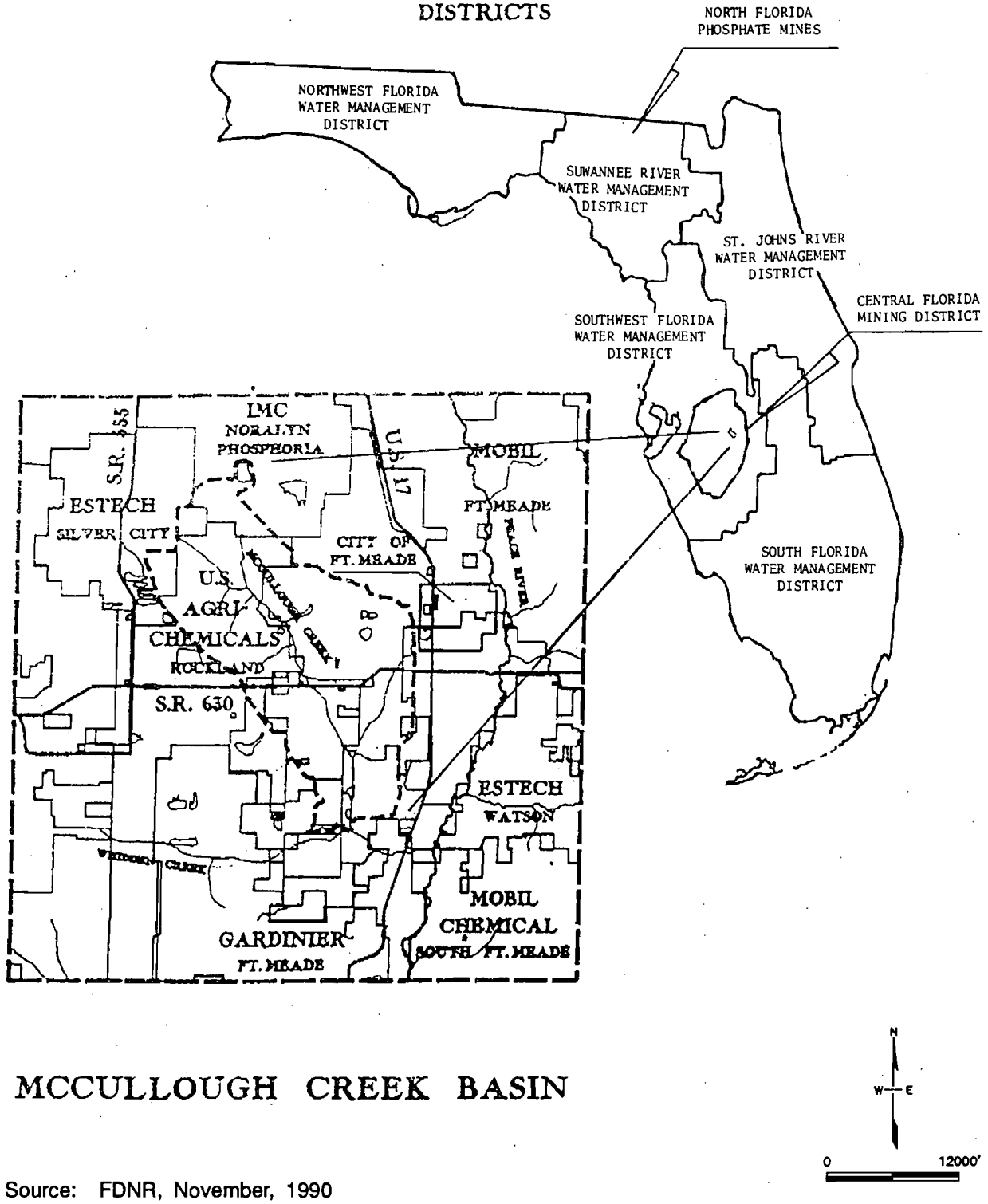
FIGURE 2.3.4-3
PROFILE OF PEACE RIVER



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FIGURE 2.3.4-4
USGS STATION LOCATIONS



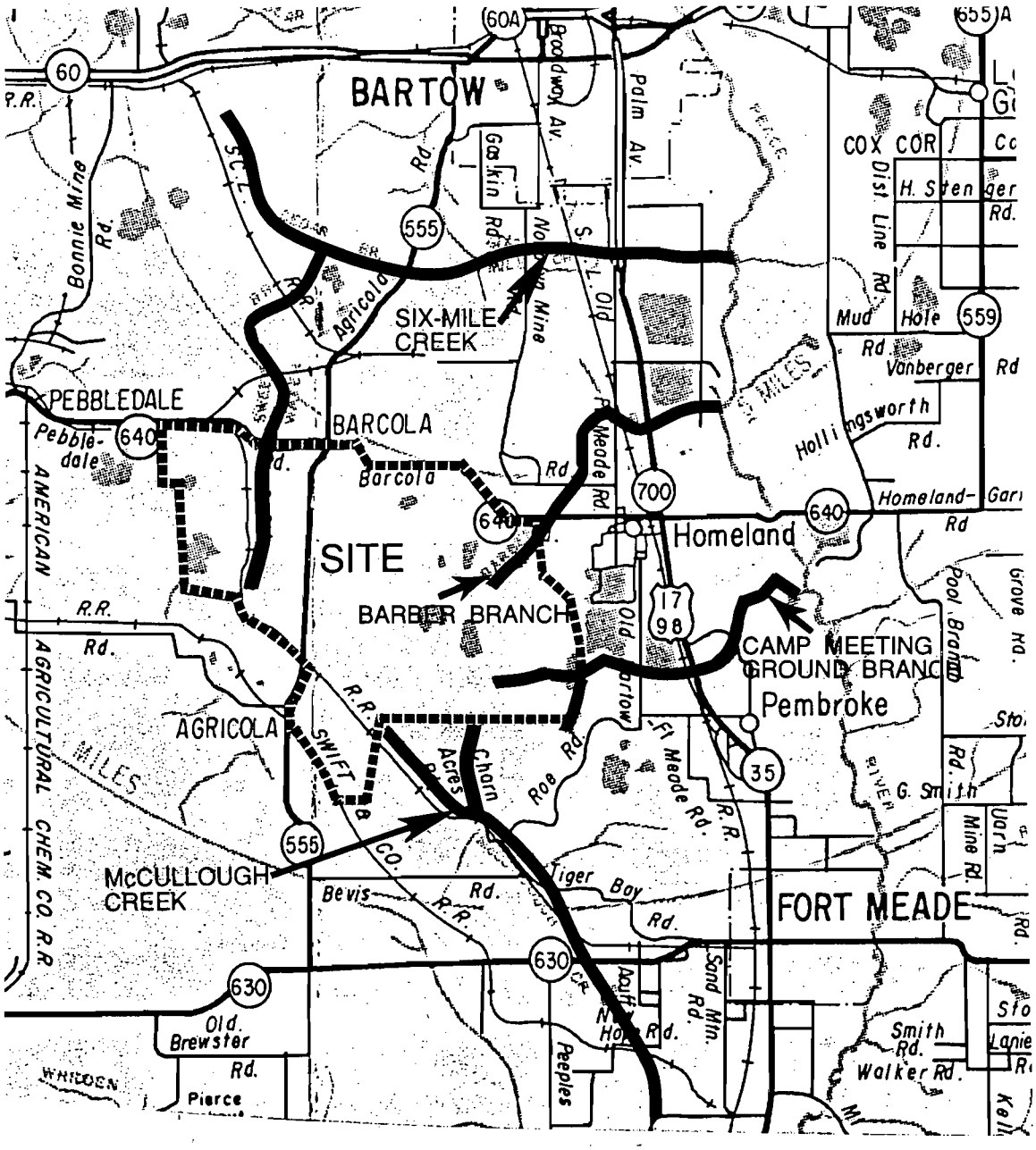
MCCULLOUGH CREEK BASIN

Source: FDNR, November, 1990

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FIGURE 2.3.4-5
PRE-MINING DELINEATION OF MCCULLOUGH CREEK BASIN

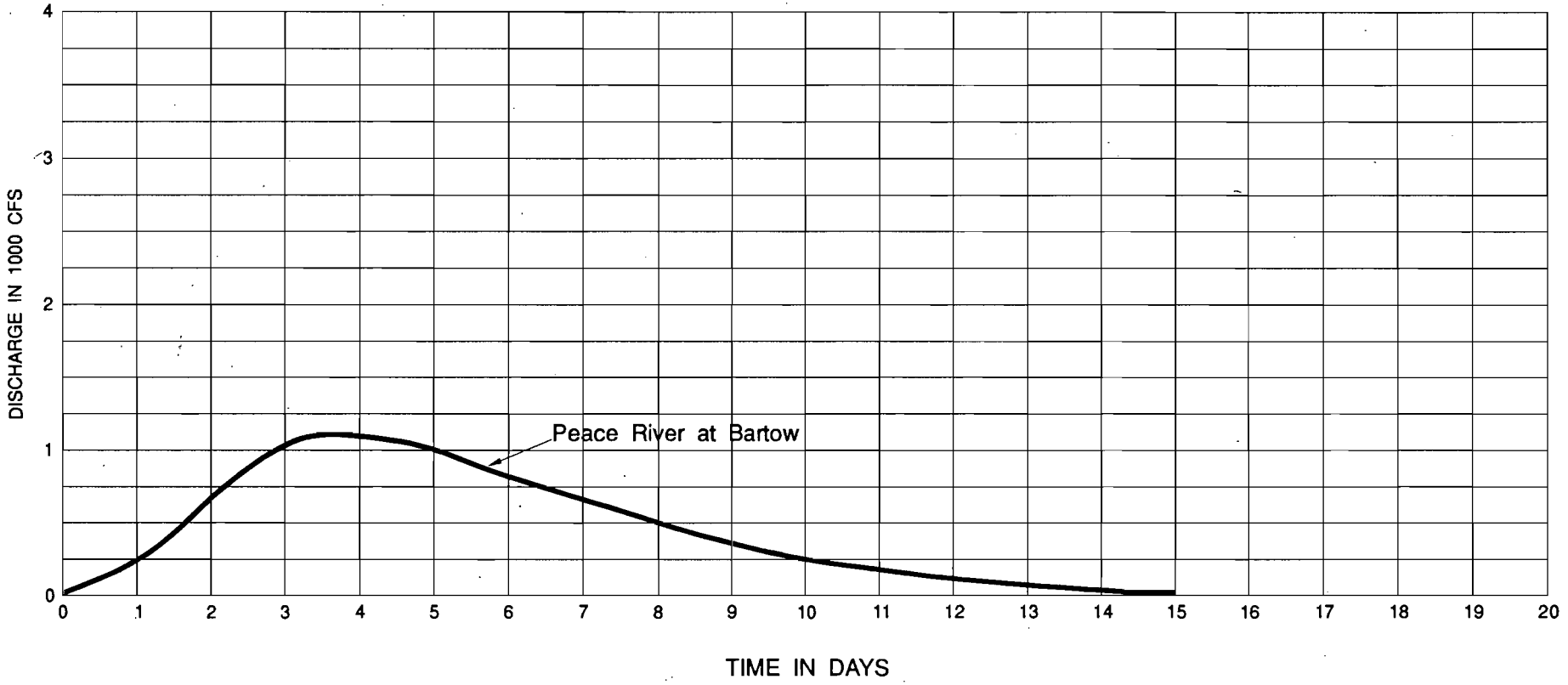


Source: Champion Maps, undated

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FIGURE 2.3.4-6
PRE-MINING ON-SITE WATER BODIES

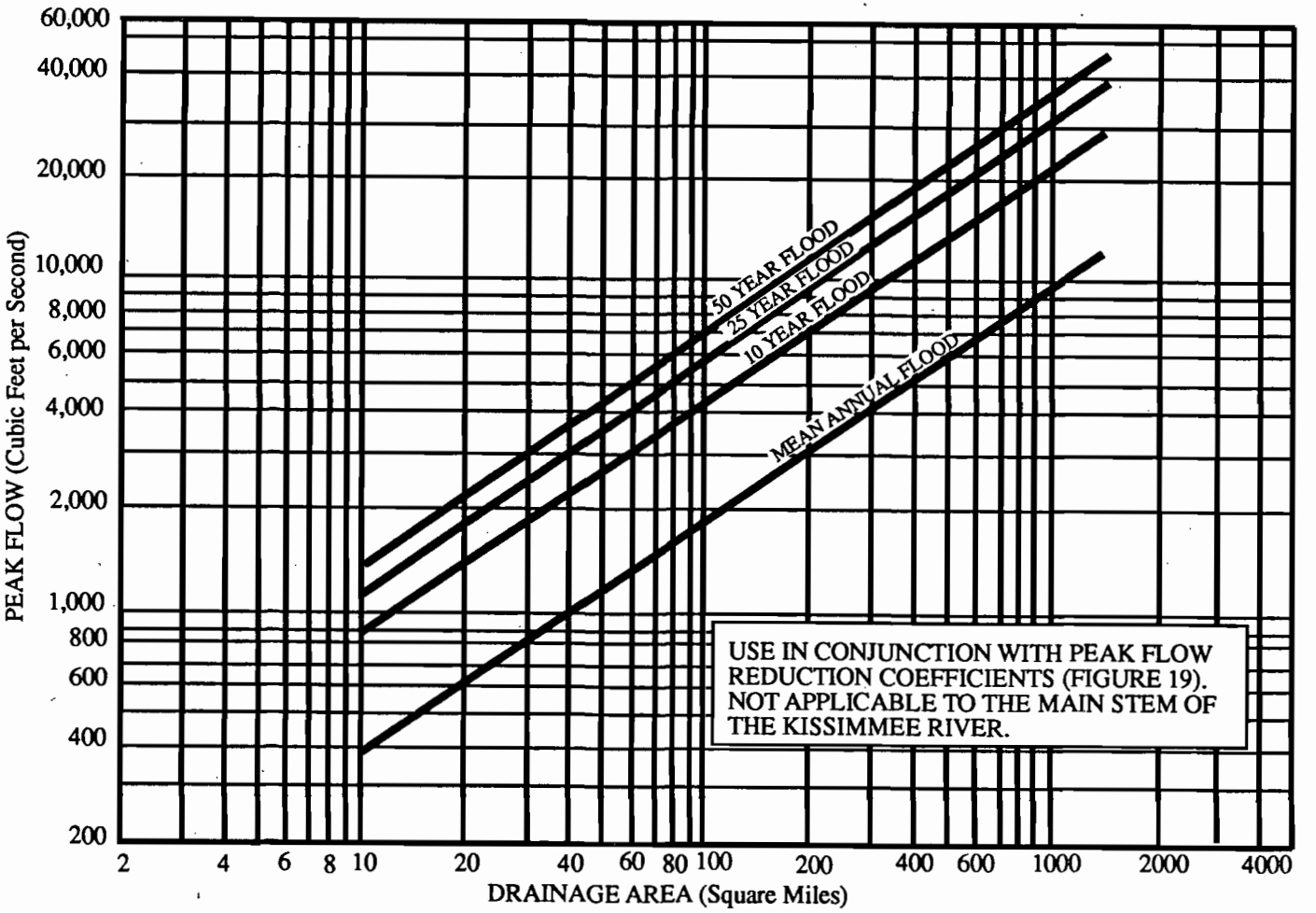


Source: Peace River Valley Water Conservation and Drainage District, 1960

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.4-7
UNIT HYDROGRAPH
PEACE RIVER AT BARTOW, FLORIDA



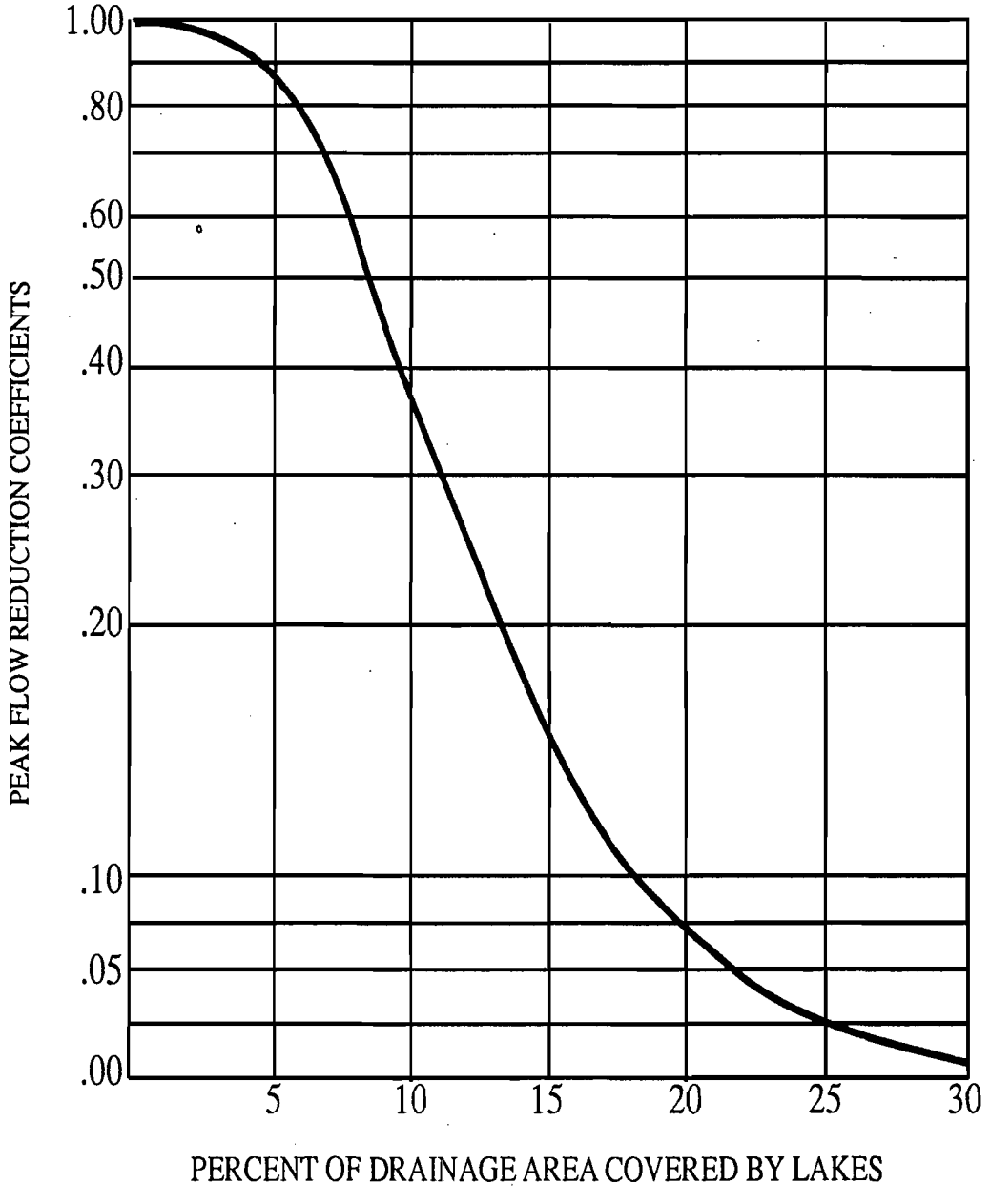
Source: U.S. Geological Survey, Tallahassee, Florida, 1961

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.4-8

PEAK FLOW, FLOOD FREQUENCY, AND DRAINAGE AREA RELATIONSHIP, POLK COUNTY STREAMS

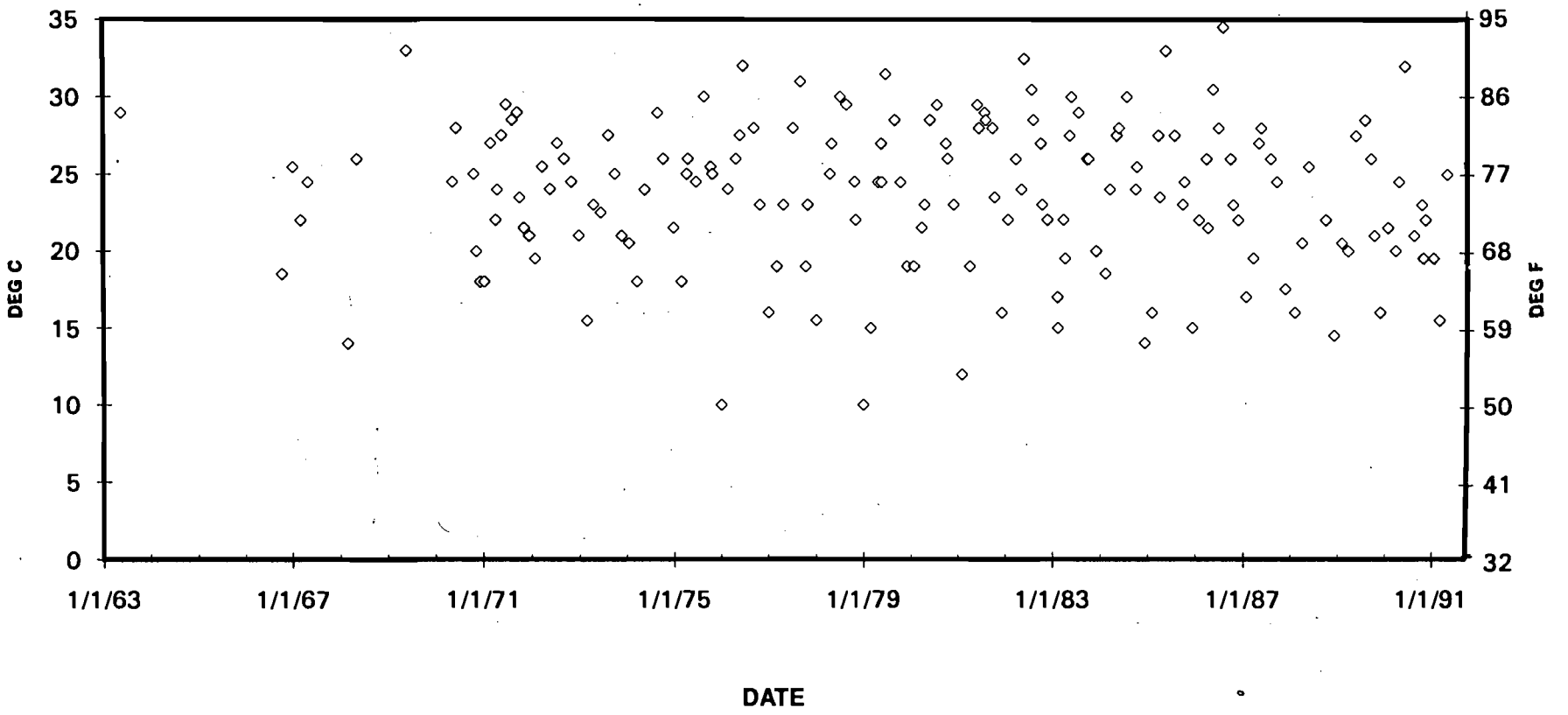


Source: Ebasco Environmental, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.4-9
PEAK FLOW REDUCTION COEFFICIENTS

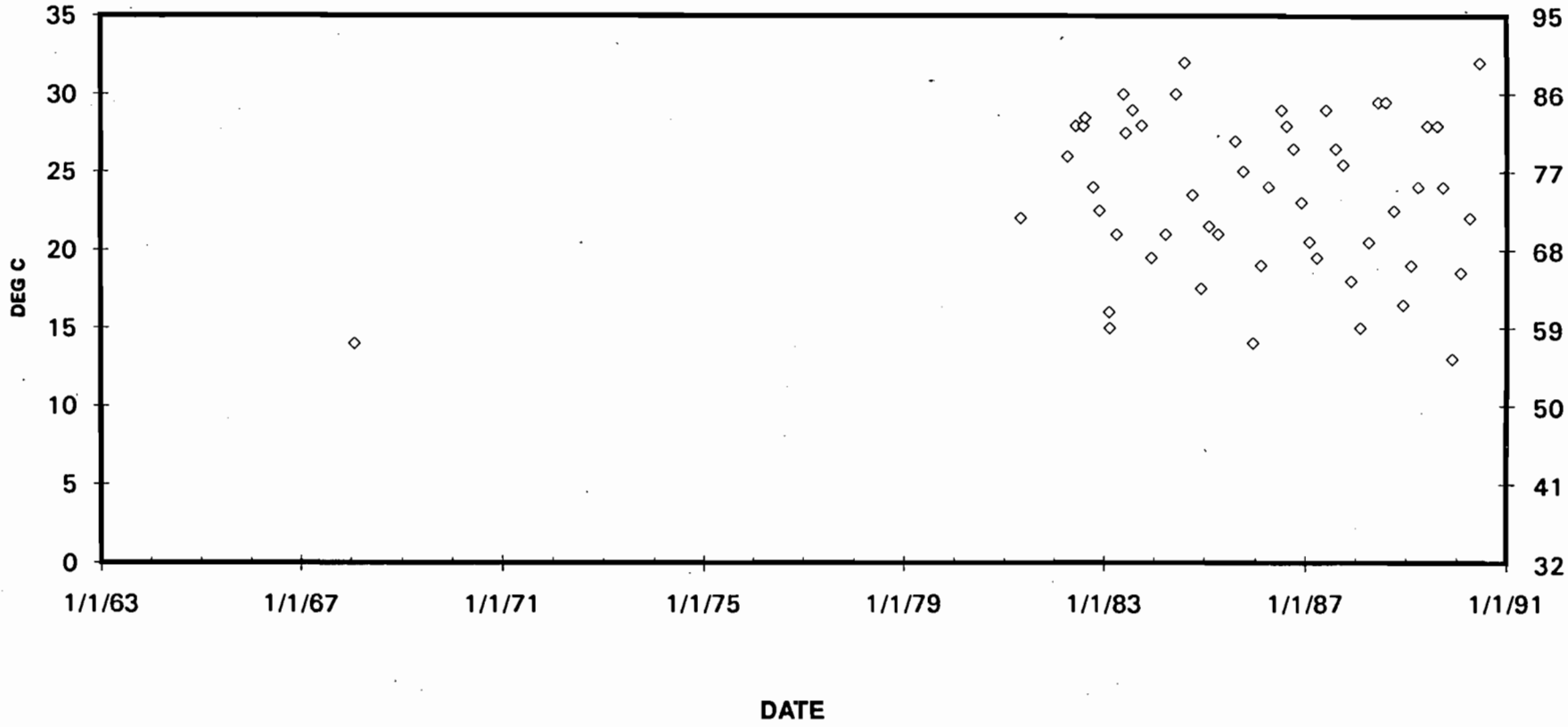


Source: Ebasco Environmental, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.4-10
WATER TEMPERATURE
PEACE RIVER AT BARTOW

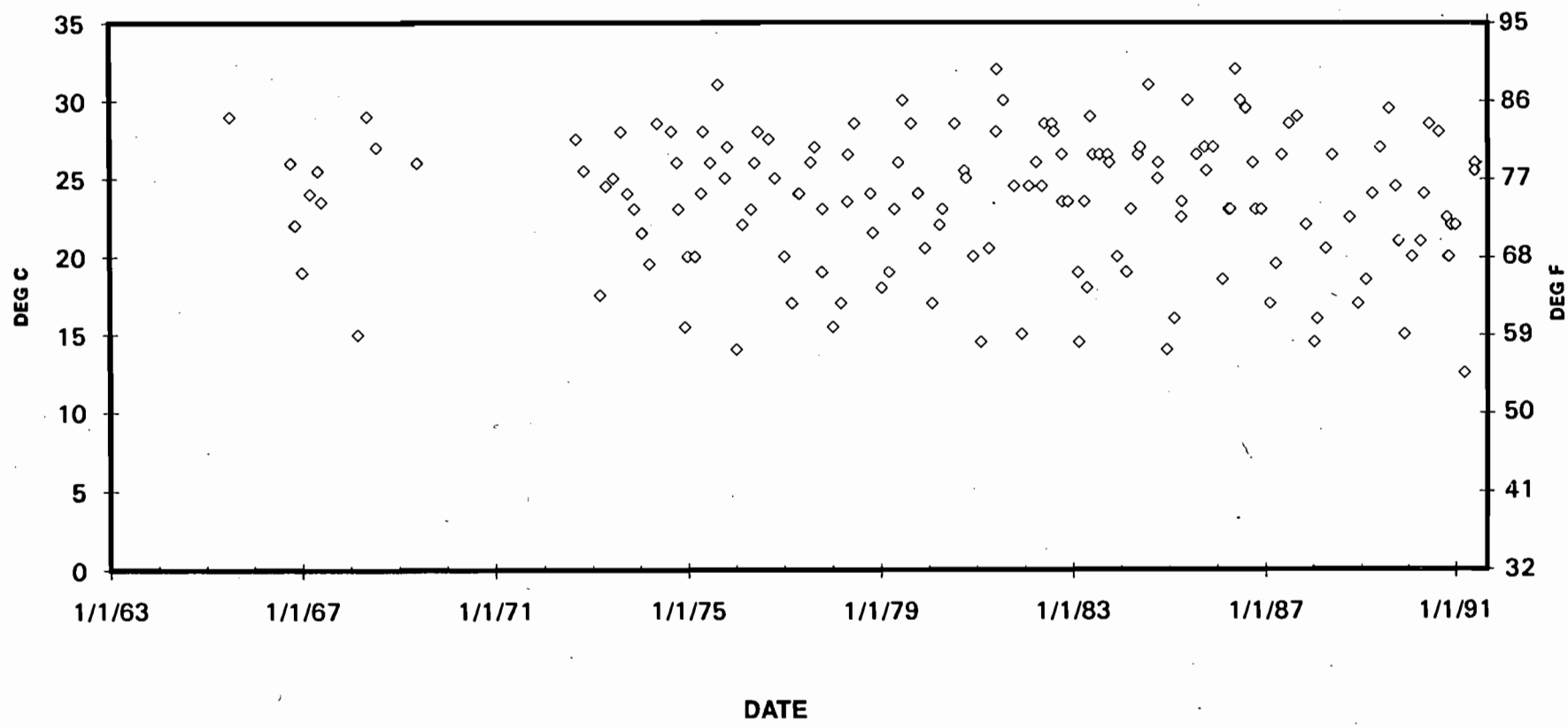


Source: Ebasco Environmental, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.4-11
WATER TEMPERATURE
PEACE RIVER NEAR HOMELAND

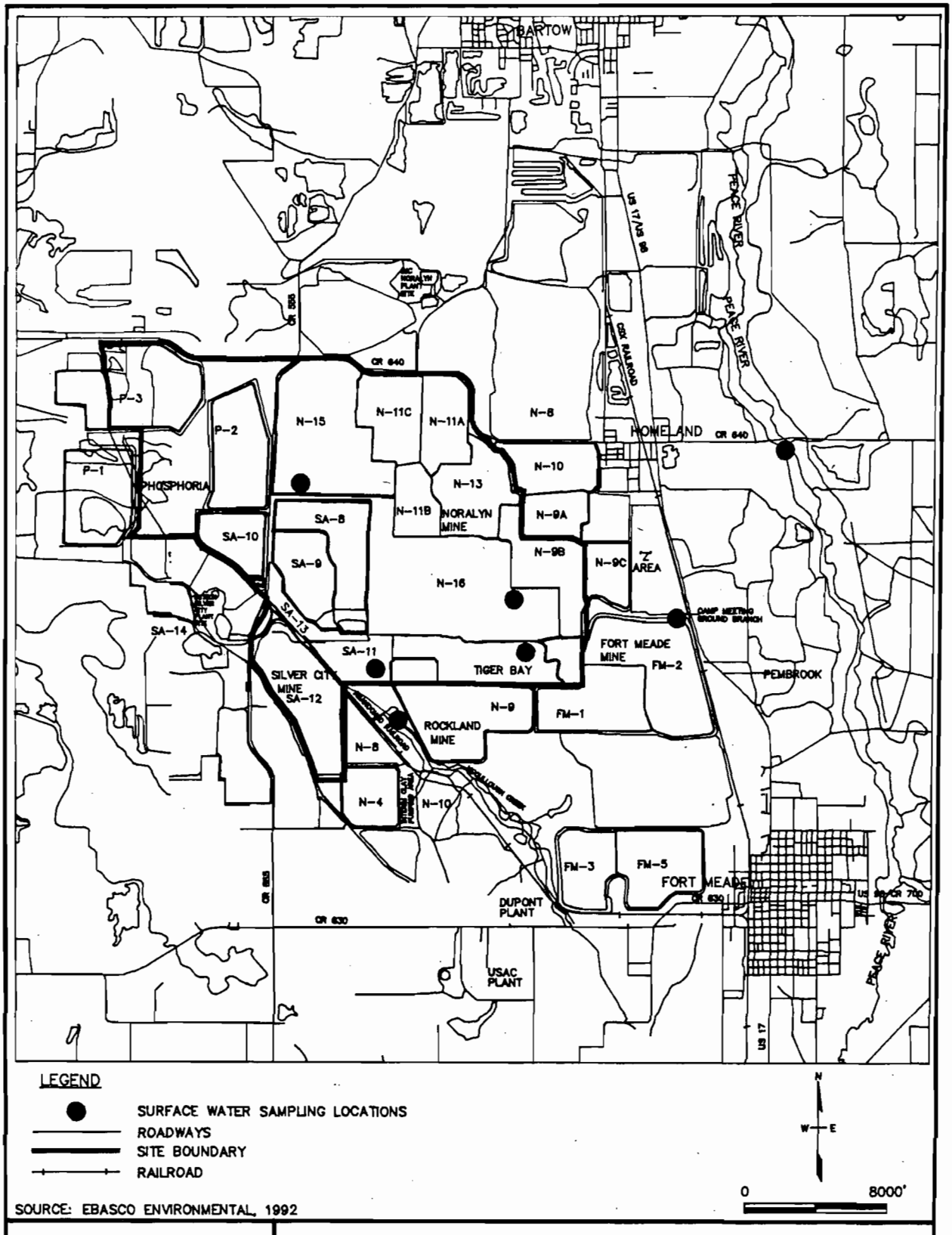


Source: Ebasco Environmental, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.4-12
WATER TEMPERATURE
PEACE RIVER AT FORT MEADE

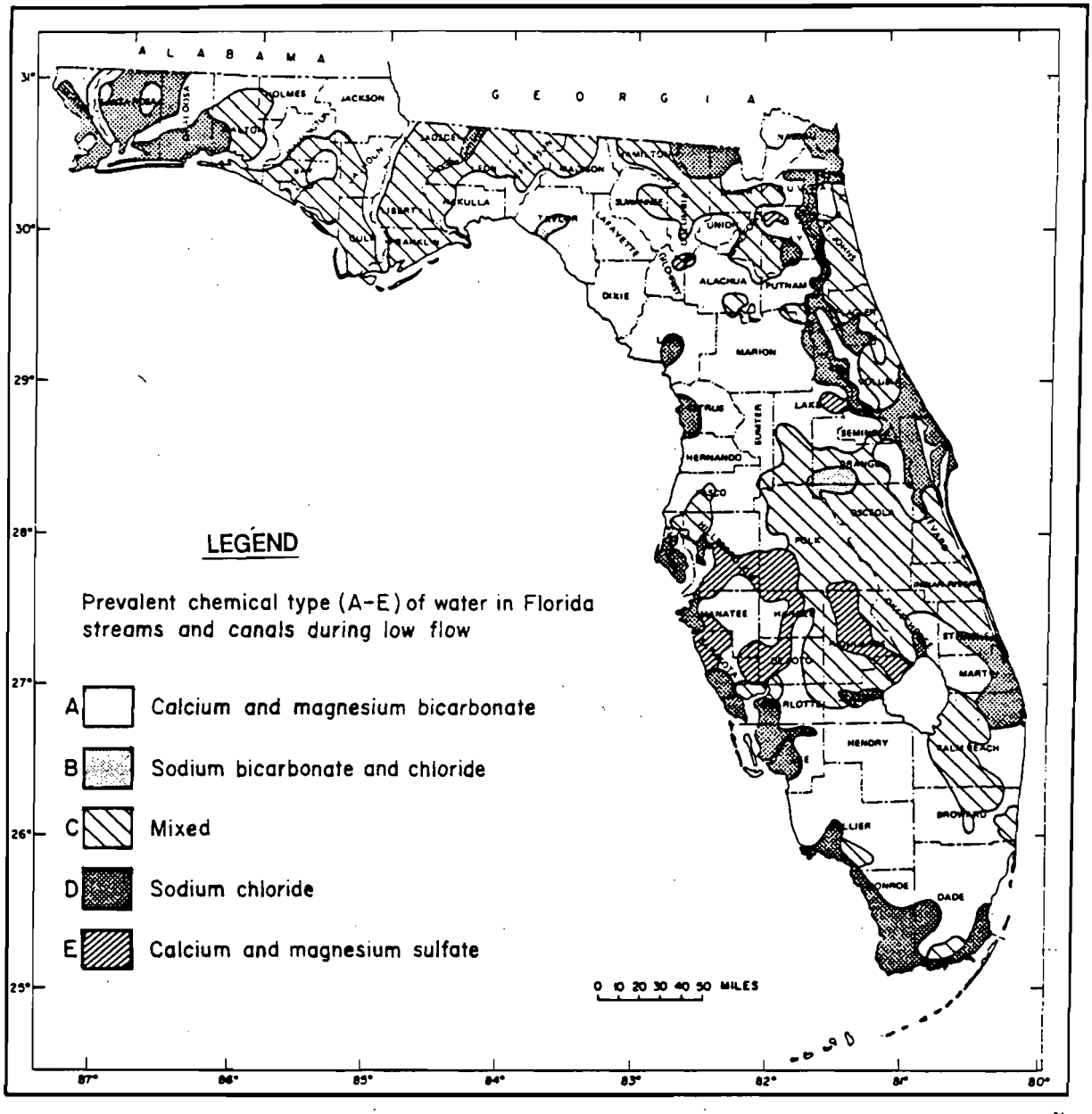


SOURCE: EBASCO ENVIRONMENTAL, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.4-13
SURFACE WATER SAMPLING SITE LOCATIONS

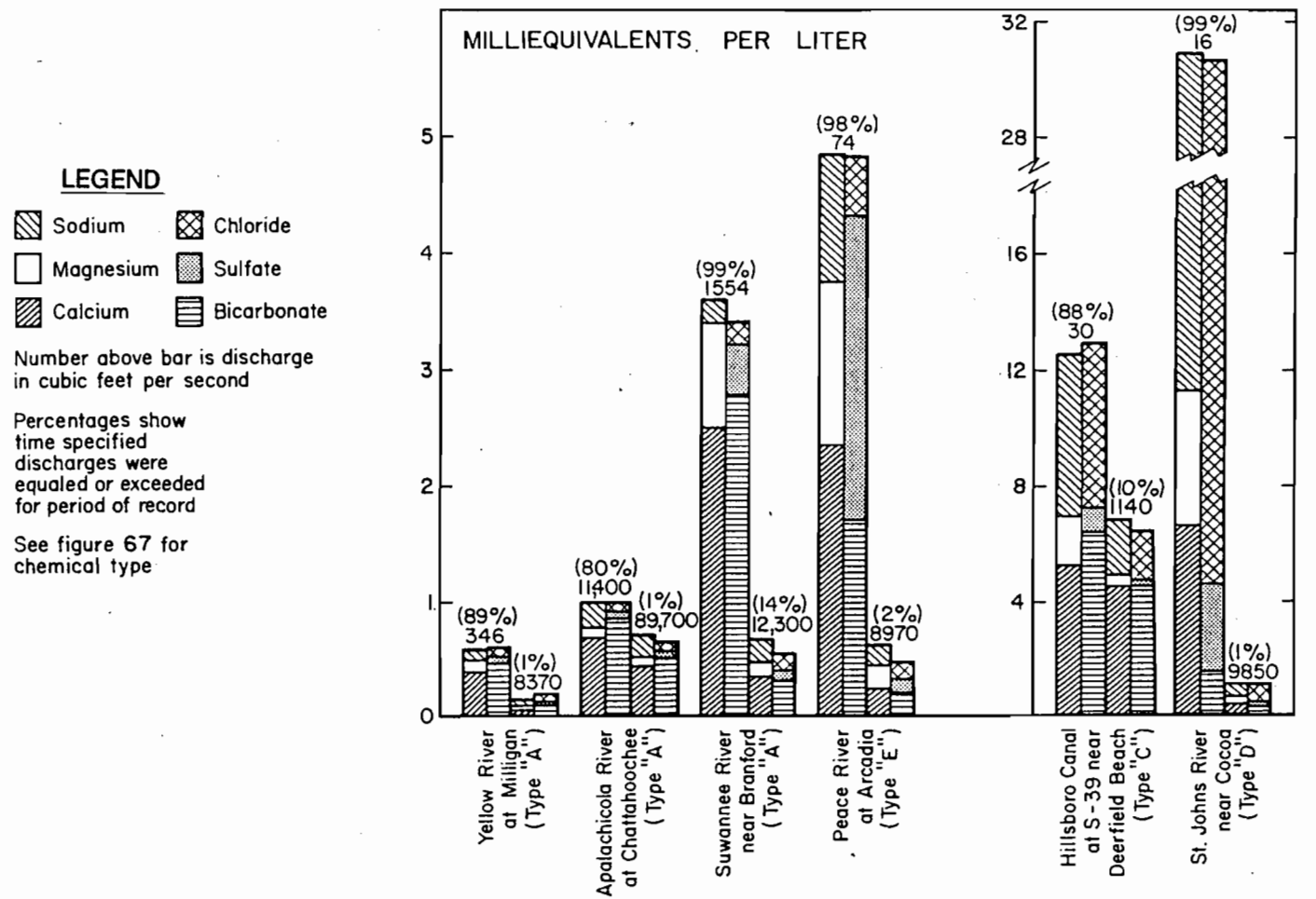


Source: USGS Open File Report 81-1107, 1981 (modified from Kaufman, 1971)

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.4-14
CHEMICAL TYPES OF WATER IN FLORIDA STREAMS

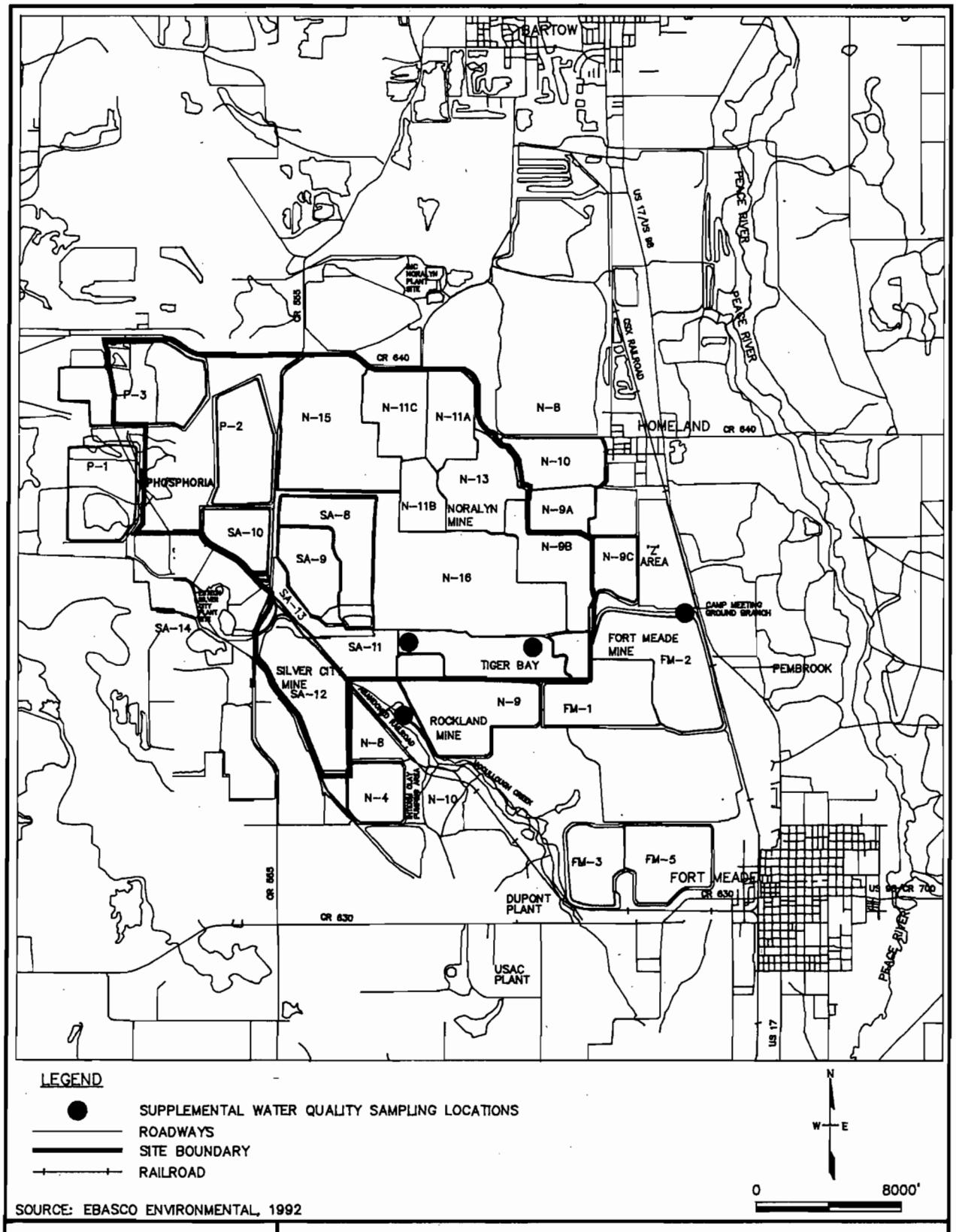


Source: USGS Open File Report 81-1107, 1981 (modified from Kaufman, 1971)

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.4-15
RELATIONS AMONG CHEMICAL COMPOSITION, CONSTITUENT CONCENTRATION, AND DISCHARGE FOR SIX FLORIDA STREAMS AND CANALS DURING LOW VERSUS HIGH STREAMFLOW

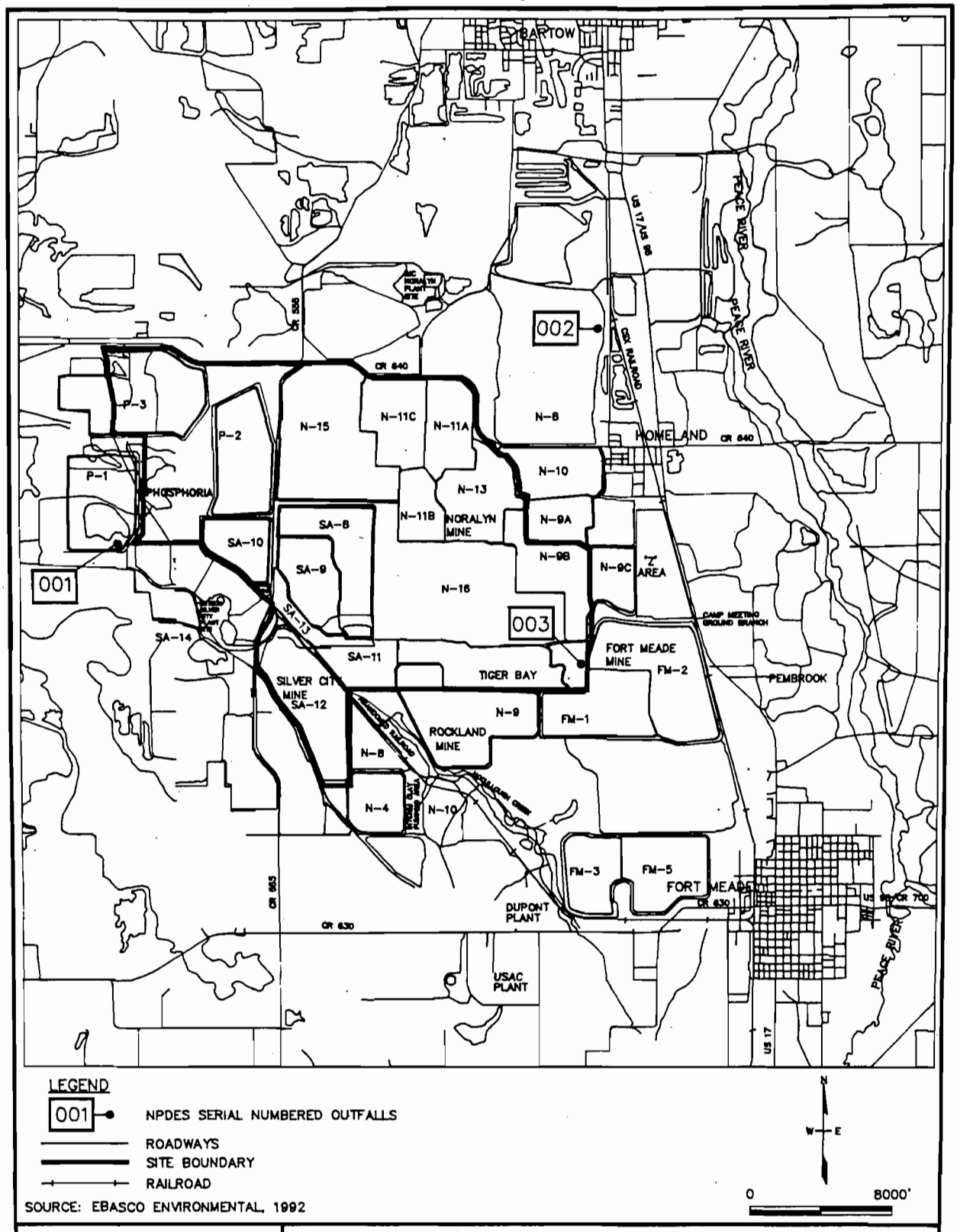


SOURCE: EBASCO ENVIRONMENTAL, 1992

Florida Power CORPORATION

Polk County Site

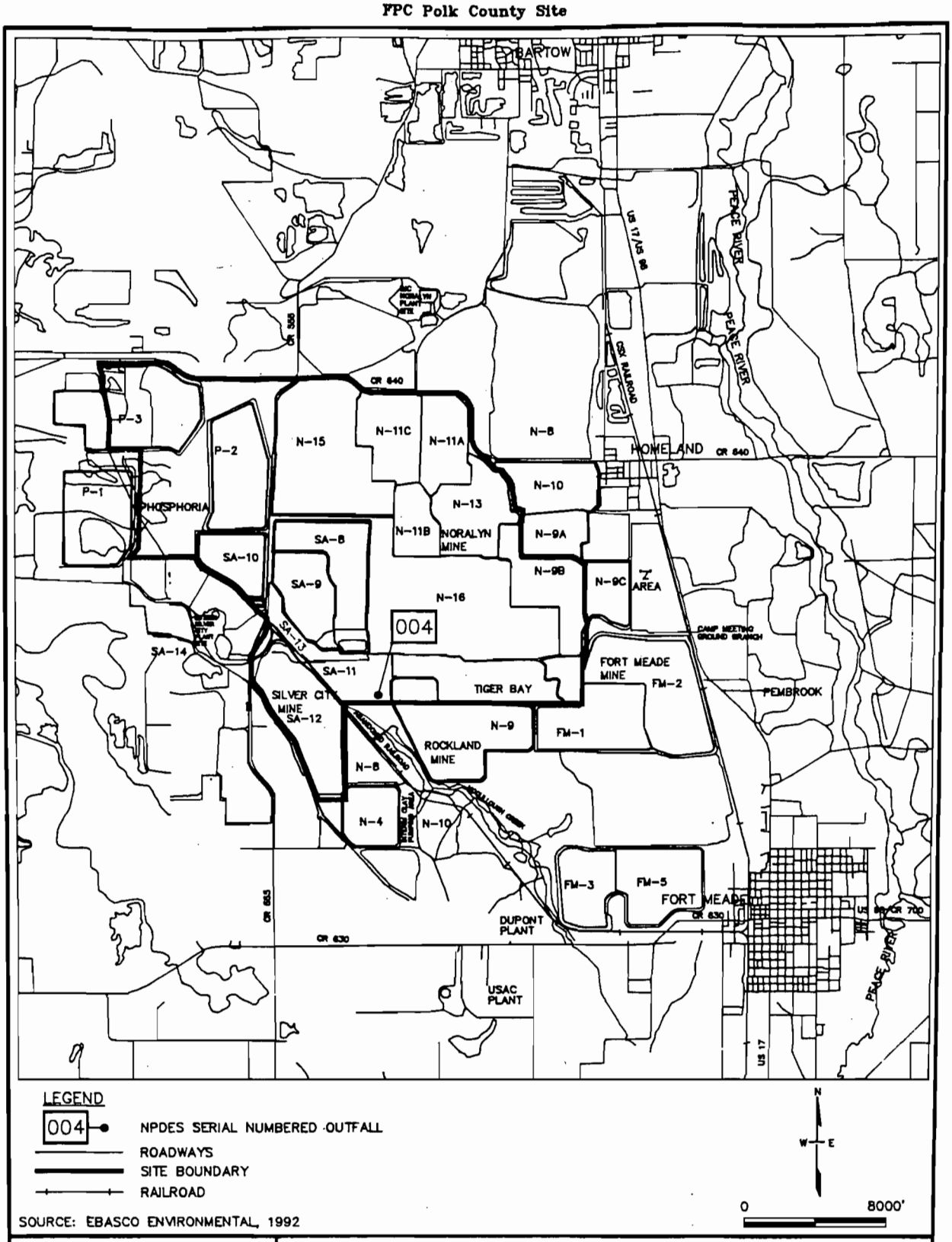
FIGURE 2.3.4-16
SUPPLEMENTAL WATER QUALITY SAMPLING SITE LOCATIONS



Florida Power CORPORATION

Polk County Site

FIGURE 2.3.4-17
IMC NPDES OUTFALLS

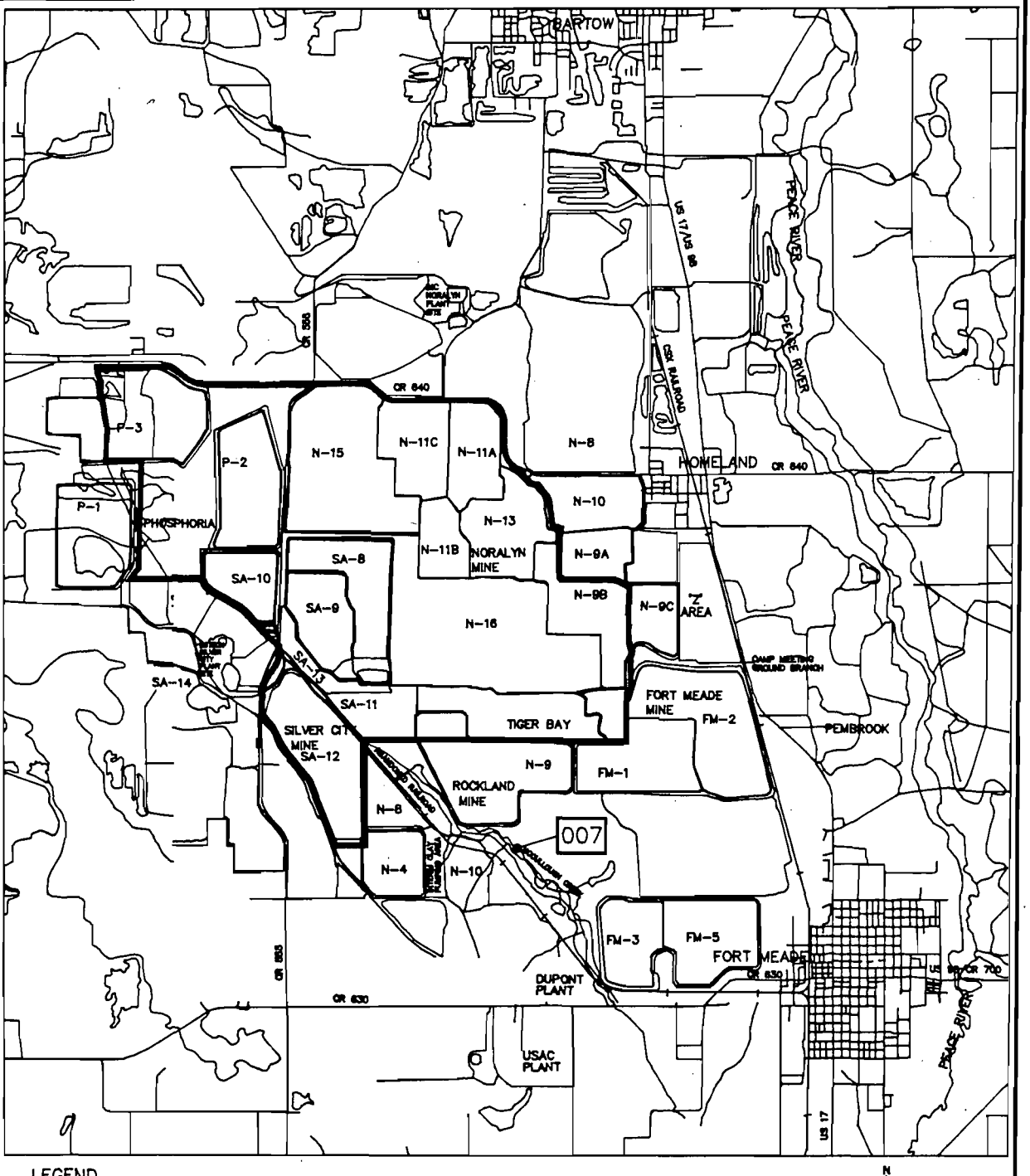


SOURCE: EBASCO ENVIRONMENTAL, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.4-18
ESTECH NPDES OUTFALL



SOURCE: EBASCO ENVIRONMENTAL, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.4-19
USAC N-9 NPDES OUTFALL

2.3.5 Vegetation/Land Use

The FPC Polk County Site consists of mandatory lands (where mining began in 1975 or more recently) and nonmandatory lands (where mining began prior to 1975). Mandatory lands are subject to reclamation plans which must be approved by the FDNR. Nonmandatory lands do not have reclamation requirements. For economic, liability and safety reasons, nonmandatory clay settling areas are dewatered by mining companies. Following dewatering, which consolidates the clays, these areas are typically converted to pasture, citrus, and cropland. Each of these land cover types have low ecological value.

As discussed in Section 2.1.2, the baseline conditions used for impact assessment purposes in this document are those land cover conditions that would exist under FDNR existing approved (pre-1992) reclamation plans for mandatory lands, and that would most likely be present at the site in the absence of the power plant for reclaimed nonmandatory lands. For reference purposes only, a summary discussion of existing conditions is presented in this section along with the discussion of baseline conditions. The status of existing conditions is temporary because mine reclamation plans and dewatering normally associated with these lands will result in major land cover alterations. Additionally, with the cessation of mining, ecological succession changes occur rapidly and dramatically in both aquatic and terrestrial vegetation communities.

2.3.5.1 Baseline Conditions

The baseline condition of the FPC Polk County Site, upon which impact assessments have been made, is the designed end product of mandatory reclamation processes as approved by the FDNR and nonmandatory reclamation as normally undertaken by mining companies. The baseline condition for SCA purposes, therefore, is the projected condition of the site at the conclusion of reclamation processes. Use of existing conditions as the baseline is not appropriate for most of the site because of the significant changes to the landscape which will result from the conclusion of mining and approved reclamation processes. The exceptions are Tiger Bay, which is a reclaimed and released area, and Tiger Bay East, which was mined and has revegetated naturally without reclamation.

SITE DESCRIPTION

Figures 2.3.5-1 and 2.3.5-1A through 2.3.5-1F are vegetation/land use maps of the site under reclaimed baseline conditions. According to FDNR (1992) quarterly reclamation reports, the Polk County Site includes 3,681 acres of mandatory lands and 4,485 acres of nonmandatory lands. The two mining companies that own most of the land on the site have reclamation projects in progress on several portions of the site. These projects usually consist of conversion of mined lands to pasture or citrus grove. Approximately 5,898 acres of the proposed site would probably be converted to pasture or citrus grove under the as-reclaimed baseline conditions (Table 2.3.5-1). Tiger Bay (417 acres) has been reclaimed to a mixture of uplands, wetlands, and open water, and subsequently released by the FDNR. Additionally, the Tiger Bay East area (102 acres) was mined and has naturally revegetated to a mixture of upland, wetlands, and open water. The balance of 1,749 acres is currently approved for reclamation to a combination of upland and wetland vegetation community types.

The following vegetation/land use types would be present in the site area under the reclaimed baseline condition. Classification is based on Levels I and II Florida Land Use, Cover and Forms Classification System.

- Agricultural
- Native uplands
- Wetlands
- Lakes

DOMINANT INDICATOR VEGETATION

In order to characterize the vegetation/land use types identified above, vegetative cover was surveyed with one transect on-site and qualitative descriptions of reclaimed and released IMC lands both on-site and off-site as described in Section 2.3.6.3. Survey locations were selected as representative of what the site would become under as-reclaimed baseline conditions.

Quantitative surveys were conducted during the wet season (November 1991) and dry season (March 1992) in the mandatory portion of P-2. Transect profile information is provided in Tables 2.3.5-2 and 2.3.5-3. Qualitative surveys were conducted in the Spring (June 1992) in

Tiger Bay and Tiger Bay East, and three areas off-site: West of K-6 reclamation site, Hookers Prairie reclamation site, and Homeland-9 reclamation site. Survey data on these reclaimed and released areas were supplemented by the review of IMC monitoring reports provided in Appendices 10.5.5.3 through 10.5.5.6. Vegetative cover is described below. Taxonomic nomenclature was based on Wunderlin (1982) and protected species status was based on Wood (1991).

On-site quantitative surveys were conducted in P-2. P-2 is currently in the latter stages of reclamation to upland agriculture but has not been released by the FDNR. It was previously used as a clay settling area during mining operations. The reclamation procedure presently occurring involves drainage and vegetation clearing with the future use as agricultural land.

An on-site qualitative survey was performed in Tiger Bay and Tiger Bay East. Tiger Bay is composed of 417 acres of uplands, wetlands, and open water lakes. Mining was completed in the area in 1978 (Appendix 10.5.5.3). Reclamation activities such as grading, seeding, mulching, and fertilization were completed in 1982, but planting continued until 1986. The FDNR released Tiger Bay in 1988. Tiger Bay East is a nonmandatory tract that was mined and abandoned over 30 years ago. The area was never used for clay settling purposes. Since abandonment, Tiger Bay East has revegetated naturally without the assistance of a reclamation program. It is currently a mix of forested wetlands, uplands and small lakes.

Three off-site areas were selected as being representative of vegetation communities which would be expected at the FPC Polk County Site under baseline conditions. Emphasis on the selection of these areas was on both the maturity and types of vegetation communities. The maximum maturity of these lands is about twelve years because mandatory reclamation has only been required for mining begun after 1975. No mandatory reclaimed forested lands, for example, could be much over 15 years old. The off-site reclaimed lands selected as representative of baseline conditions are all IMC properties. Consequently, the reclamation procedures used are those of the principal mining company of the site.

The West of K-6 reclamation site was released by FDNR in August 1985 (Appendix 10.5.5.4). The site contained agricultural, upland, wetland, and open water habitats. Planting of wetland species began in 1982 and concluded in 1984. In 1986, the upland plantings were completed. The reclamation plan included not only native plant communities but also a 20-acre orange grove. A key feature of this program is the connection of the reclaimed West of K-6 wetland

with the Hall's Branch tributary system. In effect, the West of K-6 wetland now forms the headwaters of the Hall's Branch system.

The Hookers Prairie reclamation site consisted of a 125-acre recreated wetland (Appendix 10.5.5.5). The wetland was constructed and planted in early 1990. This restoration site was created as mitigation for a 96-acre portion in the northwest perimeter of Hookers Prairie which was initially isolated in 1985.

The Homeland-9 site was one of the first IMC wetland reclamation sites to be planted and released (Appendix 10.5.5.6). It is located on the western edge of the Peace River floodplain forest, but it occurs at a considerably higher elevation. The site consists of upland, wetland and open water habitats. Homeland-9 is a relatively old mine site and the wetland portions were created by incompletely filling a clay settling pond with sand tailings. The planting and other revegetation tasks were completed in 1981.

All four reclaimed areas (Tiger Bay, West of K-6 reclamation site, Hookers Prairie reclamation site, and Homeland-9 reclamation site) were planted with large numbers of a variety of native plant species (see Appendices 10.5.5.3 through 10.5.5.6). The contouring of the land before planting, the species chosen for planting, and the patterns in which species were planted have the goal of achieving specific acreage figures of desired community types. Some community types were developing well, but all had been hindered by mortality of planted species and/or competitive pressure from undesirable invasive species.

These on-site and off-site areas form the basis for the following discussion of baseline conditions for the projected site vegetation cover types. Table 2.3.5-4 shows which locations reflect the baseline condition vegetation types.

Reclaimed agricultural land in West of K-6 and the Polk County Site vicinity was generally one of three types: cropland, pasture, or citrus. All three types were well drained, low in plant species diversity and exhibited minimal wildlife usage. Pastures were either improved or unimproved. Improved pastures were usually graded and seeded so that desirable forage grasses dominated the ground cover. Improving a pasture decreases plant species diversity. Citrus and most crop species require well drained soils. The soils were also regularly disturbed by the planting and replanting processes. In addition, the regular application of pesticides and herbicides have obvious detrimental effects to habitat quality.

There were generally two types of uplands observed in the on-site and off-site reclamation areas: upland herbaceous/shrub and upland forests. Upland herbaceous/shrub was often dominated in the herbaceous layer by invasive weedy plans such as cogongrass (Imperata cylindrica), bahia grass (Paspalum notatum), hairy indigo (Indigofern hirsuta), shy-leaves (Aeschynomene americana) and various other grasses and herbs. The shrub layer (not always present) was often dominated by species such as groundsel tree (Bacharis halimifolia) and wax myrtle (Myrica cerifera). Upland herbaceous/shrub closely resembles unimproved pasture.

The second type of upland is upland forests. The upland forests in the reclamation areas were not well developed, but Tiger Bay East, which has naturally revegetated, contained some relatively mature second growth upland forest dominated by live oak (Quercus virginiana), and black cherry (Prunus serotina). Upland forests in reclaimed areas typically contained species such as live oak (Quercus virginiana), laurel oak (Q. laurifolia), slash pine (Pinus elliottii), longleaf pine (P. palustris), elm (Ulmus americana), sugarberry (Celtis laevigata), black cherry (Prunus serotina), southern red cedar (Juniperus silicicola), wax myrtle (Myrica cerifera) and various herbaceous species. All the above named species were planted during the reclamation process.

Wetlands were generally of two types: forested wetland and herbaceous wetland. Typically, the forested wetlands in the reclaimed areas were restricted to a relatively narrow band around lake margins where favorable soil moisture conditions exist. This vegetation type was developing relatively well in most of the reclaimed sites visited. High mortality was locally observed where planted individuals experienced flooding or desiccation beyond their ability to survive. Forested wetlands contained species such as Carolina willow, groundsel tree, pop ash (Fraxinus caroliniana), red maple (Acer rubrum), sweetgum (Liquidambar stryraciflua), water hickory (Carya aquatica), blackgum (Nyssa sylvatica var biflora) and bald cypress (Taxodium distichum). All the above species were planted except for Carolina willow, primrose willow, and groundsel tree, which have become established naturally. These three invasive undesirable species place competitive pressure on this vegetation type.

The herbaceous wetlands, the second type of wetlands, in the reclaimed areas were either located along the fringes of lakes or in low areas which remain flooded most, if not all, of the year. This vegetation type typically requires deeper water and longer periods of flooding than forested wetlands require. One of the reclaimed areas visited (Hookers Prairie) contained a high diversity of desirable herbaceous species with very few invasive undesirable species present (i.e.,

cattail). Invasive species were being eradicated from the Hookers Prairie site by periodic herbicide spraying. The herbaceous wetlands typically contained species such as cattail (Typha sp.), pickerelweed (Pontederia cordata), marsh pennywort (Hydrocotyle umbellata), smartweed (Polygonum punctatum), torpedo grass (Panicum repens), water lettuce (Pistia stratiotes), spatterdock (Nuphar lutea), waterlily (Nymphaea sp.), golden canna (Canna flaccida), arrowhead (Sagittarria sp.), alligator flag (Thalia genticulata), soft rush (Juncus effusus), common water nymph (Najas quadalupensis), duckweed (Lemna obscura), and mosquito fern (Azolla caroliniana). The only above species planted or seeded during the reclamation process were pickerelweed, smartweed, soft rush, golden canna, and arrowhead. The remaining species had become established in the areas by natural means.

Open water lakes were present in Tiger Bay, West of K-6, and Homeland-9 reclamation site. All of the lakes had an abundance of both emergent (i.e. cattails) and submergent (i.e. Hydrilla) vegetation along margins and often extending far into open water areas. The ecological quality in these areas was medium to high based on wildlife usage.

VEGETATION COMMUNITY QUALITY AND CONDITION

A qualitative evaluation of overall vegetation community quality is summarized in Table 2.3.5-1. Mapped data and descriptive accounts which follow reflect site conditions as they would likely occur with as-reclaimed baseline conditions.

Agricultural land would dominate the site covering approximately 70 percent of the area. Agricultural land is considered low in ecological quality. The remaining 30 percent of the site would be composed of uplands, wetlands, and open water lakes. As shown in Table 2.3.5-1 and stated above, approximately one-fourth (519 acres) of the remaining 30 percent is already present in reclaimed and released Tiger Bay, and Tiger Bay East. By factoring out already present wetlands in Tiger Bay and Tiger Bay East, there would be a total of 866 acres of wetlands (excluding open water lakes) yet to be created under the existing approved (pre-1992) reclamation plans. With the implementation of the existing approved (pre-1992) reclamation plans for N-16, seepage from this area into Tiger Bay would be essentially eliminated. Loss of this seepage source would result in significantly lower water levels in Tiger Bay and the transition of current wetlands in Tiger Bay to uplands.

It is assumed that uplands, wetlands, and lakes would develop into community types of medium ecological quality following reclamation based upon inspections of other reclamation in progress. However, many environmental factors would determine the success of their establishment and development. For example, it has been shown that hydrology, nutrient availability, and soil condition affect the survival of planted tree seedlings during standard reclamation procedures (Paulic, 1991). Additionally, long term success can often be dictated by competition between desirable planted species and undesirable invasive species which typically dominate unreclaimed mine areas.

Tiger Bay is considered low to medium in ecological quality. The planting of over 30 wetland and transitional species during reclamation has increased the plant species diversity of Tiger Bay. Some of the planted tree and shrub species are well established and formed narrow bands along lake margins. However, cattail, carolina willow, and hydrilla (Hydrilla verticillata) clearly dominate the majority of the wetlands. These three undesirable invasive species have not been planted or seeded but instead have become established by natural means.

Tiger Bay East is also considered low to medium in ecological quality. The area had revegetated naturally and contains some relatively mature second growth upland forests. In fact, the small (102 acres) area contains the majority of the upland forest community types on-site. Tiger Bay East has relatively high plant species diversity and exhibits some plant community types at intermediate stages of successional development.

SUMMARY

Under the reclaimed baseline conditions, approximately 70 percent of the site would end up as agricultural land. The remaining 30 percent would be composed of uplands, wetlands, and lakes. The ecological quality of the uplands, wetlands, and lakes would be highly dependent upon the long term success of the existing approved (pre-1992) reclamation plans.

2.3.5.2 Existing Conditions

SITE DESCRIPTION

The site currently exhibits nearly the complete range of mining operations, from land that has not yet been mined to mined land which has been reclaimed and released. The majority of the site consists of clay settling ponds in various stages of filling. The various stages of settling ponds include partially filled, nearly filled, and areas being drained for purposes of clay consolidation prior to being reclaimed to a different land cover type. For example, N-16 is in the earliest stages of being filled with clays, N-15 is nearly filled, and SA-8 and SA-9 are completely filled and undergoing drainage and vegetation removal.

Due to the nature of clay settling ponds, these areas are often invaded by vegetation before they are drained. Ecological succession rapidly progresses in many clay settling areas from cattail dominance to dense shrub dominance. The soil base is made up of fine clays mixed with some sand. Following clay deposition, evaporation and drying of the soil results in the formation of a crust overlying the very soft clays. Typically, clay settling areas are drained and vegetation is removed as part of the clay consolidation process during reclamation to allow an alternate upland land use.

Tiger Bay, which has been mined, reclaimed, and released by FDNR, and nonmandatory Tiger Bay East are discussed in Section 2.3.5.1, Baseline Conditions.

DOMINANT INDICATOR VEGETATION

Vegetation community types on-site were surveyed at station locations as described in Section 2.3.6.3. Qualitative surveys were conducted during the wet (July and August 1991) and dry (March 1992) seasons. Data summaries are provided in Appendix 10.5.5.1.

The majority of the site presently consists of shrub/forested wetland dominated by Carolina willow, herbaceous wetland dominated by cattail, and open water lakes. As stated earlier, Carolina willow and cattail are considered undesirable invasive plant species. They are also used as characteristic indicators of disturbance and early plant community succession.

VEGETATION COMMUNITY QUALITY AND CONDITION

Descriptive accounts represent existing site conditions within 6 months of the filing date of this Site Certification Application (SCA). All plant communities on-site reflect the use of the area for mining. Phosphate mining activities have both removed pre-existing vegetation cover types and drastically altered the soil and hydrologic conditions which supported those types. The different vegetation community types that have developed are a direct reflection of both the type of mining activities and the time since those activities occurred. The majority of the vegetation communities on-site are of low quality due to low plant species diversity, absence of protected plant species, and early stages of plant community succession.

SUMMARY

Vegetation on the entire site has been dramatically altered due to extensive mining activities. The vegetation communities found were the result of succession since mining activities began. Therefore, vegetation communities were at relatively early stages of ecological succession as is reflected in their low plant species diversity. Early successional plant communities are unstable and not as self-sustaining as more mature successional stages, such as mature forests. Additionally, food webs are poorly developed in these early stages (Odum, 1971). Plant communities present were low to medium in ecological quality. The ecological quality tends to temporarily increase in some wetland communities as indicated by increased wildlife usage. However, the existing conditions are subject to change due to reclamation activities with or without the project.

2.3.5.3 References

FDOT (Florida Department of Transportation). 1985. Florida Land Use, Cover and Forms Classification System. 2nd Ed. Proc. No. 550-010-001-A. FDOT, State Topography Bureau. Tallahassee, Florida.

Odum, E. P., 1971. Fundamentals of Ecology, 3rd edition. Saunders Co. Philadelphia, Pennsylvania.

Paulic, M., 1991. Factors Influencing the Establishment of Hardwood Swamps on Clay Settling Ponds, in Evaluation of Alternatives for Restoration of Soil and Vegetation on Phosphate Clay Settling Ponds. H.T. Odum, B.T. Rushton, M. Paulic, S. Everett, T. McClanahan, M. Munroe, and R.W. Wolfe. Florida Institute of Phosphate Research. Publ. No. 03-076-094. Bartow, Florida.

Wood, D.A., 1991. Official Lists of Endangered and Potentially Endangered Fauna and Flora in Florida. Florida Game and Fresh Water Fish Commission. Tallahassee, Florida.

Wunderlin, R.P., 1982. Guide to the Vascular Plants of Central Florida. University Presses of Florida. Gainesville, Florida.

TABLE 2.3.5-1
ACREAGE AND QUALITY OF VEGETATION/LAND USE
FOLLOWING RECLAMATION

Vegetation/Land Use Types	Approximate Area On-Site (acres)	Ecological Quality of Site Areas	Approximate Area Already Present in Tiger Bay (acres)	Approximate Area Already Present in Tiger Bay East (acres)	Total Area
Agricultural	5,898	low	0	0	5,898
Native Uplands	242	medium	98	55	395
Wetlands	866	medium	251	30	1,147
Lakes	641	medium	68	17	726
Total Area	7,647		417	102	8,166

Source: FDOT, 1985
FDNR, 1992
Ebasco Environmental, 1992

TABLE 2.3.5-2
QUANTITATIVE VEGETATION COMMUNITY DATA - P-2 (WET SEASON)

STRATUM/Species	Common Name	Station Number/Percent Cover (%)									
		1	2	3	4	5	6	7	8	9	10
1) CANOPY											
2) SHRUB LAYER											
Brachiaria mutica	PARAGRASS	50	20	60	+	35	5			10	80
Ludwigia peruviana	PRIMROSE WILLOW	50	5		40	40				20	+
Salix caroliniana	CAROLINA WILLOW		5				5	+			
Macroptilium lathyroides	PHASEY BEAN				60	15					
Baccharis halimifolia	GROUNDSEL TREE				5					20	
Eupatorium capillifolium	DOG FENNEL				5	+		5		50	
Ludwigia octovalvis	SHRUBBY WATER PRIMROSE						+	15	5	5	
Andropogon glomeratus	BUSHY BLUESTEM						30		20		
Paspalum urvillei	VASEYGRASS							30	30		
Aster dumosus	BUSH ASTER							+		+	
Typha sp.	CATTAIL									5	
3) HERB LAYER											
Brachiaria mutica	PARAGRASS	95	100	100		30					95
Ludwigia peruviana	PRIMROSE WILLOW	30			15	25					
Macroptilium lathyroides	PHASEY BEAN				40	15					
Polygonum hydropiperoides	MILD WATER PEPPER				20	10		+		+	
Setaria geniculata	FOXTAIL				40	25	+	10	5		
Cyperus sp.	FLATSEDGE				20						
Eupatorium capillifolium	DOG FENNEL						+			5	
Ludwigia octovalvis	SHRUBBY WATER PRIMROSE						10		+	+	
Aster dumosus	BUSH ASTER						+			+	
Paspalum urvillei	VASEYGRASS						20	20	20		
	UNIDENTIFIED GRASS						75	50	60	20	
Baccharis halimifolia	GROUNDSEL TREE						+		+		
Ludwigia repens	RED LUDWIGIA							+	+	+	
Hydrocotyle umbellata	MARSH PENNYWORT							+			
Senecio glabellus	GOLDEN RAGWORT							+			
Imperata cylindrica	COGON GRASS							+			
Pluchea sp.	FLEABANE							+			
Bare Ground		None	None	None	None	None	None	5	10	10	None
Litter		15	20	15	5	10	5	25	20	50	15
Soil Moisture		Damp	Damp	Damp	Damp	Damp	Damp	Damp	Damp	Damp	Damp

TABLE 2.3.5-3
QUANTITATIVE VEGETATION COMMUNITY DATA - P-2 (DRY SEASON)

Stratum/Species	Common Name	Station Number/Percent Cover (%)									
		1	2	3	4	5	6	7	8	9	10
1) CANOPY											
2) SHRUB LAYER											
Salix caroliniana	CAROLINA WILLOW							+			
Baccharis halimifolia	GROUNDSEL TREE									10	
Typha sp.	CATTAIL									+	
3) HERB LAYER											
Brachiaria mutica	PARAGRASS	15	30	40		60					30
Ludwigia peruviana	PRIMROSE YELLOW	+			5	10					
Senecio glabellus	GOLDEN RAGWORT		+		10	25		5	+		
Macroptilium lathyroides	PHASEY.BEAN		+								
Polygonum hydropiperoides	MILD WATER PEPPER				5			5			
	UNIDENTIFIED GRASS				75	20	75	50			
Paspalum urvillei	VASEYGRASS				10			15	30		
Ludwigia octovalvis	PRIMROSE WILLOW						+			+	
Baccharis halimifolia	GROUNDSEL TREE						+		+		
Eupatorium capillifolium	DOG FENNEL						5			20	
Mikania scandens	CLIMBING HEMPWEED						+				
Andropogon glomeratus	BUSHY BLUESTEM						10		10		
Hydrocotyle umbellata	MARSH PENNYWORT							+			
Imperata cylindrica	COGON GRASS								35	20	
Typha sp.	CATTAIL									10	
Solidago sp.	GOLDENROD									+	
Bare Ground		None	25	None	20	15	20	25	25	5	30
Litter		95	75	80	25	15	20	25	40	85	70
Soil Moisture		Damp	Damp	Damp	Damp	Damp	Damp	Damp	Damp	Damp	Damp

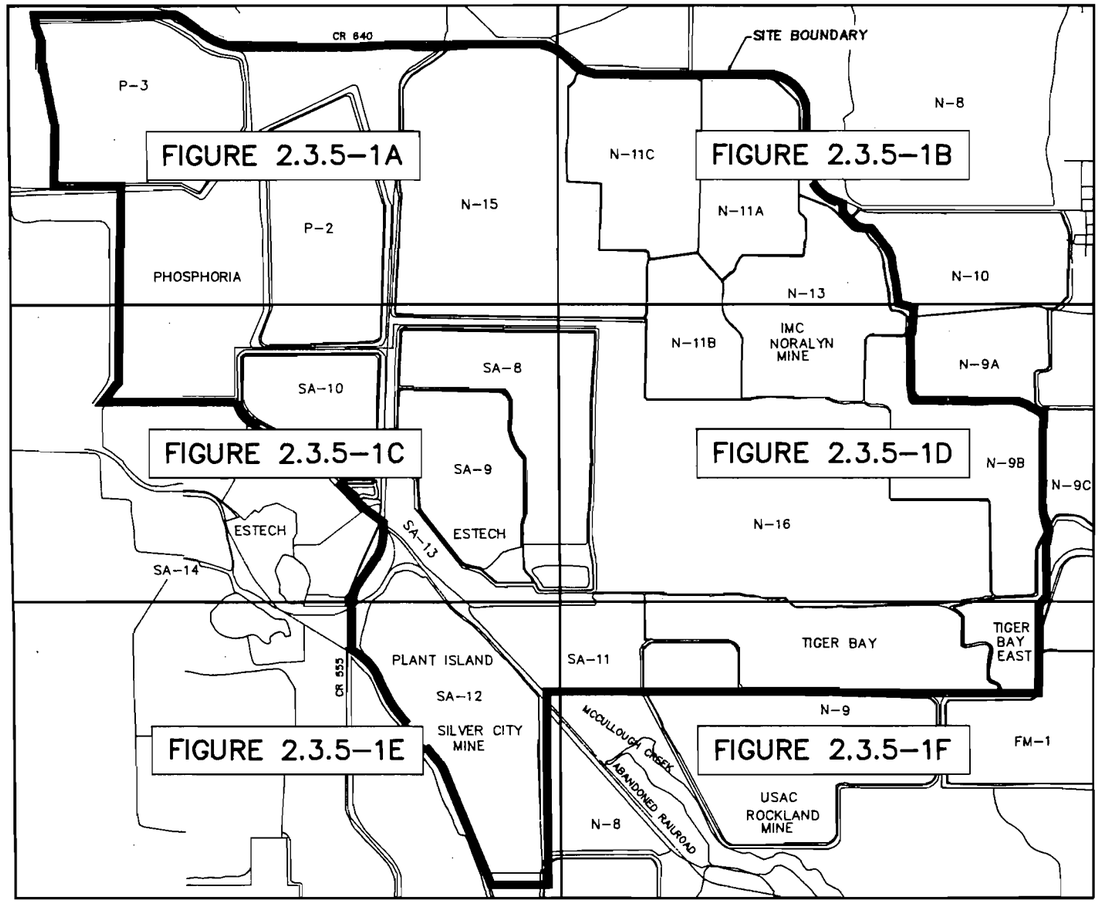
Notes: There was no standing water at any of the 10 stations. Stations were located along a transect at 20 meter intervals.
A light surface fire has occurred since the dry season survey.
+ = Present with less than 5 percent cover.
Dry season data collected November 1991 and wet season data collected March 1992.

Source: Ebasco Environmental, 1992.

TABLE 2.3.5-4
BASELINE VEGETATION COVER SURVEY LOCATIONS

	Reclamation Area Location	
	On-site	Off-site
Agriculture	P-2	Site Vicinity, West of K-6
Native Uplands	Tiger Bay, Tiger Bay East, P-2	Homeland 9, West of K-6
Wetlands	Tiger Bay, Tiger Bay East	West of K-6, Homeland 9, Hookers Prairie
Lakes/Ponds	Tiger Bay	West of K-6, Homeland 9

Source: Ebasco Environmental, 1992



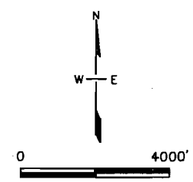
KEY

NOTES

KEY AND ASSOCIATED FLUCCS CODE LEGEND TO BE USED IN THE FOLLOWING FIGURES:
2.3.5-1A
2.3.5-1B
2.3.5-1C
2.3.5-1D
2.3.5-1E
2.3.5-1F

FLUCCS CODE LEGEND

210	CROPLAND AND PASTURELAND
220	CITRUS
310	UPLAND HERBACEOUS
320	UPLAND SHRUB AND BRUSHLAND
400	UPLAND FORESTS
520	LAKES
630	WETLAND FORESTS
640	VEGETATED NON-FORESTED WETLANDS
830	UTILITIES

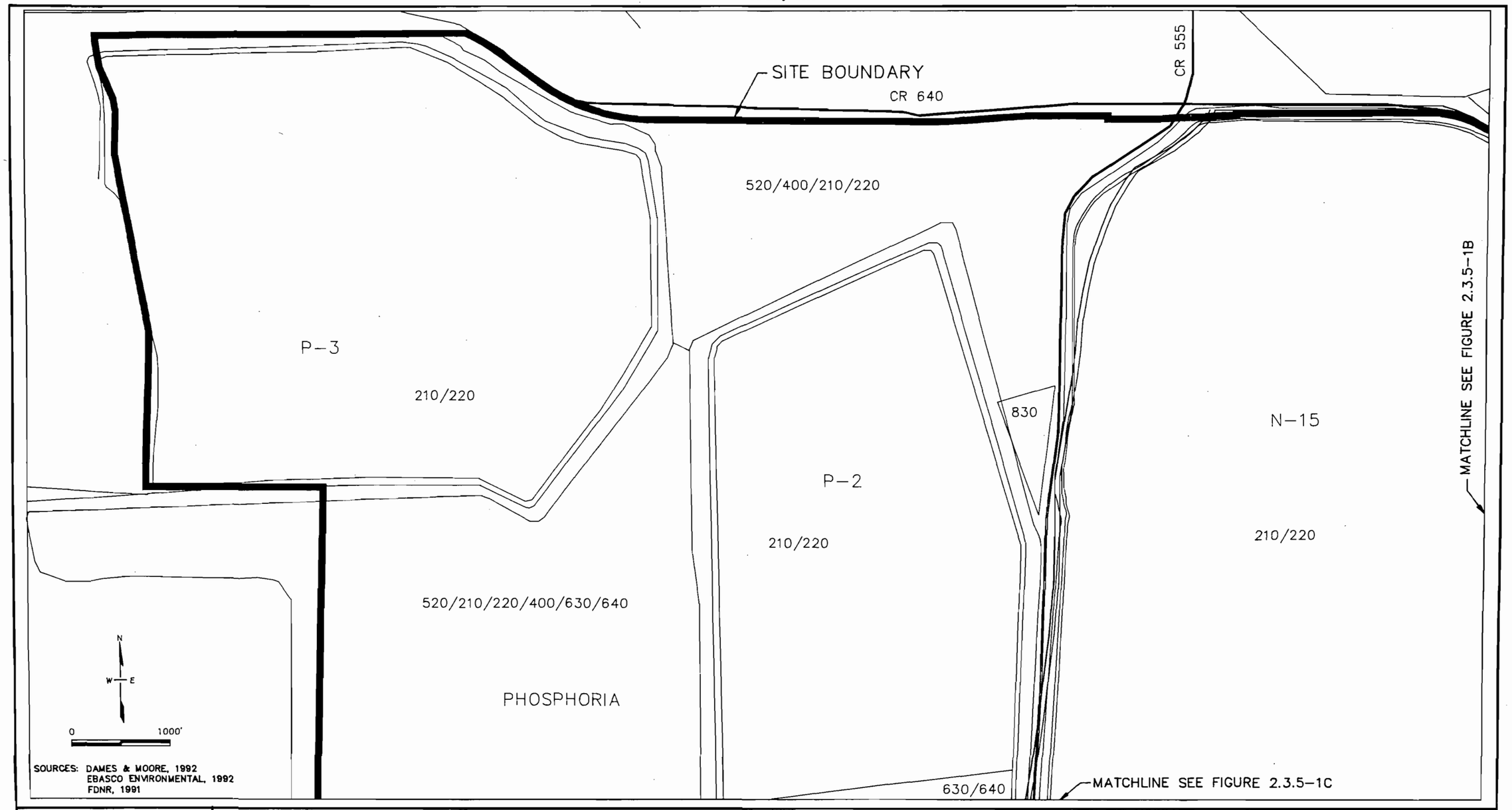


SOURCES: DAMES & MOORE, 1992
EBASCO ENVIRONMENTAL, 1992
FDNR, 1991

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Polk County Site

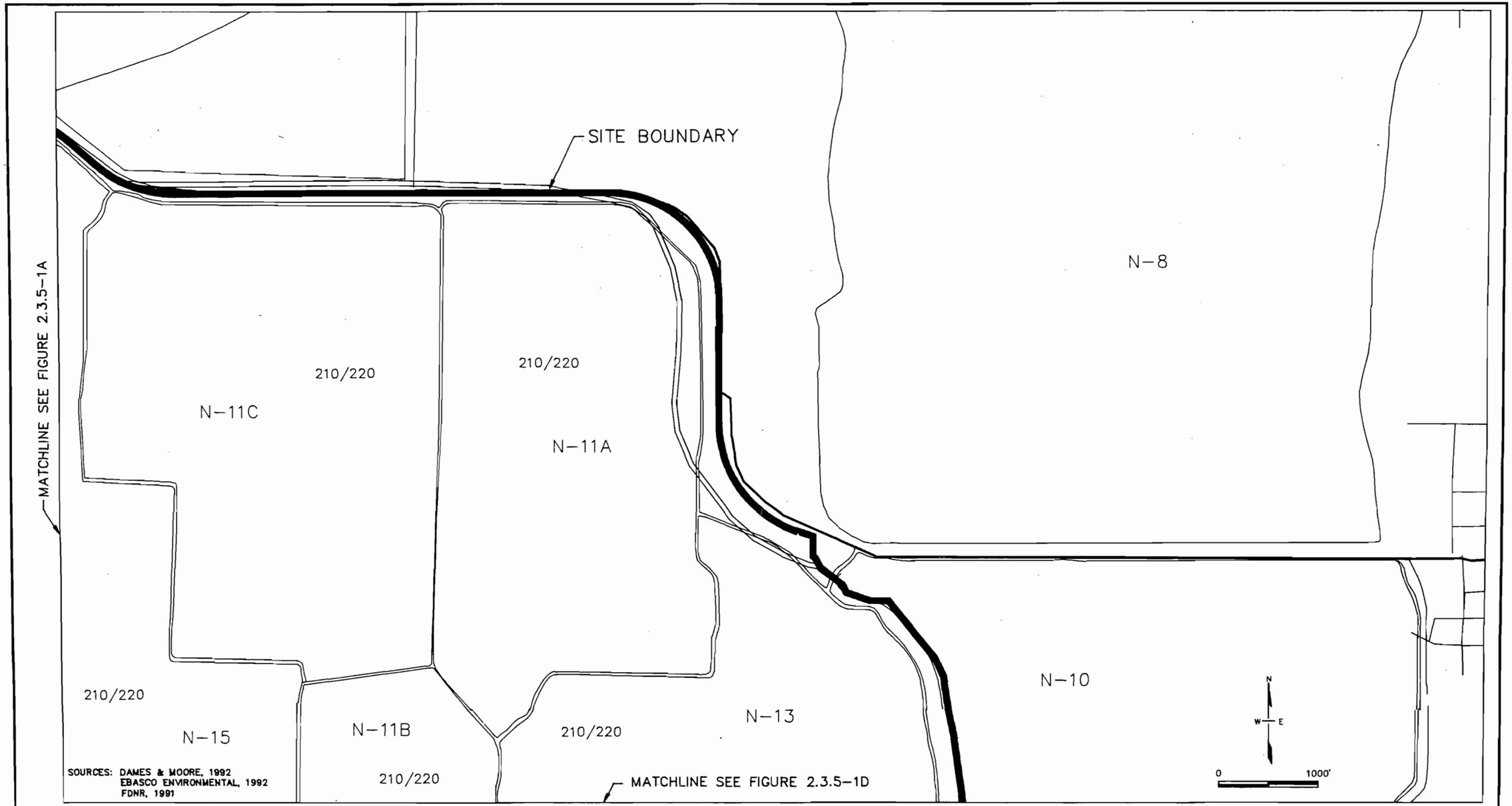
FIGURE 2.3.5-1
VEGETATION/LAND USE MAP
BASELINE CONDITIONS
KEY



Florida Power CORPORATION

Polk County Site

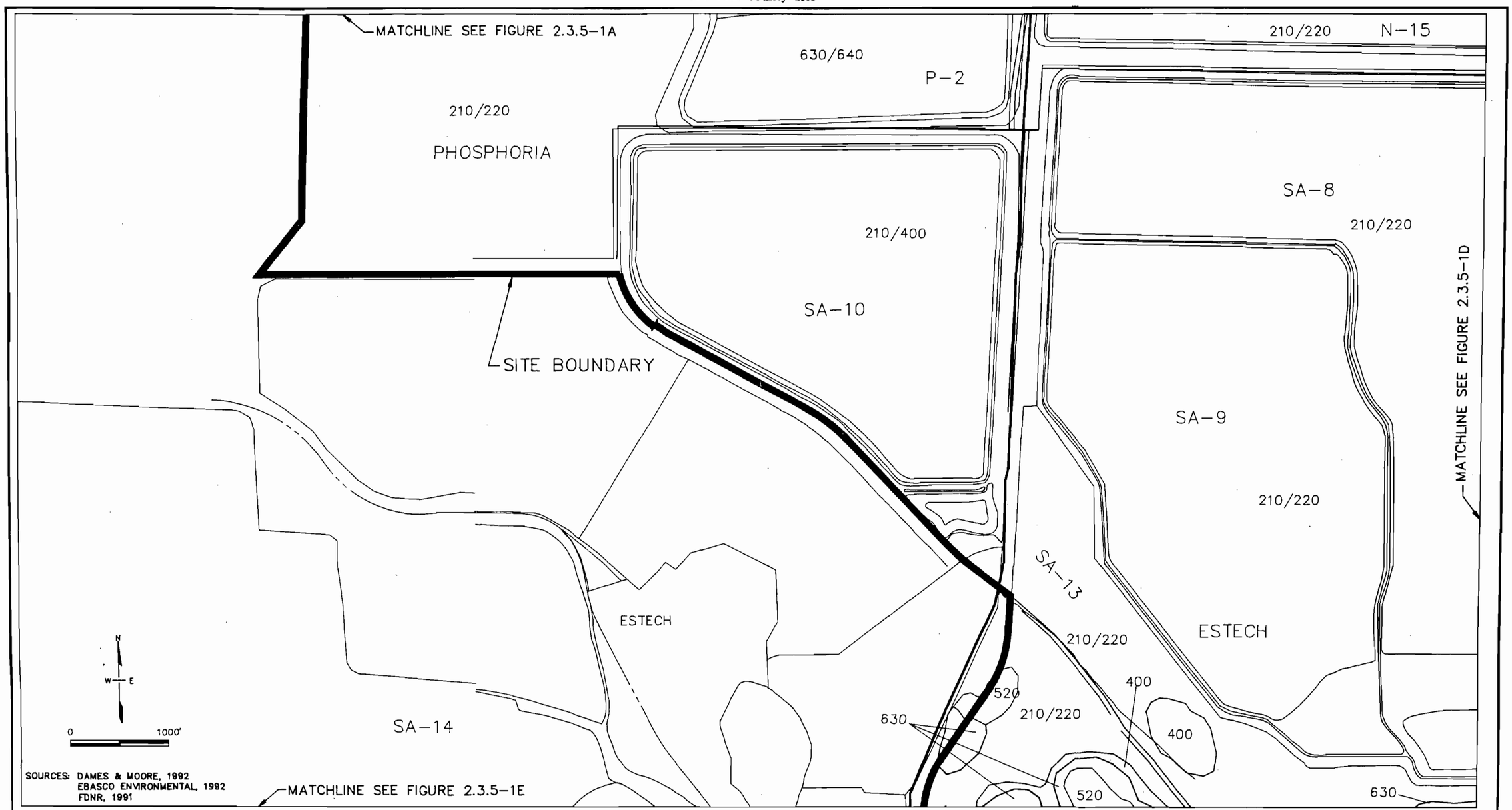
FIGURE 2.3.5-1A
VEGETATION/LAND USE MAP
BASELINE CONDITIONS
SHEET A



Florida Power CORPORATION

Polk County Site

FIGURE 2.3.5-1B
VEGETATION/LAND USE MAP
BASELINE CONDITIONS
SHEET B

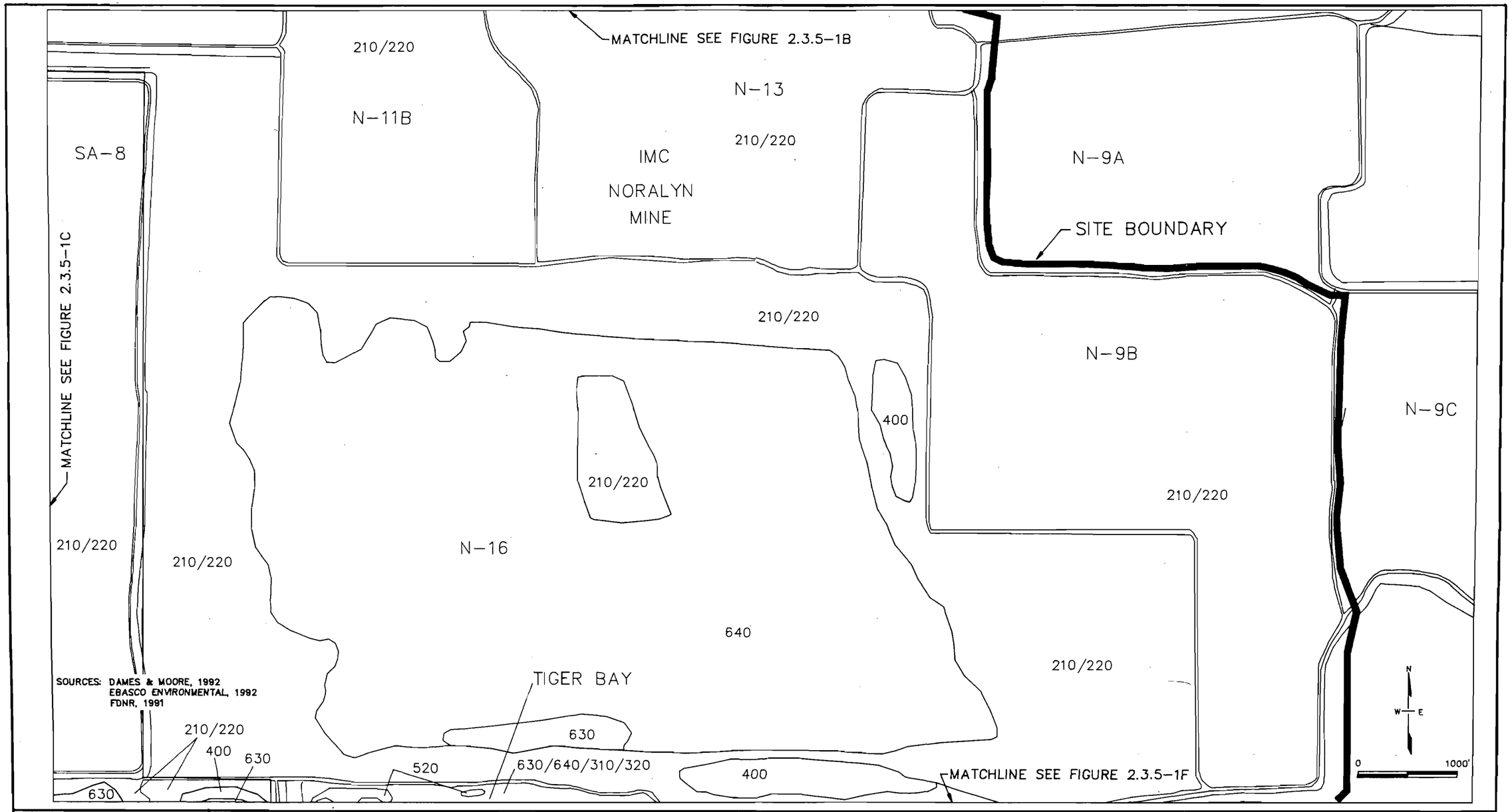


Florida Power CORPORATION

Polk County Site

FIGURE 2.3.5-1C

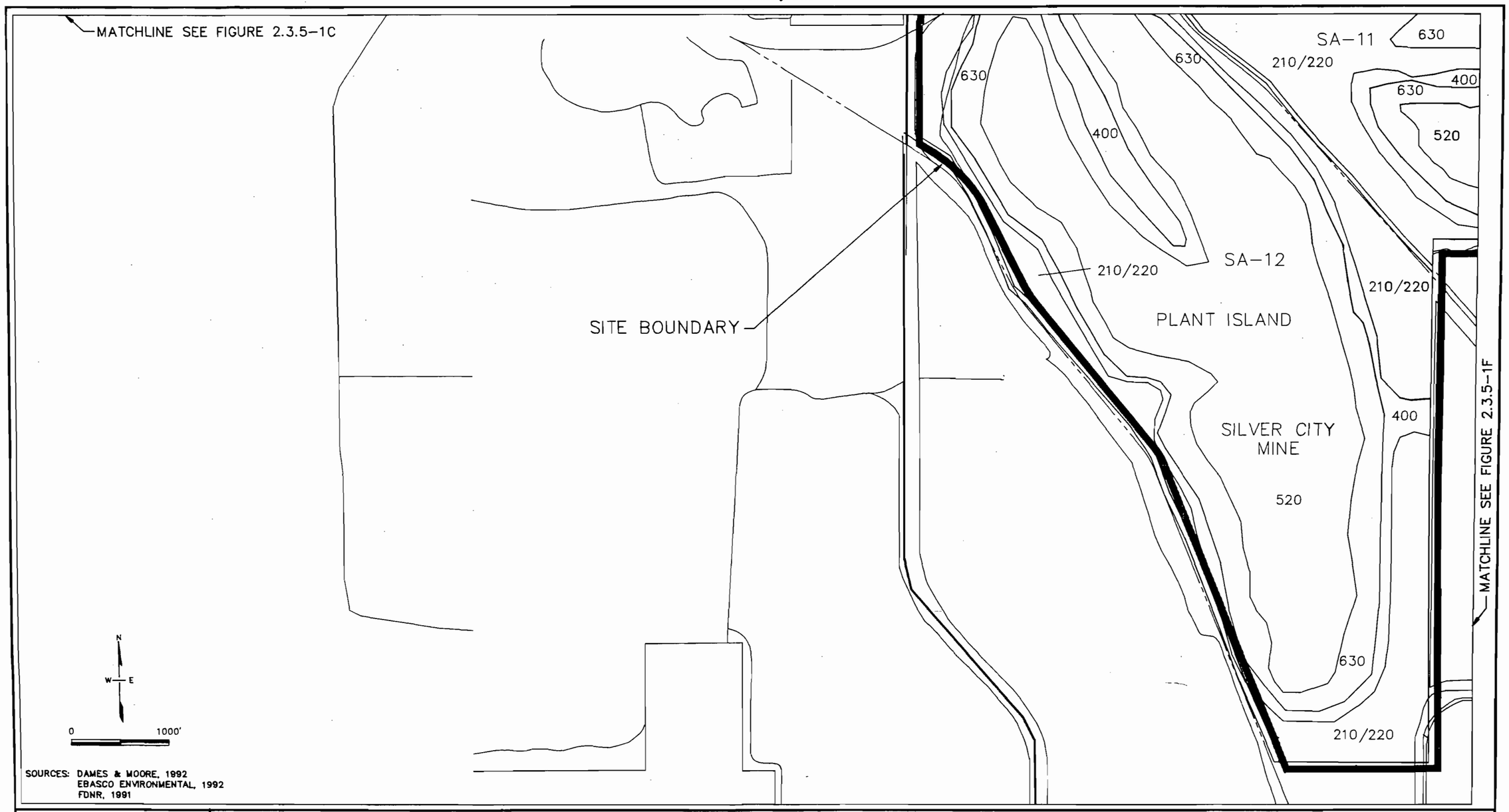
VEGETATION/LAND USE MAP
BASELINE CONDITIONS
SHEET C



Florida Power CORPORATION

Polk County Site

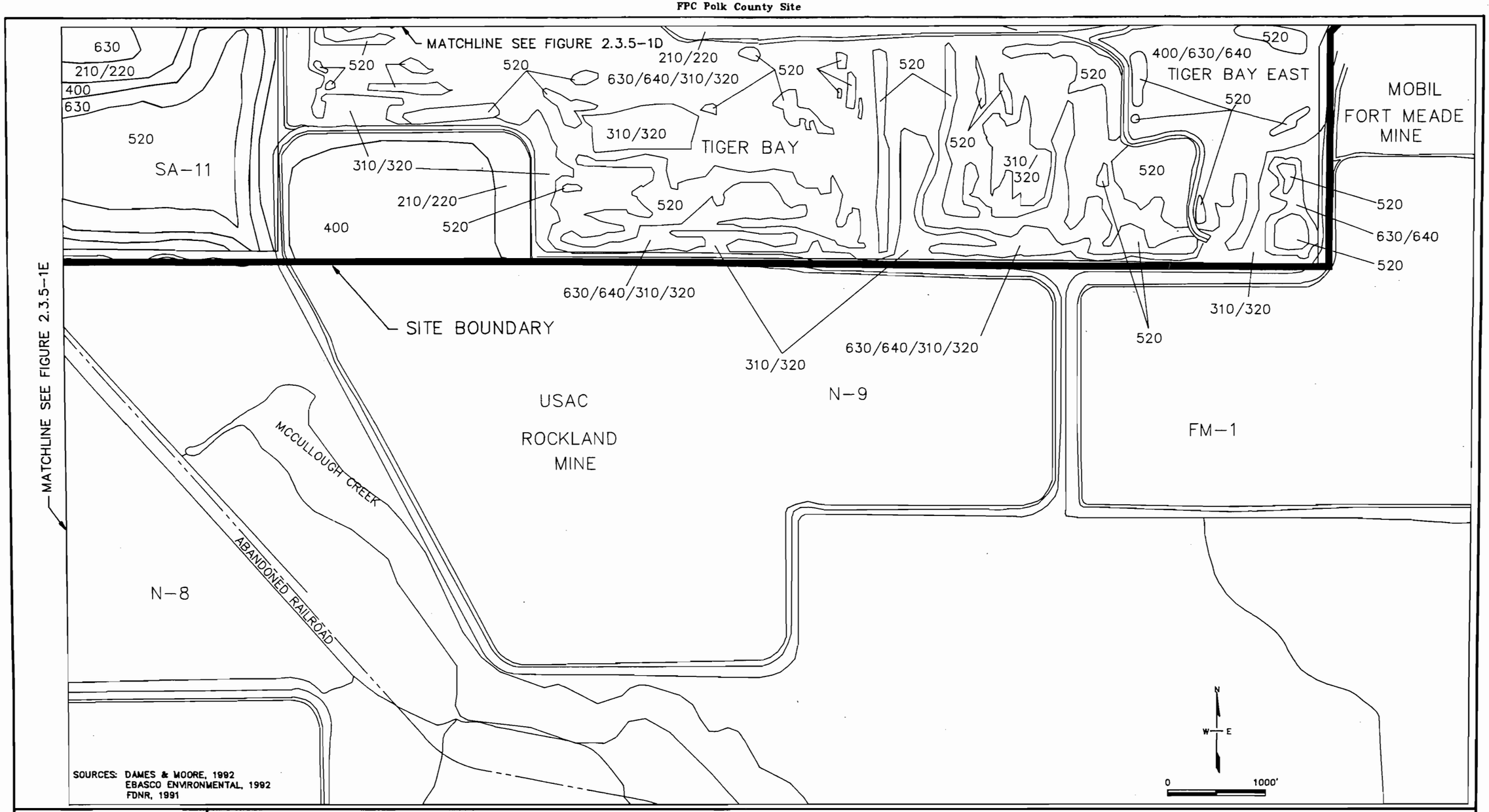
FIGURE 2.3.5-1D
VEGETATION/LAND USE MAP
BASELINE CONDITIONS
SHEET D



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Polk County Site

FIGURE 2.3.5-1E
VEGETATION/LAND USE MAP
BASELINE CONDITIONS
SHEET E



Florida Power CORPORATION

Polk County Site

FIGURE 2.3.5-1F
VEGETATION/LAND USE MAP
BASELINE CONDITIONS
SHEET F

2.3.6 Ecology

As discussed in Section 2.1.2, for impact assessment purposes, the baseline conditions used in this document are those land cover conditions which would exist upon completion of mine reclamation. These conditions were established based on existing approved (pre-1992) reclamation plans for mandatory lands and anticipated reclamation to agriculture of nonmandatory lands. This land cover represents that which would most likely be present at the site in the absence of the power plant with its associated modified reclamation plans. In accordance with the Binding Written Agreement on the Plan of Study, a summary discussion of existing conditions is presented for reference purposes only. The status of existing conditions (Figure 2.3.6-1) is temporary because additional ecological succession changes occur rapidly and dramatically in terrestrial and wetlands vegetation communities with the cessation of mining.

The status of important flora and fauna is highlighted in this section. Importance status is based upon species or assemblages of species which are:

- Threatened or endangered species by the U.S. Fish and Wildlife Service (FWS)
- Threatened or endangered species or species of special concern by the FGFWFC and Department of Agriculture and Consumer Services (DACS)
- Game, furbearers, or fishery resources by the FGFWFC
- Indicators of species that are endemic or unique to specific plant communities or habitat types
- Functionally dominant species in their vegetation communities or habitat types

The site baseline characterization below presents an analysis of the proposed post-reclamation on-site habitats to important species found in the region. For important species, site habitat status is tabulated. One area on the site, Tiger Bay, has been reclaimed and released by FDNR, so its current conditions represent baseline conditions.

This section is presented in three parts, beginning first with species-environmental relationships. Secondly, the presence of environmental stress following reclamation and its effect on area biota

is discussed. Finally, the methodologies used to obtain the baseline site characterization data are described. A listing of literature used for the site study and published ecological literature of the area are included in the last subsection.

In order to characterize as-reclaimed baseline conditions, data were collected from both on-site and off-site reclaimed areas. Off-site reclamation areas were visited on foot and by flyover. All of the off-site study areas are IMC reclamation projects and include West of K-6, Hookers Prairie and Homeland-9 reclamation sites. IMC monitoring reports were used to supplement field inspections.

Three on-site reclamation areas were studied. These include P-2, which is representative of non-forested upland habitats and has yet to be released by the FDNR (see Section 2.3.5.1); Tiger Bay which has uplands and wetlands, and has been released by the FDNR; and Tiger Bay East, a nonmandatory mined land, which has become revegetated naturally with both upland and wetland species.

These areas are considered representative of wildlife habitats which would occur on the site under baseline conditions. Aquatic ecology sampling in Tiger Bay, Tiger Bay East (headwaters of Camp Meeting Ground Branch), and N-16 provided baseline data for impact assessment. N-16 data are representative of large open water habitats including SA-11 and SA-12.

2.3.6.1 Species - Environmental Relationships

AQUATIC SYSTEMS

BASELINE CONDITIONS. Following are descriptions of the aquatic systems anticipated following reclamation. The following areas were chosen as representative of baseline aquatic conditions on-site.

Site Description. N-16 was sampled for purposes of summary characterization of baseline aquatic conditions, such as would occur in SA-11 and SA-12 following reclamation. Although plans call for reclamation of N-16 as a mixture of wetlands and uplands, data from the existing N-16 were considered indicative of lake habitats which would result from existing approved (pre-1992) reclamation plans on the site in the SA-11 and SA-12 areas.

N-16 consists of a mixture of open water habitats in its eastern portion and isolated coves in its western portion. The cove areas in the western portion were produced by the deposition of overburden from mine operations. These overburden areas were deposited in long strips and form ridges dividing the open water habitat of the original mine pit into a series of interconnecting coves which were generally oriented in an east-west direction and are connected with north-south oriented channels. In the southwestern corner of N-16, the coves have become completely isolated, forming small pond habitats similar to those seen in Tiger Bay. These ridges were vegetated by plant species including Carolina willow (Salix caroliniana), primrose willow (Ludwigia peruviana), wax myrtle (Myrica cerifera), Brazilian pepper (Schinus terebinthifolius), groundsel tree (Baccharis halimifolia), and cogon grass (Imperata cylindrica). There is abundant aquatic vegetation in the littoral areas along the shoreline dominated by cattail (Typha sp.). The shoreline is steeply sloped and consists of silt, sand, and overburden from mining operations. The banks are stabilized by the presence of the vegetation, but appear susceptible to erosion by wave action produced by winds and light boat traffic. The bottom substrates typical of these habitats are predominantly fine sands, silts, and clays which have been eroded from the shoreline or deposited directly as a result of clay settling activities (Table 2.3.6-1).

Tiger Bay is a reclaimed mine area which consists of small isolated open wetlands separated by areas of overburden and beds of thick cattail growth. Because Tiger Bay is a mandatory area which has been reclaimed and released, aquatic wetlands and upland habitats in Tiger Bay are also representative of similar habitat types proposed under existing approved (pre-1992) reclamation plans at the site. The banks of Tiger Bay wetlands are stable and well-vegetated by cogon grass, sea myrtle, Carolina willow, wax myrtle, cattail and planted bald cypress (Taxodium distichum). Aquatic vegetation is abundant in these wetlands and includes Hydrilla (Hydrilla ventricillata), water spangles (Salvinia rotundifolia), duckweed (Lemna minor), and wild water pepper (Polygonum hydropiperoides). Hydrilla is a submerged aquatic plant which exhibits rapid growth. In doing so it can affect water quality characteristics and other organisms which inhabit an aquatic system. Hydrilla grows into dense mats which reduce light penetration. At the same time, Hydrilla reduces oxygen levels by increasing biological oxygen demand. There has been no power boat traffic in these wetlands and the banks are protected from wind generated wave action by the beds of aquatic vegetation growing in the littoral zone. The bottom substrates characteristic of this habitat were predominantly fine sands, silts, and clays resulting from erosion of the shoreline and originally from clays deposited into the area (Table 2.3.6-1).

Station Location and Description. Three aquatic ecology stations were set-up on N-16, three stations on Tiger Bay, and two stations on Camp Meeting Ground Branch (one in a lentic habitat and one in a lotic habitat). Station locations were selected from aerial photography. Factors considered in selection were status and condition of the mine areas, subhabitats within each aquatic area, and accessibility. Transects were determined at each station randomly. These station locations are presented in Figure 2.3.6-2. Field investigations were conducted at these stations during the wet season (September 1991) and during the dry season (February 1992). Field investigations included collection of fish species typical of the habitats, sampling of substrates for grain size analysis and benthic macroinvertebrate population composition, and water quality sampling. The field sampling program methodology is described in Section 2.3.6.3. The following paragraphs discuss the aquatic ecology stations in Tiger Bay and N-16. The Camp Meeting Ground Branch station is discussed under existing conditions.

TIGER BAY (TB) STATIONS:

Tiger Bay stations were selected at representative points at either end of the area as well as central locations in order to sample the range of its isolated aquatic systems.

Station TB-01 was located in a small isolated wetland in the southeast corner of the Tiger Bay area. This station had a well defined littoral zone with abundant cattail growth bordering the entire shoreline. There was also an abundant growth of Hydrilla ventricillata submerged below the open water area of the wetland and apparently covering the entire wetland. The depth at this station was 20.4 feet. The banks were stable, gradually sloped, and well vegetated. There was no obvious bank erosion at this station as a result of its bank conditions and the presence of an established littoral zone. The station transect extended from the northeast shoreline toward the south, a distance of 80 feet. Electrofishing at this station concentrated along the Hydrilla beds and littoral zone of the northeast shoreline.

Station TB-02 was located in a large wetland, much of which was covered by dense cattail growth. The cattail growth in this wetland subdivided it into several small open water areas surrounded by cattails. TB-02 was located in one such open water area which extended the entire width of the Tiger Bay area, from the north shoreline to the south shoreline. This station had a well defined littoral zone with abundant cattail growth along the entire open water area. Submerged beds of Hydrilla ventricillata covered the entire station. The north and south shorelines were stable, gradually sloped, well vegetated, and showed no signs of erosion. The

depth at this station was 15.8 feet. The station transect was established across the open water area in the northern portion of the wetland and extended from the eastern cattail beds to those on the west, a distance of 75 feet. Electrofishing collections at this station concentrated along the southern shoreline and the eastern cattail stands.

Station TB-03 was located in an open water wetland in the northwest corner of the Tiger Bay area. The banks at this station were stable, gradually sloping, well vegetated, and showed no signs of erosion. The depth at this station was 11.8 feet. The well developed littoral zone supported a dense growth of cattail surrounding the entire wetland. Hydrilla growth was present at the station, but was not as dense as at the other Tiger Bay stations. The station transect was established from the north shoreline to the south shoreline, a distance of 25 feet. Electrofishing activities concentrated along the north shoreline.

N-16 STATIONS:

The three stations in N-16 were selected to be representative of three general aquatic habitat types in the site area, such as those proposed for SA-11 and SA-12. These include open water, coves, and transitional waters between coves and open water. No submerged aquatic vegetation was present at these stations.

The three N-16 aquatic ecology stations were designated as N-16(01), N-16(02), and N-16(03). N-16(01) was representative of an open water habitat and was located immediately southeast of the N-16 boat ramp. This station had an approximate depth of 19.4 feet. The banks at this station were eroded and dropped very steeply to the bottom resulting in a reduced littoral zone available for vegetation growth. The banks were well vegetated above the eroded zone with the roots of shrubs exposed by wave action. This station extended from the north point of the peninsula northeast to a small island, a distance of 250 feet. All samples were collected along this transect with the exception of the fisheries collections in which a gill net was set from the north corner of the island toward the south shore.

Station N-16(02) was located in the western portion of N-16 in a small cove. The depth at this station was 20.6 feet. The banks were stable with vegetation extending into the water. The littoral zone was reduced and the banks dropped steeply to the bottom, restricting vegetative growth. The south bank exhibited abundant cattail growth around a small island and cove area where the littoral zone was more pronounced. The station included the entire width of the cove

(approximately 80 feet), with the electrofishing collection concentrating along the north bank and the island and cove on the south bank.

Station N-16(03) was located in the southern portion of N-16, in an area which is transitional between the open water habitat of the eastern portion and the cove dominated habitats of the western portion of N-16. The depth at this station was approximately 9.2 feet. The banks were stable with vegetation extending into the water, and abundant cattail growth along the southern shoreline. The northern bank dropped steeply to the bottom reducing the littoral zone aquatic vegetation growth along this shore. The slope along the southern shore was more gradual allowing for a littoral zone to support the cattails. The station transect extended from the north bank of the island to the south shoreline, a distance of about 250 feet. Electrofishing at this station concentrated on the north bank and the cattail beds along the south shore.

Water Chemistry. The physical and chemical characteristics of the stations are presented in Table 2.3.6-2. Chemical water quality data were collected to characterize the benthic and fisheries environment at the time of sampling in areas where biological sampling took place. Sampling did not take place in Tiger Bay, for example, at locations where other water quality sampling took place. Water temperatures between the stations ranged from 27.3°C to 34.5°C during the wet season (summer) and from 15.6°C to 17.7°C during the dry season (winter). Dissolved oxygen concentrations between the stations ranged from 2.1 ppm to 14.2 ppm during the wet season and from 5.4 ppm to 12.0 ppm during the dry season. The pH values between the stations ranged from 6.7 to 9.4 during the wet season and between 7.5 and 8.6 during the dry season. Specific conductivity was not measured during the wet season due to an instrument malfunction, but values ranged from 230 μmhos to 670 μmhos during the dry season. Turbidity measurements were not reproducible and therefore thought to be false readings during the wet and dry seasons. Light transmissivity (secchi disk readings) ranged from 0.44 meters to 1.50 meters during the wet season and from 0.53 meters to 2.06 meters during the dry season.

Analysis of variance (ANOVA) and the Scheffé method for multiple comparison were used to determine statistical differences ($\alpha = 0.05$) between the stations within each habitat and habitat by season. When stations within a habitat were compared, there were no significant differences noted between water temperatures, dissolved oxygen concentrations, and pH data. When comparing the habitats by season, it was noted that the mean seasonal water temperatures at the Tiger Bay stations were significantly higher (29.0°C) during the wet (summer) season than during the dry (winter) season (15.6°C). Using a nested ANOVA to compare habitats (including

all stations), there were no significant differences in water temperatures, dissolved oxygen concentrations, and pH values.

Fisheries. Because of their importance as a recreational resource, adult and juvenile fish populations are normally the aquatic fauna of greatest interest to both the environmental regulatory agencies and the general public during the development of any project potentially impacting an aquatic system. The fish species potentially occurring in the Polk County area, along with their life history information, are presented in Appendix Tables 10.5.5-17, and 10.5.5-18. These tables are provided to indicate the fish species which are likely to inhabit aquatic habitats in this area and information on their significance, trophic classification, habitat, food, and spawning requirements. A description of the fish species collected during the wet and dry season field investigations is presented in Table 2.3.6-3. The number of individuals collected represents the number collected for a set unit effort (30 minutes of continuous electrofishing time), which was kept constant throughout the study. In addition to electrofishing, gill nets were set for a 24-hour period at N-16(01) to collect open water species often missed by electrofishing along the littoral zone.

The fish species and numbers of individuals vary with the habitats in which they were collected. Electrofishing was difficult because of the water depth, steep banks and shorelines, abundant aquatic vegetation at all the stations, and working from a small rubber raft due to restricted boat access to the Tiger Bay stations. Many specimens stunned were not collected because they recovered before collection was possible. This was especially true of large fish such as largemouth bass and Florida gar, several specimens of which were observed but were not collected. Many of the live-bearers (Poeciliidae) were so numerous that it was impossible to collect all of the individuals stunned. Gill nets were not set at all stations because alligators, otters, and waterfowl which are frequently attracted to the fish collected in the nets, might become entangled and damage themselves, the nets, and the samplers. Because of these factors, the catch per unit effort does not accurately represent the numbers of individuals at each station, but it may be an accurate representation of the species comprising the fish populations.

During the wet season, fifteen species, representing eight families, were collected or observed during sampling. Eleven species, representing four families, were collected or observed at the N-16 stations during the dry season. Of these species only threadfin shad (Dorosoma petenense), brown bullhead (Ictalurus nebulosus), taillight shiner (Notropis maculatus), redear sunfish (Lepomis microlophus), and blue tilapia (Tilapia aureus) were collected from these

stations. Seven species representing four families were collected from the Tiger Bay stations during the dry season. Florida gar (Lepisosteus platyrhincus) was the only species collected or observed at this station during this season which was not noted at the other stations.

During the dry season, twenty-one species representing eleven families were collected or observed. Thirteen species representing ten families were collected or observed from the N16 stations. Eight of these species, gizzard shad, threadfin shad, brown bullhead, blue tilapia, Seminole killifish (Fundulus seminolis), brook silverside (Labidesthes sicculus), and swamp darter (Etheostoma fusiforme) were collected from only this station during this season. Five families including eight species were collected or observed from the Tiger Bay stations. Three species, lake chubsucker (Erimyzon sucetta), sailfin molly (Poecilia latipinna), and warmouth (Lepomis gulosus) were collected from this habitat during the dry season.

The Fulton coefficient of condition (K) is an indication of a fish's physical condition relative to its length and weight. This coefficient provides a means of comparing populations of the same species from different habitats. The mean K values and ranges for the sport and commercial fish collected for the site are presented in Tables 2.3.6-4, and 2.3.6-5. Means and ranges of the calculated K values are presented in Table 2.3.6-6. The K values for the fish species collected during this study compare favorably with those reported by Carlander (1967, 1977). The black crappies collected from N-16 during the dry season collections had a mean K value less than the published range, indicating that these specimens may be less fit than those collected in the published study or that the young age group collected influenced the results. The upper range of K values for black crappie, however, did fall within the published range. Bluegill sunfish collected from the N-16 and Tiger Bay had a mean less than the published central 50 percent range; the upper range of K values exceeded the central 50 percent range. There were no published K values (Carlander, 1977) listed for spotted sunfish and blue tilapia; these species were not compared to other studies, but appeared to be healthy and robust individuals with no sign of disease.

Benthic Macroinvertebrates. Benthic macroinvertebrates are defined as "benthic or substrate dwelling organisms visible to the unaided eye and are retained on a U.S. Standard No. 30 sieve" (ASTM, 1986). They represent an important link in the food chain of many fish species. The majority of these organisms are juvenile or mature life stages of five classes or subclasses: Oligochaeta, Crustacea, Insecta, Gastropoda, and Pelecypoda. Larger individuals or species of several other classes may also be considered macroinvertebrates. Benthic macroinvertebrate

communities are often used as indicators of stress on an aquatic system because they are relatively immobile and their composition and density are largely determined by substrate types and local environmental conditions.

Tables 10.5.5-19 through 10.5.5-21 present the benthic macroinvertebrate species and numbers collected from N-16 and Tiger Bay. Population data from these samples are presented in Table 10.5.5-22 (population percentages) and 10.5.5-23 (density and diversity). Number of taxa and diversity represent minimum values because chironomid larvae were identified only to the family level. A total of 8,825 individuals representing a minimum of 47 taxa and 27 families were collected from the three habitats.

A total of 2,875 individuals were collected from the three N-16 stations representing fifteen taxa. Of these, 43.3 percent were copepods, 38.0 percent insects, and 17 percent were oligochaete worms. The insect population consisted entirely of fly larvae (Diptera) including Bezzia sp. (0.5 percent), Chaoborus punctipennis (59.2 percent), and unidentified chironomid species (40.3 percent). The mean diversity of the N16 stations was 0.875 (range= 0.147-0.156) and the mean density was 9,468.9 individuals per square meter (range= 1,722.4-21,573.1).

The Tiger Bay station collections contained a total of 2,111 individuals representing 35 taxa. Of these, 50.9 percent were insects, 25.7 percent were copepods, 13.9 percent were oligochaete worms, 5.6 percent were cladocera, and 1.9 percent were amphipod crustaceans. The insect population consisted of eight orders, including Ephemeroptera (1.2 percent), Odonata (1.2 percent), Hemiptera (2.1 percent), and Diptera (95.0 percent). The Diptera population included Bezzia sp. (1.2 percent), Palpomyia sp. (0.6 percent), Chaoborus punctipennis (48.1 percent), Tabanus sp. (0.1 percent), and unidentified chironomids (50.0 percent). The mean diversity was 1.06 (range= 0-1.69) and the mean density was 4,097 individuals per square meter (range= 560-17,095). This figure represents a minimum species diversity because multiple levels of taxa (i.e., lowest level of identification) were included.

The benthic macroinvertebrate species collected at N-16 using Hester-Dendy substrates are appended in Table 10.5.5-24. Population data from these samples are appended in Table 10.5.5-25 (population percentages) and Table 10.5.5-26 (density and diversity). A total of 38,207 individuals representing a minimum of 27 taxa and 24 families were collected from the three habitats. Eight species [Chaetogaster sp. (Oligochaeta), Enallagma sp. (Odonata), Treporates sp. (Heteroptera), Symphitopsyche sp. (Trichoptera), Orthotrichia sp. (Trichoptera), Oecetis sp.

(Trichoptera), Cyrnellus sp., and Dineutis sp. (Coleoptera)] were collected using the artificial substrates which were not collected during the quantitative sampling. Twenty-seven species were collected from the quantitative samples which were not collected using the artificial substrates.

Specimens collected from N-16 stations totaled 24,993 individuals, representing 16 taxa. Insect species represented the largest fraction (98.12 percent) of the population collected from the artificial substrates at these stations, of this 98.21 percent were Diptera, predominately chironomids (99.99 percent). The mean diversity at the N-16 stations was 0.23 (range = 0.030 - 0.827) and the mean density was 15,412.35 organisms per square meter (range = 8,558.1 - 21,445.2).

A total of 1,320 individuals representing 18 taxa were collected from the Tiger Bay stations. Of these individuals, 72.34 percent were insect species, 15.95 percent were amphipods, and 6.27 percent were oligochaetes. Of the insect species, 81.71 percent were fly larvae (Diptera) and 14.11 percent were mayflies (Ephemeroptera). The Diptera population consisted predominately (98.33 percent) of chironomid larvae. The mean diversity was 1.34 (range = 1.014 - 1.861) and the mean density was 917.83 individuals per square meter (range = 1.014 - 1.861).

Statistical comparisons of the diversity and density data as compared to habitat and stations indicate statistical differences ($\alpha = 0.05$) were present. When the stations were compared (ANOVA and Scheffe's Multiple Comparison), the densities at the Tiger Bay stations were all significantly lower than the densities at N-16(01). When the habitats were compared (ANOVA and Scheffe's Multiple Comparison), the density at the Tiger Bay habitat was significantly higher than that at the N-16 habitat. No significant differences were noted when the stations were compared within each habitat.

Site Habitat Value. The wetlands associated with the site appear to be productive and contain abundant fish populations. They represent a recreational fishing resource to a local sports club which leases these lakes as well as several other local lakes and wetlands. These wetlands also provide a habitat for the abundant waterfowl which inhabit the area, providing fish for food and protection from predators. In time, however, these resources will deteriorate.

The dissolved oxygen concentration did fluctuate between the seasons at the Tiger Bay stations. These stations had abundant submerged aquatic vegetation, Hydrilla verticillata. However, during the wet season, it was noted that oxygen was abundant near the surface where it was

being produced by the vegetation, but was depleted at depth, probably by the breakdown of organic compounds in and near the organic sediments coupled with lack of light reaching the area due to the dense Hydrilla layer. In addition to the reduced dissolved oxygen concentrations, an indication of the anaerobic conditions within the wetlands was the presence of methane gas being produced within the sediments, as was evident during the substrate analysis. This decrease in dissolved oxygen concentration is common in eutrophic lakes and wetlands which are highly productive. As the vegetation begins to die back at the end of its growing season during late summer, the dissolved oxygen concentration bottoms out creating anaerobic or nearly anaerobic conditions throughout the entire water column resulting in a lack of oxygen and a potential for fish kills.

Diel fluctuations in dissolved oxygen concentration are also common in eutrophic waters due to large amounts of oxygen being produced by the vegetation during the day, and similar quantities being utilized at night by the breakdown of the organic material within the water column and sediments. Many fish species have adapted to these variations in dissolved oxygen concentration and are capable of surviving long periods of anaerobic conditions. These include many of the killifish, poecillids, and catfish. These species survive the periods of low dissolved oxygen by breathing at the surface and are able to utilize the available habitats once the dissolved oxygen levels increase. Poecillid fish were the most common fish species collected during the baseline investigations, representing 64.0 percent of the individuals collected. At the N-16 stations, low diversities (low number of species collected and high numbers of individuals collected) may reflect the low dissolved oxygen concentrations. The species collected at these stations are capable of surviving low dissolved oxygen concentrations.

Food Chain Relationships. The high concentrations of nutrients and organic materials found within these habitats make them very productive. The organic materials are broken down slowly by chemical and biological decomposition in the sediments and released as nutrients. Naturally occurring nutrients (phosphate) are also very common in these wetlands, thereby increasing their productivity. The plankton and detritivore (oligochaetes and certain aquatic insects which feed on decomposing organic materials) form the basis of the food chain and provide food for the primary consumers in the ecosystem (aquatic insects, crustaceans, and small fish, such as the poecilids) which provide food to the secondary consumers (predators). Gizzard and threadfin shad are examples of primary consumers collected at the site which feed exclusively on plankton. The killifish, cyprinids, and poecillids are primary consumers, as well as predators; they feed on aquatic insects, small crustaceans, and algae. These fish are then fed upon by larger fish

(sunfish, bass, and crappie), water snakes, mammals and wading birds. The larger predatory fish are also the prey of many terrestrial predators including wading birds, raptors, mammals, and humans. This process continues as organic material, predominately dead vegetation, becomes reincorporated, breaks down and becomes available as nutrients to the aquatic system.

Species Importance Criteria. Species importance is based on the following criteria:

- Threatened, endangered, or species of special concern status (50 CFR 17; FGFWFC, 1987)
- Freshwater game or commercial fish
- Indicator, endemic and exotic species
- Ecological significance

Following is a discussion of site fisheries resources as they relate to the above criteria.

Threatened and Endangered Species and Species of Special Concern. No state or federally threatened or endangered species, or species of special concern, are known to occur in the aquatic habitats associated with or near the site (50 CFR 17; FGFWFC, 1987).

Freshwater Game or Commercial Fish. Limited sport fishing is presently permitted on the site but is likely to be discontinued under the baseline condition. The Fin and Feather Club, a local IMC employees organization, presently uses the IMC mine properties for sport fishing. Freshwater sport species collected on the site include: largemouth bass, bluegill sunfish, redear sunfish, spotted sunfish, warmouth, and brown bullhead catfish. Largemouth bass are the most desirable game fish in this area. Although limited commercial fishing of nile perch (blue tilapia) and bait fish is allowed by permit from the Fin and Feather Club, none have been issued.

The life history and habitat requirements for the freshwater game and commercial fish species thought to potentially exist on or near the site are presented in Tables 10.5.5-17 and 10.5.5-18. Largemouth bass and bluegill sunfish were collected from all of the site habitats. Redear sunfish and black crappie were collected from N-16. Brown bullhead were collected from N-16 only.

Indicator, Endemic, and Exotic Species. There are no indicator species thought to potentially exist on or near the site. Six fish species, Florida gar (Lepisosteus platyrhincus), banded

topminnow (Fundulus cingulatus), marsh killifish (Fundulus confluentus), Seminole killifish (Fundulus seminolis), flagfish (Jordanella floridae), and bluefin killifish (Luncania goodei), are Florida endemic species (species whose natural distributions are mainly contained within the state) which potentially exist on or near the site. The life histories and habitat requirements for the endemic and exotic fish species thought to potentially occur on or near the site are presented in Tables 10.5.5-17 and 10.5.5-18. Of those species listed, Florida gar were collected or observed at N-16 and Tiger Bay. Bluefin killifish were collected from Tiger Bay. Seminole killifish were collected from N-16. Four exotic species, walking catfish (Clarias batrachus), Rio Grande perch (Cichlasoma cyanoguttatum), blue tilapia (Tilapia aureus), and Mozambique tilapia (Tilapia mossambicus), are thought to potentially exist on or near the site. Of these, only blue tilapia was collected from the site property and only from station N-16(01).

Species Significant to Local Ecological Systems. In addition to the important sport and commercial species discussed earlier which function as the predominant predators living within the aquatic ecosystems on the site, several additional species, gizzard shad (Dorosoma cepedianum), threadfin shad (Dorosoma petenense), golden shiner (Notemigonus crysoleucas), lake chubsucker (Erimyzon sucetta), brook silverside (Labidesthes sicculus), and mosquitofish (Gambusia affinis) are important to the local environment. Gizzard shad, threadfin shad, golden shiner, lake chubsucker, and brook silverside and smaller individuals of many other species are valuable forage fish for largemouth bass. Mosquitofish, in addition to being a forage fish for many smaller predatory fish species, are important in helping control the local mosquito population. This species has been transplanted into many different areas of the world to help control mosquitos.

The life history and habitat requirements for gizzard shad, threadfin shad, golden shiner, lake chubsucker, and brook silverside have been included in Tables 10.5.5-17 and 10.5.5-18. Brook silverside and threadfin shad were collected from N-16 only. Lake chubsuckers were collected from Tiger Bay only. Golden shiners were collected from N-16. Gizzard shad were collected from all of the habitats sampled.

EXISTING CONDITIONS. Baseline aquatic ecology conditions are described above. For most of the site, existing ecological conditions are not representative of ecological systems which would be present with implementation of existing approved (pre-1992) reclamation plans and nonmandatory reclamation plans. With the exceptions of SA-11, SA-12, Tiger Bay, and Tiger

Bay East, the approved reclamation plans will result in conversion of site aquatic habitats to primarily upland conditions and some wetlands.

Studies done at N-16, Tiger Bay, and Tiger Bay East (Camp Meeting Ground Branch) were designed to be representative of both existing and baseline site conditions for aquatic systems. Descriptions of N-16 and Tiger Bay aquatic systems are presented under the baseline conditions discussed above. In accordance with the Binding Written Agreement on the Plan of Study, Camp Meeting Ground Branch, including the portion in Tiger Bay East, is discussed here to provide a complete description of existing on-site aquatic systems. However, Camp Meeting Ground Branch is not representative of baseline conditions, nor will it be impacted by power plant development. Therefore, this information is not relevant to the impact assessment presented in Chapters 4 and 5.

Site Description. Camp Meeting Ground Branch originates east of, and receives seepage from, the Tiger Bay area. It was generally isolated from Tiger Bay, but in major storm events, has been supplied by overflow from the eastern portion of Tiger Bay. The Camp Meeting Ground Branch drainage basin consisted of a series of small wetlands (lentic habitats) connected by a stream of flowing water (lotic habitats). Both of the habitat types characteristic of this drainage were investigated during the baseline field activities. Bank conditions along this drainage appeared to be stable with abundant vegetative cover including live oak (Quercus virginiana, black cherry (Prunus serotina), persimmon (Diospyros virginiana), fox grape (Vitus munsoniana), shrub verbena (Lantana camera), marsh pennywort (Hydrocotyle umbellata), fern (Thelypteris hispidula), cogon grass, cattail, Carolina willow, primrose willow and wax myrtle. Aquatic vegetation in the littoral zone in lotic habitats included water lettuce (Pistia stratiotes) and duckweed. The dominant substrates in both lentic and lotic habitats were fine sands and silts (Table 2.3.6-1).

Station Location and Description. Two stations on Camp Meeting Ground Branch were selected (one in a lentic habitat and one in a lotic habitat). Station selection and sampling characteristics are the same as those described above for baseline study areas (N-16 and Tiger Bay).

CAMP MEETING GROUND BRANCH (CMG) STATIONS:

CMG-01 was a flowing water (lotic) station located off-site near the point where flows exit the eastern portion of the IMC-Noralyn Mine property. The station was located at a gauging station

used to monitor stream flow past that point. A small weir at the downstream end of the station was used as a calibrated discharge point enabling stream flow to be determined. This weir also impounded the water behind it, slightly decreasing the velocity, increasing the stream width, and reducing its depth. The depth at this station was approximately 1.0 feet. The streambanks were stable, well vegetated, and showed no signs of erosion. Upstream of the station, the stream was covered by a canopy of primrose willow and Carolina willow, but at the station the canopy opened up and cattail and Hydrocotyle umbellata grew along the banks, a width of 25 feet. The length of the station extended from the upstream weir to the point where the stream became too overgrown to sample (about 75 feet). The station transect extended from the north bank to the south bank. Electrofishing was conducted throughout the entire station. Camp Meeting Ground Branch at this point is bordered on the south by the Mobil-Fort Meade Mine property. During the February 1992 field investigations, the dike associated with this mine was being modified in an area adjacent to the station. Silt fencing was in place to protect the drainage, but it may have been possible for sediment from the construction activities to enter the stream.

Station CMG-02 was located in a small open water wetland upstream from CMG-01 in an area also referred to as Camp Meeting Ground Branch in Tiger Bay East. This station had stable, gradually sloping, well vegetated banks with no signs of erosion. The littoral zone was well developed and supported abundant cattail growth around the entire wetland. The depth at this station was approximately 8.5 feet. The station transect extended from the west bank to the east bank, about 150 feet. Electrofishing activities were concentrated along the western shoreline.

Water Chemistry. Water temperature, pH, dissolved oxygen, turbidity, and specific conductance data for the Camp Meeting Ground Branch Stations in wet and dry seasons are shown in Table 2.3.6-2.

Fisheries. Fish species potentially occurring in the Polk County area and their life history information are presented in Tables 10.5.5-17 and 10.5.5-18. Table 2.3.6-3 provides a description of fish species collected during the wet and dry season field investigations.

During both the wet and dry season field investigations, a total of ten species representing five families were collected or observed at the Camp Meeting Ground Branch stations.

The Fulton coefficient of condition (K) values for fish collected at the site are presented in Tables 2.3.6-4 through 2.3.6-6. The black crappies collected from Camp Meeting Ground

Branch during the dry season had a mean K value less than the published range, indicating that these fish may be less fit that those collected in the published study or that the young age group collected influenced the results. The upper range of K values for black crappies, however, did fall within the published range.

Benthic Macroinvertebrates. Tables 10.5.5-19 through 10.5.5-23 include benthic macroinvertebrate results from Camp Meeting Ground Branch. Specimens collected from Camp Meeting Ground Branch totaled 3,839 individuals representing 49 taxa. Of these, 55.2 percent were oligochaete worms, 37.1 percent were insects, 3.9 percent were copepods, and 1.6 percent were amphipods. The insect population consisted of 4 orders, including Ephemeroptera (11.1 percent), Odonata (0.1 percent), Trichoptera (0.2 percent), and Diptera (88.4 percent). The Diptera population consisted of Bezzia sp. (19.8 percent), Palpomyia sp. (0.1 percent), Chaoborus punctipennis (4.7 percent), and unidentified chironomid species (75.4 percent). The mean diversity was 0.983 (range= 0.369-1.380) and the mean density was 13,779.22 individuals per square meter (range= 2,842.0-31,735.2).

Statistical comparisons of the mean diversity and density data as compared to stations within each habitat and station by season indicated one significant difference ($\alpha = 0.05$). When the mean diversities were compared by habitat and station, CMG-02 was significantly higher than CMG-01. Primarily, this was because station CMG-01 (lentic), oligochaete worms (one family) made up a higher percentage of the abundance population (77.2 percent) than at station CMG-02 (lotic), where they only comprised 19.7 percent, significantly less than the diversity at CMG-01.

The benthic macroinvertebrate species collected using Hester-Dendy substrates are presented in Table 10.5.5-24 through Table 10.5.5-26. The Camp Meeting Ground Branch station collections contained a total of 11,894 individuals representing 22 taxa. Of these individuals, insect species made up the predominant group, representing 96.78 percent of the population. The insect population consisted of 27.60 percent Trichoptera larvae and 70.98 percent Diptera. The caddisfly (Trichoptera) population consisted predominantly of hydropsychid larvae (86.53 percent) and polycentropodid larvae (10.92 percent). The Diptera population consisted predominantly of chironomid larvae (97.11 percent). The mean diversity was 1.19 (range = 0.738 - 1.698) and the mean density was 1,101.95 individuals per square meter (range = 915.75 - 29,614.8).

Site Habitat Value. Camp Meeting Ground Branch aquatic systems are of relatively low value because of relatively high turbidity, locally low dissolved oxygen and pH, low benthic diversity, and low fisheries species diversity.

Food Chain Relationships. Food chain relationships are generally as discussed in the baseline conditions above.

SPECIES IMPORTANCE. Using species importance criteria described in the baseline conditions above, there are no known threatened or endangered species or species of special concern in the Camp Meeting Ground Branch portion of the site area.

Largemouth bass, bluegill sunfish, redear sunfish, and black crappie are sport fish which were collected from Camp Meeting Ground Branch. No indicator species are thought to exist at the site. Species important to local ecological systems are similar to those described above in the baseline section.

BASELINE TERRESTRIAL AND WETLAND CONDITIONS

SPECIES IMPORTANCE CRITERIA. Descriptions of expected baseline vegetation community structure, vegetation species dominance, and floral species composition are presented in Section 2.3.5. Within these communities is the potential for occurrence of faunal and floral species which are of special importance. This special importance arises from species status as being either:

- Threatened, endangered, or species of special concern
- Game animals or furbearers
- Indicator and endemic species
- Vertebrate species significant to local ecological systems

Threatened or Endangered Plant Species. Endangered, or federally threatened plants whose ranges include the Site are listed in Table 2.3.6-7. Individual discussions are provided below for the 27 plant species. Many of the plant species discussed are not expected to occur within the FPC Polk County Site. This is due to either absence of a species suitable habitat or distance beyond a species known range. For conservative evaluation purposes, consideration was given

to species whose known occurrence is within a one county radius of Polk County. None of the species described below have been found at the site or at the off-site study areas. No threatened or endangered plant species have been planned for inclusion in existing approved (pre-1992) reclamation plans.

Protected species importance is based on species lists of the FWS (50 CFR 17.11-12), the FGFWFC (Section 39-27.003-005 F.A.C.), and the Florida Department of Agriculture and Consumer Services (DACS) (Preservation of Native Flora Act, Section 581.185-187, F.S.).

CURTISS MILKWEED (Ascelepias curtissii) is an endemic species in central peninsular Florida and has been recorded in Polk County by Florida Natural Areas Inventory (FNAI). This species is listed by FDAC as endangered. It is commonly found in upland areas that have well drained soils, and its habitat includes sand pine scrub and mixed hardwood hammocks. This species has not been observed and is not expected to occur at the site due to the lack of suitable habitat.

AURICLED SPLEENWORT (Asplenium auritum) is a rare fern that grows in hammocks. It has been recorded in only a few counties of central and southern Florida and is therefore listed by FDAC as endangered. This species was not observed and is not expected to occur on site due to a minimal amount of preferred habitat.

FLORIDA BONAMIA (Bonamia grandiflora) is a rare species that has been reported in Polk County by FNAI. It grows in sand pine scrub and is listed by FWS as threatened and DACS as endangered. This species has not been found at the site and is not expected to occur there due to the lack of suitable habitat.

MANY-FLOWERED GRASS PINK (Calopogon multiflorus) commonly occurs throughout central peninsular Florida in pine flatwoods. It is listed by FWS as threatened. This species was not found and is not expected to occur on the site due to a minimal amount of preferred habitat.

SPURRED NEOTTIA (Centrogenium setaceum) is a rare orchid only reported in Dade and Highlands Counties. It grows in dense hammocks and is listed by DACS as endangered. This species was not observed and is not expected to occur at the site due to a minimal amount of suitable habitat and its reported range.

PIGMY FRINGETREE (Chionanthus pygmaeus) has been reported in Polk County by FNAI. It is occasionally found in Florida's central counties growing in sand pine scrub. It is listed by both FWS and DACS as endangered. This species was not found and is not expected to occur on-site due to the lack of suitable habitat.

SATINLEAF (Chrysophyllum olivaeforme) is a small tree growing up to 30 ft tall. It is listed by DACS as endangered. It occasionally occurs in hammocks and pinelands from the Florida Keys northward to Brevard County. This species was not observed and is not expected to occur at the site due to the minimal amount of preferred habitat.

FLORIDA GOLDEN ASTER (Chrysopsis floridana) is a rare plant reported only in sand pine scrub of Hillsborough, Pinellas, and Manatee Counties. It is listed by both the FWS and the DACS as endangered. This species was not recorded and is not expected to occur at the site due to the lack of preferred habitat and its known range.

SCRUB BALM (Dicerandra frutescens) is a rare mint species endemic to Florida. It occurs only in dry oak scrub on the Central Florida Ridge from Highlands County north to Marion County. It is listed by both FWS and DACS as endangered. This species was not found and is not expected to occur on the site due to a lack of suitable habitat.

SCRUB CELERY (Eryngium cuneifolium) is a rare species reported in only sand pine scrub of Highlands County. It is listed by both FWS and DACS as endangered. This species was not found and is not expected to occur on the site due to a lack of preferred habitat.

CRESTED CORALROOT (Hexalectris spicata) is an orchid occasionally found in hammocks throughout Florida. It is listed by DACS as endangered. This species is not expected to occur at the site due to the minimal amount of suitable habitat and it was not observed there.

HIGHLANDS SCRUB ST. JOHN'S WORT (Hypericum cumulicola) is a rare plant occurring in only sand pine scrub of Highlands and Polk Counties. It is listed by both FWS and DACS as endangered. This species was not found and is not expected to occur on the site due to the absence of suitable habitat.

COOLEY'S WATER WILLOW (Justicia cooleyi) is a rare endemic species found in only a few moist rocky hammocks in Hernando and Lake Counties. It is listed by both FWS and DACS

as endangered. This species was not found and is not expected to occur on the site due to its known reported range.

NODDING PINWEED (Lechea cernua) is frequently found in scrub throughout central peninsular florida. It is listed by DACS as endangered. This species was not observed and is not expected to be present on the site due to the absence of scrub habitat.

PINE PINWEED (L. divaricata) is occasionally found in pinelands throughout central peninsular Florida. It is listed by DACS as endangered. This species was not found and is not expected to occur on the site due to the minimal amount of preferred habitat.

SCRUB BLAZING STAR (Liatris ohlingerae) is a rare plant that grows in sand pine scrub only in Polk and Highlands Counties. It is listed by both FWS and FWAC as endangered. It was not found and is not expected on the site due to the absence of preferred habitat.

SCRUB LUPINE (Lupinus aridorum) is a rare species found only in sand pine scrub of Polk and Orange Counties. It is listed by both FWS and DACS as endangered. This species was not found and is not expected to occur on the site due to the lack of suitable habitat.

SCRUB BEARGRASS (Nolina brittoniana) is occasionally found in dry pinelands and sand pine scrub of central peninsular Florida. It is listed by DACS as endangered. This species is not expected to occur on the site due to the absence of preferred habitat and was not reported there.

HAND FERN (Ophioglossum palmatum), listed by DACS as endangered, is a rare epiphyte on the cabbage palm. Its distribution is restricted to southern and south central peninsular Florida. This species was not observed and is not expected to occur on the site due to the lack of cabbage palms.

PAPER-LIKE NAILWORT (Paronychia chartacea) is occasionally found in central peninsular Florida. It is listed by FWS as threatened and the DACS as endangered. It grows in well drained sandy soils of sand pine scrub. This species was not recorded and is not expected to occur on the site area due to lack of suitable habitat.

SCRUB MILKWORT (Polygala lewtonii) is occasionally found in sandpine scrub and dry oak woods of central peninsular Florida. It is listed by DACS as endangered. It is not expected to occur in the site area due to the minimal amount of suitable habitat and was not observed there.

HAIRY JOINTWEED (Polygonella ciliata var. basiramia) is a rare plant found only in sand pine scrub of Highlands and Polk Counties. It is listed by both FWS and DACS as endangered. This plant was not found and is not expected to occur on the site due to the absence of preferred habitat.

SCRUB PLUM (Prunus geniculata) is restricted to the sand pine scrub of the Central Florida Ridge from Highlands County north to Lake and Polk Counties. It is listed by both FWS and DACS as endangered. This species was not observed and is not expected to occur on-site due to the lack of preferred habitat.

CHAFFSEED (Schwalbala americana) is a rare species that grows in dry oak woods and pinelands of only Levy and Highlands Counties. It is listed by DACS as endangered. This species was not found and is not expected to occur on-site due to a minimal amount of suitable habitats and its reported range.

CLASPING WAREA (Warea amplexifolia) is a rare species found in dry pinelands and sand hill communities of north-central peninsular Florida. It has been recorded in Polk County by FNAI. It is listed by both FWS and DACS as endangered. This species was not found and is not expected to occur at the site due to a lack of preferred habitat.

CARTER'S MUSTARD (W. carteri) occasionally occurs in sand pine scrub and sandhill communities of central peninsular Florida. It has been recorded in Polk County by FNAI. It is listed by both FWS and DACS as endangered. This species was not found and is not expected to occur on the site due to a lack of suitable habitat.

SIMPSON ZEPHYR LILY (Zephyrnanthes simpsonii) frequently occurs throughout peninsular Florida in wet pine flatwood and wet prairies. It is listed by DACS as endangered. This species was not found but may occur in small isolated areas of the site where natural vegetation still remains or has developed over time such as Tiger Bay and Camp Meeting Ground Branch.

Threatened, Endangered, or Species of Special Concern (Animals). Terrestrial vertebrate protected species status for the site based on habitats expected to exist following reclamation is summarized in Table 2.3.6-8. No protected invertebrates occur in the site vicinity (Wood, 1991) and are not likely to occur at the site following reclamation. With implementation of reclamation, the significantly disturbed characteristics of the site resulting from cattle grazing, citrus farming, and the previous mining history (See Section 2.3.6.2) will render it poorly suited for habitation by most threatened or endangered species except in wetlands areas. Descriptions of habitat requirements, species range and other life history characteristics of protected vertebrate species potentially occurring at the site with baseline reclamation are given below.

COMMON SNOOK (Centropomus undecimalis) is a fish of coastal bays, estuaries, canals, and streams in southern Florida on an annual basis. It is found north of this area on a seasonal basis. The species is a popular game fish. The common snook feeds upon other fish and some crustaceans. The species is very sensitive to low temperatures (Lee et.al., 1980). This species is not likely to occur in the site vicinity because of loss of stream habitats leading to the site area, and the overall aquatic habitat modification in phosphate mined lands with baseline reclamation.

FLORIDA GOPHER FROG (Rana areolata) has been recorded throughout most of Florida. Its most common habitat association is in and around gopher tortoise burrows. The preferred habitat is dry but near enough to grassy ponds for breeding. The gopher frog feeds upon insects and toads. No habitat for the species currently exists on the site. Habitats for this species will likely be present on the site with baseline reclamation. The latter will likely include the greater area of available habitat depending on the status of burrowing vertebrates, especially the gopher tortoise. Habitat loss and human disturbance are cause for this listing as a species of special concern (McDiarmid, 1978).

GOPHER TORTOISE (Gopherus polyphemus), a species of special concern in Florida, has large populations within the state of Florida. Species habitat includes dry, well drained soils covered with a variety of upland pine and oak species, as well as old field vegetation communities. Vegetation cover is usually a habitat requirement. Gopher tortoises feed on grasses, leaves, and other herbaceous matter. This species excavates long burrows for its own use; however, a variety of other species also use these burrows for shelter: eastern indigo snake (Drymarchon corais couperi) and gopher frog. Some species use only tortoise burrows for life history needs (McDiarmid, 1978). Potential habitat for the gopher tortoise would be found in

any reclaimed upland areas of the site. Areas with flat topography and high wet season water table would limit burrowing habitat. Sandy soils versus soils with rock and solidified hard clays on the site will be preferred by the tortoise. The gopher tortoise was recorded on the site area prior to mining (FNAI files, Tallahassee, FL), but not observed during field inspections.

SUWANNEE COOTER (Pseudomys cocinna suwanniensis), Hillsborough County and northern Polk County are at the southern extent of the range of the Suwannee cooter. This species inhabits lower drainages and river mouths. It feeds on turtle grass and other aquatic vegetation, carrion and small anthropods. A combination of habitat degradation and disturbance by humans has resulted in its listing as a species of special concern (Ashton and Ashton, 1985; McDiarmid, 1978). Habitat for this species does not now occur on the site nor will it occur on the site with any approved or proposed reclamation plans.

AMERICAN ALLIGATOR (Alligator mississippiensis), federally classified as threatened through its similarity in appearance to the American crocodile (Crocodylus acutus), and a species of special concern in Florida, has populations existing throughout the state and over much of the southeastern United States coastal plain. This species is found in nearly all wetland and aquatic habitat types in Florida. Food for the alligator includes aquatic and wetland vertebrates and larger invertebrates (McDiarmid, 1978). Potential habitat for this species following baseline reclamation in the site area ranges from drainage canals to freshwater depression type wetlands, and ponds. Alligators were observed to be very common in clay settling ponds on the site.

SHORT-TAILED SNAKE (Stilosoma extenuatum) is found in Florida from the northeastern portion of the state south to Highlands County. This species is associated with xeric conditions of longleaf pine-turkey oak communities and in oak hammocks. Its natural history is poorly known (Ashton and Ashton, 1988). Habitat loss from timber operations and development are the primary reasons for its threatened status (McDiarmid, 1978). Habitat is not present on the site but will be of limited occurrence with baseline reclamation.

FLORIDA PINE SNAKE (Pituophis melanoleucus mugitus) is found throughout most of northern and eastern Florida. It occupies sandy habitats such as longleaf pine and turkey oak communities. The pine snake feeds upon small mammals, birds, and other small vertebrates (Ashton and Ashton, 1988). Habitat loss is the primary reason for its population decline and listing as a species of special concern. No habitat for this species is currently on the site. Baseline reclamation plan conditions would contain limited appropriate habitat.

EASTERN INDIGO SNAKE (Drymarchon corais couperi), classified as threatened by Florida and the federal government, is generally found in Florida and southeastern Georgia. Species habitat includes dry sandy areas, as well as moist vegetation communities. The indigo snake frequently uses gopher tortoise burrows as shelter in xeric habitats, in part to avoid desiccation. Food for this species includes a wide range of small upland vertebrates including other snakes (McDiarmid, 1978). Potential habitat for the indigo snake in the site area exists in pine flatwoods and pine and wet prairies and would be present at the site with baseline reclamation. No indigo snakes were observed at the site. The indigo snake has been observed in several areas of Polk County prior to mining (FNAI, 1992).

BLUE-TAILED MOLE SKINK (Eymeces egregius lividus) occurs on the Lake Wales Ridge in Polk and Highlands Counties. Its habitat is sand pine and scrub where it burrows in the St. Lucie Fine Sand. Occasionally, it is found in the turkey oak vegetation community. This species consumes small invertebrates such as roaches, spiders, and crickets. Habitat loss is reason for its threatened status (McDiarmid 1978). The site currently lacks habitat for this species. The baseline reclamation plans include limited and marginal habitat which might be suitable for the species.

SAND SKINK (Neoseps reynoldsi) occupies loose sandy ridges in central Florida from Lake County southward to Highlands County (Ashton and Ashton, 1985). This species inhabits sand pine/scrub forests and turkey oak communities burrowing in the sand and beneath fallen logs and vegetation litter (McDiarmid, 1978). No habitat occurs on the site at present. Limited and marginal habitat would exist at the site under existing approved (pre-1992) reclamation plans. Habitat loss is the primary reason for the species threatened status.

WOOD STORK (Mycteria americana) is considered endangered in Florida with nesting colonies occurring in South Carolina, southeastern Georgia and Florida. Nesting and feeding occur in freshwater wetlands and brackish mangrove swamps. Food for this species includes small fish usually obtained from shallow water. Inland nesting is frequently in large cypress trees while mangrove islands provide nesting habitat in estuarine and marine environments (Kale, 1978). Shallow open water and isolated marsh lands represent potential feeding habitat for the wood stork in the site area, particularly under low water conditions when fish are concentrated. This habitat exists along ditches, in depressions and in shallow areas on clay settling ponds. Wood storks were observed feeding in these habitats on the site. No suitable freshwater swamp nesting

habitat and minimal feeding habitat were found to occur at or near the site. Wood storks were observed feeding in off-site reclaimed wetlands and adjacent ponds.

SOUTHERN BALD EAGLE (Haliaeetus leucocephalus), considered threatened by the State of Florida and endangered by the federal government, occurs throughout the state; however, nesting is concentrated in north central counties and along coastal portions of Charlotte, Lee, Collier, Monroe, and Dade Counties. Nesting usually occurs near feeding areas along shorelines and over shallow water bodies. Nests are solitary and are usually in tall pine or cypress trees often with good visibility over the surrounding countryside. Although fish are this species' primary food source, other vertebrate prey may be captured (Kale, 1978). Feeding habitat for this species includes clay settling ponds and marshlands which occur now and will occur following reclamation. The potential for nesting at the site is low now but would increase with implementation of the baseline reclamation.

SOUTHEASTERN AMERICAN KESTREL (Falco sparverius paulus), considered threatened by the State of Florida, is an open habitat bird preferring open pine forest and clearings with dead trees. However, it can also be found along the open edges of river bottoms, coastal regions, suburban areas, and even in large cities. Large insects are the primary food item with small rodents and reptiles also being important prey items. Falco sparverius paulus ranges from South Carolina south to southern Alabama and Florida with recent observations indicating that the Florida population is declining (Kale, 1978). Kestrels were observed occasionally at the site during the winter surveys, but not during the breeding season surveys. Habitat for this species would be present on the site with baseline reclamation.

CRESTED CARACARA (Polyborus plancus), considered threatened by the State of Florida, ranges through much of Florida, southern Texas, Arizona and northern Baja, California. In Florida, the caracara can be found as far south as the lower Florida Keys (Monroe County) and northward to Nassau County. This is a bird of the open country. Dry prairies having scattered cabbage palms (Sabal palmetto) are the typical habitat. Wetter areas, improved pasture and even relatively wooded areas are also used, though less frequently. Caracara are opportunistic feeders eating carrion and capturing a variety of insects, fish, snakes, turtles, birds, and mammals (Kale, 1978). Habitat within the site area suitable to support the caracara is marginal and with implementation of baseline reclamation it will remain so.

OSPREY (Pandion haliaetus) occurs at and near rivers, lakes and wetlands throughout the state. The population in the Keys is listed as a species of special concern. It has received consideration here because of its protected status elsewhere in the state, its previous decline due to chlorinated insecticides, and its high level position in the food chain. The osprey nests on tall structures near feeding areas or near the ground on islands with low predator populations (Kale, 1978). The species feeds upon fish. The site is occupied by osprey during all seasons. Nest platforms in Tiger Bay have been occupied by nesting pairs regularly during the breeding season. The implementation of baseline reclamation plans would result in less feeding habitat for the osprey.

FLORIDA SANDHILL CRANE (Grus canadensis pratensis) is classified as threatened in Florida and ranges from extreme southeastern Georgia (Okefenokee Swamp) southward through peninsular Florida, becoming scarce in Monroe and Dade Counties. The preferred habitat includes wet prairies, marshy lake margins, and low-lying improved cattle pastures. Nesting activity is related to water level with eggs hatching normally in March and April. Sandhill cranes feed on a wide range of plants. Besides eating various grains, they consume herbaceous foliage, underground stems, tubers, and roots. Invertebrates such as grasshoppers, beetles, caterpillars and snails along with certain amphibians and mammals make up the bulk of the animal portion of its diet (Kale, 1978). Suitable feeding habitat exists in Tiger Bay and would likely be limited to herbaceous wetlands and possibly nonmandatory lands if they were to be converted to pasture land instead of citrus groves under baseline reclamation conditions. No sandhill cranes were observed on the site.

LIMPKIN (Aramus guarauna), a species of special concern in Florida, can be found throughout peninsular Florida where they favor slow-moving freshwater rivers and streams, marshes and lake shores. Nesting in Florida probably occurs year round and corresponds with the availability of foods. Various snails along with other freshwater mussels are the limpkin's primary foods. Lizards, insects, frogs and worms are eaten in lesser amounts (Kale, 1978). Suitable limpkin habitat was present at the site, however, this species was not observed on the site. The lack of slow moving watercourses now and with baseline reclamation limits the opportunity for limpkin usage. This species may feed in the area but would not be common.

LITTLE BLUE HERON (Egretta caerulea), a Florida species of special concern, breeds along much of the Atlantic and Gulf coasts. In Florida, they range from the panhandle south to the Florida Keys. Cypress (Taxodium distichum), southern willow (Salix caroliniana), red

mangrove, black mangrove, cabbage palm (Sabal palmetto), and Brazilian pepper are among the more common trees used during the breeding season which, in Florida, spans the months of February to September. These tree species occur in habitats ranging from fresh to saltwater. Little blue herons prefer to forage in freshwater habitats for the crustaceans, insects, small fish, frogs and lizards which form the major portion of their diet (Kale, 1978). The site contains suitable feeding habitat for the little blue heron and with implementation of existing approved (pre-1992) reclamation plans would also provide this habitat in herbaceous and fringe wetlands. Little blue heron feeding was occurring in off-site reclaimed wetlands where standing water was present. Nesting by this species occurred in 1991 in mine area N-11A. Nesting may continue to occur there until the soil surface dries following removal of the mine recirculating water system. However, suitable meeting habitat would not be expected to be present following baseline reclamation.

SNOWY EGRET (Egretta thula), a Florida species of special concern, is typically restricted to coastal areas. It is found from Maine to Florida along the Atlantic Coast and to Texas along the Gulf. This small white egret nests in both inland and coastal colonies throughout peninsular Florida, but only rarely in western Florida. The largest nesting colonies occur in coastal estuarine habitats often in association with tricolored heron. Woody species typically chosen for nest sites include mangroves, willow, buttonbush, and wax myrtle stands. Small fish and various invertebrates are among the more common food items. Feeding habitat for the snowy egret exists at the site and would occur with implementation of reclamation. No nesting birds were observed in off-site reclaimed wetlands though feeding birds were present.

TRICOLORED HERON (Egretta tricolor), classified as a species of special concern in Florida, can be found along the entire Atlantic and Gulf coasts to include the Caribbean and West Indies to northern Brazil. In peninsular Florida, this large wader is most commonly found in estuarine colonies and only occasionally in freshwater habitats. Mangroves, willow, buttonbush, marsh elder, and wax myrtle are among the more common woody species used for nesting. Nesting may begin as early as February or as late as July (Kale, 1978). Small fish are the primary food source while a variety of invertebrates are also consumed to a lesser extent. Nesting habitat for the tricolored heron occurs within the site as noted for the little blue heron above. Suitable feeding habitat is present and would be present with implementation of existing approved (pre-1992) reclamation plans.

LEAST TERN (Sterna albifrons) occurs in coastal areas throughout the state. Nesting colonies have occurred at widely scattered inland locations. The tern has nested near Polk County in both Lake and Highlands Counties. Nesting generally occurs on open flat sandy areas. Feeding habitat includes aquatic areas where they feed upon small fish (Kale, 1978). The site may be sparingly used by this species for feeding. It could be used in a similar fashion under baseline reclamation conditions until sand deposits and open water habitats revegetate. Habitat loss and human disturbance are the reasons for its listing as a threatened species.

BURROWING OWL (Athene cunicularia) occurs throughout much of the central peninsula of Florida. Its habitat includes prairies, pastures, sand hills with a sandy soil and low vegetation. This species feeds upon a variety of small mammals, amphibians and reptiles, and insects. Habitat loss and modification is the basis for this species being listed as a species of special concern (Kale, 1978). No habitat for the owl occurs on this site at present. Marginal habitat would be present if the site area is under baseline reclamation conditions.

RED-COCKADED WOODPECKER (Picoides borealis), a species classified as endangered by the federal government and as threatened by Florida, has a range primarily restricted to coastal plain pine woods of the southeastern United States. In Florida, this bird is found throughout most of the state south to the Homestead area. Historically, red-cockaded woodpecker cavities have been found in a variety of pine species. Trees chosen usually are advanced in age and infected by a fungus disease that softens its heartwood. Studies from different parts of the south found that the average cavity tree age ranged from 62 to 149 years with cavities rarely found in trees as young as 30 to 40 years (Hooper et al., 1980). No habitat for the red-cockaded woodpecker was present at the site. No colonies were observed or are reported to exist near the site. No colonies are likely to develop at the site with implementation of baseline reclamation.

FLORIDA SCRUB JAY (Aphelocoma coerulescens) inhabits oak scrub communities in scattered locations about the peninsula of Florida. Wet areas and forests are avoided. The jay feeds on small frogs and lizards and anthropods in the spring and summer and primarily acorns and berries during the other seasons. No habitat for the species exists at the site and minimal habitat would be present with implementation of baseline reclamation plans for this site. Habitat conversion to development and agriculture has resulted in its status being listed as threatened (Kale, 1978).

FLORIDA GRASSHOPPER SPARROW (Ammodramus savannarum floridanus) is restricted to a small portion of central Florida including portions of Polk, Osceola, Highlands, Okeechobee, Glades, and Hendry Counties. Habitat for this species includes dwarf oak and stunted saw palmetto and pastures with scattered saw palmetto. No habitat for this species exists at the site and minimal habitat would occur under baseline reclamation conditions. Conversion of the preferred habitat for this species to open pastureland is the cause of its listing as endangered (Kale, 1978).

FLORIDA PANTHER (Felis concolor coryi), is a species considered endangered by both the State of Florida and the FWS. In Florida, this species is generally found in large undeveloped lands in the central parts of the state southward. It feeds primarily on large mammals, such as deer, rabbits, raccoons, etc. It may be diurnally active. The Florida panther has a large home range and may travel extensively up to 25 miles in a given night (Whitaker, 1980). Unofficial observations of the species were made at the site in the area between N-15 and SA-8. No tracks of the species could be found in either instance. Several subsequent trips to the site, to locate tracks and scat of this species, did not result in any panther evidence. The FNAI files show no records of the panther in the site region.

FLORIDA BLACK BEAR (Ursus americanus floridanus) has been recorded at scattered locations throughout the state. Records exist for the species occurring in the north part of Polk County. This species prefers dense vegetation cover and is omniverous in its feeding habits. Habitat loss, hunting, and other human disturbance have contributed to the decline of populations of this species and its listing as threatened (Layne, 1978). Habitat is present on the site for the bear. Minimal habitat will be present on the site under baseline reclamation conditions.

SHERMAN'S FOX SQUIRREL (Sciurus niger shermani), a Florida species of special concern, prefers the longleaf pine-turkey oak vegetation association of the sandhills. However, smaller numbers are known to occupy certain ecotonol situations. Among these transition areas are zones where range includes much of peninsular Florida east of the Suwannee River and north of Lake Okeechobee. Pine seeds and acorns along with a few insects are the primary food items (Layne, 1978). Suitable habitat does not exist on the site. However, it could possibly exist under baseline reclamation conditions.

Game Animals and Furbearers. The site is relatively high in population levels of most game animals and furbearers. This condition is temporary given the rate of ecological succession at

the site and the implementation of baseline reclamation plans. Given the probability that nonmandatory lands will be converted to pasture or citrus grove, habitat for game animals and furbearers will be relatively limited after reclamation. Table 2.3.6-8 summarizes the expected status of these animals in the site area with the existing reclamation plans in effect. It should be noted that no hunting has been allowed on the site.

Indicator and Endemic Vertebrate Species. No animal species endemic to Florida are likely to occur on the site with reclamation. Few indicator species are likely to be observed at the site with reclamation. The following indicator species characteristic of a given habitat type may be present before and after reclamation:

- Eastern Meadowlark - Pasture and Rangeland
- Marsh Rice Rat - Herbaceous Wetlands
- Bullfrog - Ponds
- Pig Frog - Ponds
- Southern Leopard Frog - Ponds, Herbaceous Wetlands
- Southern Cricket Frog - Ponds
- American Alligator - Ponds

Vertebrate Species Important to Local Ecological Systems. The importance of vertebrate species to ecological systems on the site with baseline reclamation is based upon roles species play in the local food chains and their ability to impact this energy flow by virtue of their numbers present. Most of the site will be under agricultural usage with baseline reclamation conditions. Baseline conditions, therefore, will include most of the species currently using the site, but the number of individuals of these species will be much reduced because of nonagricultural habitat reduction. Seasonal shifts in faunal ecosystem roles can complicate site food chain characteristics. For example, breeding, migratory and wintering birds differ seasonally in their food requirements and use of site habitats. Additionally, during the dry season, when many site wetland areas dry out for several months, these areas take on terrestrial characteristics. Consequently, habitat availability for species changes during the course of a year.

Table 10.5.5-27 presents a listing of amphibian and reptile species which could potentially use the site. Reptilian species which may be most prominent at the site could include the following: black racer, skinks (Genus Eumeces), common garter snake and eastern diamondback rattlesnake in upland areas. In site wetlands, the American alligator, cooters, and water snakes (Nerodia sp.) are expected to be most abundant.

The following discussion of avian species important to local ecological systems focuses on winter and breeding season populations. During these periods of time, species populations are, at least in part, directly dependent on site habitats for food, cover and other life history requirements. During migratory seasons avian populations have less of a dependence upon site resources. The combined ecological effects of migratory birds of all species likely influence populations of most site biota.

Birds significant to local ecological systems are generally those with larger population densities or those considered to be upper and top carnivore species. Upper and top carnivore species (Appendix Table 10.5.5-28) include raptors, shrikes, and large wading birds. For most of the smaller migratory bird species, dietary shifts occur in preparation for migration and winter occupation (when high energy content foods such as grains are required) and for nesting (when higher protein content foods are required for egg production and nestling growth). During the breeding season, therefore, many of these migratory species position in the food chain will rise with more carnivorous diets and in the other seasons fall at times when more herbivorous or graniverous diets are required.

Large wading bird use of the site with baseline reclamation conditions would be restricted generally to shallow ditches and open isolated wetlands with standing water. This situation was observed in off-site reclaimed wetlands areas where standing water was present. If pastureland were present, the cattle egret would likely be a prominent food-chain component. Red-tailed and red-shouldered hawks would be observed throughout the open and forested portions of the site respectively. Red-shouldered hawks would be observed more often in and near forested habitats. Red-tailed hawks would be more often observed foraging in open pine flatwoods and pastureland and rangelands. The northern harrier would occur, foraging over open low vegetation in large dry wet prairies, rangelands and pasturelands as they are present. Loggerhead shrikes would most frequently be observed in pasture and pine flatwoods. Barbed wire used in the cross fencing of pasturelands would likely supplant the general lack of vegetation with thorns required by shrikes to assist in securing prey. In open water, waterfowl

including ducks, coots, common moorhens, double-crested cormorants, white and brown pelicans and anhingas would dominate the food chain systems at the upper trophic levels.

The most significant mammals affecting the local ecological system in agricultural lands with baseline reclamation would be domestic cattle and possibly feral hogs. Their effects are described in Section 2.3.6.2, Pre-existing Stresses. Other noticeable effects would likely be from the armadillo. The above species disturb ground cover vegetation particularly in wetland areas where softer soils prevail. The only confirmed indications of top or upper carnivore species presence at the site were that of the bobcat and fox. These species would also be present at the site with baseline reclamation.

The occurrence and food chain status of mammals potentially occurring at the site under baseline conditions are presented in Table 10.5.5-26.

In wetlands, streams, and open pond habitats, river otters would likely be the most prominent mammals. Elsewhere, where there is adequate cover, the assortment of medium-sized mammals as currently occur at the site would likely occur after reclamation. These include raccoons, opossum, armadillos, and bobcats. The white-tailed deer should also be present. In addition to the bobcat as a top carnivore, the gray and red fox could be present in adequate numbers to significantly influence the food chain. Other species which could be present include the eastern cottontail and marsh rabbits, and striped skunks. Small mammals which could be present include several rodents and shrews.

EXISTING TERRESTRIAL AND WETLAND CONDITIONS

Previous discussion of baseline conditions in Sections 2.3.5 and 2.3.6.1 is indicative of existing conditions. Baseline vegetation community types are similar to exiting vegetation community types. However, under the baseline condition, most of these vegetation communities will be more extensive than existing communities, with the exception of the emergent wetland vegetation occurring in the clay settling areas in the buffer area. As discussed below, this vegetation community is of low ecological quality and would be eliminated with normal mine reclamation.

Discussions of protected species, game and fur bearers, indicator and endemic vertebrate species and vertebrate species important to local ecosystems, and species which would occupy the site in the baseline reclamation discussion above, are applicable to existing conditions. Most of the

site is rapidly undergoing land cover change. Clay settling area N-15 has, within a year, gone from a large pond occupied by numerous water fowl to one of limited open water with less water fowl usage. Clay and sand introduction to N-15 has filled up much of the pond and has resulted in stands of cattails and water hyacinth becoming established.

Other clay settling areas including P-2, P-3, Phosphoria, SA-8 and SA-9 are in varying stages of being drained and having surface vegetation cut as part of the reclamation process. Nonmandatory lands such as N-11A and N-13 are in the latter stages of clay consolidation and awaiting drainage and reclamation to upland agricultural usage. N-16 is in the early stages of clay deposition.

The transition from early clay settling status to reclamation is relatively short in time, but involves significant changes in ecological succession and attendant wildlife usage. Early in the process, significant wildlife usage occurs. This trend declines as cattails develop and willows and other shrub species become established. This pattern was seen in the various mine conditions on the site.

Tiger Bay and Tiger Bay East are the two site areas where existing conditions are the baseline conditions. No generation and associated facilities are to be placed in these areas.

2.3.6.2 Pre-existing Stresses

Pre-existing stresses for this discussion consist of environmental disturbances which would occur under baseline conditions. Generally, stresses which would be expected at the site include the following categories:

- Effects of cattle grazing
- Effects of feral hog disturbance
- Effects of human activity
- Effects of the decline of Tiger Bay

EFFECTS OF CATTLE GRAZING

Conversion of land to pasture limits the number of available vegetation strata and inhibits an increase in species diversity. Grazing pressure tends to maintain ground cover in a form with limited habitat value. With reclamation, up to about 70 percent of the site could be pastureland (i.e. 5,898 acres could be pasture or citrus).

EFFECTS OF FERAL HOG DISTURBANCE

Feral hogs are present in the region and represent a localized soil disturbance, particularly in wetlands. Under baseline conditions these animals can be expected to occupy the site area. In other parts of Florida, for example, feral hogs significantly affect the organic layer of wetlands soils by rooting and penetrating the more permeable soils beneath. The consequence is an increase in wetland drainage and oxidation/loss of the organic layer.

EFFECTS OF HUMAN ACTIVITY

Effects of human activity will result from cattle management or grove management and the conversion process of developing a pasture or grove from a drained and consolidated clay settling area. Periodic movement of soils and machinery in each case degrades habitat value of the land. As noted above, up to 70 percent of the site would be converted to pasture or citrus with reclamation.

EFFECTS OF THE DECLINE OF TIGER BAY

As noted above, the water quality and aquatic habitat in Tiger Bay are declining. These wetlands will continue to decline over time. The lack of a circulation pattern in shallow isolated ponds, vegetative cover (Hydrilla and cattails), and shallow water depths will "choke" aquatic systems in Tiger Bay. Additionally, with the removal of the weir draining the N-16 and buffer area (N-11A, N-13, and N-9B), which would occur under baseline reclamation conditions, Tiger Bay would lose its input of seepage water and the decline of wetlands is expected to accelerate. The shift in land cover would be to more upland acreage.

2.3.6.3 Measurement Program

Methods associated with aquatic ecology studies and terrestrial and wetlands ecological studies are described within this section. Two types of data are addressed in these studies: a general characterization of existing conditions and a more detailed evaluation of site conditions proposed with conclusion of mining operations and implementation of existing approved (pre-1992) reclamation plans.

DATA SEARCH/LITERATURE SURVEY

AQUATIC ECOLOGY. The focus of aquatic studies was on important species which are designated as follows:

- Listed as endangered or threatened by the FWS
- Listed as endangered, threatened, or species of special concern by the FGFWFC
- Listed as game or freshwater game or fish in the Florida Administrative Code (F.A.C.) Chapter 39-1
- Species which are indicators of, endemic to, or are otherwise unique to specific plant communities and habitat types

TERRESTRIAL AND WETLANDS ECOLOGY. The objective of the literature review was to obtain varied types of ecological information to be used to develop an understanding of the site following reclamation. This information focused on the following:

- Regional vegetation descriptions
- Plant species lists and ecological reports for the area
- Lists and ecological reports of birds, mammals, reptiles, and amphibians common to the area
- Wetlands reclaimed within and near to the proposed project
- Species checklists, reports of sightings, or abundance estimates

- Interspecific relationships and food chains of important species
- Locations of rare, threatened, or endangered species or critical habitats for these species in the region
- Occurrence of potential preexisting stresses

Several data sources were used in the preparation of the impact assessment as related specifically to wetlands, important species, and plant communities. These were:

- SCS maps
- Site inspections by ground and during flyovers
- Aerial photographs
- IMC monitoring reports for off-site reclamation areas

A description of potential ecological resources at the site and its associated facilities was developed from a data base including information from available literature. Information sources reviewed for relevant ecological data were:

- In-house computer search utilizing the appropriate biological data bases
- Contacts with the FNAI
- Existing approved mine reclamation plans for the site

The information identified during the literature review included:

- Regional vegetation descriptions, including successional patterns
- Lists of birds, mammals, reptiles, and amphibians common to the vicinity of the proposed site
- Species checklists, reports of sightings, or abundance estimates
- Locations of rare, threatened or endangered species or critical habitats for these species

- Information on sulfur dioxide, nitrogen dioxide, ozone, acid precipitation (from the Florida Acid Deposition Study) and trace element effects on vegetation

- Occurrence of preexisting stresses or perturbations such as insect infestations, fires, flooding, overgrazing, and severe weather at reclaimed mine sites

- Vegetation land cover required for approved reclamation plans on-site and off-site

VEGETATION/LAND USE. A description of land cover characteristics of the site and its associated facilities with implemented reclamation plans was prepared. The objective of this task was to collect and organize text and mapping data to provide the following:

- A 1:12,000 scale land use and vegetation map of the site and 1:24,000 scale land use and vegetation map of associated facilities

- Dominant or indicator vegetation species in vegetation communities

- An assessment of the quality or condition of site vegetation communities after reclamation

FIELD AND DATA COLLECTION PROGRAM

AQUATIC ECOLOGY. Baseline aquatic field data were collected in Tiger Bay (a reclaimed and FDNR-released area), N-16, and Camp Meeting Ground Branch (Figure 2.3.6-2). Because of the disturbed characteristics of the site and ongoing mining operations, minimal site-specific ecological information exists. Two primary seasons, representing summer or wet and winter or dry water periods were field investigated. The aquatic field survey consisted of a baseline program summarized in Tables 2.3.6-9 and 2.3.6-10 and below. The program consisted of fisheries and benthos surveys conducted in a manner which satisfied statistical design requirements and included replicate sampling at randomly selected locations in two seasons. Plankton sampling was not included because the baseline conditions for impact assessment do not exist yet on-site.

Parametric analysis of variance and non-parametric tests were used to determine differences in distribution and abundance of organisms.

Specifically, the biology studies investigated and characterized:

- Aquatic habitats for fisheries resources in project area waters, including water quality and substrate types
- Fish communities, including relative abundance of each species, with special attention to recreational species and their distribution
- Benthic communities, including relative abundance and importance in the food web
- Presence of threatened or endangered aquatic species and their potential habitat

Each sampling station was photographed. A field map was also prepared for each station layout, cross-sectional features for representative stretches, significant features, and overhangs. Also, areas with significant changes in substrate types were indicated.

Water Quality Characterization. Measurements for water quality characteristics were made at the same point at each sampling station at the time of sampling for aquatic investigations, as follows:

- pH
- Dissolved oxygen (DO)
- Temperature (air and water)
- Conductivity
- Physical characteristics

These stations differed from water quality sampling stations used for data presented in Section 2.3.4.

A Corning 103 Hand-Held pH Meter was used for pH measurements. The pH meter was calibrated and operated according to the manufacturer's specifications. Both pH 4.00 and pH 7.00 buffers were used for calibration.

Water and air temperatures were measured using an American Society for Testing and Materials (ASTM) thermometer calibrated against a National Bureau of Standards traceable thermometer. The data and time of day of sampling were recorded.

Dissolved oxygen and water temperatures were taken directly using a YSI Model 57 dissolved oxygen meter or equivalent meter. The probe was hand agitated in the water, with sufficient time allowed for the probe to stabilize before readings were taken. Prior to field calibration, the probe membrane was inspected for damage and underlying bubbles; the membrane and potassium chloride solution were replaced, as necessary. Instrument calibration and operation were performed according to the manufacturer's instructions.

Conductivity was measured using a YSI Model 33 S-C-T Meter or equivalent meter. The instrument was calibrated and operated according to the manufacturer's instructions. Calibration information was documented and any factors, such as weather conditions or unusual habitat conditions which could have resulted in unusual readings were described on the field data sheet.

Physical characteristics, depth, and light transmission, were determined at each station. Depths at the wetland, slough, and ditch locations were measured directly to the nearest 0.1 meter. Light transmission was recorded using a Secchi Disc and recorded to the nearest 0.1 m (0.3 foot).

Substrate Analysis. A single substrate sample was collected at each sampling station using a Ponar dredge. Each sample collected was sieved through a series of five steel mesh sieves with mesh sizes of 5 (4.0 mm or 0.16 in), 10 (2.0 mm or 0.08 in), 18 (1.0 mm or 0.04 in), 35 (0.5 mm or 0.02 in), and 200 (0.075 mm or 0.0002 in) in order to separate the substrates into size fractions, using a classification system from Platts (1983) presented in Table 2.3.6-11.

The substrates contained on the Number 5 sieve were predominantly large sediments (gravel and rubble). The substrates contained on the number 10 and 18 sieves were predominantly large fine sediments (large sand) and the substrates contained on the number 35 and 200 sieves were predominantly fine sediments (fine sand and silt). Large and small boulders were not sampled using this method, but their presence was noted visually. These size fractions were then weighed in the field and their weights recorded to determine a percent composition of each fraction within the substrate.

Benthic Macroinvertebrate Sampling. Benthic macroinvertebrates are defined as being "benthic or substrate dwelling organisms visible to the unaided eye and are retained on a U.S. Standard No. 30 sieve" (ASTM, 1986a). They represent an important link in the food chain of many fish species. The majority of these organisms are juvenile or mature life stages of five classes or subclasses: Oligochaeta, Crustacea, Insecta, Gastropoda, and Pelecypoda. Larger individuals or species of several other classes may also be considered macroinvertebrates. Benthic macroinvertebrate communities are often used as indicators of stress on an aquatic system because they are relatively immobile and their composition and density are largely determined by substrate types and local environmental conditions.

Because macroinvertebrates are found in almost all aquatic environments, sampling equipment and sampling methodology utilized was specific to each aquatic environment present. Quantitative samples consisted of several replicate samples of a known substrate area (Table 2.3.6-11). These replicate samples were obtained using sampling devices specific to the types of habitats to be sampled. The sampling program yielded quantitative baseline information which was used to provide the following:

- Correlation of macroinvertebrate species composition and community attributes with seasonal variation
- Correlation of macroinvertebrate species composition and community attributes with habitat types

PONAR Grab Samples. Benthic macroinvertebrate populations were sampled during the wet and dry seasons sampling stations designated. Three replicate samples were collected at each sampling station. Each replicate was taken from different locations within each habitat type, in order to be representative of the physical features of each habitat.

All lentic (nonflowing) habitats and lotic (flowing) habitats over one foot in depth were sampled using a Ponar dredge and methodologies described by ASTM (1986). After collection, the samples were placed in a Wildco Standard No. 30 mesh wash bucket and washed to remove fine substrates. All benthic macroinvertebrate samples were transferred from the wash bucket into appropriately sized sample bottles with sufficient amount of preservative to be added to the sample to prevent decomposition. A solution of 70 to 80 percent ethanol was used to preserve all benthic macroinvertebrate samples.

Before laboratory sorting, each sample was stained with rose bengal solution (Rand et al., 1976) to aid in sample sorting. A two-power magnifying lamp was used to simplify sorting. As the organisms were removed from the substrate they were placed into a vial containing 70 to 80 percent ethanol.

All macroinvertebrates were identified to the lowest practicable taxonomic level (in most gases genus or species) and enumerated using stereo microscopes with appropriate magnification capabilities within the range of 6.4x to 80x. Identifications were made using the following keys: Merritt and Cummins (1987), Brigham et al. (1982), Pennak (1978), Parrish (1975), Hobbs (1981), and Wiggins (1977). Larval fish collected in the macroinvertebrate collections were identified and enumerated. Each identified group of organisms was placed into a separate labeled vial and preserved in 70 to 80 percent ethanol; glycerin was added to each sample to prevent desiccation.

Hester-Dendy Artificial Substrate Sampling. In addition to the quantitative grab samples collected from each station during the wet and dry seasons, Hester-Dendy artificial substrate samplers were placed at each station for a 3-week period once during the study. The artificial substrate samples were used to supplement the grab samples.

Hester-Dendy or multiple samplers consist of 14 tempered hardwood plates which serve as artificial substrates to be colonized by benthic macroinvertebrates. Each plate has a diameter of 7.5 cm and has a smooth surface on one side and a rough surface on the other. The sampler plates are held in place by a 0.63 cm diameter eyebolt. The first nine plates are separated by a single 2.5 cm diameter spacer which separates each plate approximately 3 mm. The tenth plate is separated by two spacers, plates 11 and 12 by three spacers and plates 13 and 14 by four spacers. Each sampler provides an efficient sampling surface area of 0.13 m^2 and the variable spacing of the plates allows for variable spaced habitats for colonization.

Three samplers were placed at each station. The samplers were floated at a depth of approximately 4 feet in deep water areas to insure the samplers were exposed in the euphotic zone to allow for the maximum abundance and diversity of macroinvertebrates to colonize the plates. In areas where the water depth was less than 2.5 m, the samplers were suspended half way between the surface and the sediments. Samplers were suspended in such a way as to prevent the samplers from contacting the substrates which may allow for excess silting of the

sample, inhibiting colonization of the artificial substrates. Each sampler was anchored to the bottom to prevent relocation of the samplers by currents.

Samplers remained in place for four weeks, after which they were retrieved. To prevent the loss of organisms during sample retrieval, the samples were collected in a Wildco Standard No. 30 mesh wash bucket before being removed from the water. After being removed from the water, each sampler was disassembled and each plate and spacer was scrubbed with a toothbrush to remove the colonized organisms, which were collected in the wash bucket. Care was taken to insure that all of the organisms were removed from the plates and the spacers. Each sample was transferred from the wash bucket to an appropriately sized sample container and a sufficient amount of 70 to 80 percent ethanol was added to the sample to prevent decomposition. Each sample was labeled inside and out with the following information: station number, sampling date, sample number (composed of the station number, sample time, sampling date and replicate number), type of sample and collectors' names. All samples were promptly returned to the laboratory for analysis.

Immediately upon arrival in the laboratory, each sample was logged in on a sample status log and temporarily stored prior to processing. Each sampler was disassembled and each part cleaned to remove the organisms which colonized the artificial substrates. The washed samples were concentrated through a standard No. 30 mesh sieve in order to standardize the organism size and placed in an appropriate sized container before the identifications were conducted. After all of the samplers were disassembled and the samples concentrated, the organisms were identified.

All macroinvertebrates were identified to the lowest practicable taxonomic level (genus or species in most cases) and enumerated using stereo microscopes with appropriate magnification capabilities within the range of 6.4x to 80x. Identifications were made using the following primary keys: Merritt and Cummins (1987), Bringham et al. (1982), Smith (1986, 1987), Pennak (1978), Parrish (1975), Hobbs (1981), and Wiggins (1977). Data sheets containing the taxa, number collected, and sample number were maintained during the identification. Each identified group of organisms was placed into a separate vial and preserved in 70 to 80 percent ethanol; glycerin was added to each sample to prevent desiccation. Each vial was labeled internally with the taxonomic information (order, family, genus, and species), project name, species number (a combination of the sample number and individual number to indicate species), date collected, date identified and the identifier's name. After each sample was identified, an

entry was made in the sample status log indicating the date and the identifier's name. Ten percent of all of the identified specimens were verified by a technical reviewer for quality assurance purposes.

All of the identified specimens were stored and their storage location noted in the sample status log. The samples will be inspected periodically to insure that the levels of preservative remain sufficient and that the samples are in good condition.

Fish Sampling. Wet and dry seasonal fish samples were collected at each station. Samples were collected over a minimum fifteen minute period of continuous sampling time using a Smith-Root backpack electrofishing unit. Care was taken to ensure that all habitat types within the station were sampled and that the sampling effort remained constant between stations. Netted fish were placed into a bucket of fresh water carried by one of the two samplers and all collected fish were held until the sample was completed. Two 125 by 6 foot, S panel experimental field nets with 1-inch, 2-inch, 3-inch, 4-inch and 5-inch diagonal mesh sizes were set perpendicular to the shore for a 24-hour period at an open water area of N-16.

Fish were identified and counted in the field. All specimens not identified in the field were preserved and returned to the laboratory for identification. All game fish were measured to the nearest millimeter (total length) and weighed to the nearest gram. Fish were also examined for general condition with general appearance, abnormalities, and presence of external parasites noted. Species, sex, and reproduction condition were recorded, including presence of gravid females, and spawning condition of the males.

Voucher specimens of all species and all specimens not readily identifiable were retained and preserved in 10 percent buffered formalin. Specimens retained greater than approximately 5 inches in length had an incision made on the right side of the abdomen to facilitate penetration of the preservative. Live fish were returned to the water. All dead fish were either kept as vouchers, or if an excessive number of individuals died, were buried.

All fish were identified to the species level using taxonomic keys and species distributions appropriate to the region (Carr and Goin, 1955; Page, 1983; Lee et al., 1980; Smith-Vaniz, 1968; Eddy and Underhill, 1969, Page & Burr, 1991). Identifications were made using a 2X magnifying lamp and binocular dissecting microscope with scanning capabilities.

Data Analysis. All data were presented in tabular form to best document the established environmental conditions at each sampling area. Separate tables were developed for each sampling parameter. In addition to merely reporting numbers of organisms collected, simple descriptive statistics were computed (e.g., means; standard deviations; Shannon-Weaver Diversity Index [Shannon, 1948]; Fulton Condition Factor) as appropriate for the specific sampling parameter.

TERRESTRIAL AND WETLANDS ECOLOGY. The objective of the field sampling program was to investigate the predominant vegetation and wildlife communities of the proposed site and directly associated facilities. This was done to document important botanical, wetland, and zoological features, such as the presence of rare, threatened or endangered biota, for characterization of existing site conditions. A second objective was to investigate locations which were considered to be representative or indicative of mined areas following reclamation. Figure 2.3.6-3 shows the site area including mine designations where vegetation and wildlife surveys were conducted. Areas outside the site where surveys were conducted are shown on Figure 2.3.6-4.

Qualitative field studies to characterize existing conditions were performed in the wetlands, forest lands, and disturbed areas encompassing the proposed project and associated facilities. A quantitative vegetation transect survey was conducted on reclaimed land for impact assessment. Most site areas did not lend themselves to transect use because of access, and terrain variability. The terrestrial monitoring program is presented in Table 2.3.6-12. Plant identifications were made using Bell and Taylor (1982), Godfrey and Wooten (1979), Hitchcock (1971), and Wunderlin (1982).

Monitoring data regarding off-site reclaimed lands and habitat types were obtained from IMC. These reports were reviewed and the reclaimed lands were inspected by low level flyovers with a helicopter. Observations of reclamation progress were made as well as wildlife usage.

Threatened and endangered plant species surveys were conducted in appropriate seasons on the site. Site visits were made to record their presence or absence. The protected status of plant species was determined using the April 1, 1991 Official Lists of Endangered and Potentially Endangered Fauna and Flora in Florida (Wood, 1991):

Vegetation data were recorded from sampling areas located in representative communities selected on the basis of the following:

- Land cover types proposed under existing approved (pre-1992) reclamation plans
- Community size
- Community or species importance (wetlands, rarity, habitat of threatened or endangered species)
- Degree of habitat disturbance, and
- Likelihood of an effect from project development

Major existing vegetation/land use types and areas were delineated and mapped. Vegetation was sampled in the summer (July and August, 1991), fall (November 1991), and winter (March 1992). Wildlife data (existing conditions) were recorded from the same major community types sampled for vegetation using techniques shown on Table 2.3.6-12. Efforts were directed primarily in wetlands and those habitats potentially supporting rare, protected, or recreationally important species. General observation wildlife data were obtained during track surveys of the site. A more systematic survey method such as time area counts for bird populations was not used because of the excessive wind conditions at the surface (above 5 miles per hour) which precluded consistent call recognition. Mammal track surveys were reduced in number during drought periods and periods of frequent rain at the site due to poor track quality. In addition, site vehicular traffic made tracks and other signs difficult to identify during dusty and wet conditions.

The terrestrial and wetlands field program:

- Described plant communities of the site area
- Described the habitats and wildlife populations at the site, including mammals, birds, amphibians, and reptiles
- Determined the presence and habitat of state or federally protected plant and animal species that could occur in the site area
- Described the occurrence status of significant wildlife populations in the area

Surveying of existing terrestrial habitats for wildlife botanical species and habitat types began in June 1991.

Vegetation Community Field Studies in Reclaimed Lands. Vegetation communities selected for sampling were based upon those wetlands communities scheduled for creation in mandatory reclamation lands where power plant facilities are proposed. Additionally, lands reclaimed on-site were surveyed as representative of upland reclaimed land. The identified vegetation communities were surveyed to provide quantitative data on community composition and relative cover.

Detailed vegetation data were obtained through use of a transect method of sampling. One transect was established in previously identified vegetation communities. The transect location is shown on Figure 2.3.6-3. Quantitative information regarding community or habitat components were obtained as described below. Additionally, three off-site reclamation areas were qualitatively surveyed in locations shown on Figure 2.3.6-4.

The P-2 vegetation transect was laid out and the following vegetation layer components were sampled: tree canopy, shrub, and the herbaceous layers. Tree layer vegetation in excess of 10 cm (4 in) diameter at breast height (dbh) was sampled at each station along the transect in 10m by 10m quadrats. Shrub layer vegetation (dbh under 10 cm) greater than 1 m in height was sampled in 5m by 5m nested quadrats. Herbaceous layer vegetation less than 1 m in height was sampled in 1m by 1m nested quadrats at each station location. The transect was established through the center of the reclaimed area.

Aerial photography of P-2 was examined to establish a transect which would include all of the major habitat variations in the mandatory portion of the reclaimed mine. The transect chosen was in the center of P-2 and through the length of the mandatory area.

The number of stations in the transect depended on a species area curve consideration and the extent of a community type. Intervals between stations were the same. The percentage cover of each species was recorded, whether or not its stem originated from within the sampling area.

At each station location additional special observations were recorded when appropriate. These were:

- Organic (O horizon) soil status
- General soil and drainage characteristics
- Evidence of disturbance such as fire and grazing
- Evidence of injury, disease, or other signs of the health of the vegetative community
- Miscellaneous features such as signs of wildlife occurrence

Species occurrence and qualitative descriptions of species composition of vegetation strata were also recorded. In addition, evident correlations of species occurrence with physical features including drainage, and local land uses were also noted.

Wildlife Studies - Mammals. Medium and large mammal studies were performed during the winter and summer. Documentation of game mammal and furbearer presence was:

- Observation of mammals incidental to other programs and during aerial surveys
- Observation of signs, such as tracks and scat, encountered

Nongame mammal data were derived from agency contacts and literature searches. Sitings of species incidental to other sampling programs were incorporated into this data base.

Wildlife Studies - Birds. Data regarding bird species occurrences at the site were derived from:

- Winter bird and breeding bird surveys conducted in late January into early February and May and June, respectively
- Records of birds observed in all seasons as encountered during other field work at the site

Bird surveys were conducted in the winter and summer (breeding season) periods along roads atop dams located on the site as shown on Figure 2.3.6-3 for characterization of existing conditions. The low level helicopter flyover of reclaimed lands was conducted on June 18, 1992. During this inspection, wildlife usage of these areas was evaluated.

Special attention was given to site usage by important game species. Emphasis was placed on determining the occurrence of any threatened or endangered species in the site areas, and/or the presence of habitat suitable for these species.

Wildlife Studies - Reptiles and Amphibians. The occurrence of reptiles and amphibians was determined through observations made while conducting other terrestrial and aquatic field studies. These observations included species and numbers seen or heard by habitat type and locations. Tables were prepared providing amphibian and reptile species, occurrence at the site, special protected status, and preferred habitat types.

VEGETATION/LAND USE. A preliminary vegetation/land cover map of the site was prepared from 1992 aerial photography using FLUCCS Level II classifications. This map was taken to the site and checked for accuracy in the field. Cover areas greater than 5 acres in size were mapped.

Input from ecological field studies was used to identify dominant or indicator species in plant communities. Specific detailed survey and sampling programs concluded to fulfill obligations of this section are covered in the Terrestrial and Wetlands Ecology portion above.

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TABLE 2.3.6-1
SUBSTRATE ANALYSES DURING
FISHERIES INVESTIGATIONS

SEASON	STATION	SIEVE SIZE									
		#5		#10		#18		#35		#200	
		WEIGHT	PERCENT	WEIGHT	PERCENT	WEIGHT	PERCENT	WEIGHT	PERCENT	WEIGHT	PERCENT
WET	NI601	2	<1	4	<1	9	<1	146	8	1756	92
	NI602	1	<1	5	2	4	2	7	3	255	94
	NI603	2	<1	19	2	25	2	84	7	1081	89
	TB01	2	2	6	7	5	6	2	2	73	83
	TB02	2	3	0	0	2	3	1	1	66	93
	TB03	82	15	52	10	62	11	709	18	280	51
	CMG01	18	2	12	1	20	2	185	17	864	79
	CMG02	6	<1	16	1	20	2	32	3	1062	94
DRY	NI601	2	5	0	0	2	5	6	15	30	75
	NI602	0	0	0	0	0	0	6	13	40	97
	NI603	92	7	38	3	27	2	88	6	1120	82
	TB01	0	0	0	0	1	2	2	5	38	93
	TB02	122	29	20	5	12	3	20	5	254	59
	TB03	40	4	46	4	66	6	78	7	850	79
	CMG01	34	2	31	2	52	4	328	22	1052	70
	CMG02	10	<1	38	3	24	2	38	3	1288	92

Note: Weight measured in grams.

Source: Ebasco Environmental, 1992

TABLE 2.3.6-2
WATER QUALITY DURING
FISHERIES INVESTIGATIONS

SEASON	STATION	DATE/TIME COLLECTED	AIR TEMPERATURE (deg. C)	WATER TEMPERATURE (deg. C)	DISSOLVED OXYGEN (ppm)	pH	SPECIFIC CONDUCTANCE (μmhos)	TURBIDITY (NTU)	SECCHI (cm)
WET	NI601	09/20/91 @ 1000	34.5	30.1	8.8	8.9	N/A (1)	56	61
	NI602	09/20/91 @ 1130	31.0	30.9	9.1	8.5	N/A	52	71
	NI603	09/20/91 @ 1555	32.0	34.5	14.2	9.4	N/A	46	44
	TB01	09/21/91 @ 1400	33.0	30.0	7.5	7.7	N/A	54	91
	TB02	09/23/91 @ 1030	26.7	27.3	2.1	6.7	N/A	56	135
	TB03	09/23/91 @ 1515	26.9	27.6	5.8	7.2	N/A	52	150
	CMG01	09/24/91 @ 0920	26.8	27.8	4.8	7.2	N/A	64	CTB
	CMG02	09/24/91 @ 1145	26.4	30.4	8.3	5.6	N/A	65	43
DRY	NI601	02/10/92 @ 1030	18.8	16.4	7.2	7.6	670	N/A(2)	55
	NI602	02/10/92 @ 1305	22.3	17.0	9.9	8.0	600	N/A	53
	NI603	02/11/92 @ 1223	18.4	17.7	12.0	8.6	610	N/A	39
	TB01	02/09/92 @ 1155	19.4	15.7	7.8	7.5	230	N/A	168
	TB02	02/08/92 @ 1255	15.6	15.6	5.4	7.5	250	N/A	206
	TB03	02/08/92 @ 1030	14.4	15.6	9.4	7.7	230	N/A	157
	CMG01	02/07/92 @ 0935	10.6	14.5	6.0	7.1	670	N/A	CTB
	CMG02	02/07/92 @ 1010	12.6	15.6	10.8	7.8	300	N/A	48

CTB - Clear To Bottom
(1) Salinity - Conductivity - Temperature meter was damaged during shipment. Conductivity readings were inconclusive.
(2) Turbidimeter not operational during dry season collection.

Source: Ebasco Environmental, 1992

TABLE 2.3.6-3
FISHERIES SPECIES COLLECTED

		WET SEASON								DRY SEASON								
Scientific Name (Class/Species)	Common Name	N16-01	N16-02	N16-03	TB-01	TB-02	TB-03	CMG-01	CMG-02	N16-01	N16-02	N16-03	TB-01	TB-02	TB-03	CMG-01	CMG-02	TOTAL
Lepisosteidae																		
Lepisosteus platyrhincus	Florida Gar					(3)	(3)			1			1					2
Clupeidae																		
Dorosoma cepedianum	Gizzard Shad	4				(3)			1	43								53
Dorosoma petenense	Threadfin Shad	31 (1)		2														34
Cyprinidae																		
Notemigonus crysoleucas	Golden shiner							3	1	3	2							9
Notropis maculatus	Taillight Shiner			1														
Catostomidae																		
Erimyzon sucetta	Lake Chubsucker												1	1	1			3
Ictaluridae																		
Ictalurus nebulosus	Brown Bullhead		4 (2)	2 (2)						10								16
Cyprinodontidae																		
Fundulus seminolis	Seminole Killifish	10						1		9	2	1						23
Lucania goodei	Bluefin Killifish												1	3	1	2	1	8
Poecilidae																		
Gambusia affinis	Mosquitofish	18	4	7	34	52	29	32	37	38	2	10	27	87	13		15	405
Heterandria formosa	Least Killifish			1	4			6	1				5	7				25
Poecilia latipinna	Sailfin Molly				1			32						1				34
Atherinidae																		
Labidesthes sicculus	Brook Silverside									8								8
Centrarchidae																		
Lepomis gulosus	Warmouth								1				1					2
Leopomis macrochirus	Bluegill Sunfish		2	3			1	3	11	4						2	2	28
Lepomis microlophus	Redear Sunfish			1												4		5
Lepomis punctatus	Spotted Sunfish															4		4
Micropterus salmoides	Largemouth Bass	1		(3)	1		1	(3)		1				1		3	2	10
Pomoxis nigromaculatus	Black Crappie									23		1					1	25
Percidae																		
Etheostoma fusiforme	Swamp Darter										1							1
Cichlidae																		
Tilapia aureus	Blue Tilapia	2								27								29
TOTAL NUMBER OF TAXA COLLECTED		6	3	7	4	1	3	6	6	12	4	3	6	6	3	5	6	20
TOTAL NUMBER OF INDIVIDUALS COLLECTED		66	10	17	40	52	31	77	52	168	7	12	36	100	15	15	22	724

(1) Five Threadfin shad observed, but not collected from gillnet.
(2) Electrofishing equipment attracted many more brown bullhead, but didn't stun them so that they could be captured.
(3) Species observed at station, but unable to capture.

Source: Ebasco Environmental, 1992

TABLE 2.3.6-4
FULTON CONDITION FACTORS FOR SPORT FISH COLLECTED FROM THE SITE-WET SEASON (SEPTEMBER 1991)

STATION	SPECIES	LENGTH (mm)	WEIGHT (gm)	CONDITION[1]
N16-01	Largemouth Bass-Micropterus salmoides	203	119	1.422521
	Blue Tilapia-Tilapia aurea	145	86	2.265294
	Blue Tilapia-Tilapia aurea	135	42	1.707057
N16-02	Bluegill Sunfish-Lepomis macrochirus	165	93	2.07029
	Bluegill Sunfish-Leopmis macrochirus	130	36	1.638598
	Brown Bullhead-Ictalurus nebulosus	132	27	1.173929
	Brown Bullhead-Ictalurus nebulosus	152	44	1.252916
	Brown Bullhead-Ictalurus nebulosus	121	21	1.185395
		122	21	1.156484
N16-03	Bluegill Sunfish-Lepomis macrochirus	118	29	1.76503
	Bluegill Sunfish-Lepomis macrochirus	114	25	1.687429
	Bluegill Sunfish-Lepomis macrochirus	106	20	1.679239
	Red-ear Sunfish-Lopomis microlopus	162	78	1.834635
	Brown Bullhead-Ictalurus nebulosus	132	28	1.217408
	Brown Bullhead-Ictalurus nebulosus	158	55	1.394413
TB-01	Largemouth Bass-Micropterus salmoides	77	5	1.095211
TB-03	Largemouth Bass-Micropterus salmoides	107	15	1.224447
	Bluegill Sunfish-Lepomis macrochirus	58	3	1.537578
CMG-01	Bluegill Sunfish-Lepomis macrochirus	114	26	1.754926
	Bluegill Sunfish-Lepomis macrochirus	54	3	1.905197
	Bluegill Sunfish-Lepomis macrochirus	46	2	2.054738
CMG-02	Bluegill Sunfish-Lepomis macrochirus	102	17	1.601948
	Bluegill Sunfish-Lepomis macrochirus	115	24	1.578039
	Bluegill Sunfish-Lepomis macrochirus	96	14	1.582393
	Bluegill Sunfish-Lepomis macrochirus	90	12	1.646091
	Bluegill Sunfish-Lepomis macrochirus	88	9	1.320671
	Bluegill Sunfish-Lepomis macrochirus	88	10	1.467412
	Bluegill Sunfish-Lepomis macrochirus	59	3	1.460714
	Bluegill Sunfish-Lepomis macrochirus	62	5	2.097949
	Bluegill Sunfish-Lepomis macrochirus	45	2	2.194787
	Bluegill Sunfish-Lepomis macrochirus	29	1	4.100209
	Bluegill Sunfish-Lepomis macrochirus	28	1	4.555394
	Warmouth-Lepomis gulosus	64	5	1.907349

[1] Fulton condition factor is an indication of the physical condition of a fish relative to its length and weight.

Source: Ebasco Environmental, 1992

TABLE 2.3.6-5
FULTON CONDITION FACTORS FOR SPORT FISH COLLECTED FROM THE SITE-DRY SEASON (FEBRUARY 1992)

STATION	SPECIES	LENGTH (mm)	WEIGHT (gm)	CONDITION[1]
N16-01	Blue Tilapia-Tilapia aurea	192	130	1.836706
	Blue Tilapia-Tilapia aurea	197	150	1.961971
	Blue Tilapia-Tilapia aurea	205	156	1.810769
	Bluegill Sunfish-Lepomis macrochirus	179	104	1.813319
	Bluegill sunfish-Lepomis macrochirus	193	134	1.863944
	Brown Bullhead-Ictalurus nebulosus	211	156	1.660647
	Brown Bullhead-Ictalurus nebulosus	200	166	2.075
	Brown Bullhead-Ictalurus nebulosus	192	126	1.780192
	Brown Bullhead-Ictalurus nebulosus	224	228	2.028574
	Bluegill Sunfish-Lepomis macrochirus	230	238	1.956111
	Bluegill Sunfish-Lepomis macrochirus	215	196	1.972153
	Bluegill Sunfish-Lepomis macrochirus	210	152	1.641291
	Redear Sunfish-Lepomis microlopus	203	142	1.697463
	Brown Bullhead-Ictalurus nebulosus	203	158	1.888726
	Brown Bullhead-Ictalurus nebulosus	211	180	1.916131
	Largemouth Bass-Micropterus salmoides	198	150	1.932394
	Largemouth Bass-Micropterus salmoides	205	162	1.880414
	Bluegill Sunfish-Lepomis macrochirus	201	152	1.871783
	Bluegill Sunfish-Lepomis macrochirus	192	134	1.89322
	Bluegill Sunfish-Lepomis macrochirus	209	184	2.015482
	Bluegill Sunfish-Lepomis macrochirus	198	136	1.752087
	Bluegill Sunfish-Lepomis macrochirus	203	148	1.769186
	Bluegill Sunfish-Lepomis macrochirus	197	142	1.857333
	Bluegill Sunfish-Lepomis macrochirus	204	148	1.743296
	Bluegill Sunfish-Lepomis macrochirus	197	130	1.700375
	Bluegill Sunfish-Lepomis macrochirus	198	146	1.880864
	Bluegill Sunfish-Lepomis macrochirus	199	94	1.192803
	Bluegill Sunfish-Lepomis macrochirus	173	94	1.815472
	Bluegill Sunfish-Lepomis macrochirus	186	100	1.554036
	Bluegill Sunfish-Lepomis macrochirus	121	28	1.580527
	Brown Bullhead-Ictalurus nebulosus	378	638	1.181259
	Brown Bullhead-Ictalurus nebulosus	416	980	1.361276
	Brown Bullhead-Ictalurus nebulosus	131	58	2.579967
	Brown Bullhead-Ictalurus nebulosus	356	644	1.427368
	Brown Bullhead-Ictalurus nebulosus	191	76	1.090721
	Brown Bullhead-Ictalurus nebulosus	197	90	1.177183
	Brown Bullhead-Ictalurus nebulosus	184	76	1.220001
	Brown Bullhead-Ictalurus nebulosus	175	70	1.306122
	Black Crappie-Pomoxis nigromaculatus	154	46	1.259493
	Black Crappie-Pomoxis nigromaculatus	141	32	1.141544
	Black Crappie-Pomoxis nigromaculatus	156	50	1.317032
	Black Crappie-Pomoxis nigromaculatus	159	52	1.293636
	Black Crappie-Pomoxis nigromaculatus	178	70	1.241189
	Black Crappie-Pomoxis nigromaculatus	139	28	1.04259
	Black Crappie-Pomoxis nigromaculatus	131	22	0.9786081
	Black Crappie-Pomoxis nigromaculatus	141	40	1.42693
	Black Crappie-Pomoxis nigromaculatus	152	42	1.172668
	Black Crappie-Pomoxis nigromaculatus	140	36	1.311953
	Black Crappie-Pomoxis nigromaculatus	131	28	1.245501

TABLE 2.3.6-5
FULTON CONDITION FACTORS FOR SPORT FISH COLLECTED
FROM THE SITE-DRY SEASON (FEBRUARY 1992)

STATION	SPECIES	LENGTH (mm)	WEIGHT (gm)	CONDITION[1]
N16-01	Black Crappie-Pomoxis nigromaculatus	136	32	1.272135
	Black Crappie-Pomoxis nigromaculatus	146	28	0.8997036
	Black Crappie-Pomoxis nigromaculatus	144	40	1.339592
	Black Crappie-Pomoxis nigromaculatus	136	48	1.113118
	Black Crappie-Pomoxis nigromaculatus	144	32	1.071674
	Black Crappie-Pomoxis nigromaculatus	153	42	1.172668
	Black Crappie-Pomoxis nigromaculatus	138	30	1.141521
	Black Crappie-Pomoxis nigromaculatus	139	30	1.117061
	Black Crappie-Pomoxis nigromaculatus	138	30	1.141521
	Black Crappie-Pomoxis nigromaculatus	140	28	1.020408
	Black Crappie-Pomoxis nigromaculatus	137	28	1.088921
	Black Crappie-Pomoxis nigromaculatus	121	28	1.580527
N16-03	Black Crappie-Pomoxis nigromaculatus	295	356	1.386705
TB-01	Warmouth-Lepomus gulosus	93	14	1.740521
TB-02	Largemouth Bass-Micropterus salmoides	298	312	1.178978
CMG-01	Largemouth Bass-Micropterus salmoides	242	208	1.467632
	Largemouth Bass-Micropterus salmoides	233	144	1.1384
	Largemouth Bass-Micropterus salmoides	184	72	1.15579
	Bluegill Sunfish-Lepomis macrochirus	120	36	2.08333
	Bluegill Sunfish-Lepomis macrochirus	112	28	1.992985
	Redear Sunfish-Lepomis microlopus	129	40	1.863335
	Redear Sunfish-Lepomis microlopus	124	32	1.678359
	Redear Sunfish-Lepomis microlopus	152	70	1.993275
	Redear Sunfish-Lepomis microlopus	76	8	1.822423
	Spotted sunfish-Lepomis punctatus	167	98	2.01415
	Spotted sunfish-Lepomis punctatus	169	102	2.113197
	Spotted sunfish-Lepomis punctatus	132	54	2.347859
	Spotted sunfish-Lepomis punctatus	154	78	2.135662
CMG-02	Largemouth Bass-Micropetrus salmoides	356	572	1.267786
	Largemouth Bass-Micropterus salmoides	259	216	1.243238
	Bluegill Sunfish-Lepomis macrochirus	66	6	2.086986
	Bluegill Sunfish-Lepomis macrochirus	70	6	1.749271
	Black Crappie-Pomoxis nigromaculatus	279	278	1.280066

[1] Fulton condition factor is an indication of the physical condition of a fish relative to its length and weight.

Source: Ebasco Environmental, 1992

TABLE 2.3.6-6
MEANS AND RANGES OF FULTON CONDITION FACTORS (K values)
CALCULATED FROM SITE FISH DATA

	N16			TB			CMG			TOTAL			CARLANDER (1) (2)		
SPECIES	N	MEAN	RANGE	N	MEAN	RANGE	N	MEAN	RANGE	N	MEAN	RANGE	N	MEAN	RANGE
Brown Bullhead															
Ictalurus nebulosus	15	1.33	1.09-2.58	-	-	-	-	-	-	15	1.33	1.09-2.568	4602	1.27	1.06-1.50
Warmouth Sunfish															
Lepomis gulosus	-	-	-	1	1.74	1.74	1	1.91	1.91	2	1.82	1.74-1.91	1791	2.11	1.74-2.36
Bluegill Sunfish															
Lepomis macrochirus	8	1.72	1.64-2.07	1	1.54	1.54	18	2.06	1.32-4.55	27	1.89	1.32-4.55	-	1.89 (3)	1.78-2.05(3)
Redear Sunfish															
Lepomis microleopus	1	1.83	1.83	-	-	-	4	1.83	1.68-1.99	5	1.83	1.68-1.99	1567	-	1.41-2.08
Spotted Sunfish															
Lepomis punctatus	-	-	-	0	-	-	4	2.17	2.10-2.33	4	2.17	2.10-2.35	-	-	-
Largemouth Bass															
Micropterus salmoides	2	1.30	1.19-1.42	3	1.16	1.09-1.22	5	1.26	1.14-1.48	10	1.24	1.09-1.48	6472	1.43	1.19-1.66
Black Crappie															
Pomoxus nigromaculatus	23	1.19	0.90-1.58	-	-	-	1	1.28	1.28	24	1.20	0.90-1.55	263	1.44	1.33-1.88
Blue Tilapia															
Tilapia aurea	28	1.86	1.64-2.26	-	-	-	-	-	-	28	1.68	1.64-2.26	-	-	-

(1) Carlander, 1967
(2) Carlander, 1977
(3) Represents a mean of published data and a central 50% range.

Source: Ebasco Environmental, 1992

TABLE 2.3.6-7
PROTECTED PLANT SPECIES POTENTIALLY OCCURRING IN THE FPC POLK COUNTY SITE REGION

Scientific Name	Common Name	Designated Status FDAC	Designated Status USFWS	Habitat	Polk Site Status
Asclepias curtissii *	Curtiss milkweed	E		scrub, sandhills	Habitat not present
Asplenium auritum	Auricled spleenwort	E		hammock	Habitat marginal; species not found
Bonamia grandiflora *	Florida bonamia	E	T	scrub	Habitat not present
Calopogon mutliflorus	Many-flowered grass pink		T	pine flatwoods	Habitat marginal, species not found
Centrogenium setaceum	Spurred neottia (orchid)	E		hammock	Habitat marginal, species not found
Chionanthus pygmaeus *	Pigmy fringetree	E	E	scrub	Habitat not present
Chrysophyllum olivareforme	Satinleaf	E		hammock, pine flatwoods	Habitat marginal, species not found
Chrysopsis floridana	Florida golden aster	E	E	scrub	Habitat not present
Dicerandra frutescens	Scrub balm	E	E	oak scrub	Habitat not present
Eryngium cuneifolium	Scrub celery	E	E	scrub	Habitat not present
Hexalectris spicata	Crested coralroot (orchid)	E		hammock	Habitat marginal, species not found
Hypericum cumulicola *	Highlands scrub St. John's wort	E	E	scrub	Habitat not present
Justicia cooleyi	Cooley's water willow	E	E	moist hammock, rocky woods	Habitat marginal, species not found
Lechea cernua *	Nodding pinweed	E		scrub	Habitat not present
L. divaricata	Pine pinweed	E		pinelands	Habitat marginal, species not found
Liatris ohlingerae *	Scrub blazing star	E	E	scrub	Habitat not present
Lupinus aridorum *	Scrub lupine	E	E	scrub	Habitat not present
Nolina brittoniana *	Scrub beargrass	E		scrub, dry pine	Habitat not present
Ophioglossum palmatum *	Hand adder's tongue fern	E		epiphyte on Sabal palm	Habitat not present
Paronychia chartacea *	Paper-like nailwort	E	T	scrub	Habitat not present
Polygala lewtonii *	Scrub milkwort	E		dry oak, scrub	Habitat marginal, species not found
Polygonella ciliata var. basiramia *	Hairy jointweed	E	E	scrub	Habitat not present
Prunus geniculata *	Scrub plum	E	E	scrub	Habitat not present
Schwalbaea americana	Chaffseed	E		pine, dry oak	Habitat marginal, species not found
Warea amplexifolia *	Clasping warea	E	E	dry pine, sandhills	Habitat not present
W. carteri *	Carter's mustard	E	E	scrub	Habitat not present
Zephyranthes simpsonii	Simpson zephyr lily	E		wet pine flatwoods, wet prairie	Habitat marginal, species not found

FDAC = Florida Department of Agriculture and Consumer Services
USFWS = U.S. Fish and Wildlife Service
E = Endangered
T = Threatened
* = Recorded as present in Polk County by Florida Natural Areas Inventory. April 1991.

Source: Ebasco Environmental, 1992

TABLE 2.3.6-8
PROTECTED VERTEBRATE SPECIES
POTENTIALLY OCCURRING ON THE FPC POLK COUNTY SITE
FOLLOWING RECLAMATION

		Designated Status			
Scientific Name	Common Name	FGFWFC	USFWS	Habitat	Polk Site Status
Fish					
Centropomus undecimalis	Common snook	SSC		coastal, some inland waters	
Amphibians & Reptiles					
*Alligator mississippiensis**	American alligator		T	aquatic habitats	common
*Drymarchon corais copuperi**	Eastern indigo snake	T	T	variety	uncommon
*Eumeces egregius lividus**	Blue-tailed mole skink	T	T	scrub	rare
*Gopherus polyphemus**	Gopher tortoise	SSC		xeric habitats near water	common
*Neoseps reynoldsi**	Sand skink	T	T	sand ridges, scrub	rare
*Pituophis melanoleucus**	Florida pine snake	SSC		pinelands	rare
Pseudemys concinna suwannienis	Suwannee cooter	SSC		certain rivers and springs	absent
Rana areolata	Gopher frog	SSC		sandhills, scrub	rare
Stilosoma extenuatum	Short-tailed snake	T		longleaf/turkey oak	rare
Birds					
*Ammodramus savannarum floridanus**	Florida grasshopper sparrow	E	E	saw palm/dwarf oak	rare/absent
*Aphelocoma coerulescens coerulescens**	Florida scrub jay	T	T	oak scrub	rare/absent
Aranus guarauna	Limpkin	SSC		freshwater wetlands open,	uncommon
Athene cunicularia	Burrowing owl	SSC		dry, sandy lowland	absent
Campephilus principalis	Ivory-billed woodpecker	E	E	hardwood	absent (extinct?)

TABLE 2.3.6-8
PROTECTED VERTEBRATE SPECIES
POTENTIALLY OCCURRING ON THE FPC POLK COUNTY SITE
FOLLOWING RECLAMATION

		Designated Status			
Scientific Name	Common Name	FGFWFC	USFWS	Habitat	Polk Site Status
*Egretta caerulea**	Little blue heron	SSC		wetlands	common
*E. thula**	Snowy egret	SSC		wetlands	common
*E. tricolor**	Tricolored Heron	SSC		wetlands	common
Falco sparverius paulus	Southeastern American kestrel	T		open habitats, disturbed areas	common(winter)
*Grus canadensis pratensis**	Florida sandhill crane	T		wet prairie, marsh, pasture	commmon
*Haliaeetus leucocephalus**	Bald eagle	T	E	near water	uncommon
*Mycteria americana**	Wood stork	E	E	wetlands	common
Pandion haliaetus	Osprey	SSC		near water	absent
*Picoides borealis**	Red-cockaded woodpecker	T		mature pinelands	absent
*Polyborus plancus audubonii**	Audubon's crested caracara	T	E	open areas	absent
Sterna antillarum	Least tern	T	T	open beach, sandy spoil, rooftops	uncommon
<u>Mammals</u>					
Felis concolor	Florida panther	E	E	dense cover	unconfirmed
*Podomys floridanus**	Florida mouse	SSC		scrub, xeric habitats	uncommon
*Sciurus niger shermanii**	Sherman's fox squirrel	SSC		sandhills, pine flatwood	uncommon
Ursus americanus floridanus	Florida black bear	T		dense cover	absent

FGFWFC = Florida Game and Fresh Water Fish Commission
USFWS = U.S. Fish and Wildlife Service
E = Endangered
T = Threatened
SSC = Species of Special Concern
* = Recorded as present in county by Florida Natural Areas Inventory, April 1991.

Sources: Wood, 1991; Ebasco Environmental, 1992

TABLE 2.3.6-9
SITE-SPECIFIC AQUATIC ECOLOGICAL FIELD SAMPLING PROGRAM

Biota[1]	Location/Habitat[2]	Sampling Frequency	Stations	Replicates	Total No. of Samples/Year
Fish	Tiger Bay	2 Seasons	3	1	6
	Camp Meeting Ground Branch	2 Seasons	2	2	8
	N-16	2 Seasons	3	1	6
Benthos (grab)	Tiger Bay	2 Seasons	3	3	18
	Camp Meeting Ground Branch	2 Seasons	2	3	12
	N-16	2 Seasons	3	3	18
Benthos (artificial substrate)	Tiger Bay	1 Season	3	3	9
	Camp Meeting Ground Branch	1 Season	2	3	6
	N-16	1 Season	3	3	9

(1) Gear Used Where Appropriate:

Fish
- Trammel or gill nets (1.8 m x 30 m [5.9 ft x 98 ft]) where greater than 2 m (6.6 ft); set to bottom perpendicular to shoreline; mesh Size 2.5, 3.8 and 5.0 cm^2(0.4, 0.6, and 0.8 in^2); 24-hour sample
- Seines, dipnets, or minnow traps for depths less than 2 m (6.6 ft)
- Boat mounted electro-shocker where nets were unsuitable; survey lengths and durations held constant

Benthos - Ekman grab in open habitats

(2) Physical parameters to be recorded and equipment to be used at each sample station:

a) Air temperature - ASTM thermometer
b) Water temperature - ASTM thermometer
c) pH - Corning 103 pH meter
d) Dissolved Oxygen - YSI Model 54A
e) Conductivity - YSI Model 133
f) Turbidity - Secchi Disk
g) Flow Rates - Marsh-McBirney meter
h) General Weather Conditions
i) Substrate Materials - Sieves (Mesh size to be determined)

Source: Ebasco Environmental, 1992

TABLE 2.3.6-10
LABORATORY AND DATA ANALYSIS PROGRAM FOR AQUATIC ECOLOGICAL SAMPLES

Biota	Laboratory Processing	Analysis	Primary Reference Materials
Fish	In Field: Counting, weighing, length, reproductive condition, presence of ectoparasites or diseases. Laboratory: Verification of identification. Voucher Collection to be prepared.	Range, Mean, S.D., Diversity Index (Shannon-Weiner), Condition Factor, Equitability Index (Electrofishing and gill net results were combined for N-16)	Carr, A. and C. Goin. 1955. Guide to the Reptiles, Amphibians and Freshwater Fishes of Florida. University of Florida Press.
Benthos	Preparation: Washing through Wildco No. 30 Mesh Sieve. Preservation: 5% buffered formalin with Rose Bengal Stain. Sorting: Hand sorted with table magnification with Nikon binocular microscopes up to 8-80x. Preservation: 70% ethanol. Voucher Collection to be prepared.	Range, Mean, S.D., Diversity (Shannon-Weiner), Equitability Index	Pennak, R. 1978. Freshwater Invertebrates of U.S. John Wiley and Sons. New York, N.Y. 803 pp. Merritt, R.W. and K.W. Cummins. 1984. An Introduction to the Aquatic insects of North America. 2nd Ed. Kendal/Hunt Publishing Co. Dubuque, Iowa. 722 pp. Hobbs, H. 1942. Crayfishes of Florida. University of Florida Biota Sciences Series. 3(2):1-17. Brown, H.P. 1972. Aquatic Dryopoid Beetles of the U.S. Biota of Freshwater Ecosystems. Identification Manual No. 6. USEPA EP 2.10:18050 ELD04/76(6). Brigham, A.R., W.U. Brigham and A. Unilka, eds. 1982. Aquatic Insects and Oligochaetes of North and South Carolina. Midwest Aquatic Enterprises. Mahone T., Ill. 837 pp.

Source: Ebasco Environmental, 1992

TABLE 2.3.6-11
CLASSIFICATION OF STREAM SUBSTRATE CHANNEL MATERIALS BY PARTICLE SIZE

PARTICLE DIAMETER SIZE		
(Millimeters)	(Inches)	Sediment Classification
610.0 or more	24.0 or more	Large boulder
305.0 to 609.0	12.0 to 23.9	Small boulder
76.1 to 304.0	3.0 to 11.9	Rubble (cobble)
4.81 to 76.0	0.19 to 2.9	Gravel
0.83 to 4.71	0.033 to 0.18	Fine sediment - large
0.83 or less	0.033 and less	Fine sediment - fine

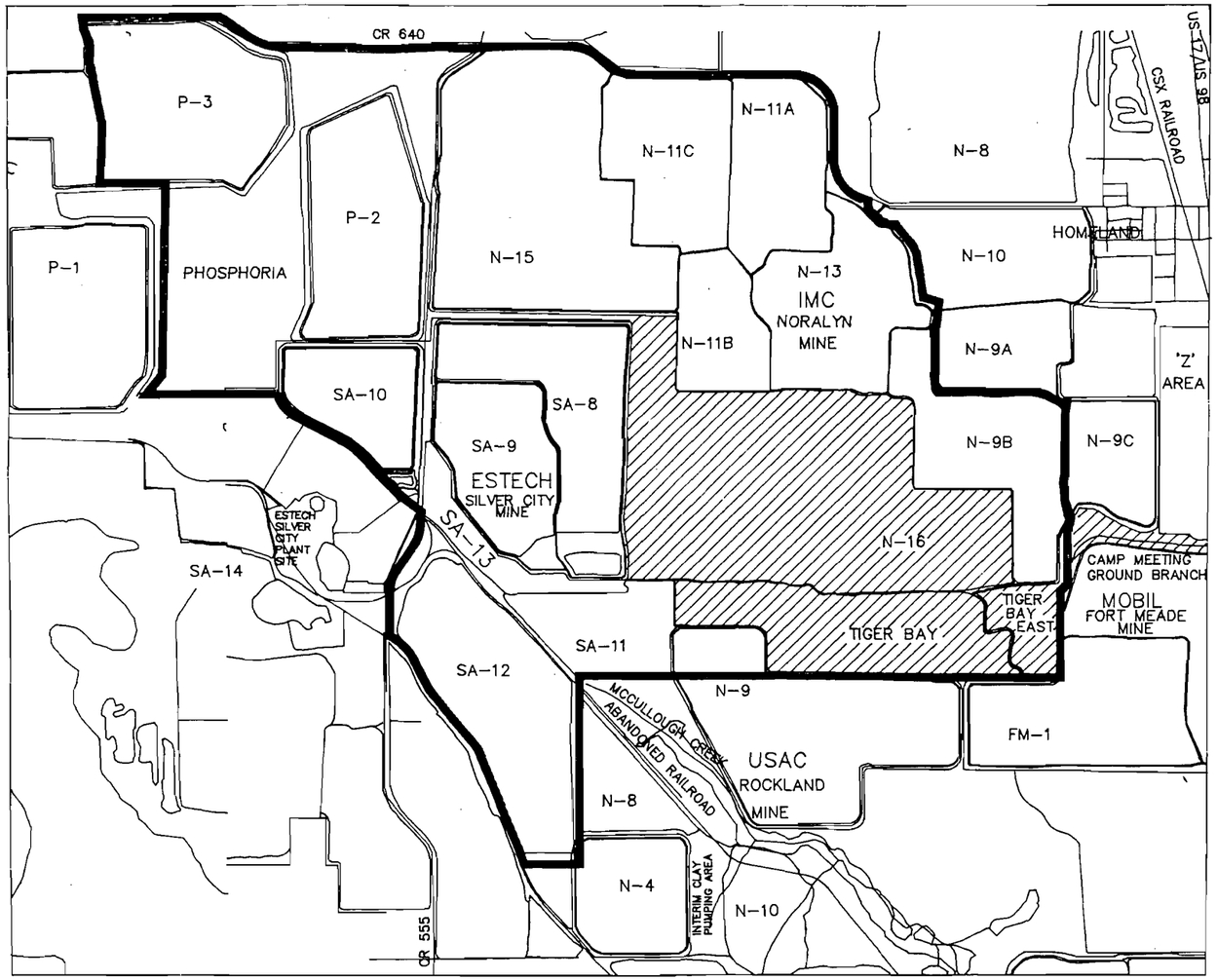
Source: Platts et al. (1983).

TABLE 2.3.6-12
TERRESTRIAL MONITORING PROGRAM - SPECIES COMPOSITION, DENSITY, DOMINANCE, DIVERSITY, AND FREQUENCY

Type of Vegetation or Organism	Method[1]	Sampling Schedule	Sampling Frequency	Equipment	Data Analysis
Vegetation Layers:					
Canopy	Quadrats (100m² or 1,076 ft²) along transects and/or qualitative descriptions and ground and air reconnaissance	Dry and wet	Once each season in each mine area	Tape measure; DBH tape; flagging	Dominance, percent cover, frequency and/or species presence and qualitative descriptions
Shrub	Nested quadrats (25m² or 269 ft²) and/or qualitative descriptions and ground and air reconnaissance	Dry and wet	Once each season in each mine area	Tape measure; DBH tape; meter stick	Dominance, percent cover, frequency and/or species presence and qualitative descriptions
Herbaceous	Nested quadrat (1m²or 10.8 ft²) and/or qualitative descriptions and ground reconnaisance	Dry and wet	Once each season in each mine area	Tape measure; meter stick	Dominance, percent cover, frequency and/or species presence and qualitative description
Birds	General observation and flyovers	Winter and breeding season	As encountered	9x binoculars; 25x spotting scope	Relative abundance
Raptors	General observation	Winter and breeding season	As encountered	9x binoculars	Relative abundance
Waterfowl	General observation	Winter and breeding season	As encountered	9x binoculars; 25x scope	Density
Mammals	Observations of tracks, other signs of activity, state records	Winter and early summer	As encountered	N/A	Relative abundance
Amphibians	Observation for location and relative abundance, call recognition	Dry and wet	As encountered	N/A	Relative abundance
Reptiles	Observation for location and relative abundance	Dry and wet	As encountered	N/A	Relative abundance

(1) Transects conducted in reclaimed and released mine areas only and where community types are homogeneous enough to establish a transect.

Source: Ebasco Environmental, 1992



LEGEND

SITE BOUNDARY

AQUATIC ECOLOGY STUDY AREA

N
W E

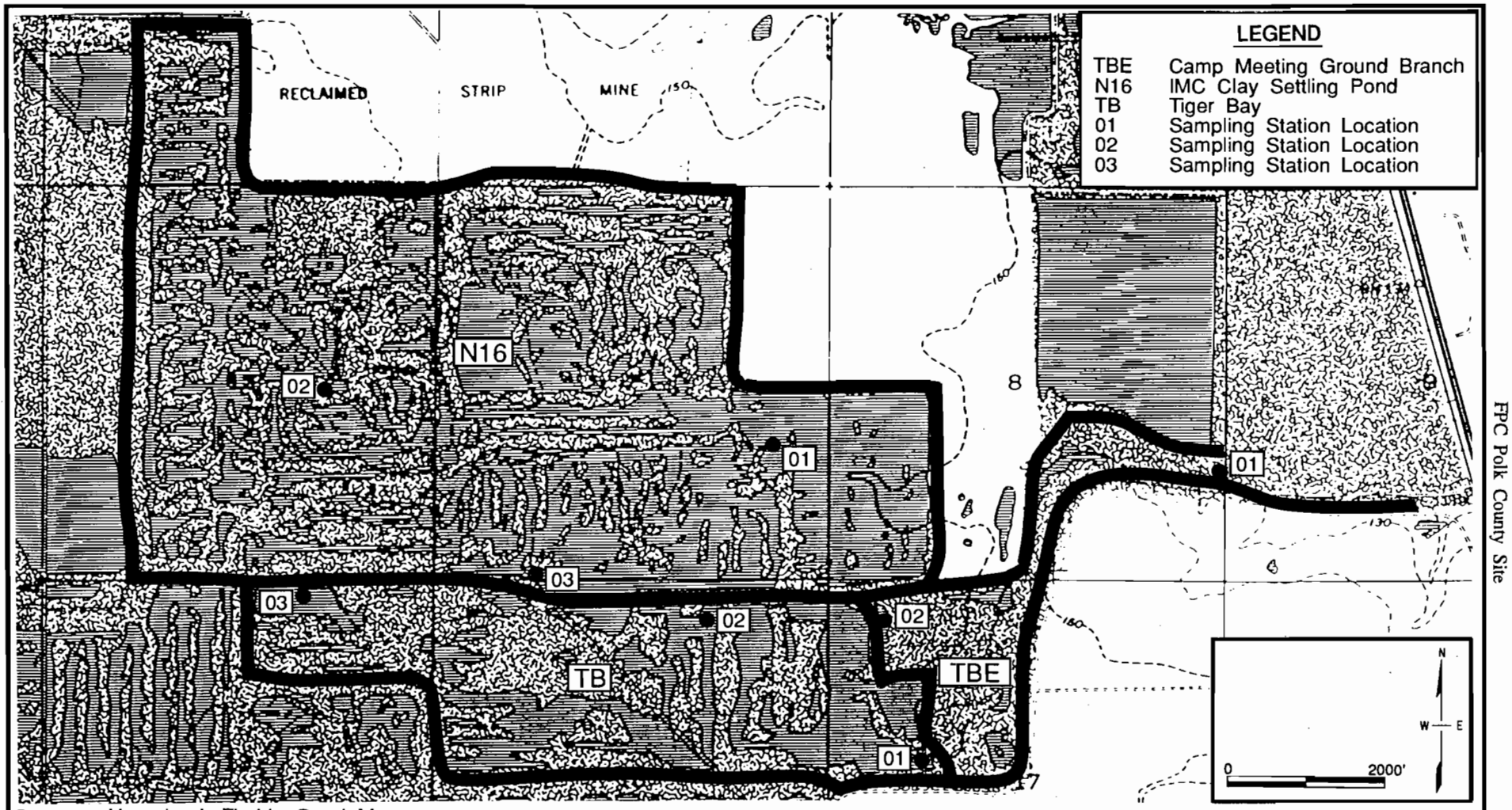
0 4000'

SOURCE: EBASCO ENVIRONMENTAL, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.6-1
AQUATIC ECOLOGY STUDY AREA

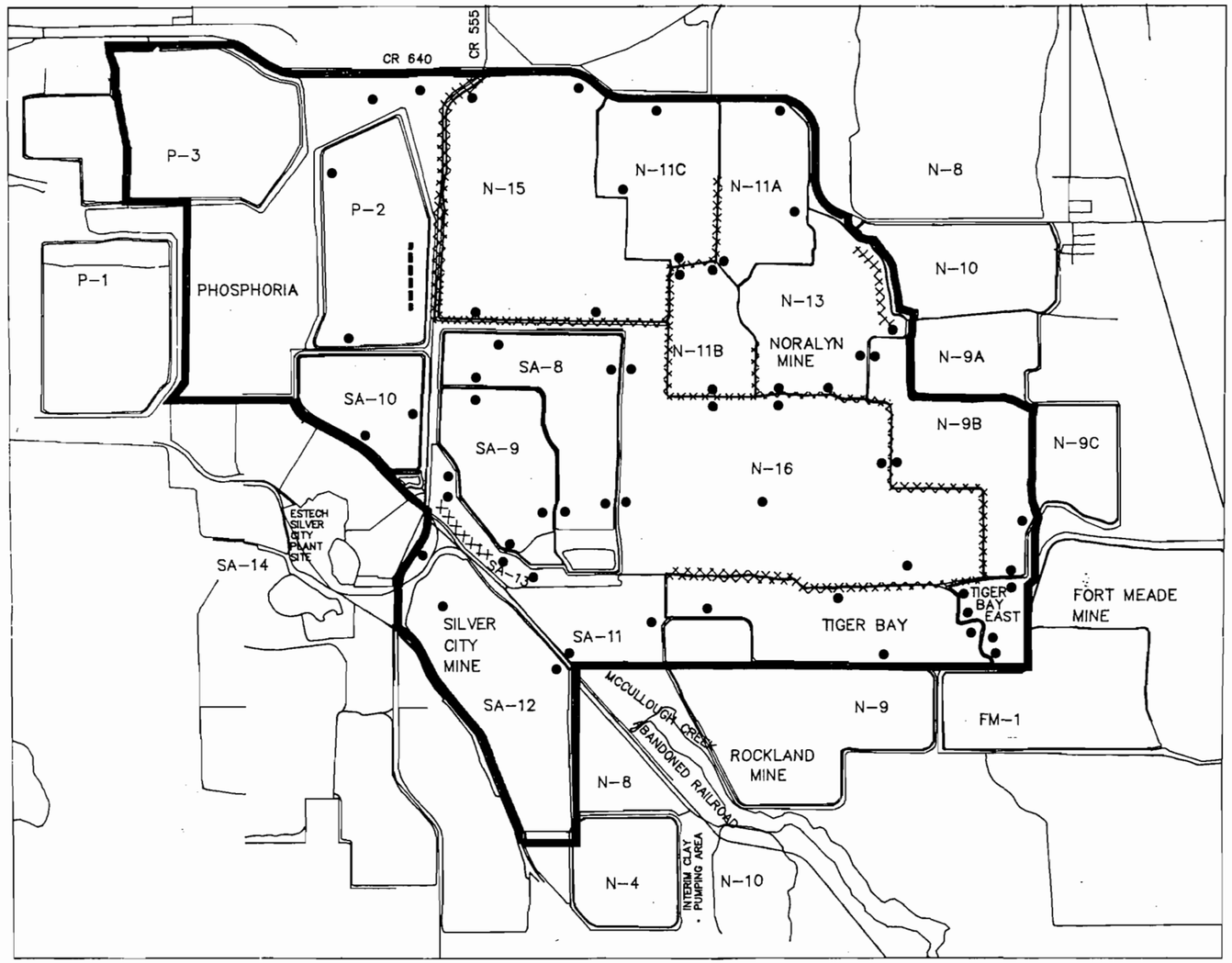


Source: Homeland, Florida Quad Map

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.6-2
AQUATIC ECOLOGY SAMPLING LOCATIONS



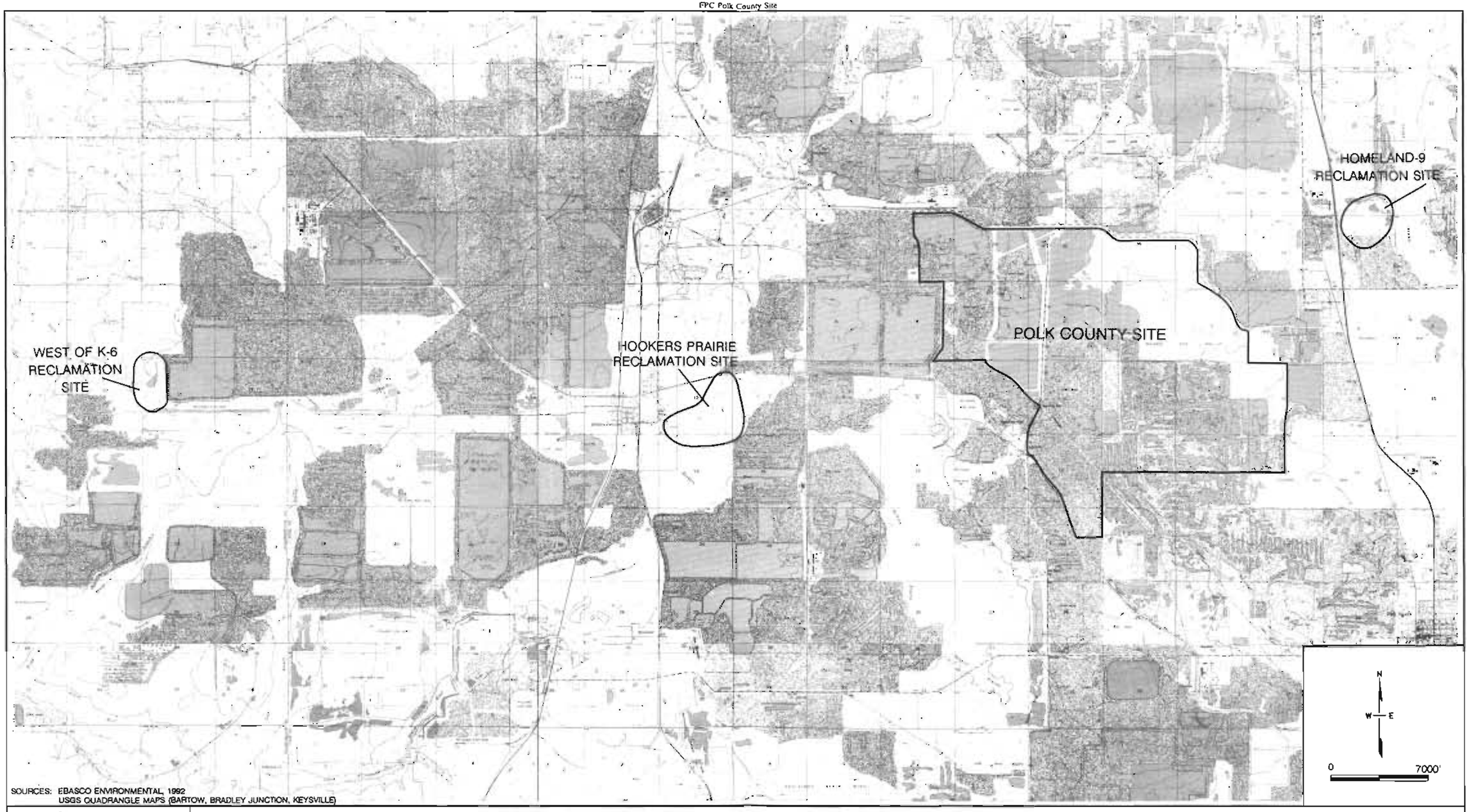
SOURCE: DAMES & MOORE, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.6-3

VEGETATION AND WILDLIFE SAMPLING LOCATIONS ON-SITE



Florida Power CORPORATION

Polk County Site

FIGURE 2.3.6-4

VEGETATION AND WILDLIFE SAMPLING LOCATIONS OFF-SITE

2.3.7 Meteorology and Ambient Air Quality

2.3.7.1 Meteorology

REGIONAL CLIMATE

The climate in central Florida is classified as subtropical with maritime influences from both the Atlantic Ocean and the Gulf of Mexico. Summers are long, warm, and relatively humid, while winters are mild because of the latitude and the warming influence of the Gulf Stream. Coastal locations average slightly warmer in winter and cooler in summer than do the inland areas. The summer heat is tempered by sea breezes along the coasts and by frequent afternoon or early evening thunderstorms in all areas. Thunderstorms, which on the average, occur on about one-half of the days in the summer, frequently are accompanied by a temperature drop of as much as 10 to 20 degrees. They cause high winds, heavy rain, occasional hail, and frequent lightning. Tornadoes that reach the surface are a rare occurrence in this part of the state, and very destructive tornadoes are almost nonexistent. Tornadoes are most likely to occur during seasonal changes when cool, dry air and warm, moist air clash.

Hurricanes are tropical cyclones in which winds reach speeds of 74 mph or more and blow in a large spiral around a relatively calm center. Near the center (eye), hurricane winds may gust to more than 200 mph, and the storm dominates the ocean surface and lower atmosphere over tens of thousands of square miles. The fastest non-gust wind speed (fastest mile of wind) recorded at Tampa was 84 mph, and the fastest 5-minute average was 75 mph. These both occurred with the passage of the Labor Day hurricane of September 3 to 5, 1935 (NOAA, 1977).

Gentle breezes occur almost daily in all areas. Because most of the large-scale wind patterns affecting Florida have passed over water surfaces, hot drying winds seldom occur. High local winds of short duration occur occasionally in connection with thunderstorms in summer and with cold fronts moving across the state in other seasons.

The humidity in Florida is generally high. Inland areas with greater temperature extremes experience slightly lower relative humidity, especially during times of hot weather. On the average, variations in relative humidity from one place to another are small; humidities range

from about 50 to 65 percent during the afternoon hours to about 85 to 95 percent during the night and early morning hours.

Heavy fogs are usually confined to the night and early morning hours in the late fall, winter, and early spring months. On the average, they occur on about 19 days a year at Lakeland, based on a 24-year period of record (NOAA, 1977a). These fogs usually dissipate or thin soon after sunrise; heavy daytime fog is seldom observed in Florida.

Temperature and precipitation data representative of the site are available for Bartow, 8 miles north of the site, and Wauchula, 17 miles south of the site. Additional climatological data for the site area is available from the weather service offices at Tampa (47 miles northwest), Orlando (62 miles northeast), and Lakeland (21 miles north-northwest). Based on discussions with and recommendations from FDER, observations from the "first order" National Weather Service (NWS) station at Tampa are being used as representative surface and upper air wind data for the site.

The following temperature statistics are based on data collected at Bartow and Wauchula for the period-of-record 1951 through 1980. These data are summarized in Table 2.3.7-1. For normal daily mean minimum temperatures, January exhibits the lowest value of approximately 49°F. January also exhibits the lowest normal mean monthly temperature, 61°F. The highest normal daily maximum temperature (92°) occurs in July and August. Highest and lowest record temperatures of 103°F and 18°F were recorded at Bartow in June 1977 and December 1962, respectively.

Based on the same 30-year record (Gale Research, 1985), normal annual rainfall is approximately 53 inches. The monthly statistics (Table 2.3.7-2) show the start of the rainy season in May or June and its end in September. Most of the summer rainfall is derived from local showers or thunderstorms. The highest normal monthly rainfall is approximately 8.5 inches and occurs in July. November and December are the driest months, with an average of approximately 2 inches of precipitation. The maximum rainfall in one day was 6.32 inches and occurred in October 1975 (Wauchula). Record monthly precipitation occurred in July 1960, when 17.6 inches of rain were recorded (Bartow).

Wind data selected to represent the site were obtained from the Tampa International Airport, the nearest meteorological station for which comprehensive wind data are readily available. March

has the highest mean monthly wind speed of 9.7 mph (Gale Research, 1985). The lowest mean monthly wind speed of 7.2 mph is usually encountered in August. An easterly prevailing wind direction is evident during most of the year. The annual average wind speed is 7.7 mph. The predominant wind direction during the 1982 to 1986 time period was from the east-northeast, which occurred approximately 12 percent of the time. Wind directions from the east, northeast, and east-southeast each occurred more than 8 percent of the time. A wind rose for Tampa is presented on Figure 2.3.7-1.

DISPERSION METEOROLOGY

STABILITY. Atmospheric stability in conjunction with general wind patterns and mixing height determines the potential of the atmosphere to disperse airborne pollutants. Atmospheric stability conditions are typically categorized as unstable, neutral, or stable. An unstable atmosphere is one in which rapid diffusion takes place in both the horizontal and vertical directions. In terms of temperature change with height, an unstable atmosphere is characterized by a sharp decrease in temperature with height. Neutral conditions, which are characterized by moderate decreases of temperature with height, are common in the atmosphere and are associated with moderate diffusion rates. A stable atmosphere is characterized by a slight decrease (less than 1 °C per 100 meters), or even an increase in temperature with height, and greatly reduced diffusion rates in comparison with unstable or neutral atmospheric conditions.

The stability classifications presented in this section are based on the Turner (1970) classification scheme, which assigns a stability on the basis of surface wind speed, cloud cover, and solar insolation. Appendix 10.5.6.1 contains a summary of the joint frequency of occurrence of wind speed and wind direction categories classified according to stability class based on meteorological data for Tampa International Airport for the period 1982 to 1986. This is referred to as STAR (STability ARay) program data.

MIXING HEIGHT. An important parameter which describes the regional dispersion capability of the atmosphere is mixing height. Mixing height is simply the vertical extent of the surface layer within which relatively vigorous mixing of pollutants takes place. Holzworth (1972) has compiled statistical summaries for mixing height at various locations throughout the United States based on twice daily radiosonde measurements. The abundance of moisture from the ocean around southern Florida creates high humidities and low-level cloudiness that absorb heat and generally prevent the mixing height from subsiding below 500 meters. Because mixing

heights are dependent upon surface temperatures, afternoon levels reach above 1,400 meters under intense solar insolation. Lesser diurnal mixing height fluctuations occur at coastal stations in Florida, as compared to inland locations, due primarily to moderating effects of the ocean.

Table 2.3.7-3 presents the seasonal and annual average mixing heights for the period 1960 to 1964 as observed at Tampa International Airport. The Tampa upper air station has been considered regionally representative of the site by FDER in previous applications. Holzworth's comparison of morning and afternoon mixing heights based on data for 62 locations throughout the United States is shown on Figures 2.3.7-2 and 2.3.7-3. These data indicate that the site area experiences mixing heights that are typical of or higher than large areas of the eastern half of the United States. Thus, the site area experiences better than average dispersion conditions.

ON-SITE HOURLY METEOROLOGICAL MONITORING DATA ANALYSIS AND SUMMARY

A 1-year, on-site monitoring program is being conducted for meteorological and air quality parameters. Data from the first four months of the program are presented here; the remaining 8 months of data will be provided in an addendum. The monitoring program is described in Appendix 2.3.7.3.

WIND SPEED (10 METERS). The 10-meter wind speed data collected during the period of October 15, 1991, through February 14, 1992, are presented in Appendix 10.5.6.2. There were a total of 2,943 observations reported during this period, which represents a data recovery rate of 99.9 percent. The average wind speed during this period was 6.4 mph (2.9 m/sec). The maximum hourly average wind speed was 21.0 mph (9.4 m/sec). The average wind speed recorded at Tampa for this period was 7.8 mph (3.5 m/sec).

WIND DIRECTION (10 METERS). The 10-meter wind direction data collected during the period of October 15, 1991, through February 14, 1992, are presented in Appendix 10.5.6.2. There were a total of 2,943 hourly averages reported for a data recovery rate of 99.9 percent. The prevailing winds during this period were from the northeast, north-northeast, and north, as shown on Figure 2.3.7-4, which is a wind rose for the 4-month period. Wind direction data for this same 4-month period recorded at the Tampa NWS Station indicated prevailing winds from the east-northeast, as shown on Figure 2.3.7-5. This comparison of site and Tampa wind data for the same 4-month period indicates that while there was a stronger northerly component at the site, conditions were generally similar.

2.3.7.2 Ambient Air Quality

REGIONAL AIR QUALITY

The Polk County Site is located in an area that FDER currently classifies as attainment for all criteria pollutants (Section 17-2.420, F.A.C). It is designated as Class II from a Prevention of Significant Deterioration (PSD) standpoint. The nearest Class I area is the Chassahowitzka Wilderness Area, located approximately 109 km to the northwest.

Ambient air monitoring data are available which can be used to characterize the existing conditions in the vicinity of the site. A map depicting the locations of the existing ambient air quality monitoring sites is presented as Figure 2.3.7-6. The FDER data from these monitors for 1990 are summarized in Table 2.3.7-4. FDER collected ambient total suspended particulate (TSP) data during 1990 at several locations in the vicinity. However, the TSP standards have now been replaced with standards for particulate matter less than or equal to 10 micrometers aerodynamic diameter (PM_{10}). The nearest FDER PM_{10} data are from the Tampa metropolitan area and are not very representative of Polk County. However, the TSP data for Polk County indicate that existing PM_{10} concentrations would also be well below National and Florida Ambient Air Quality Standards (AAQS).

Concentrations of SO_2 have been measured by FDER at Lakeland and Nichols. FDER data from 1990 show existing SO_2 concentrations at that nearby location to be well below the AAQS. Ambient data for nitrogen oxides (NO_x), carbon monoxide (CO), ozone (O_3) and lead (Pb) have been collected by FDER only in the Tampa and Sarasota metropolitan areas. Given the rural nature of the site, existing concentrations of these pollutants, which are usually associated more closely with urban environments (since they are emitted primarily by mobile sources), should be well below the applicable standards.

A 1-year monitoring program was conducted recently by Tampa Electric Company at two sites in western Polk County, approximately 12 miles to the southwest of the FPC Polk County Site monitoring location. A summary of data from these stations, which operated from April 1, 1991 through March 31, 1992 is presented in Table 2.3.7-5.

ON-SITE HOURLY AMBIENT AIR QUALITY MONITORING DATA ANALYSIS AND SUMMARY

The 1-year on-site air quality monitoring station is currently in operation. Air quality data from the first 4 months of operation are presented below; the remaining 8 months of data will be provided in an addendum. The monitoring program is described in Appendix 2.3.7.3.

SULFUR DIOXIDE (SO_2). A tabulation of the hourly SO_2 concentrations measured at the on-site station during the period of October 15, 1991, through February 14, 1992, are presented in Appendix 10.5.6.3 and summarized in Table 2.3.7-6. A total of 2,650 hourly averages were reported for a data recovery of 89.8 percent. A graphic presentation of the hourly data collected over the 4-month period is shown on Figure 2.3.7-7.

As indicated in Table 2.3.7-6, SO_2 concentrations recorded for all averaging periods are well below the allowable National and Florida AAQS.

OZONE (O_3). A tabulation of the hourly O_3 concentrations measured on-site during the period of October 15, 1991, through February 14, 1992, are presented in Appendix 10.5.6.3 and summarized in Table 2.3.7-6. A total of 2,873 hourly averages were reported for a data recovery of 97.3 percent. These hourly data are presented on Figure 2.3.7-8.

As indicated in Table 2.3.7-6, the recorded values were well within the allowable NAAQS and FAAQS.

PARTICULATE MATTER (PM_{10}). Sampling for PM_{10} was performed on a once every sixth day basis. The monitoring results are summarized in Table 2.3.7-6 and presented in Appendix 10.5.6.4. The data indicate that background PM_{10} concentrations are well below the National and Florida AAQS. Valid samples were recovered from the primary sampler for a data recovery of 100.0 percent. Data from the 21 sampling periods are depicted on Figure 2.3.7-9.

BACKGROUND AIR QUALITY CONCENTRATIONS

Background air quality concentrations to be utilized in the modelling analysis are compiled from two sources – data collected on-site and data from the 1990 FDER state air quality data base. The on-site data were used for SO_2, O_3, and PM_{10}. The data from the FDER data base were used for CO, NO_2, and Pb. The FDER data base from the Tampa area were reviewed, and the

sites with the highest concentrations for CO, NO_2, and Pb were selected as the background concentrations. This approach will provide a conservative worst-case scenario, since these are urban monitoring locations and actual concentrations in Polk County are undoubtedly less.

A summary of the background concentrations to be used in modelling air quality impacts are presented in Table 2.3.7-7.

2.3.7.3 Ambient Monitoring Program Description

An air quality/meteorological monitoring program is required to satisfy the Florida SCA Guidelines [Section 17-1.211(1), F.A.C.], as well as the U.S. Environmental Protection Agency (EPA) Ambient Monitoring Guidelines for PSD (EPA, 1987). Based on the worst-case emissions data which were available in the summer of 1991 and preliminary modelling results for the existing and proposed sources, as presented in the Air Quality Monitoring Plan (FPC, 1991), and in agreement with the Ambient Monitoring Section of FDER, the following parameters are being monitored for the following reasons:

- O_3 - because volatile organic compound (VOC) emissions may exceed 100 tons/year
- SO_2 - because maximum predicted impacts were above the significant monitoring concentration (13 $\mu g/m^3$, 24-hr average) based on preliminary modeling
- PM_{10} - because existing source particulate impacts are close to the significant monitoring concentrations (10 $\mu g/m^3$, 24-hr average), and the project could include coal piles and by-product storage areas
- Wind speed
- Wind direction

The monitoring site selected is located south of Homeland and west of Highway 17. The location is approximately 100 feet south and 300 feet east of the southern end of paving on Old Fort Meade Road in an open field at an elevation of approximately 150 ft (MSL). Figure 2.3.7-10 illustrates the monitoring site location. Approximate Universal Transverse Mercator (UTM) coordinates for the monitoring site are 418.70 km east and 3076.35 km north (UTM Zone 17). EPA siting criteria for pollutants of interest are satisfied by the use of this location.

The SO_2 analyzer is a Monitor Labs Model 8850 fluorescent method analyzer with an EPA equivalence designation number EQSA-0779-039. This analyzer is calibrated using an Environics Model 100 calibrator. The O_3 analyzer is a Dasibi 1003-Ah UV photometry analyzer with an EPA equivalence designation number EQOA 05-77-019, which is calibrated using a Dasibi 1008-PC transfer standard calibrator. The PM_{10} samplers used are General Metal Works Model GUV-15H with a reference designation number RFPS 1287-063. The PM_{10} samplers are operated every 6 days in accordance with the FDER schedule. Data from the continuous analyzers are recorded on strip chart recorders and hourly averages are calculated by an ESC 8000 AQM data logger.

The meteorological tower is a 10-meter Climatronics triangular tower with a Climatronics F460 wind measuring system consisting of a precision 3-cup anemometer and a wind vane. Each sensor has a starting threshold of 0.5 mph and an accuracy of one percent over the range of 0 to 100 mph (wind speed) and 3 degrees over the range of 0 to 540 degrees (wind direction). The equipment shelter consists of a trailer which is 4.3 meters (14 feet) long, 2.4 meters (8 feet) wide, and 3.1 meters (10 feet) high. A stable temperature within the shelter is maintained by electric heaters and air conditioners. The temperature is verified by a maximum/minimum thermometer mounted inside the shelter and by continuous temperature monitoring by the data logger.

The station has been operated in accordance with a site-specific Standard Operating and Quality Assurance Procedures (SOQAP) manual (FPC, 1991a), previously submitted to and approved by FDER. The operating status of the equipment is tracked with station logs, equipment calibrations, computer data collection, and strip chart records. Other quality assurance procedures are performed in accordance with the specific SOQAP manual, which also describes internal quality control procedures, as well as data precision and accuracy calculation procedures. The quality assurance portion of the manual is specifically designed to meet the requirements of Appendix B of Part 58, Title 40 of the Code of Federal Regulations.

A systems audit and the first three quarterly performance audits of the air quality analyzers have been conducted by FDER. A PM_{10} audit conducted as part of EPA's National Performance Audit Program has been completed, with audits of the SO_2 and O_3 systems scheduled under this program. Three of the four quarterly data reports (FPC, 1992, 1992a, and 1992b) have been submitted to FDER.

2.3.7.4 References

CFR (U.S. Code of Federal Regulations). Title 40, Section 52.21, Prevention of Significant Deterioration of Air Quality.

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Turner, D. B. 1970. Workbook of Atmospheric Dispersion Estimates. U.S. Environmental Protection Agency. Research Triangle Park, North Carolina.

TABLE 2.3.7-1
DIURNAL AND MONTHLY TEMPERATURE MEANS AND EXTREMES
REPRESENTATIVE OF THE POLK COUNTY SITE

Month	BARTOW					WAUCHULA				
	Daily Maximum	Daily Minimum	Monthly Mean	Record High	Record Low	Daily Maximum	Daily Minimum	Monthly Mean	Record High	Record Low
January	73.1	48.7	60.9	87	22	74.0	49.0	61.5	88	21
February	74.7	49.7	62.2	91	23	75.4	49.5	62.5	93	26
March	80.1	54.8	67.5	93	23	80.4	54.4	67.4	94	23
April	85.0	59.7	72.3	96	39	85.1	58.4	71.8	97	36
May	89.5	65.3	77.4	101	49	89.4	64.1	76.8	101	46
June	91.5	69.8	80.7	103	59	91.2	69.0	80.1	99	56
July	92.6	71.5	82.1	101	64	92.0	70.9	81.5	98	57
August	92.6	71.7	82.2	99	62	92.1	71.2	81.7	98	62
September	90.5	70.5	80.6	97	57	90.4	70.4	80.4	99	55
October	85.4	63.7	74.6	96	41	85.2	63.7	74.5	95	39
November	78.7	55.8	67.3	93	25	79.5	55.6	67.6	90	26
December	74.0	50.0	62.0	90	18	74.8	50.0	62.4	92	21
Year	84.0	60.9	72.5	103	18	84.1	60.5	72.4	101	21

Note: Temperatures are in °F.
Period of Record: 1951 - 1980
Source: Gale Research, 1985

TABLE 2.3.7-2
MONTHLY PRECIPITATION MEANS AND EXTREMES
REPRESENTATIVE OF THE POLK COUNTY SITE

Month	BARTOW			WAUCHULA		
	Mean	Greatest Monthly	Greatest Daily	Mean	Greatest Monthly	Greatest Daily
January	2.52	6.65	2.79	2.40	7.84	2.41
February	3.37	8.11	4.07	3.01	7.37	3.34
March	3.32	11.53	4.72	3.02	9.22	5.75
April	2.59	8.40	3.56	2.46	8.26	5.55
May	5.35	13.05	4.30	4.94	11.32	5.72
June	7.18	13.74	3.88	8.33	16.03	5.83
July	8.33	17.58	4.00	8.50	14.60	4.73
August	7.46	12.05	4.64	6.87	12.46	3.58
September	6.68	15.59	3.15	7.03	14.38	4.82
October	2.76	9.10	2.80	2.88	10.36	6.32
November	2.03	6.52	4.57	1.76	6.43	4.97
December	2.10	4.95	2.63	1.89	4.83	2.19
Year	53.69	17.58	4.72	53.09	16.03	6.32

Note: Precipitation measurements are in inches.
Period of Record: 1951 - 1980
Source: Gale Research, 1985

TABLE 2.3.7-3
MEAN DIURNAL MIXING HEIGHTS
TAMPA, FLORIDA

Season	Morning	Afternoon
Winter	394	1,052
Spring	503	1,523
Summer	656	1,460
Fall	419	1,401
Annual Average	493	1,359

Note: Mixing heights are in meters.
Period of Record: 1960 - 1964
Source: Holzworth, 1972

TABLE 2.3.7-4
REGIONAL 1990 AMBIENT AIR QUALITY DATA

			CONCENTRATION ($\mu g/m^3$)				
			3 HOUR		24 HOUR		ANNUAL
POLLUTANT	LOCATION	SITE NO.	HI	2ND HI	HI	2ND HI	
SO_2	LAKELAND	2160004F02	122	122	42	27	5
	NICHOLS	3680010F02	341	252	66	62	9
	SARASOTA	4080002G01	245	224	62	42	6
	SARASOTA	4100012G01	103	98	45	43	8
	HILLSBOROUGH CO	1800021G02	411	388	85	80	15
	TAMPA	1800095G02	590	586	104	100	19
	N. RUSKIN	1800106J02	274	223	54	53	9
	N. RUSKIN	1800107J02	680	438	97	89	10
	TAMPA	4360035G02	369	322	143	105	21
	TAMPA	4360053G02	384	343	102	98	24
			ONE HOUR				
			HIGH			2ND HIGH	
O_3	HILLSBOROUGH BAY	1800081G03	231			219	
	TAMPA	4360035G02	242			219	
	TAMPA*	4360055G01	123			118	
	TAMPA**	4360065G01	268			213	
	CLEARWATER	0620004G01	237			213	
	ST. PETERSBURG	3980018G01	219			219	
	TARPON SPRINGS	4380002G03	251			204	
	SARASOTA	4080002G01	213			196	
	SARASOTA	4080005G01	200			200	

* JAN - APR
** APR - DEC

TABLE 2.3.7-4
REGIONAL 1990 AMBIENT AIR QUALITY DATA

			CONCENTRATION ($\mu g/m^3$)			
POLLUTANT	LOCATION	SITE NO.	ANNUAL ARITHMETIC MEAN			
NO_2	TAMPA	4360065G01	25			
	ST. PETERSBURG	3980018G01	24			
	TARPON SPRINGS	4380002G03	17			
			ONE HOUR (PPM)		8 HOUR (PPM)	
			HIGH	2ND HIGH	HIGH	2ND HIGH
CO	TAMPA	4360035G02	5	5	3	2
	TAMPA	4360045G01	8	8	6	5
	SEMINOLE HTS	4360060G01	12	10	7	6
	TAMPA	4360063G01	9	9	5	3
	LARGO	2260002G01	6	5	3	3
	ST. PETERSBURG	3980018G01	11	9	6	5
	ST. PETERSBURG	3980024G01	7	7	5	4
	TARPON SPRINGS	4380002G03	5	5	2	2
	SARASOTA	4080002G01	7	6	3	3
	SARASOTA	4080004G01	11	10	6	6
			24 HOUR		ANNUAL ARITHMETIC MEAN	
			HIGH	2nd HI		
PM_{10}	GIBSONTON	1800066G02	72	68	37	
	TAMPA	1800095G01	44	39	28	
	TAMPA	4360002G01	49	41	29	
	TAMPA	4360035G02	50	46	30	
	TAMPA	4360035G09	48	46	29	
	SEMINOLE HTS	4360060G01	70	50	31	
	LARGO	2260004G02	56	50	27	
	LARGO	2260004G09	59	48	28	
	TARPON SPRINGS	4380002G03	33	32	20	
	SARASOTA	4080003G01	54	50	27	
	SARASOTA	4080003G09	52	47	27	
	SARASOTA	4100013G01	41	35	21	
	VENICE	4560001G01	68	60	36	
	VENICE	4560001G09	56	51	36	

TABLE 2.3.7-4
REGIONAL 1990 AMBIENT AIR QUALITY DATA

POLLUTANT	LOCATION	SITE NO.	CONCENTRATION ($\mu g/m^3$)		
			24 HOUR		ANNUAL ARITHMETIC MEAN
			HIGH	2nd HI	
TSP	BRANDON	0370002G01	88	73	44
	RUSKIN	1800003G03	65	62	36
	GIBSONTON	1800066G02	129	119	78
	GARDINIER PARK	1800083G02	87	79	49
	HILLSBOROUGH	1800085G02	67	60	37
	TAMPA	1800095G01	114	94	61
	N. RUSKIN	1800106J02	58	58	40
	N. RUSKIN	1800107J02	85	77	39
	TAMPA	4360002G01	85	80	54
	TAMPA	4360002G09	90	79	54
	TAMPA	4360030G01	87	68	43
	SEMINOLE HTS	4360060G01	186	127	57
	TAMPA	4360060G09	174	122	55
	TAMPA	4360064G02	384	192	139
	TEMPLE TERRACE	4440001G01	64	52	33
	AUBURNDALE	0120001F01	169	68	46
	BARTOW	0180003F01	78	66	40
	LAKELAND	2160004F02	72	63	29
	NICHOLS	3680010F02	96	76	44
	SARASOTA	4080003G01 (2 OBS)	80	36	58
	SARASOTA	4100013G01 (8 OBS)	58	41	29
	SARASOTA	4100013G09 (4 OBS)	60	42	39

			QUARTERLY ARITHMETIC AVERAGE			
			JAN/ MAR	APR/ JUN	JUL/ SEPT	OCT/ DEC
Pb	RUSKIN	1800003G03	0.0	0.0	0.0	0.0
	TAMPA	1800103G02	0.0	0.0	0.0	0.0
	HILLSBOROUGH CO	1800104G02	0.1	NA	NA	NA
	HILLSBOROUGH CO	1800104G09	0.0	NA	NA	NA
	TAMPA	4360002G09	0.1	0.0	0.1	0.0
	SEMINOLE HTS	4360060G01	0.0	0.0	0.0	0.0
	TAMPA	4360060G09	0.0	0.0	0.0	0.0
	TEMPLE TERRACE	4440001G01	0.1	0.0	0.0	0.0

Source: FDER, 1990

TABLE 2.3.7-5
SUMMARY OF TAMPA ELECTRIC COMPANY POLK COUNTY
AIR QUALITY MONITORING DATA

Pollutant	Averaging Period	Highest Monitored Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	FAAQS ($\mu g/m^3$)
Sulfur Dioxide (SO_2)	3 hr	202	1,300	1,300
	24 hr	42	365	260
	Annual*	7	80	60
Ozone (O_3)	1 hr	192	235	235
Particulate Matter (PM_{10})	24 hr	43	150	150
	Annual*	18	50	50

*Period of Record: April 1, 1991 - December 31, 1991

Source: FDER Air Quality Data Base, Site #103680036J01

TABLE 2.3.7-6
SUMMARY OF POLK COUNTY SITE
ON-SITE AIR QUALITY MONITORING DATA

Pollutant	Averaging Period*	Highest Monitored Concentration ($\mu g/m^3$)	Second Highest Monitored Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	FAAQS ($\mu g/m^3$)
Sulfur Dioxide (SO_2)	3 hr	86	78	1,300	1,300
	24 hr	35	34	365	260
	4 mo (annual standard)	5	--	80	60
Ozone (O_3)	1 hr	149	149	235	235
Particulate Matter (PM_{10})	24 hr	37	24	150	150
	4 mo (annual standard)	17	--	50	50

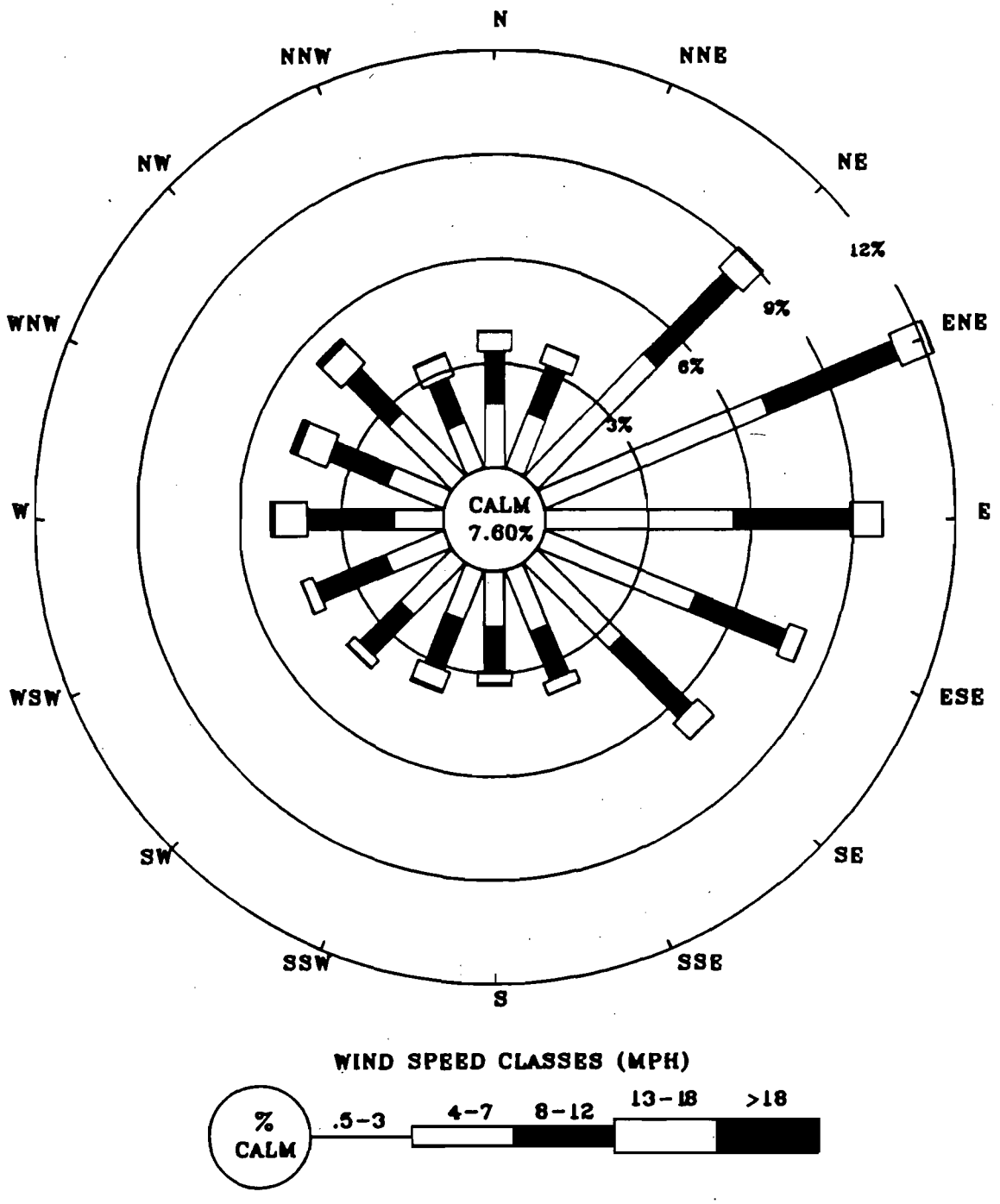
*Period of Record: October 15, 1991 through February 14, 1992

Source: Ebasco Environmental, 1992

TABLE 2.3.7-7
BACKGROUND AIR QUALITY DATA

Parameter	Averaging Period	Concentration[5] ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	FAAQS ($\mu g/m^3$)
Sulfur Dioxide (SO_2) [1]	3 hr	78	1,300	1,300
	24 hr	34	365	260
	4 mo (annual standard)	5	80	60
Ozone (O_3) [1]	1 hr	149	235	235
Particulate Matter (PM_{10}) [1]	24 hr	24	150	150
	4 mo (annual standard)	17	50	50
Carbon Monoxide (CO) [2]	1 hr	11,450	40,000	40,000
	8 hr	6,870	10,000	10,000
Nitrogen Dioxide (NO_2) [3]	Annual	25	100	100
Lead (Pb) [4]	Quarterly Average	0.1	1.5	1.5

Data Source:
[1] FPC Homeland AQ Station (10/15/91 through 02/14/92)
[2] FDER Hillsborough Site 060G01 (1990)
[3] FDER Hillsborough Site 002G09 (1990)
[4] FDER Hillsborough Site 065G01 (1990)
[5] Second-highest short-term and highest annual or long-term concentrations are presented.

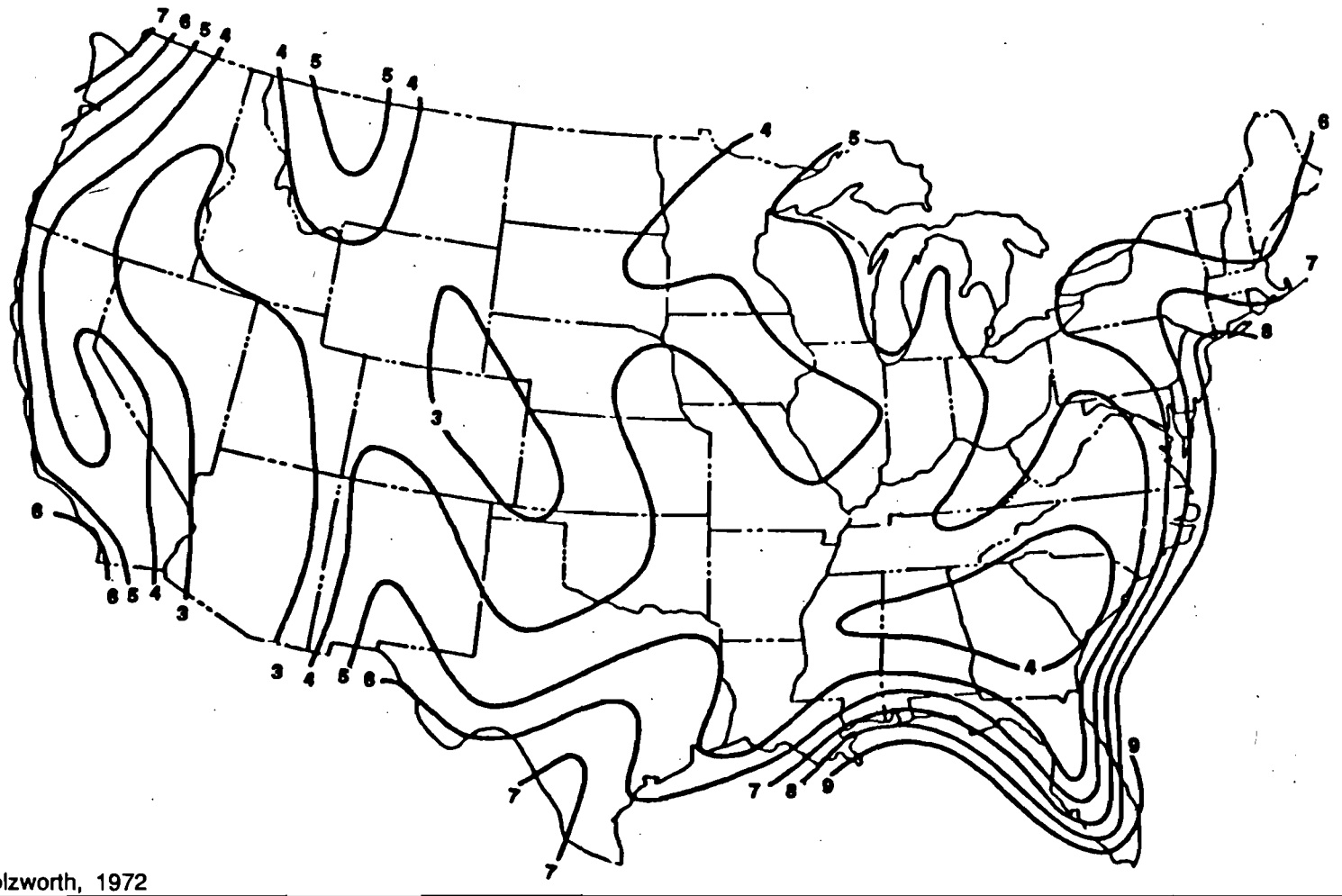


Source: NCDC Tampa, FL CD-1440 Format Data, 1982 through 1986

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.7-1
ANNUAL WIND ROSE
TAMPA, FLORIDA
1982 THROUGH 1986



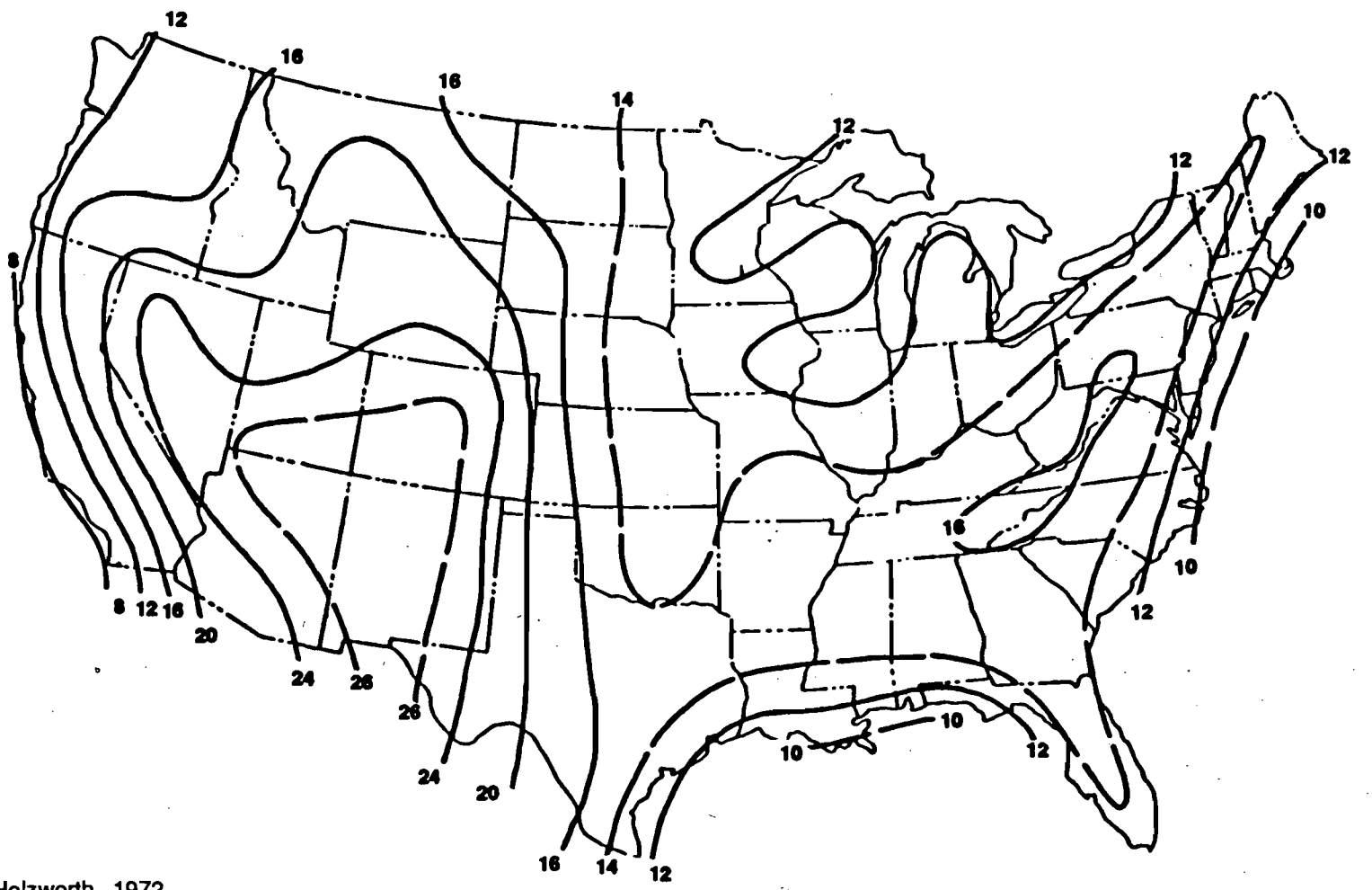
Source: Holzworth, 1972

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.7-2

ISOPLETHS ($m \times 10^2$) OF MEAN ANNUAL MORNING MIXING HEIGHTS



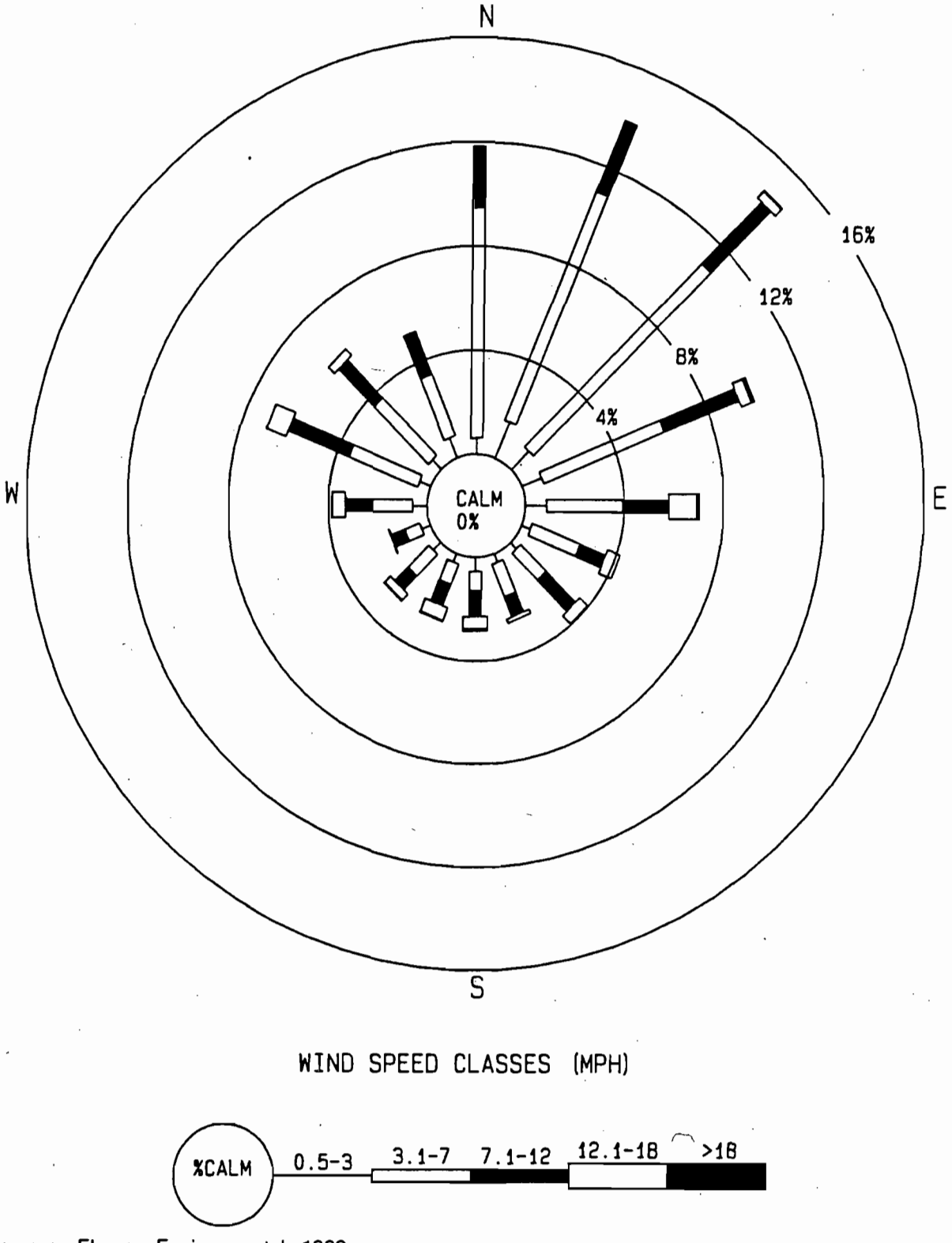
Source: Holzworth, 1972

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.7-3

ISOPLETHS (m x 10^2) OF MEAN ANNUAL AFTERNOON MIXING HEIGHTS

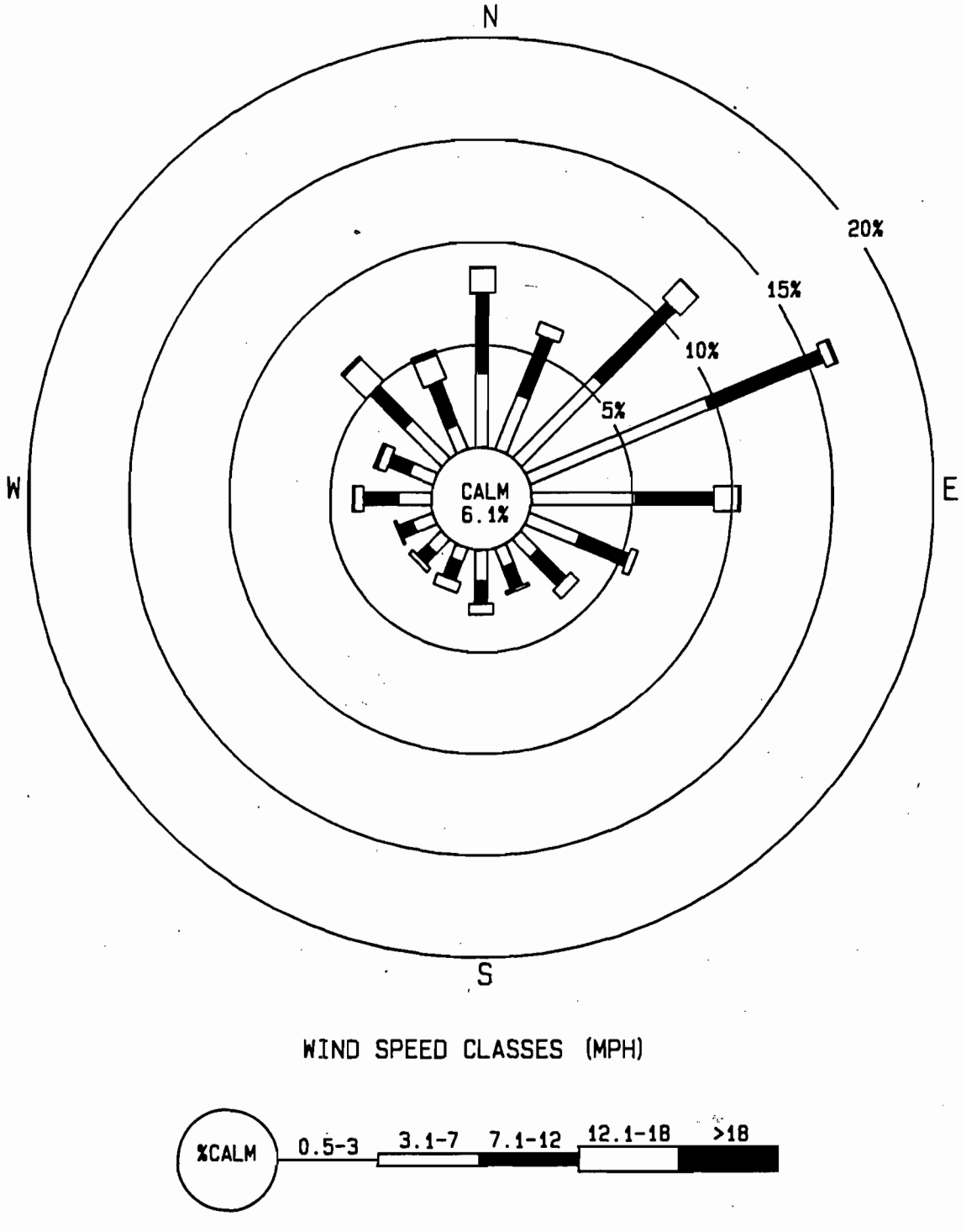


Source: Ebasco Environmental, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.7-4
ON-SITE WIND ROSE
OCTOBER 15, 1991 - FEBRUARY 14, 1992

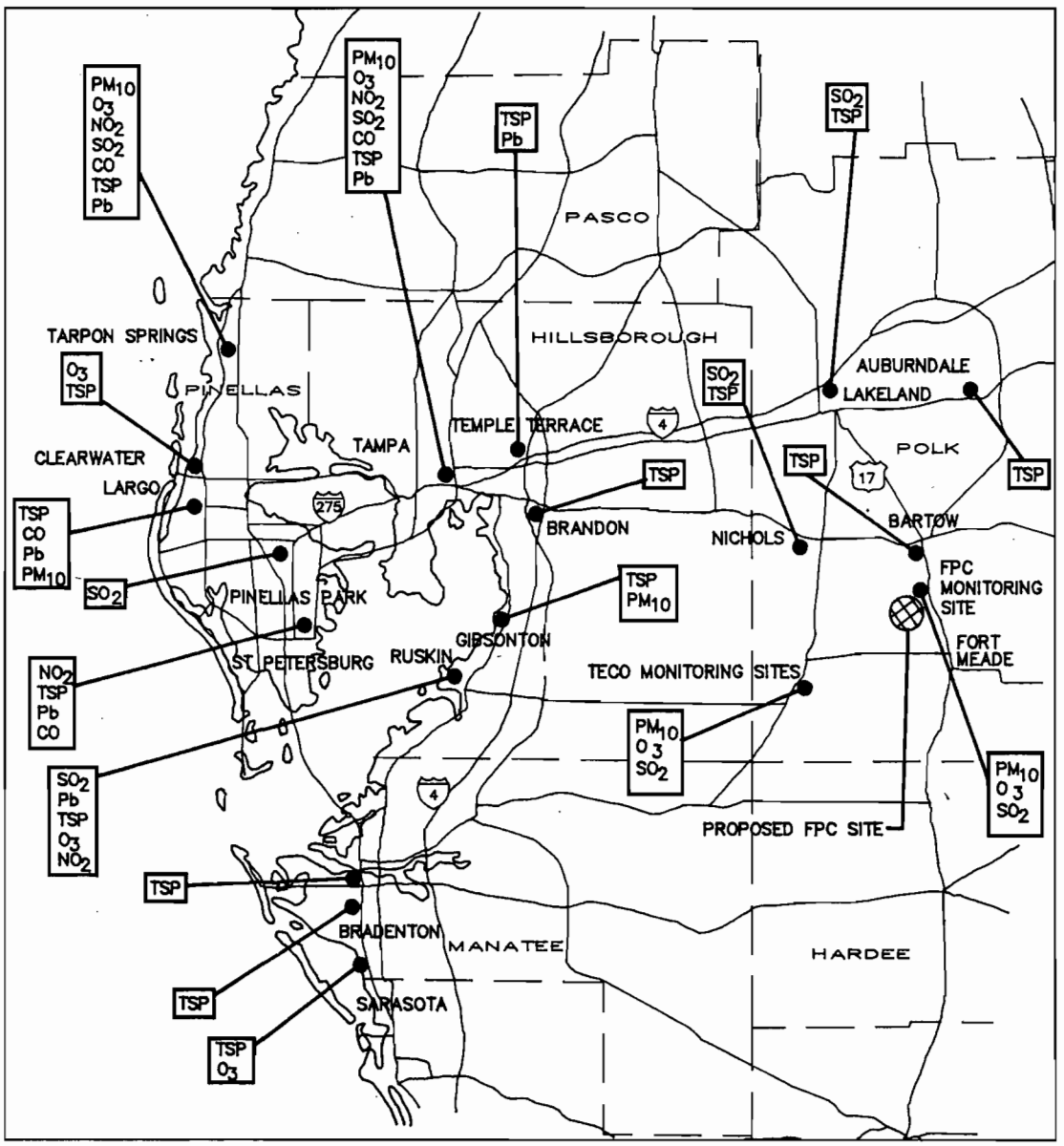


Source: NCDC Tampa FL TD-1440 Format Data, 10/91 - 2/92

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.7-5
TAMPA, FLORIDA - NWS
WIND ROSE
OCTOBER 15, 1991 - FEBRUARY 14, 1992

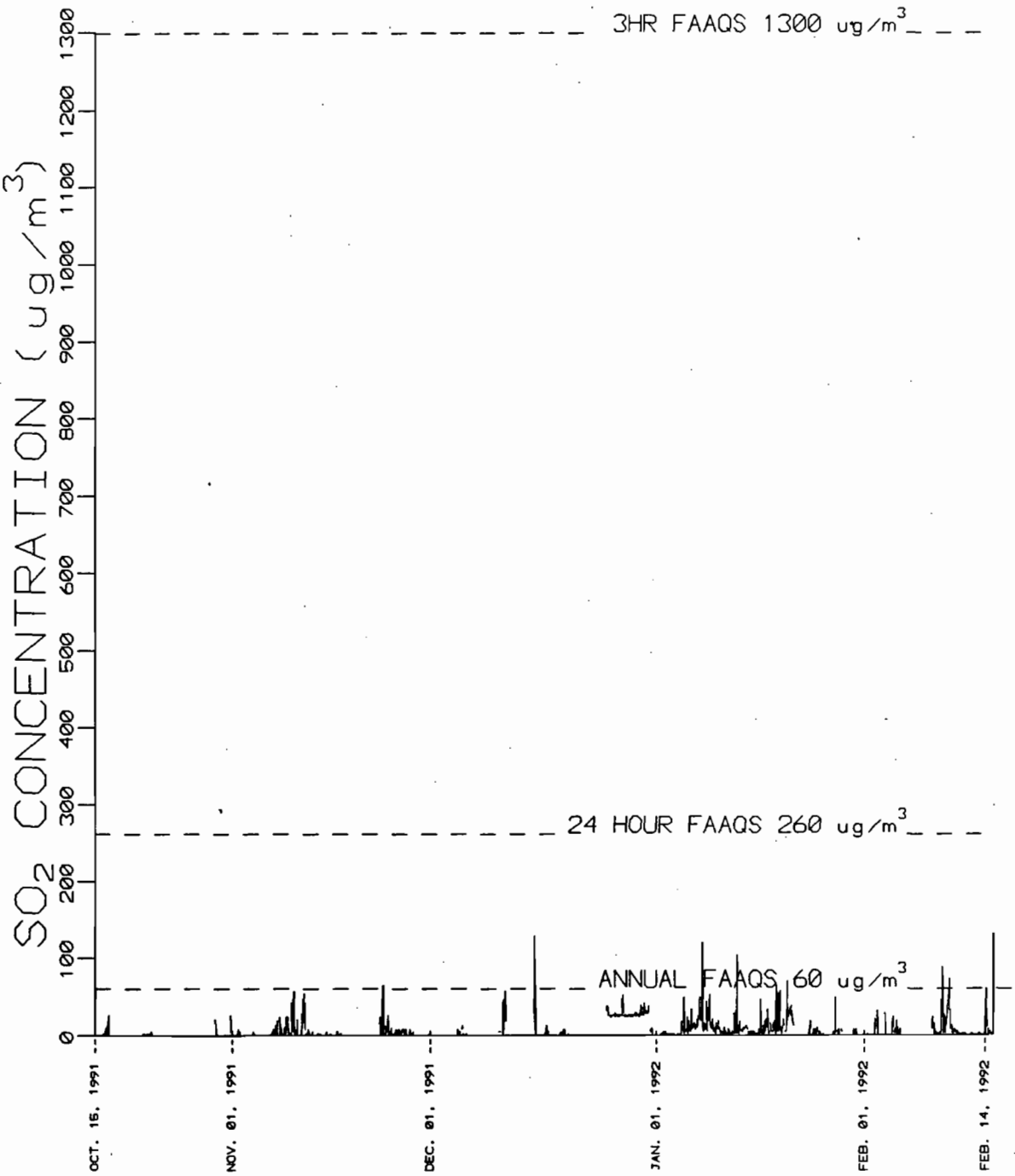


SOURCE: EBASCO ENVIRONMENTAL, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.7-6
LOCATIONS OF FDER AND OTHER AMBIENT AIR QUALITY MONITORING SITES



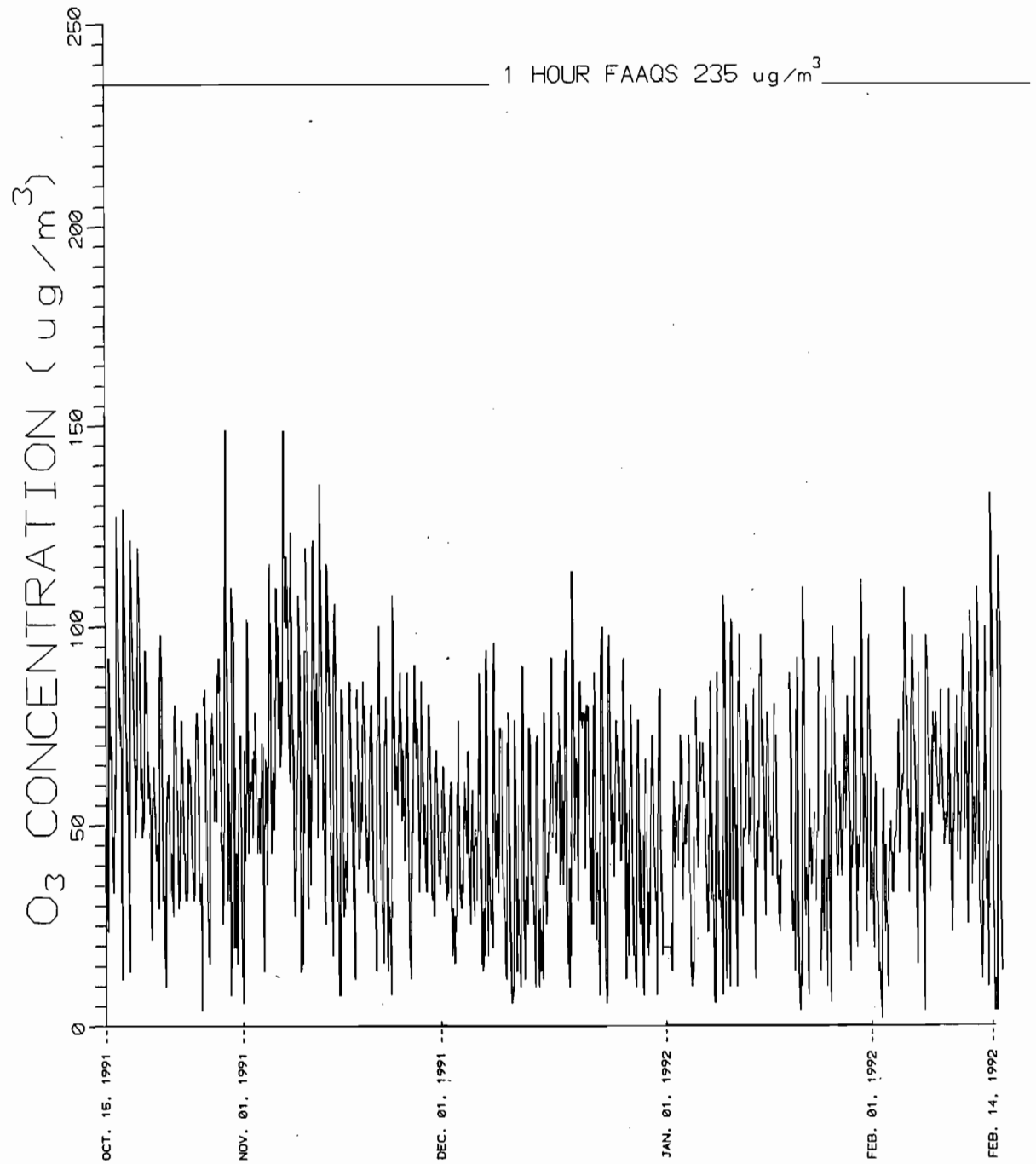
Note: A one-hour average standard for SO_2 does not exist and one hour values are not directly comparable with longer term standards.

Source: Ebasco Environmental, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.7-7
SO_2 HOURLY AVERAGE CONCENTRATIONS COMPARED WITH 3-HOUR, 24-HOUR AND ANNUAL STANDARDS (OCTOBER 15, 1991 - FEBRUARY 14, 1992)



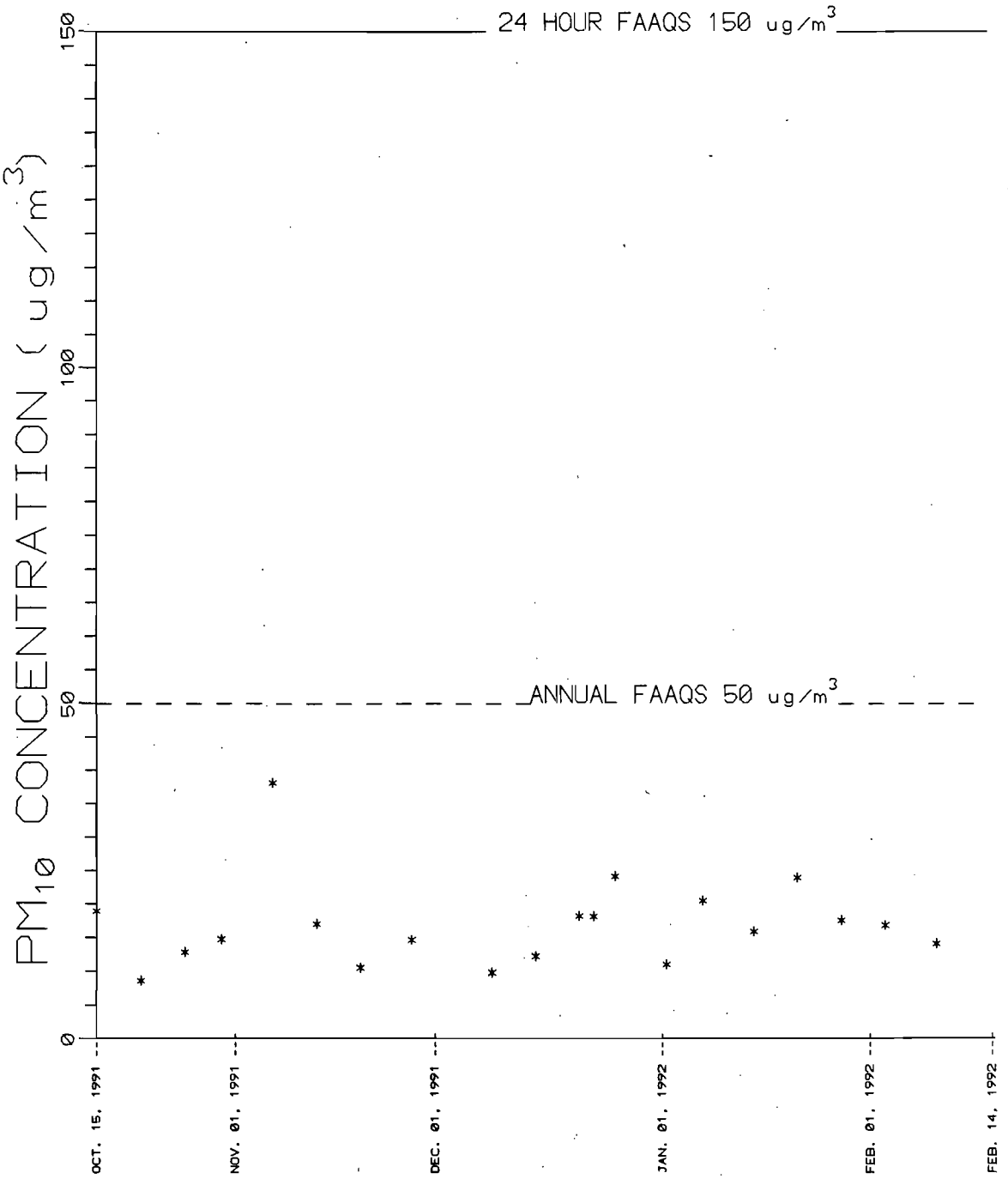
Source: Ebasco Environmental, 1992

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Polk County Site

FIGURE 2.3.7-8

O_3 HOURLY AVERAGE CONCENTRATIONS COMPARED WITH 1-HOUR STANDARD (OCTOBER 15, 1991 - FEBRUARY 14, 1992)



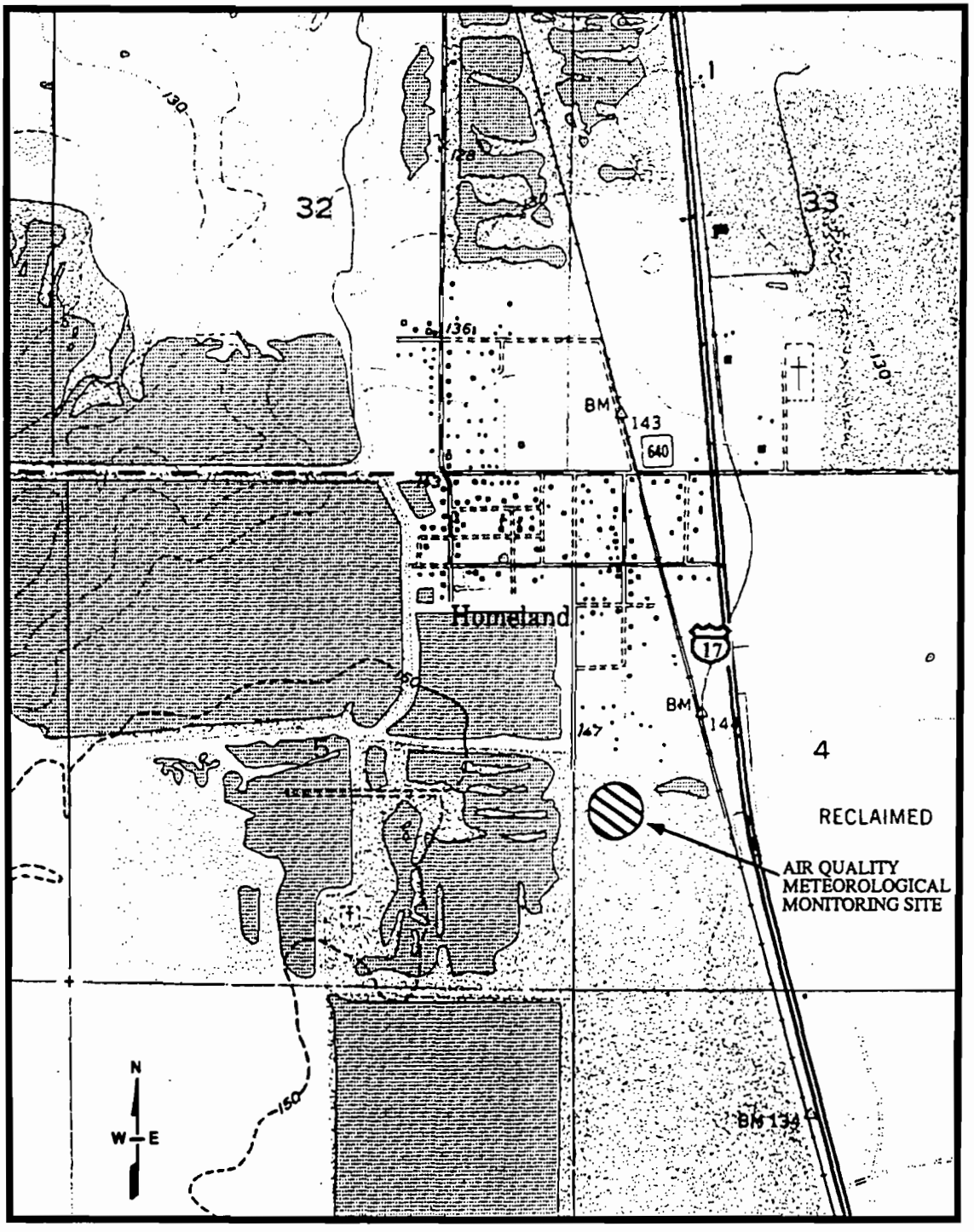
Note: 24-hour average concentrations are directly comparable with 24-hour average standards but are not directly comparable with annual standards.

Source: Ebasco Environmental, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.7-9
PM_{10} 24-HOUR AVERAGE CONCENTRATIONS COMPARED WITH 24-HOUR AND ANNUAL STANDARDS (OCTOBER 15, 1991 - FEBRUARY 14, 1992)



ONE MILE
SCALE

SOURCES: USGS 7.5' QUAD HOMELAND, FL
EBASCO ENVIRONMENTAL, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 2.3.7-10
AIR QUALITY/METEOROLOGICAL MONITORING SITE LOCATION MAP

2.3.8 Noise

2.3.8.1 Introduction

A noise monitoring program was conducted around the FPC Polk County Site during the period of January 20 to 21, 1992, to characterize the existing noise environment at the nearest noise-sensitive receptor locations, as well as at the proposed plant site. The results of the survey were compared with existing noise guidelines.

2.3.8.2 Study Area Description

Noise levels were monitored at five locations within the study area which is roughly bounded by SR 17 on the east, CR 630 on the south, CR 555 on the west, and CR 640 on the north (Figures 2.3.8-1 through 2.3.8-4). Four of the locations (Locations 1-4) were near existing noise-sensitive receptors and the fifth (Location 5) was on-site at the approximate location of the proposed power block.

The highly industrialized nature of this mining region somewhat limits residential development to existing communities such as Homeland and Fort Meade. Thus, isolated rural residences, typically found throughout most of Florida, are sparse. No residences exist within about 2.5 miles of the proposed power block area where all of the plant generating equipment, which is the primary source of noise, will be located. Three or four isolated residences are located on the south side of CR 630 near the intersection of CR 555 about 2.5 miles south, and one residence is located at the intersection of CR 640 and CR 555 about 3 miles to the north-northwest (Location 2). The communities of Homeland (Location 3) and Fort Meade (Location 4) are located about 3.5 miles northeast and 4.5 miles southeast from the power block, respectively.

Other noise-sensitive receptors in the area include two small churches located on CR 555 south-southwest of the site. The Trinity Grace Church, identified as the Old Elam Church on current topographic maps, and an unidentified church adjacent to Watson Cemetery at the intersection of CR 555 and CR 630, are about 1.5 miles and 2.5 miles from the site, respectively. Noise monitoring Location 1 was at the Trinity Grace Church.

Existing sources of noise in the area include heavy truck traffic on all the roads, and several large agri-chemical processing plants. The chemical plants include US Agri-Chemicals Corporation and Dupont on CR 630 between Fort Meade and CR 555, IMC Noralyn Plant north of CR 640 between CR 555 and SR 17, Farmland Hydro on CR 640 northwest of the plant site, and an industrial plant, Agrico South Pierce, about 4 miles due west of the site. These plants were only audible at Locations 1, 2 and 5 late at night during brief lulls in truck traffic. Truck traffic, even late at night, was by far the most significant source of noise at receptor locations.

2.3.8.3 Noise Standards or Guidelines

There are no federal, state, or local noise standards applicable to the FPC Polk County Site. The City of Fort Meade has a nuisance ordinance which prohibits unnecessary noise, but it is not applicable to the project site which is about four miles outside Fort Meade. The EPA has developed guidelines for noise levels to protect the public health and welfare with an adequate margin of safety (EPA, 1974). These guideline levels are presented in Table 2.3.8-1. The relevant criterion is the outdoor day/night level (L_{dn}) of 55 dBA. The EPA makes it clear that these are guidelines, not standards.

2.3.8.4 Noise Monitoring Methodology

Both A-weighted and octave band sound levels were obtained at the five monitoring locations. The A-weighted scale was designed to account for the manner in which the human auditory system responds to sounds of different frequencies. Very low and very high frequency sounds are attenuated electronically by the meter to produce an instrument response proportional to the subjective response of an average person. Octave band sound level measurements are taken at different frequencies to show the tonal characteristics of the overall sound.

The A-weighted sound level was measured continuously and simultaneously at the five locations over a complete 24-hour period using five Larson-Davis Laboratories Model LDL 700 precision sound level analyzers (LDL 700) with integral data loggers. These analyzers were equipped with optional circuitry and microphones to permit them to meet the more stringent requirements of ANSI S1.4-1983 Standard for Type I Precision Sound Level Meters. The microphones were Bruel & Kjaer Type 4176 prepolarized condenser precision measurement microphones. The microphones were equipped with 3.5-inch diameter foam windscreens to reduce wind effects and they were mounted at a height of 5 feet above the ground.

Two sets of octave band data were obtained of the residual or background sounds at each location using an Ivie Electronics Model IE-30A audio spectrum analyzer. The analyzer was set to measure 1/3 octave band levels to provide three times the resolution of whole octave bands. That is, the audible spectrum was divided into 30 narrow frequency bands between 20 Hertz (Hz) and 20 kiloHertz (kHz), and the level in each band was recorded. This technique is desirable in industrialized areas to aid in identifying pure tone sounds which can be produced by large fans and motors in industrial plants. Pure tone sounds are generally more noticeable than broad band sounds.

The analyzer was set to the A-weighted scale such that the level measured in each band already contained the A-weighting adjustment. Use of this technique generally ensures that the most audible frequencies will also be those with the highest peaks on the plotted graph. This is seldom the case with non-weighted octave band data where low frequency sounds are generally high in level but low in audibility.

The octave band analyzer was not operated continuously but rather was used more like a camera to take snapshots of the audio spectrum. Moments were selected by the operator when intrusive sounds, such as from traffic, were at a minimum so that only the residual sounds were characterized. This is important since the proposed plant would operate continuously, at a relatively constant level of noise, and this would impact the residual level the most. Intrusive sound levels from truck traffic will not be altered by plant operations. Two spectra were obtained at each location. One was obtained during the very early morning hours (0200 to 0400) when human activity is generally at a minimum. The other was obtained during the early afternoon hours (1300 to 1500) during the time when a normal workday level of activity was expected.

2.3.8.5 Data Analysis

The LDL 700 continuous analyzers were programmed to start automatically at 1600 on January 20, 1992, and to stop 24 hours later at 1600 on January 21, 1992. The analyzers were further programmed to compute and store the equivalent sound level (L_{eq}) occurring during each minute and each hour of the 24-hour period. The equivalent sound level is the energy averaged sound level occurring during the specified averaging period. Other hourly parameters computed and stored were the statistical sound levels exceeding 10, 50 and 90 percent of each 1-hour sample

period (L_{10}, L_{50} and L_{90}, respectively). These statistical data are useful for determining the variability of sound levels, which is a major part of the characterization of a sound environment.

At the end of the sample period, the analyzers were connected to a laptop computer to which the data were downloaded and stored. The data were then imported into the Lotus 1-2-3® spreadsheet program used to produce graphs of the data. One graph was produced of the 1-minute L_{eq} levels to show the often rapid variation in sound levels experienced in outdoor environments. Another graph was produced of the statistical sound levels (L_{10}, L_{50} and L_{90}) showing all three curves in the same plot.

The spreadsheet software was also used to compute the day/night sound level (L_{dn}) and the 24-hour L_{eq} level from the hourly L_{eq} data. The L_{dn} computation required the addition of a 10 dBA penalty to hourly L_{eq} levels occurring between the hours of 10 p.m. and 7 a.m. to account for the increased noise sensitivity during normal sleep hours. Adjusted nighttime levels were then energy averaged with unadjusted daytime hourly levels to compute resulting L_{dn} levels. The 24-hour L_{eq} level was computed by energy averaging actual hourly L_{eq} levels.

Octave band data were manually transcribed from the analyzer to preprinted data sheets and then entered into the spreadsheet for graphing. Two sets of 1/3 octave band data from each site were plotted on the same graph to permit comparison of day and night levels.

2.3.8.6 Survey Results

Following is a summary of 24-hour L_{eq} and L_{dn} levels for each of the five monitored locations.

Monitoring Location	24 Hour L_{eq} (dBA)	24 Hour L_{dn} (dBA)
1	56.6	62.7
2	58.3	64.5
3	50.0	53.2
4	53.7	57.5
5	49.9	51.2

A comparison the L_{dn} levels with the EPA guideline level of 55 dBA indicates that Locations 1, 2 and 4 already exceed the level. In all cases, this exceedance is due to heavy truck traffic. Location 2, about 150 feet from the intersection of CR 555 and CR 640, had the highest L_{dn} level at 64.5 dBA. The one mobile home residence at this location is actually closer to the intersection than the noise monitor, and levels would be expected to be slightly higher. The lowest measured levels were at Location 5 which was on-site and well away from any roads.

The graphs of the data presented in Figures 2.3.8-5 through 2.3.8-9 provide a more complete understanding of the noise environment of the area. A brief explanation of the graphs for each location follows.

LOCATION 1 (FIGURE 2.3.8-5)

Noise levels at this location in front of the Trinity Grace Church, about 150 feet from CR 555, were almost totally dominated by truck traffic. The top graph shows the extreme fluctuation in sound levels produced by the intermittent but frequent truck passages. The 1-minute L_{eq} levels ranged from as low as 30 dBA to as high as 66 dBA. The middle graph of the statistical levels also shows the tremendous influence of the truck traffic. The wide spread between the top and bottom curves (L_{10} and L_{90}) depicts a relatively quiet noise environment that is frequently interrupted by truck passages.

The octave band levels presented in the lower graph are extremely low. All of the peaks could not be identified, but it is believed that the low frequency peaks at 125 Hz during the day and at 315 Hz at night are likely signature peaks from one of the industrial plants in the area. The high frequency peak at about 4 kHz during the day is from a distant group of birds chirping. Nothing else of any consequence is indicated in the octave band data.

LOCATION 2 (FIGURE 2.3.8-6)

This location, about 150 feet from the intersection of CR 555 and CR 640, is exposed to even more truck traffic than Location 1. The interval between trucks is shorter and generally is not long enough for the sound level to decay to a low level before the next truck starts increasing the level again. This can be seen in the narrower spread in levels in both the top and middle graphs. Noise levels, and presumably traffic levels, peak between 6 and 7 a.m. The peak noise levels are very similar, but slightly higher, than those measured at Location 1.

The octave band data show peaks at 63 Hz and 125 Hz from an electrical transformer located about 200 feet from the monitor. The peak in the mid frequencies at 1 kHz is believed to be from a distant diesel truck engine and the sharp peak at 8 kHz is from crickets. Note the absence of the 8 kHz peak at night when temperatures were significantly cooler, thus, making the insects less active. This location would generally be considered unacceptable for residential purposes because of the high level of traffic noise.

LOCATION 3 (FIGURE 2.3.8-7)

This location, at the south end of Azalea Drive and about 2,000 feet west of SR 17, is farther removed from traffic noise. Consequently, the graphs look very different with lower overall levels and a much narrower spread between the L_{10} and L_{90} levels. The few tall spikes, seen in the upper graph, are due to vehicles entering and leaving the adjacent cow pasture through a steel farm gate which had to be opened and closed each time. The shorter spikes are generally due to large trucks travelling on SR 17 further away.

The hump in the octave band graph between 500 Hz and 1 kHz is due to diesel engine noise from distant trucks on SR 17. The acceptable noise environment characterized at this location is generally representative of the residential locations on the southwestern edge of the community of Homeland toward the plant site. Residences closer to SR 17 are exposed to higher levels of traffic noise.

LOCATION 4 (FIGURE 2.3.8-8)

This location was about 50 feet from the western end of 6th Street SW adjacent to the lake in Patterson Park in Fort Meade and about 800 feet west of SR 17. Truck traffic on SR 17 was the greatest source of noise. The graph of sound levels reflects the same pattern as sound levels from Location 3, because the controlling noise source is the same for both locations. However, the levels are higher at Location 4 because it is closer to SR 17. Late night L_{90} levels, which occur in the absence of traffic noise, drop to about 32 dBA, which is the same as observed in Homeland.

The octave band graph shows a peak at 1 kHz. This is believed to be diesel engine noise from the trucks on SR 17. No fixed source of noise, such as an industrial plant, was audible.

LOCATION 5 (FIGURE 2.3.8-9)

This location was about 1.5 miles into the site from CR 555. Birds appeared to be the greatest source of noise, although an occasional light truck of an angler or other site investigator would pass the monitor. Some of the tall spikes seen in the top graph are due to these vehicles. However, the tallest spikes are more likely due to birds perching on the microphone windscreen. Although none were seen, evidence was found that such perches had occurred. The lowest L_{90} levels of about 30 dBA were recorded at this location.

The highest peak at 1.2 kHz seen in the octave band graph is believed to be from the engine of a distant drill rig working on-site. This peak was recorded during the day when the rig was operating. The highest levels of 24 dBA recorded at night, in the 315 to 800 Hz bands, are thought to be from the U.S. Agri-Chemical Company (USAC) plant on CR 630 about 3 miles south of the location. Although the plant was audible, the levels were very low.

2.3.8.7 Summary

Noise levels at existing noise-sensitive receptors around the site are almost totally dominated by heavy trucks on the state and county roads. The truck traffic on the county roads is associated with the industrial plants in the area which operate 24 hours a day. Thus, the truck traffic also exists throughout the day and night. The noise environment at all of the land uses normally considered to be noise-sensitive (residences and churches) that exist adjacent to these roads around the site (Locations 1,2 and 4) is unacceptable when compared with the EPA guideline level. The locations which were far removed from the heavily travelled roads (Locations 3 and 5) were found to have acceptable noise environments. Existing industries were not audible in Homeland and Fort Meade but were audible at night at a very low level at the other three locations when there was a lull in truck traffic. Thus, these industries, except for the trucks associated with them, do not appear to adversely impact the noise environment.

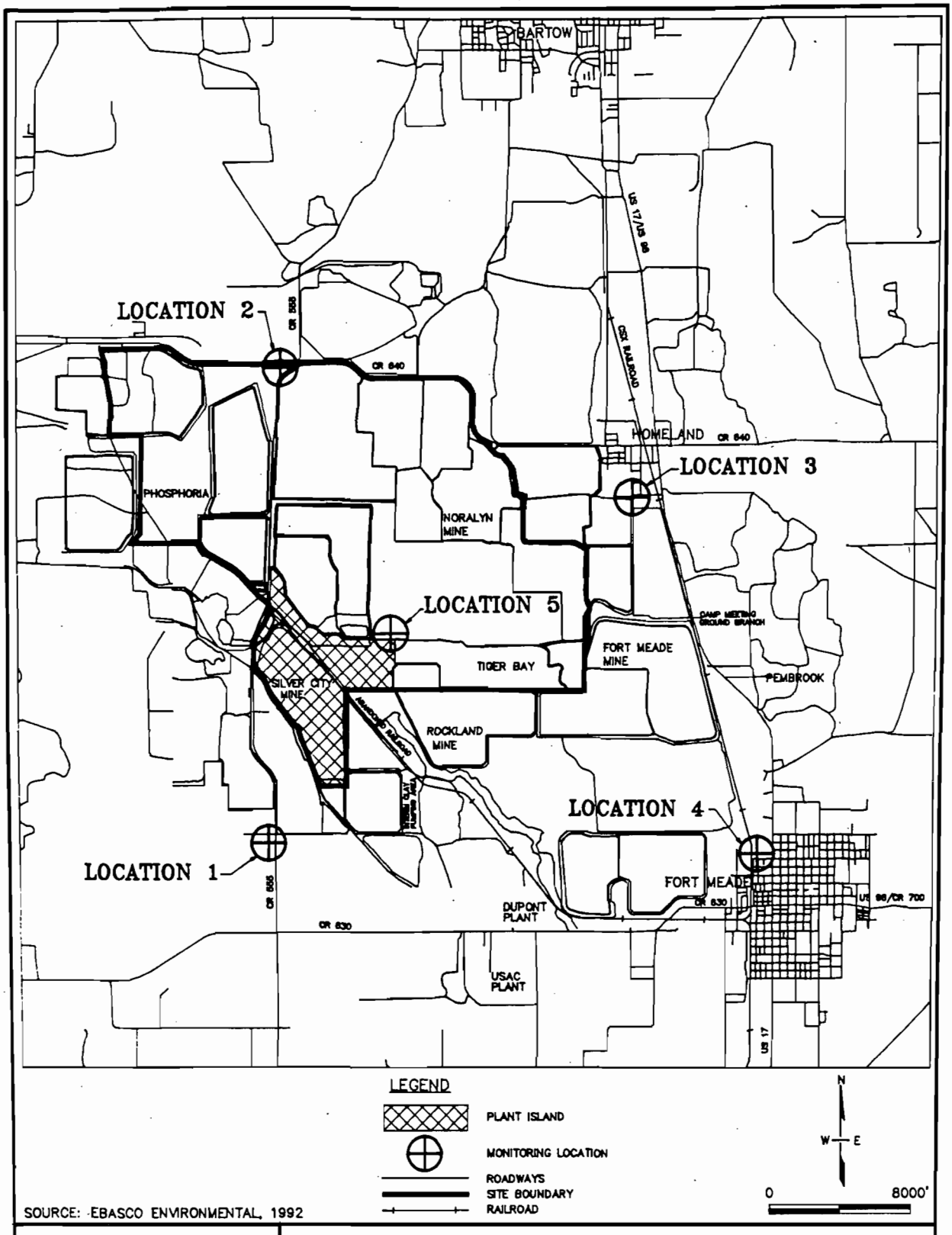
2.3.8.8 References

EPA (U.S. Environmental Protection Agency). 1974. Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. 550/9-74-004. Washington, D.C.

TABLE 2.3.8-1
SUMMARY OF EPA GUIDELINE NOISE LEVELS

Effect	Level	Area
Hearing Loss	$L_{eq}(24)$ = 70 dBA*	All Areas
Outdoor activity interference and annoyance	L_{dn} = 55 dBA	Outdoors in residential areas where people spend widely varying amounts of time and other places in which quiet is a basis for use.
	$L_{eq}(24)$ = 55 dBA	Outdoor areas where people spend limited amounts of time, such as playgrounds, school yards, etc.
Indoor activity interference and annoyance	L_{dn} = 45 dBA	Indoor residential areas
	$L_{eq}(24)$ = 45 dBA	Other indoor areas with human activities such as schools, etc.

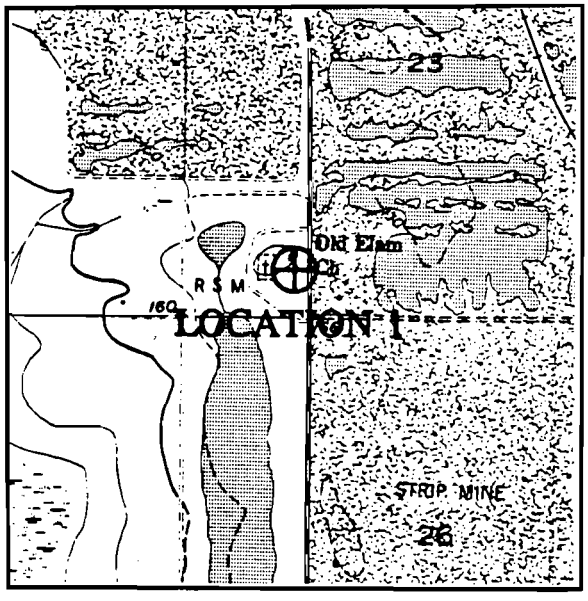
*Based on annual averages of the daily level over a period of forty years.
Source: EPA, 1974

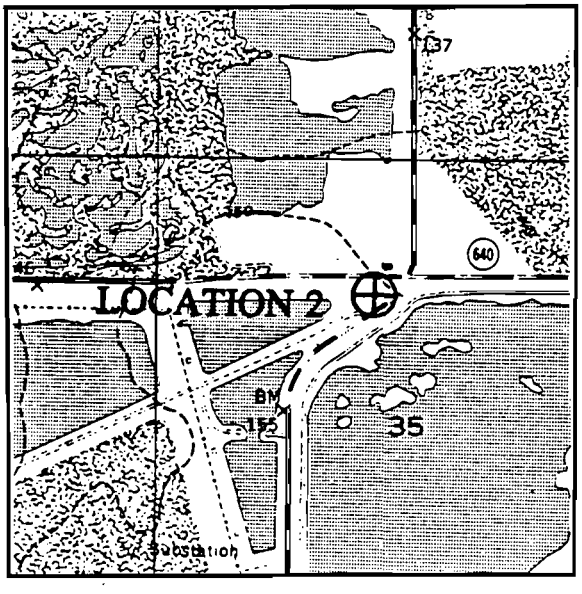


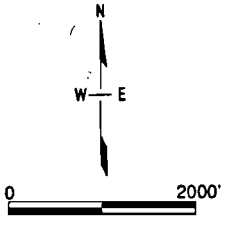
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FIGURE 2.3.8-1
NOISE MONITORING LOCATIONS





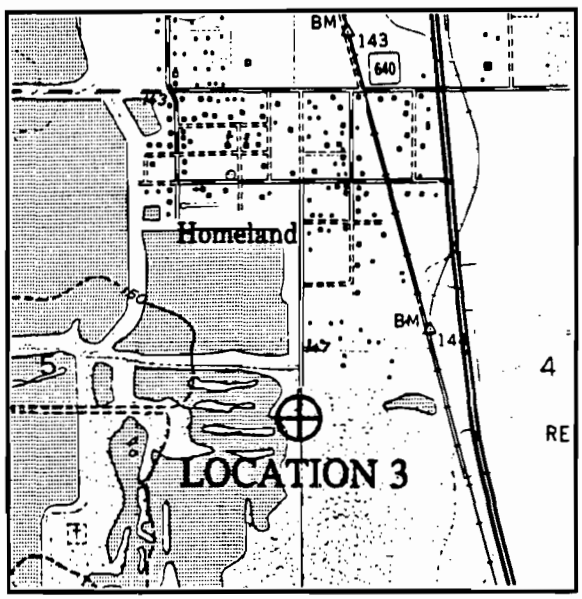


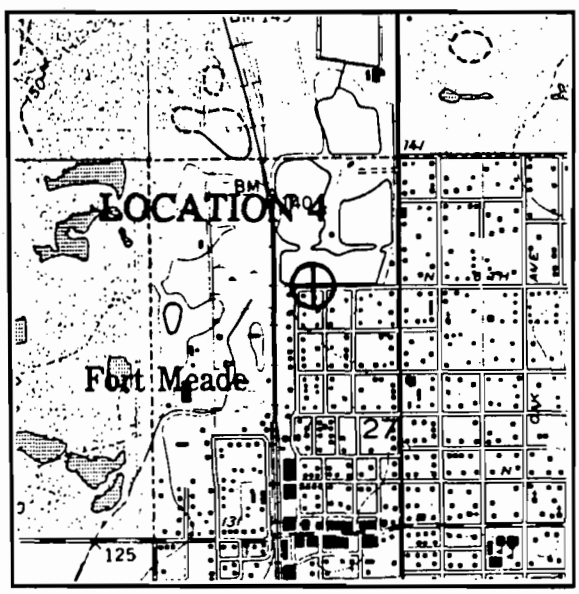
Source: Ebasco Environmental, 1992

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FIGURE 2.3.8-2
NOISE MONITORING LOCATIONS #1 AND #2



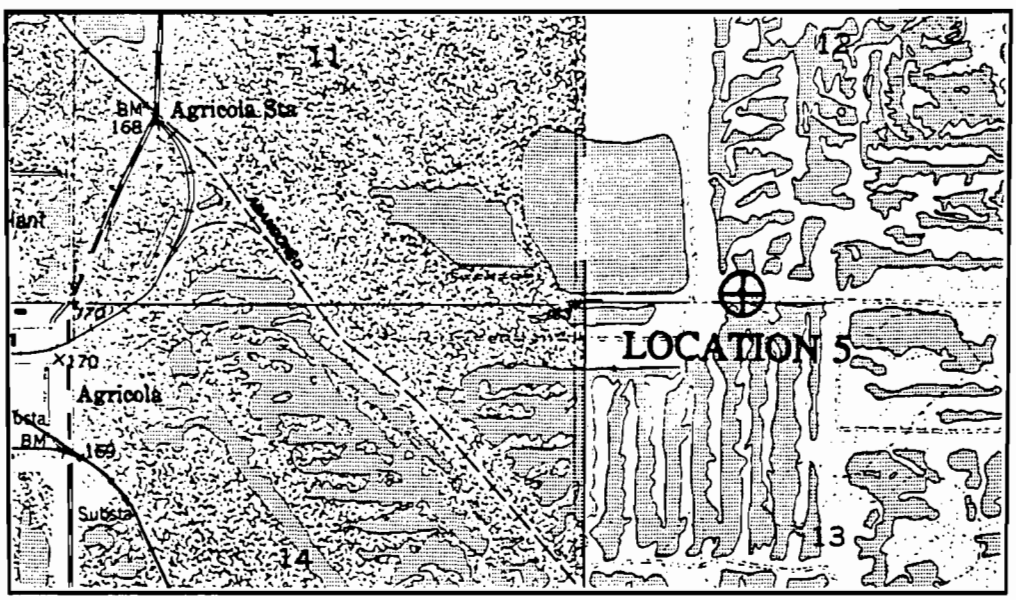


Source: Ebasco Environmental, 1992

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FIGURE 2.3.8-3
NOISE MONITORING LOCATIONS
#3 AND #4

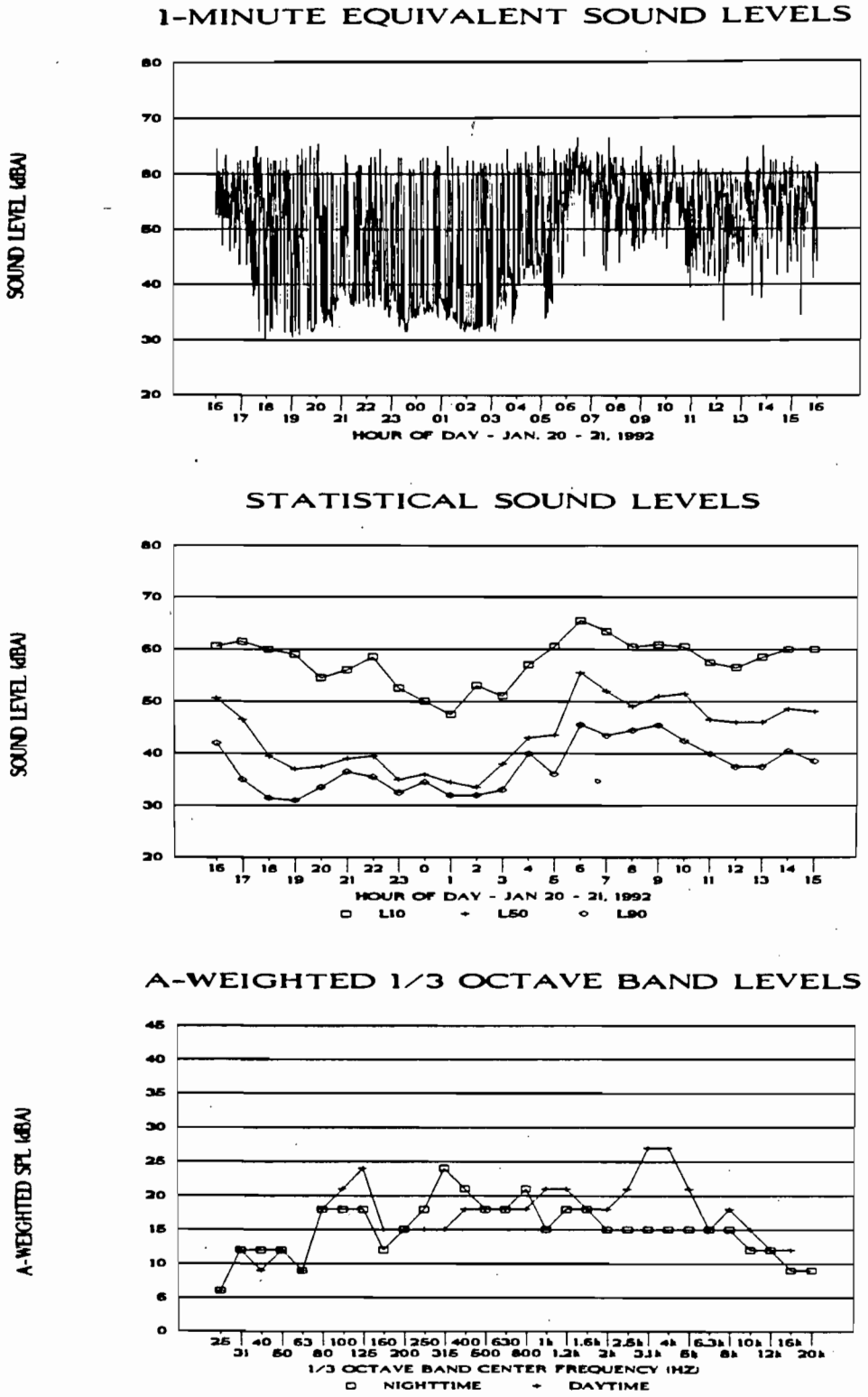


Source: Ebasco Environmental, 1992

Florida Power CORPORATION

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FIGURE 2.3.8-4
NOISE MONITORING LOCATION #5

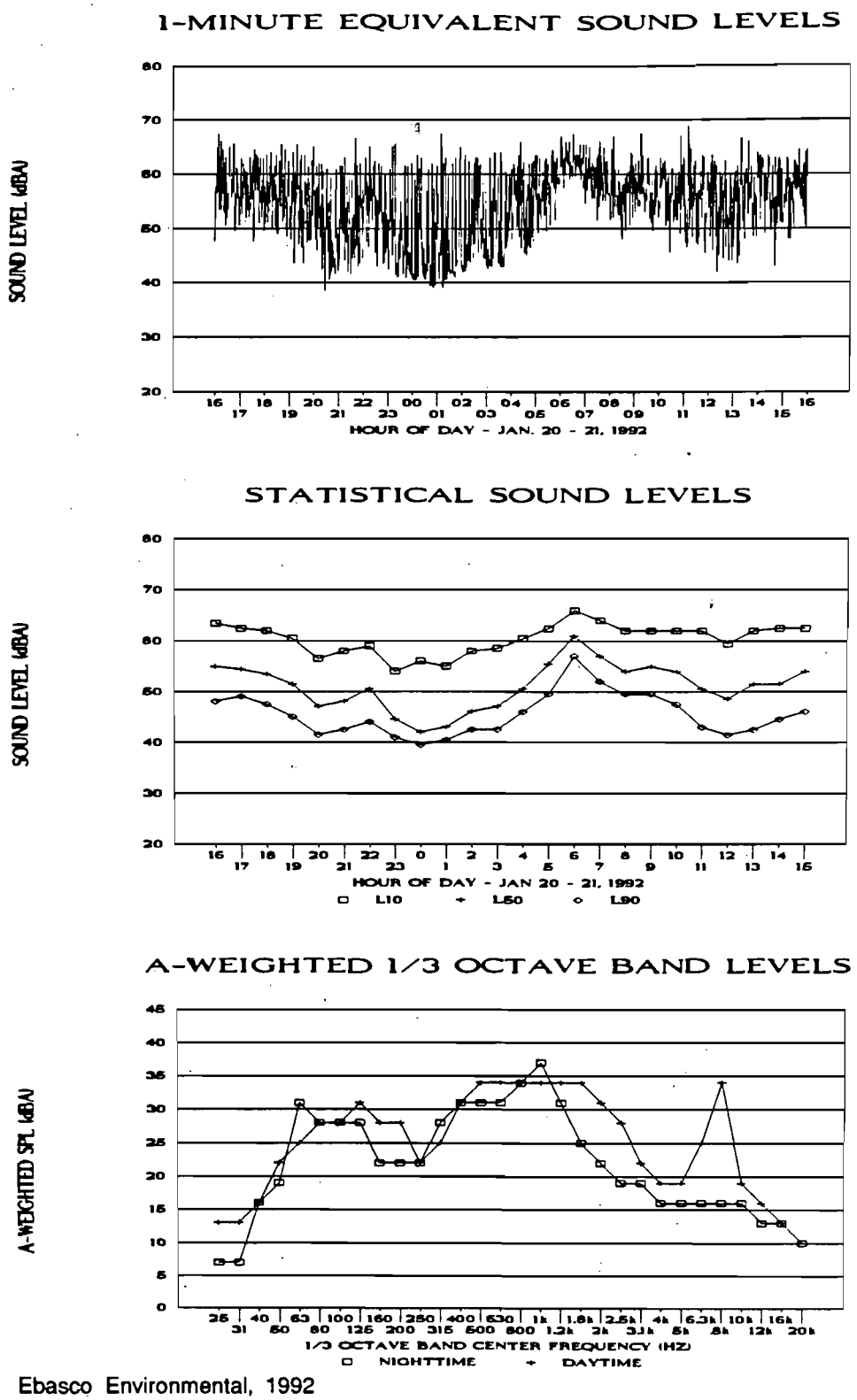


Source: Ebasco Environmental, 1992

Florida Power CORPORATION

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FIGURE 2.3.8-5
NOISE LEVELS - LOCATION 1
TRINITY GRACE CHURCH

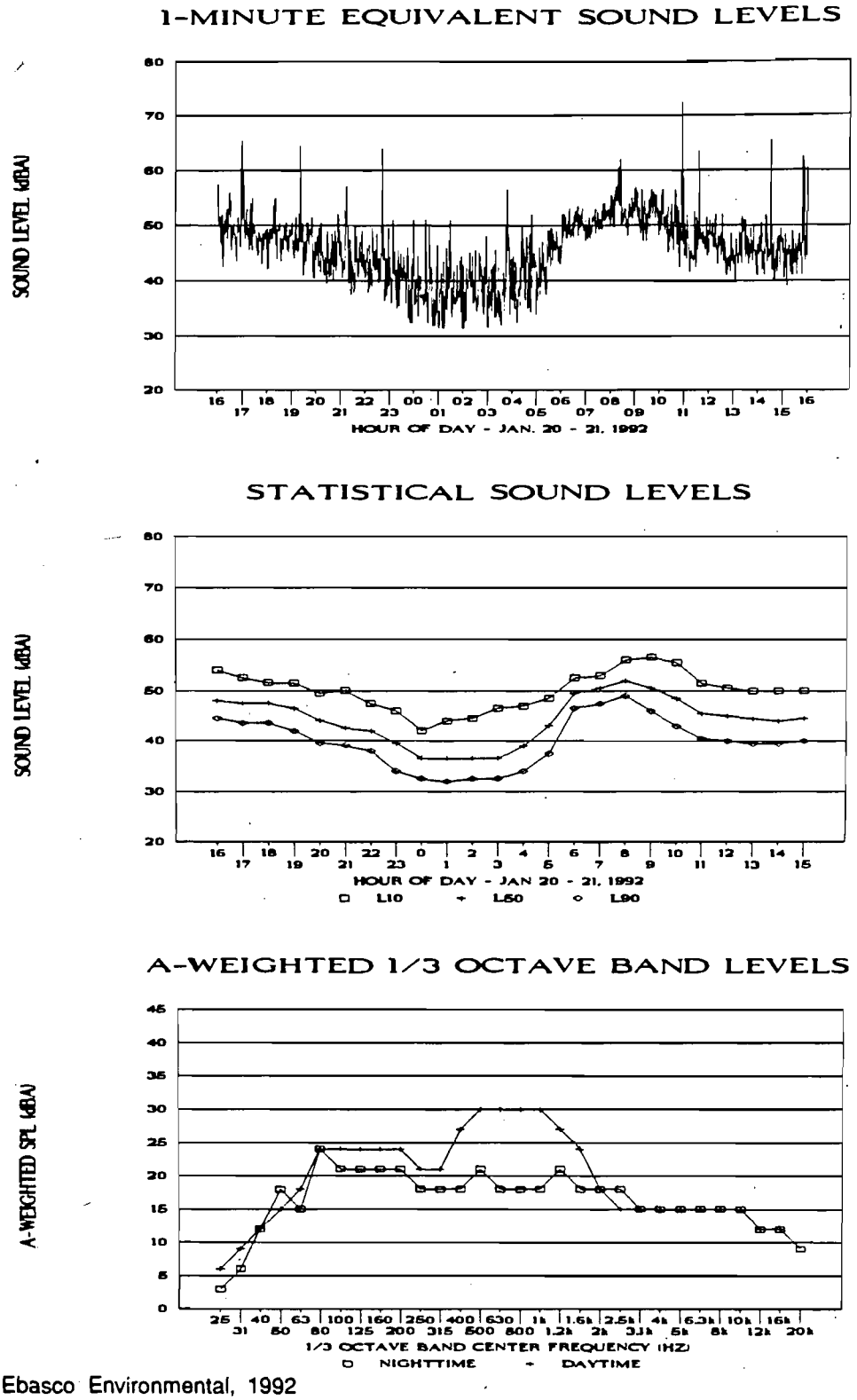


Source: Ebasco Environmental, 1992

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FIGURE 2.3.8-6
NOISE LEVELS - LOCATION 2
NORTHWEST CORNER OF SITE

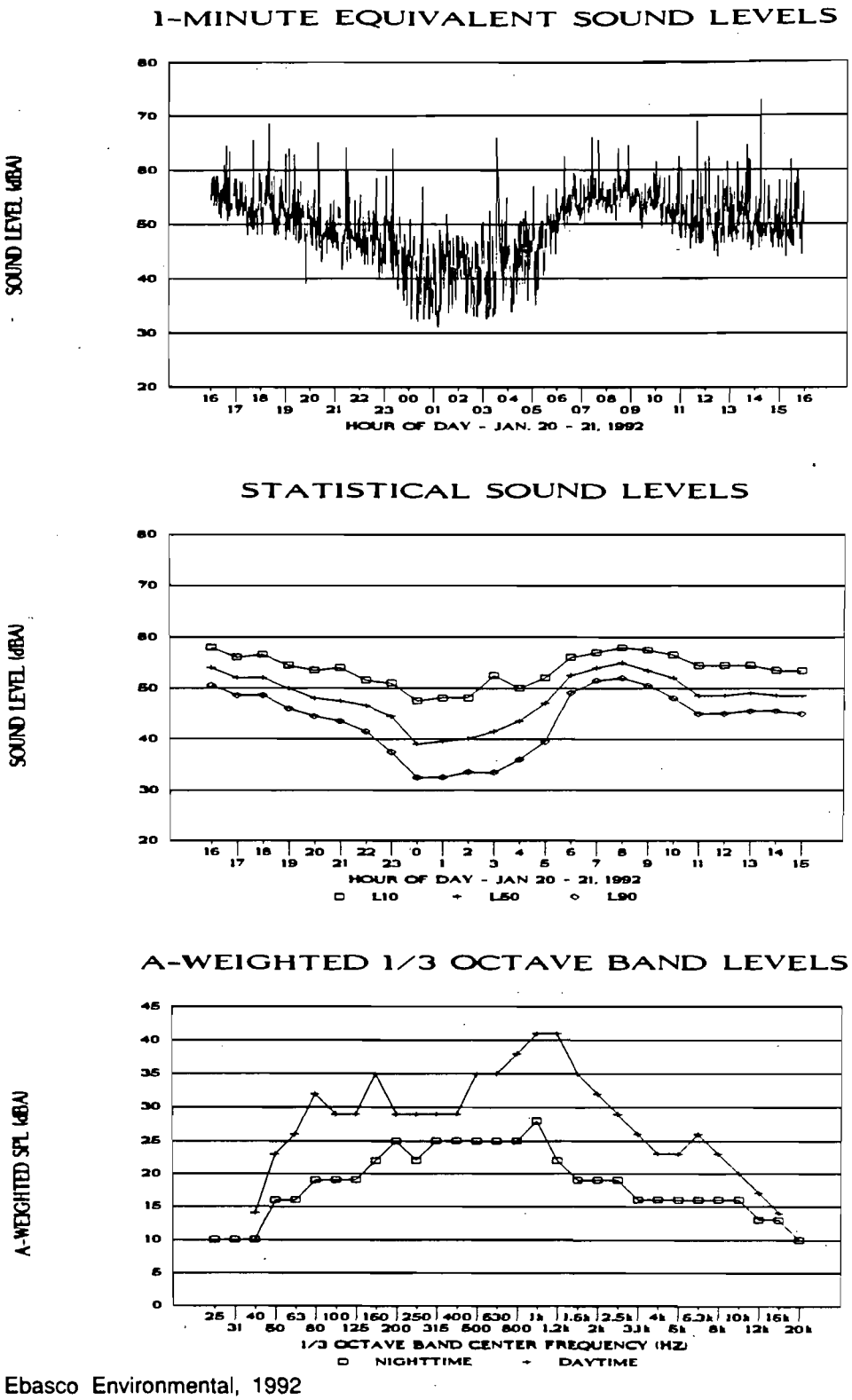


Source: Ebasco Environmental, 1992

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FIGURE 2.3.8-7
NOISE LEVELS - LOCATION 3
COMMUNITY OF HOMELAND

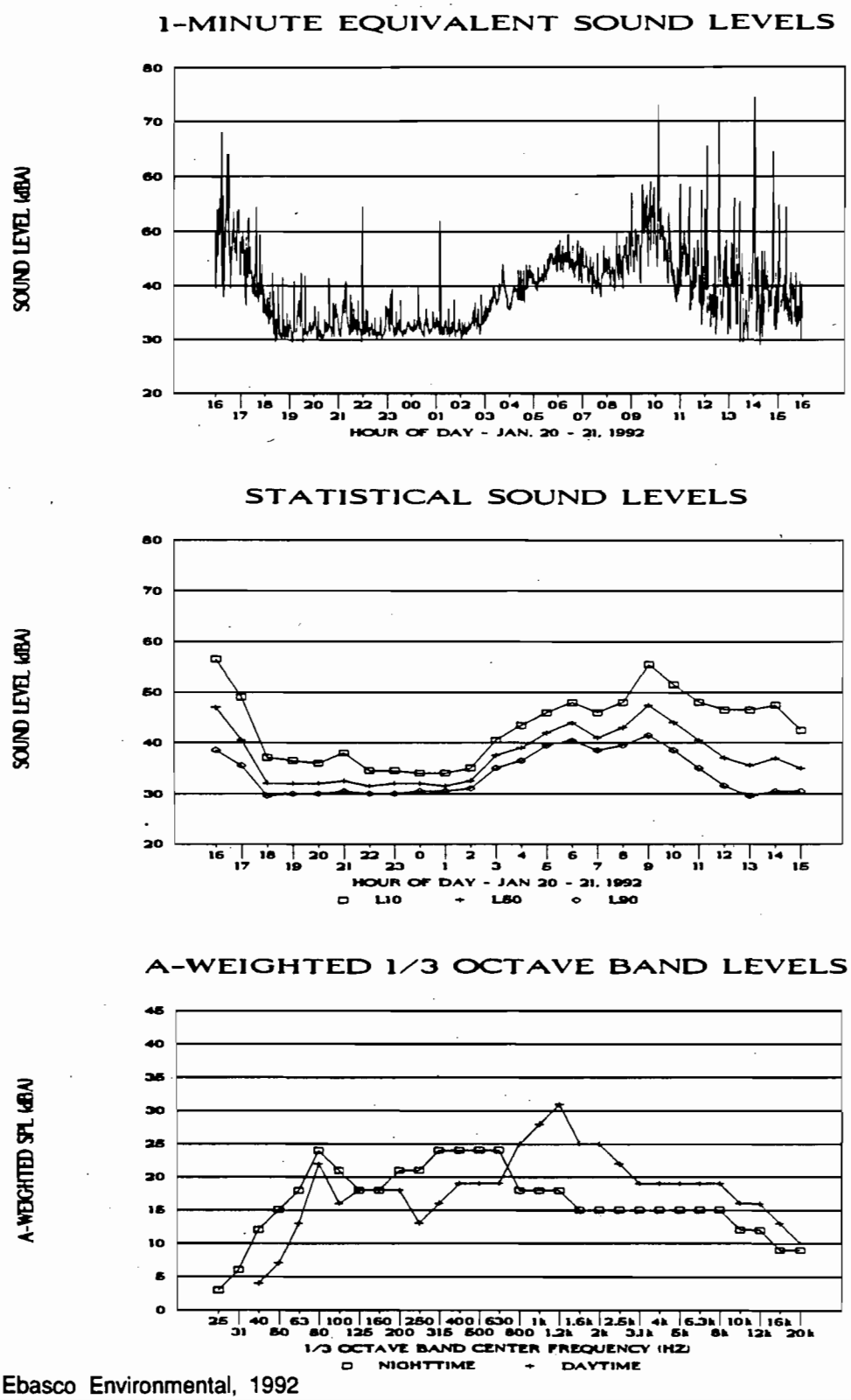


Source: Ebasco Environmental, 1992

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FIGURE 2.3.8-8
NOISE LEVELS - LOCATION 4
CITY OF FORT MEADE



Source: Ebasco Environmental, 1992

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Polk County Site

FIGURE 2.3.8-9
NOISE LEVELS - LOCATION 5
POWER BLOCK AREA

2.3.9 Other Environmental Features

Several regulatory agencies and environmental organizations have been promoting the concept of regional wildlife corridors to form an integrated habitat network. FPC is actively assisting FGFWFC, FDNR, and others in an effort to establish a wildlife corridor system in Polk County (FGFWFC, 1992). This corridor would connect wetlands habitat in Hookers Prairie to the forested floodplain of the Peace River. FPC is proposing to assist the development of this wildlife corridor by designing and modifying portions of the designated on-site buffer area for wildlife habitat enhancement. More detailed information about the corridor concept is presented in Appendix 10.9.

2.3.9.1 References

FGFWFC (Florida Game and Fresh Water Fish Commission). 1992. Letter from T. King, FGFWFC, to K. Small, Florida Power Corporation, St. Petersburg, Florida. February 18, 1992.

TABLE OF CONTENTS

CHAPTER 3

THE PLANT AND DIRECTLY ASSOCIATED FACILITIES

Section/Title		Page
3.0	THE PLANT AND DIRECTLY ASSOCIATED FACILITIES	3.0-1
3.1	BACKGROUND	3.1-1
3.2	SITE LAYOUT	3.2-1
3.2.1	Plant Island	3.2-1
3.2.2	Balance of Site	3.2-2
3.3	FUEL AND FUEL HANDLING CHARACTERISTICS	3.3-1
3.3.1	Natural Gas	3.3-1
3.3.2	Fuel Oil	3.3-1
3.3.3	Coal	3.3-2
3.3.4	Groundwater Protection/Runoff Collection and Treatment	3.3-3
3.3.5	Alternative Fuels	3.3-4
3.4	AIR EMISSIONS AND CONTROLS	3.4-1
3.4.1	Air Emission Types and Sources	3.4-1
3.4.1.1	Sources	3.4-1
3.4.1.2	Emissions	3.4-3
3.4.1.3	Emissions Inventory	3.4-3
3.4.2	Air Emission Controls	3.4-3

TABLE OF CONTENTS (Continued)

Section/Title		Page
3.4.3	Best Available Control Technology (BACT)	3.4-4
3.4.3.1	Introduction	3.4-4
3.4.3.2	Requirements and Assumptions	3.4-5
3.4.3.3	Nitrogen Oxides	3.4-6
3.4.3.4	Sulfur Dioxide	3.4-19
3.4.3.5	Sulfuric Acid Mist	3.4-26
3.4.3.6	Carbon Monoxide and Volatile Organic Compounds	3.4-27
3.4.3.7	Particulate Matter (PM_{10}) Emissions	3.4-30
3.4.3.8	Trace Pollutant Emissions	3.4-33
3.4.3.9	Summary	3.4-36
3.4.4	Design Data for Control Equipment	3.4-36
3.4.5	Design Philosophy	3.4-37
3.4.6	References	3.4-37
3.5	PROJECT WATER USE	3.5.0-1
3.5.1	Heat Dissipation System	3.5.1-1
3.5.1.1	System Design	3.5.1-1
3.5.1.2	Source of Cooling Water	3.5.1-35
3.5.1.3	Dilution System	3.5.1-36
3.5.1.4	Blowdown, Screened Organisms, and Trash Disposal	3.5.1-36
3.5.1.5	Injection Wells	3.5.1-37
3.5.1.6	References	3.5.1-37

TABLE OF CONTENTS (Continued)

Section/Title		Page
3.5.2	Domestic/Sanitary Wastewater	3.5.2-1
3.5.3	Potable Water Systems	3.5.3-1
3.5.4	Process Water Systems	3.5.4-1
3.6	CHEMICAL AND BIOCIDE WASTE	3.6-1
3.6.1	Introduction	3.6-1
3.6.2	Ultimate Development	3.6-2
3.6.2.1	Cooling Pond Circulating Water Treatment and Other Biocide Treatment	3.6-2
3.6.2.2	Well Water Treatment Wastes	3.6-3
3.6.2.3	Process Water Treatment	3.6-3
3.6.2.4	Sanitary Waste Treatment	3.6-5
3.6.2.5	Steam Cycle Water Treatment	3.6-5
3.6.2.6	Makeup Water Demineralization and Condensate Polishing Wastes	3.6-5
3.6.2.7	Chemical Cleaning Wastes	3.6-6
3.6.2.8	Miscellaneous Chemical Drains	3.6-7
3.6.2.9	Neutralization Basin	3.6-8
3.6.2.10	Oil Spill Prevention	3.6-8
3.6.2.11	Material Storage Area Runoff	3.6-9
3.6.2.12	Active Solid Waste Area Runoff	3.6-9
3.7	SOLID AND HAZARDOUS WASTES AND BY-PRODUCTS	3.7-1
3.7.1	Solid Wastes	3.7-1
3.7.1.1	Quantities and Types	3.7-1

TABLE OF CONTENTS (Continued)

Section/Title		Page
3.7.1.2	Methods of Treatment, Handling, Interim Storage and Off-Site Disposal	3.7-4
3.7.1.3	On-Site Disposal	3.7-5
3.7.2	Hazardous Wastes	3.7-29
3.7.2.1	Coal Gasification Units	3.7-29
3.7.2.2	Pulverized Coal Units	3.7-29
3.7.2.3	Other Hazardous Wastes	3.7-29
3.7.2.4	On-Site Disposal and Storage	3.7-30
3.8	ON-SITE DRAINAGE SYSTEM	3.8-1
3.8.1	Design Parameters	3.8-1
3.8.2	Construction Phase Runoff	3.8-2
3.8.3	Operational Phase Storm Water Runoff	3.8-3
3.8.4	Parcel Descriptions	3.8-3
3.9	MATERIALS HANDLING	3.9-1
3.9.1	Site Facilities	3.9-1
3.9.2	Operational Materials	3.9-3
3.10	AQUIFER STORAGE AND RECOVERY	3.10-1

LIST OF TABLES

Table/Title		Page
3.1.0-1	SCHEDULE OF ESTIMATED SITE CAPACITY VS. TIME CASE A - 3,000 MW CGCC	3.1-3
3.1.0-2	SCHEDULE OF ESTIMATED SITE CAPACITY VS. TIME CASE B - 2,000 MW CGCC AND 1,200 MW PC	3.1-4
3.2.2-1	COOLING POND PARCEL PHYSICAL CHARACTERISTICS	3.2-6
3.3.1-1	TYPICAL NATURAL GAS ANALYSIS	3.3-5
3.3.2-1	TYPICAL NO. 2 FUEL OIL ANALYSIS	3.3-6
3.3.3-1	ULTIMATE COAL ANALYSIS	3.3-7
3.3.3-2	DESIGN FUEL ANALYSIS, COAL-DERIVED GAS	3.3-8
3.4.1-1	COAL GASIFICATION COMBINED CYCLE UNITS (3,000 MW) POLLUTANT EMISSION RATES (CASE A)	3.4-39
3.4.1-2	COAL GASIFICATION COMBINED CYCLE UNITS (2,000 MW) POLLUTANT EMISSION RATES (CASE B)	3.4-40
3.4.1-3	PULVERIZED COAL UNITS (1,200 MW) POLLUTANT EMISSION RATES (CASE B)	3.4-41
3.4.1-4	COAL GASIFICATION PLANT THERMAL OXIDATION UNITS POLLUTANT EMISSION RATES	3.4-42
3.4.1-5	AUXILIARY BOILER POLLUTANT EMISSION RATES	3.4-43
3.4.1-6	DIESEL GENERATOR POLLUTANT EMISSION RATES	3.4-44

LIST OF TABLES (Continued)

Table/Title		Page
3.4.1-7	EMERGENCY FLARES POLLUTANT EMISSION RATES	3.4-45
3.4.1-8	BULK MATERIAL HANDLING SYSTEMS FUGITIVE DUST EMISSION RATES	3.4-46
3.4.1-9	SIGNIFICANT EMISSION RATE THRESHOLDS	3.4-47
3.4.2-1	COAL GASIFICATION COMBINED CYCLE UNITS SUMMARY OF PRELIMINARY BACT ANALYSIS RESULTS	3.4-48
3.4.2-2	PULVERIZED COAL UNITS, SUMMARY OF PRELIMINARY BACT ANALYSIS RESULTS	3.4-49
3.4.2-3	COAL GASIFICATION PLANT THERMAL OXIDATION UNITS, SUMMARY OF PRELIMINARY BACT ANALYSIS	3.4-50
3.4.2-4	AUXILIARY BOILER, SUMMARY OF PRELIMINARY BACT ANALYSIS	3.4-51
3.4.2-5	BULK MATERIAL HANDLING SYSTEMS, SUMMARY OF PRELIMINARY BACT ANALYSIS	3.4-52
3.4.3-1	COAL GASIFICATION COMBINED CYCLE UNITS, OTHER REGULATED AND HAZARDOUS POLLUTANT EMISSIONS (CASE A)	3.4-53
3.4.3-2	COAL GASIFICATION COMBINED CYCLE UNITS OTHER REGULATED AND HAZARDOUS POLLUTANT EMISSIONS (CASE B)	3.4-54

LIST OF TABLES (Continued)

Table/Title		Page
3.4.3-3	PULVERIZED COAL UNITS, OTHER REGULATED AND HAZARDOUS POLLUTANT EMISSIONS	3.4-55
3.4.3-4	COAL GASIFICATION PLANT THERMAL OXIDATION UNITS, OTHER REGULATED AND HAZARDOUS POLLUTANT EMISSIONS	3.4-56
3.4.3-5	AUXILIARY BOILER, OTHER REGULATED AND HAZARDOUS POLLUTANT EMISSIONS	3.4-57
3.5.1-1	HEAT REJECTION - CASE A (3,000 MW CGCC)	3.5.1-40
3.5.1-2	HEAT REJECTION - CASE B (2,000 MW CGCC + 1,200 MW PC)	3.5.1-41
3.5.1-3	COOLING POND BASINS AND ASSOCIATED WATER CROP AREAS	3.5.1-42
3.5.1-4	WELL WATER QUALITY DATA (THREE PAGES)	3.5.1-43
3.5.1-5	REPRESENTATIVE PHOSPHATIC WASTE SETTLING POND WATER QUALITY (FIVE PAGES)	3.5.1-46
3.5.1-6	WATER QUALITY MODELING RESULTS - ONE CYCLE, DISSOLVED CONSTITUENTS	3.5.1-51
3.5.1-7	WATER QUALITY MODELING RESULTS - THREE CYCLES, DISSOLVED CONSTITUENTS	3.5.1-52
3.5.1-8	MUNICIPAL SEWAGE EFFLUENT QUALITY (TWO PAGES)	3.5.1-53
3.5.1-9	CLASSIFICATION OF MINE AREA DAMS	3.5.1-55

LIST OF TABLES (Continued)

Table/Title		Page
3.5.1-10	CATEGORY 1 DAMS - MINIMUM DESIGN FACTORS-OF-SAFETY	3.5.1-56
3.5.1-11	EFFECTIVE SOIL FRICTION ANGLES (Ø)	3.5.1-57
3.5.1-12	COMPARISON OF SOIL FRICTION ANGLES	3.5.1-58
3.5.1-13	MINIMUM FACTORS-OF-SAFETY FOR PERIMETER DAMS	3.5.1-59
3.5.1-14	SUMMARY OF BUFFER AREA CONSOLIDATION	3.5.1-60
3.5.1-15	SUMMARY OF GRAIN SIZE ANALYSES FOR EVALUATION OF SAND TAIL FILTER SUITABILITY	3.5.1-61
3.5.1-16	DESIRABLE LIMITS ON COOLING WATER QUALITY	3.5.1-62
3.5.3-1	ESTIMATED TREATED POTABLE WATER ANALYSIS	3.5.3-2
3.5.4-1	PROCESS WATER DEMAND	3.5.4-4
3.5.4-2	ESTIMATED COOLING POND CHEMICAL ANALYSIS	3.5.4-5
3.6.1-1	CLIMATOLOGICAL DATA - LAKE ALFRED, FLORIDA	3.6-10
3.7.1-1	SOLID WASTES AND BY-PRODUCTS FROM COAL GASIFICATION FACILITIES	3.7-31
3.7.1-2	SOLID WASTES AND BY-PRODUCTS FROM PULVERIZED COAL UNITS	3.7-32
3.7.1-3	WORST CASE (CASE B) SOLID WASTE GENERATED	3.7-33

LIST OF TABLES (Continued)

Table/Title		Page
3.7.1-4	SUMMARY OF CONSOLIDATION PREDICTIONS	3.7-34
3.7.1-5	WASTE STORAGE VOLUME AVAILABILITY	3.7-35
3.7.1-6	SWDA CLAY THICKNESS DATA	3.7-36
3.7.1-7	PARTICLE SIZE DISTRIBUTION AND PERCENT SOLIDS CONTENT, SA-9	3.7-37
3.7.1-8	BASIC SOIL CHEMISTRY, SA-9	3.7-38
3.7.1-9	CLAY MINERALOGY, SA-9	3.7-39

LIST OF FIGURES

Figure/Title		Page
3.2.1-1	PRELIMINARY ULTIMATE SITE ARRANGEMENT - CASE A, SIX COMBINED CYCLE UNITS	3.2-7
3.2.1-2	PRELIMINARY ULTIMATE SITE ARRANGEMENT - CASE B, FOUR COMBINED CYCLE AND TWO PULVERIZED COAL UNITS	3.2-8
3.2.1-3	CASE B ELEVATION VIEWS	3.2-9
3.2.1-4A	LANDSCAPE BUFFER, LANDSCAPE PLAN - SHEET A	3.2-10
3.2.1-4B	LANDSCAPE BUFFER, LANDSCAPE PLAN - SHEET B	3.2-11
3.2.1-4C	LANDSCAPE BUFFER, LANDSCAPE PLAN - SHEET C	3.2-12
3.2.2-1	COOLING POND AREA	3.2-13
3.2.2-2	SOLID WASTE DISPOSAL AREA	3.2-14
3.2.2-3	BRINE POND AREA	3.2-15
3.2.2-4	SITE BUFFER AREA	3.2-16
3.2.2-5	TRIANGLE LAKES AREA	3.2-17
3.5.1-1	ULTIMATE COOLING POND CONFIGURATION	3.5.1-63
3.5.1-2	INITIAL COOLING POND CONFIGURATION (N-16 ONLY)	3.5.1-64
3.5.1-3	PEAK GROUND WATER WITHDRAWAL - CASE A	3.5.1-65
3.5.1.4	PEAK GROUND WATER WITHDRAWAL - CASE B	3.5.1-66

LIST OF FIGURES (Continued)

Figure/Title		Page
3.5.1-5	TOTAL WATER CROP USED CASE A, SCENARIOS 1 AND 3	3.5.1-67
3.5.1-6	TOTAL WATER CROP AND GROUND WATER USED CASE A, SCENARIOS 1 AND 3	3.5.1-68
3.5.1-7	TOTAL WATER CROP AND GROUND WATER USED CASE B, SCENARIOS 1 AND 3	3.5.1-69
3.5.1-8	CYCLES OF CONCENTRATION CASE A, SCENARIOS 1 AND 3	3.5.1-70
3.5.1-9	CYCLES OF CONCENTRATION CASE A, SCENARIOS 2 AND 4	3.5.1-71
3.5.1-10	CYCLES OF CONCENTRATION CASE B, SCENARIOS 1 AND 3	3.5.1-72
3.5.1-11	CYCLES OF CONCENTRATION CASE B, SCENARIOS 2 AND 4	3.5.1-73
3.5.1-12	ESTIMATED PROCESS WATER USE - CASE A	3.5.1-74
3.5.1-13	ESTIMATED PROCESS WATER USE - CASE B	3.5.1-75
3.5.1-14	BLOWDOWN - CASE A, SCENARIOS 1 AND 3	3.5.1-76
3.5.1-15	RECYCLED BLOWDOWN - CASE A, SCENARIOS 1 AND 3	3.5.1-77
3.5.1-16	BLOWDOWN - CASE A, SCENARIOS 2 AND 4	3.5.1-78

LIST OF FIGURES (Continued)

Figure/Title		Page
3.5.1-17	RECYCLED BLOWDOWN - CASE A, SCENARIOS 2 AND 4	3.5.1-79
3.5.1-18	BLOWDOWN - CASE B, SCENARIOS 1 AND 3	3.5.1-80
3.5.1-19	RECYCLED BLOWDOWN - CASE B, SCENARIOS 1 AND 3	3.5.1-81
3.5.1-20	BLOWDOWN - CASE B, SCENARIOS 2 AND 4	3.5.1-82
3.5.1-21	RECYCLED BLOWDOWN - CASE B, SCENARIOS 2 AND 4	3.5.1-83
3.5.1-22	CONDENSER INLET TEMPERATURE CASE A (3,000 MW CGCC)	3.5.1-84
3.5.1-23	CONDENSER INLET TEMPERATURE CASE B (3,200 MW CGCC)	3.5.1-85
3.5.1-24	NATURAL EVAPORATION	3.5.1-86
3.5.1-25	CUMULATIVE PRECIPITATION AND EVAPORATION	3.5.1-87
3.5.1-26	PRE 17-672 AND POST 17-672 DAMS-POND SERVICE HISTORY	3.5.1-88
3.5.1-27	FRICTION ANGLE DATA-CLAY POND N-16 DAMS	3.5.1-89
3.5.1-28	FRICTION ANGLE DATA-CLAY POND N-15/N-11C DAMS	3.5.1-90
3.5.1-29	INITIAL STAGE COOLING EMBANKMENT PLAN - N-16	3.5.1-91
3.5.1-30	TYPICAL SLOPE REINFORCEMENT/WAVE EROSION PROTECTION DETAILS - N-16	3.5.1-92

LIST OF FIGURES (Continued)

Figure/Title		Page
3.5.1-31	CONCEPTUAL CROSS-SECTION A-A' SOUTH EMBANKMENT N-16	3.5.1-93
3.5.1-32	CONCEPTUAL CROSS-SECTION B-B' EAST EMBANKMENT N-16	3.5.1-94
3.5.1-33	CONCEPTUAL CROSS-SECTION C-C' NORTH EMBANKMENT N-16	3.5.1-95
3.5.1-34	CONCEPTUAL DETAIL OF EMBANKMENT SEEPAGE COLLECTION AND DISCHARGE SYSTEM	3.5.1-96
3.5.1-35	AS-BUILT CROSS-SECTION D-D' WEST EMBANKMENT N-16	3.5.1-97
3.5.1-36	TYPICAL STOPLOG STRUCTURE	3.5.1-98
3.5.1-37	CONCEPTUAL CROSS-SECTION E-E' NORTH-SOUTH DIVIDING EMBANKMENT N-16	3.5.1-99
3.5.1-38	CONCEPTUAL CROSS-SECTION F-F' EAST-WEST DIVIDING EMBANKMENT N-16	3.5.1-100
3.5.1-39	ULTIMATE STAGE COOLING EMBANKMENT PLAN N-15, N-11B, N-11C	3.5.1-101
3.5.1-40	CONCEPTUAL DESIGN OF FLOW-THROUGH PENETRATION	3.5.1-102
3.5.1-41	TYPICAL SLOPE REINFORCEMENT/WAVE EROSION PROTECTION DETAILS - N-15	3.5.1-103

LIST OF FIGURES (Continued)

Figure/Title		Page
3.5.1-42	TYPICAL SLOPE REINFORCEMENT/WAVE EROSION PROTECTION DETAILS - N-11B, N-11C	3.5.1-104
3.5.1-43	AS-BUILT CROSS-SECTION G-G' SOUTH EMBANKMENT N-15	3.5.1-105
3.5.1-44	AS-BUILT CROSS-SECTION H-H' NORTH AND WEST EMBANKMENTS N-15	3.5.1-106
3.5.1-45	TYPICAL CROSS-SECTION, PROPOSED MODIFICATION TO N-15 AREA SAND DRAIN	3.5.1-107
3.5.1-46	CONCEPTUAL CROSS-SECTION I-I' NORTH EMBANKMENT N-11C	3.5.1-108
3.5.1-47	CONCEPTUAL CROSS-SECTION K-K' EAST EMBANKMENT, N-11C, N-11B	3.5.1-109
3.5.1-48	CONCEPTUAL CROSS-SECTION J-J' INTERIOR ULTIMATE STAGE EMBANKMENT WASTE CLAY DEPOSITS	3.5.1-110
3.5.1-49	TYPICAL CROSS-SECTION AT SPILLWAY EMBANKMENT N-15	3.5.1-111
3.5.1-50	MINED/CLAY SETTLING AREAS SITE MAP	3.5.1-112
3.5.1-51	SOLIDS CONTENT PROFILE - CLAY POND N-15, BORING C-19	3.5.1-113

LIST OF FIGURES (Continued)

Figure/Title		Page
3.5.1-52	SOLIDS CONTENT PROFILE - CLAY POND N-11B, BORING C-14	3.5.1-114
3.5.1-53	SOLIDS CONTENT PROFILE - CLAY POND N-11C, BORING C-16	3.5.1-115
3.5.1-54	SOLIDS CONTENT PROFILE - CLAY POND N-11A, BORING C-3	3.5.1-116
3.5.1-55	SOLIDS CONTENT PROFILE - CLAY POND N-13, BORING C-4	3.5.1-117
3.5.1-56	SOLIDS CONTENT PROFILE - CLAY POND N-9B, BORING C-9	3.5.1-118
3.5.1-57	ATTERBERG TEST RESULTS - PROPOSED COOLING POND AREAS N-11B, N-11C AND N-15	3.5.1-119
3.5.1-58	CLAY CONSOLIDATION MODELING PREDICTION CLAY POND N-15	3.5.1-120
3.5.1-59	CLAY CONSOLIDATION MODELING PREDICTION CLAY POND N-11B, BORINGS C-13, C-14	3.5.1-121
3.5.1-60	CLAY CONSOLIDATION MODELING PREDICTION CLAY POND N-11C, BORINGS C-16, C-44	3.5.1-122
3.5.4-1	TYPICAL WATER MASS BALANCE ULTIMATE DEVELOPMENT CASE B, (WITH PULVERIZED COAL UNITS) ANNUAL AVERAGE CONDITIONS	3.5.4-6

LIST OF FIGURES (Continued)

Figure/Title		Page
3.5.4-2	PROJECTED WATER MASS BALANCE ULTIMATE DEVELOPMENT - CASE B, (WITH PULVERIZED COAL UNITS) PEAK CONDITIONS	3.5.4-7
3.5.4-3	TYPICAL WATER MASS BALANCE ULTIMATE DEVELOPMENT CASE A (ALL COAL GASIFICATION COMBINED CYCLE UNITS) ANNUAL AVERAGE CONDITIONS	3.5.4-8
3.5.4-4	TYPICAL WATER MASS BALANCE ULTIMATE DEVELOPMENT CASE A (ALL COAL GASIFICATION COMBINED CYCLE UNITS) PEAK CONDITIONS	3.5.4-9
3.7.1-1	INITIAL SOLID WASTE AREA - PLAN VIEW	3.7-40
3.7.1-2	INITIAL SOLID WASTE AREA - CROSS-SECTION	3.7-41
3.7.1-3	EMBANKMENT PLAN - SA-8 AND SA-9	3.7-42
3.7.1-4	EMBANKMENT PLAN - SA-10	3.7-43
3.7.1-5	EMBANKMENT PLAN - P-2	3.7-44
3.7.1-6	EMBANKMENT PLAN - P-3	3.7-45
3.7.1-7	SA-8 PROBE - SECTION 1, NORTH-SOUTH DIRECTION	3.7-46
3.7.1-8	SA-8 PROBE - SECTION 2, EAST-WEST DIRECTION	3.7-47
3.7.1-9	SA-8 PROBE - SECTION 3, NORTH-SOUTH DIRECTION	3.7-48
3.7.1-10	SA-8 PROBE - SECTION 4, EAST-WEST DIRECTION	3.7-49

LIST OF FIGURES (Continued)

Figure/Title		Page
3.7.1-11	SA-8 PROBE - SECTION 5, NORTH-SOUTH DIRECTION	3.7-50
3.7.1-12	SA-8 PROBE - SECTION 6, EAST-WEST DIRECTION	3.7-51
3.7.1-13	SA-8 PROBE - SECTION 7, NORTH-SOUTH DIRECTION	3.7-52
3.7.1-14	SA-9 PROBE - SECTION 8, NORTH-SOUTH DIRECTION	3.7-53
3.7.1-15	SA-10 PROBE - SECTION 1, NORTH-SOUTH DIRECTION	3.7-54
3.7.1-16	P-2 PROBE - SECTION 1, NORTH-SOUTH DIRECTION	3.7-55
3.7.1-17	P-2 PROBE - SECTIONS 2/3, EAST-WEST AND NORTH-SOUTH DIRECTIONS	3.7-56
3.7.1-18	P-3 PROBE - SECTIONS 1/2, NORTH-SOUTH AND EAST-WEST DIRECTIONS	3.7-57
3.7.1-19	P-3 PROBE - SECTIONS 5/6, EAST-WEST AND NORTH-SOUTH DIRECTIONS	3.7-58
3.7.1-20	P-3 PROBE - SECTIONS 3/4, NORTH-SOUTH AND EAST-WEST DIRECTIONS	3.7-59
3.7.1-21	CLAY CONSOLIDATION MODELING PREDICTION CLAY POND SA-8, BORINGS C-20, C-22, C-26, C-28	3.7-60
3.7.1-22	CLAY CONSOLIDATION MODELING PREDICTION CLAY POND SA-9, BORINGS C-23, C-24, C-25, C-27	3.7-61

LIST OF FIGURES (Continued)

Figure/Title		Page
3.7.1-23	CLAY CONSOLIDATION MODELING PREDICTION CLAY POND SA-10	3.7-62
3.7.1-24	CLAY CONSOLIDATION MODELING PREDICTION CLAY POND P-3, BORINGS C-37, C-38, C-39	3.7-63
3.7.1-25	PERMEABILITY RELATIONSHIPS SOLID WASTE DISPOSAL AREAS	3.7-64
3.7.1-26	ATTERBURG TEST RESULTS	3.7-65
3.7.1-27	TYPICAL EDGE LINER AND LEACHATE COLLECTION DETAIL, SOLID WASTE DISPOSAL AREA	3.7-66
3.7.1-28	CONCEPTUAL CROSS-SECTION A-A' SA-8 EAST EMBANKMENT	3.7-67
3.7.1-29	CONCEPTUAL CROSS-SECTION B-B' SA-8 NORTH AND NORTHWEST EMBANKMENTS	3.7-68
3.7.1-30	CONCEPTUAL CROSS-SECTION C-C' SA-9 NORTH EMBANKMENT	3.7-69
3.7.1-31	CONCEPTUAL CROSS-SECTION D-D' SA-9 EAST EMBANKMENT	3.7-70
3.7.1-32	CONCEPTUAL CROSS-SECTION E-E' SA-9 WEST AND SOUTHWEST WALLS	3.7-71
3.7.1-33	CONCEPTUAL CROSS-SECTION F-F' SA-9 SOUTH EMBANKMENT	3.7-72

LIST OF FIGURES (Continued)

Figure/Title		Page
3.7.1-34	CONCEPTUAL CROSS-SECTION A-A', SA-10 EMBANKMENT	3.7-73
3.7.1-35	CONCEPTUAL CROSS-SECTION A-A', P-2 EMBANKMENT	3.7-74
3.7.1-36	CONCEPTUAL CROSS-SECTION B-B', P-2 EMBANKMENT	3.7-75
3.7.1-37	CONCEPTUAL CROSS-SECTION A-A', P-3 EAST EMBANKMENT	3.7-76
3.7.1-38	CONCEPTUAL CROSS-SECTION B-B' P-3 SOUTHEAST EMBANKMENT	3.7-77
3.7.1-39	CONCEPTUAL CROSS-SECTION C-C' P-3 SOUTH EMBANKMENT	3.7-78
3.7.1-40	CONCEPTUAL CROSS-SECTION D-D' P-3 WEST EMBANKMENT	3.7-79
3.7.1-41	CONCEPTUAL CROSS-SECTION E-E' P-3 NORTH EMBANKMENT	3.7-80
3.7.1-42	TYPICAL EDGE LINER DETAIL A SA-9 BRINE POND	3.7-81
3.7.1-43	SCHEMATIC OF FIRST LIFT - WASTE FILL ADVANCEMENT SEQUENCING	3.7-82
3.7.1-44	UNDRAINED SHEAR STRENGTH DATA CLAY SETTLING AREAS	3.7-83
3.7.1-45	STABILITY ANALYSIS - PLACEMENT OF FIRST SOLID WASTE LIFT	3.7-84

LIST OF FIGURES (Continued)

Figure/Title		Page
3.7.1-46	STABILITY ANALYSIS - PLACEMENT OF SECOND SOLID WASTE LIFT	3.7-85
3.7.1-47	PERIMETER STABILITY OF SOLID WASTE DISPOSAL AREA TEST 1	3.7-86
3.7.1-48	PERIMETER STABILITY OF SOLID WASTE DISPOSAL AREA TEST 2	3.7-87
3.8.2-1	SURFACE WATER DRAINAGE (DURING RECLAMATION)	3.8-7
3.8.2-2	SURFACE WATER DRAINAGE (DURING POWER PLANT CONSTRUCTION)	3.8-8
3.8.3-1	SITE DRAINAGE - INITIAL OPERATIONAL PHASE (NOVEMBER 1998 - JULY 2006)	3.8-9
3.8.3-2	SITE DRAINAGE - ULTIMATE DEVELOPMENT OPERATIONAL PHASE (POST-JULY 2006)	3.8-10

3.0 THE PLANT AND DIRECTLY ASSOCIATED FACILITIES

The following sections describe the plant and associated on-site facilities proposed for the Polk County Site. Section 3.1 describes the generating technology options and their influence upon selection of other site equipment. Section 3.2 gives a summary of the layout of the site, with associated acreages. Section 3.3 describes the anticipated primary and backup fuels, and their delivery, handling, and storage on-site. Section 3.4 describes the expected air emissions from the plant, and the proposed emission control methods and equipment. Section 3.5 describes plant water use and Section 3.6 describes plant wastewater generation and handling. Section 3.7 describes the solid wastes and hazardous wastes expected to be generated by the plant, and how they will be treated, stored, and/or disposed, as applicable. Section 3.8 describes the zero-discharge surface water management system (site drainage). Section 3.9 describes materials handling during both the construction and operational phases of the project. Section 3.10 addresses aquifer storage and recovery, which is not proposed for the Polk County Site.

3.1 BACKGROUND

Florida Power Corporation (FPC) proposes to install and operate multiple generating units at the Polk County Site beginning in 1998. The units are to be brought on-line sequentially, with the scheduling of units to match the estimated growth of demand through the ultimate site capacity of up to 3,200 megawatts (MW). The expansion of generating capacity at the Polk County Site will be accomplished using the most cost-effective fuel and generating technology throughout the life of the project. This approach offers FPC maximum flexibility and cost control.

The initial phase of generating units, providing approximately 940 MW (470 MW of which are addressed in the Florida Public Service Commission (PSC) Need Determination Order), will consist of natural gas-fired combined cycle (CC) units capable of conversion to coal gasification units (CG) which would be fired by coal-derived gas. Later units within the ultimate site capacity being requested will be optimized with the same flexibility, and may include pulverized coal (PC) units. At the present time, natural gas prices are projected to remain competitive beyond the end of the decade. At that time, coal is expected to be the more cost effective fuel. Among the advantages of CC technology are its fuel flexibility, modularity, and efficiency. If coal becomes the more economical fuel, the CC units can be converted to burn synthetic coal gas. Because of the modularity of CC units, they can be sized and built incrementally to match demand without losing the economy of scale.

The present status of advanced combustion turbine technology is such that the largest, most efficient configuration for stand-alone units (one combustion turbine [CT], one heat recovery steam generator [HRSG], and one steam turbine [ST] per unit) will produce approximately 235 MW of electricity. Future progress in CT technology is expected to continue, resulting in new and/or retrofitted units of nominal 250 MW capacity. Since the filing of the Plan of Study (POS) for this project, one vendor has already raised the rating of their advanced CT by 9 MW as a result of improved burner design. It should been noted that CT output varies significantly with ambient air temperatures; the cooler and more dense the air, the higher the output. An equivalent option would consist of 2 CTs coupled to one HRSG and one ST to form a nominal 500 MW unit. As a result, CC unit size, as measured by number of megawatts, is variable, depending on design, unit configuration and ambient temperature, and could range from 235 MW to more than 500 MW.

Site development has been predicated on the assumption that the ultimate installation could include the following cases:

Case A - 12 CTs with associated HRSGs, STs, and gasification units for a total site capacity of 3,000 MW

Case B - 8 CTs with associated HRSGs, STs, and gasification units plus 2 PC units, each of nominal 600 MW size, for a total site capacity of 3,200 MW

Cases A and B represent the development associated with worst-case environmental effects. Another case (Case C), consisting of 12 CTs with associated HRSGs and STs, but without coal gasification units, for a total site capacity of 3,000 MW, represents the worst case with respect to net economic and social benefits and is addressed only in Chapter 7 of this SCA.

The design of ancillary facilities (solid waste and by-product disposal areas, cooling pond, etc.) is predicated upon an ultimate site capacity of 3,200 MW (Case B).

Schedules of estimated site capacity over time, for both Case A Coal Gasification Combined Cycle (CGCC) and Case B (CGCC/PC) are presented in Tables 3.1.0-1 and 3.1.0-2. The sequence and timing of the units may vary somewhat from those shown in these tables.

TABLE 3.1.0-1
SCHEDULE OF ESTIMATED
SITE CAPACITY VS. TIME
CASE A - 3,000 MW CGCC

YEAR	MW	FUEL	YEAR #
1998	235	NATURAL GAS	1
1999	705	"	2
2000	940	"	3
2001	940	"	4
2002	1,190	"	5
2003	1,190	"	6
2004	1,440	"	7
2005	1,440	"	8
2006	1,690	"	9
2007	1,690	"	10
2008	1,940	"	11
2009	1,940	"	12
2010	1,940	COAL-GAS	13
2011	1,940	"	14
2012	2,190	"	15
2013	2,190	"	16
2014	2,440	"	17
2015	2,440	"	18
2016	2,690	"	19
2017	2,690	"	20
2018	3,000	"	21
2019	3,000	"	22
2020	3,000	"	23
2021	3,000	"	24
2022	3,000	"	25
2023	3,000	"	26
2024	3,000	"	27
2025	3,000	"	28
2026	3,000	"	29
2027	3,000	"	30

Source: Ebasco Environmental, 1992

TABLE 3.1.0-2
SCHEDULE OF ESTIMATED
SITE CAPACITY VS. TIME
CASE B - 2,000 MW CGCC & 1,200 MW PC

YEAR	NATURAL GAS-FIRED MEGAWATTS	COAL-GAS FIRED MEGAWATTS	PC-FIRED MEGAWATTS	TOTAL MEGAWATTS	YEAR #
1998	235			235	1
1999	705			705	2
2000	940			940	3
2001	940			940	4
2002	940			940	5
2003	940			940	6
2004	940		600	1,540	7
2005	940		600	1,540	8
2006	940		600	1,540	9
2007	940		600	1,540	10
2008	940		600	1,540	11
2009	940		1,200	2,140	12
2010		940	1,200	2,140	13
2011		940	1,200	2,140	14
2012		1,190	1,200	2,390	15
2013		1,190	1,200	2,390	16
2014		1,440	1,200	2,640	17
2015		1,440	1,200	2,640	18
2016		1,690	1,200	2,890	19
2017		1,690	1,200	2,890	20
2018		2,000	1,200	3,200	21
2019		2,000	1,200	3,200	22
2020		2,000	1,200	3,200	23
2021		2,000	1,200	3,200	24
2022		2,000	1,200	3,200	25
2023		2,000	1,200	3,200	26
2024		2,000	1,200	3,200	27
2025		2,000	1,200	3,200	28
2026		2,000	1,200	3,200	29
2027		2,000	1,200	3,200	30

Source: Ebasco Environmental, 1992

3.2 SITE LAYOUT

The FPC Polk County Site as shown on Figures 2.1.3-1A and 2.1.3-1B contains a plant island and several ancillary areas which make up the balance of the site. This section provides a description of potential arrangements of the power generating facilities and associated facilities on-site.

3.2.1 Plant Island

Figures 3.2.1-1 and 3.2.1-2 depict the preliminary ultimate site arrangement options for the 3,000 to 3,200 MW (nominal) Polk County Site. Figure 3.2.1-1 shows the site arrangement for Case A (3,000 MW) utilizing six 470 MW CC units, each with two CTs and one or two STs, and coal gasification facilities. Figure 3.2.1-2 shows the site arrangement for Case B (3,200 MW) utilizing four 470 MW CC units, each having two CTs and one or two STs, coal gasification facilities, and two additional 600 MW PC steam electric units. The decision of whether or not to install PC units or coal gasification combined cycle units for ultimate site development will depend on which generation technology is judged more appropriate considering environmental, technological, and economic factors. The plant island arrangement for either site arrangement will occupy approximately 964 acres of the site.

The site arrangements shown on Figures 3.2.1-1, and 3.2.1-2, utilize a plant island which will be located in the southern portion of the site, east of CR 555. The plant island consists of existing phosphate mining company parcels designated as SA-11, SA-12 and SA-13. The respective areas of parcels SA-11, SA-12, and SA-13 are approximately 200, 601, and 163 acres, for a total of 964 acres. These parcels were selected for the plant island because, although originally intended to be waste clay settling areas, they were never so utilized. Thus, there are no waste clays in these areas which could complicate the structural foundation design.

Equipment, such as combustion turbines, electrical generators, heat recovery steam generators, gasification facilities, and steam turbine generators, in addition to water and wastewater treatment facilities will be located in parcel SA-11. The CC units will be situated in the northern portion of parcel SA-11, while water and wastewater treatment facilities and fuel oil tanks will be south of the CC units. The storm water retention pond will be located in the southern portion of parcel SA-12 to take advantage of existing topography. Rail access will be

located in the northern portion of parcel SA-12 and also parcel SA-13. The main plant access road and electrical transmission line corridor will also be located in parcel SA-13. Fuel oil storage will be located in SA-11 and coal storage in SA-12.

Should the Case B option, utilizing four CC units plus two PC units, be implemented, these units will be located as shown on Figure 3.2.1-2. The two PC units will be situated west of the CC units. The sludge conditioning building, thickeners, sludge stockout and limestone handling facilities will be west of the PC units. Figure 3.2.1-3 depicts the Case B elevation views with approximate facility heights given.

In accordance with the Polk County CUP, the site arrangement includes a 100-foot landscape buffer along the western boundary of the plant island where it borders CR 555. A plan for the landscape buffer is provided on Figures 3.2.1-4A, 3.2.1-4B and 3.2.1-4C in compliance with CUP conditions.

3.2.2 Balance of Site

The balance of the site will be used as described below.

Cooling Pond

One of the requirements for steam electric power plants is a reliable supply of cooling water to allow condensing and recycling of the steam. A cost-effective device to achieve that supply, while minimizing the consumptive use of water, is a cooling pond. The parcels designated as N-16, N-15, N-11B, and N-11C, amounting to approximately 2,600 acres, have been set aside for that purpose. During the early development of the project (presently estimated to be 1998 through 2009), only N-16 will be required for cooling. When fully developed, parcels N-15, N-11B, and N-11C will be added and the cooling pond will be designed to operate at two water levels. The northern portion (N-15, N-11B, N-11C) will operate at a fixed water level, while the southern portion (N-16) will operate at a varying level. This will allow storage of water obtained by water cropping from idle solid waste disposal areas and, during the early stage of cooling pond development, parcels N-15, N-11C, and N-11B. Water cropping has been defined for this project as the capture and reuse of rainfall runoff. The cooling pond is shown on Figure 3.2.2-1.

The estimated physical dimensions of the cooling pond are tabulated in Table 3.2.2-1. Detailed descriptions of cooling pond design and operation are presented in Section 3.5.1.

Solid Waste Disposal

Although every effort will be made to market combustion and gasification by-products, the property boundary has been selected to provide enough on-site disposal area to store virtually all of the potentially produced solid waste. To this end, the areas designated as SA-8, SA-10, P-2, P-3, and Phosphoria, are planned for solid waste disposal. The solid waste disposal areas (SWDA) are approximately 2,179 acres. The estimated acreages of the individual areas to be used for solid waste disposal are:

Area	Acreage
SA-8	429
SA-10	294
P-2	448
P-3	483
Phosphoria	523
Total	2,179

The types of solid waste which could be stored in those areas include slag from coal-gasifiers; fly ash, bottom ash and flue gas desulfurization (FGD) wastes from PC units; and solids from water and wastewater treatment facilities. When operating on coal-derived gas, slag is estimated to be produced at a rate of about 1,060 tons per year per megawatt. A PC unit will generate bottom and fly ash at rates of about 92 and 858 tons per year per megawatt respectively, and about 300 tons of scrubber sludge per year per megawatt, if wet scrubbers are used for sulfur dioxide (SO_2) removal. Sludge from water and/or wastewater treatment facilities can be expected to be generated in the range of about 5.8 tons per year per megawatt.

All of these materials have been determined previously to be non-hazardous at similar facilities. However, elements in these waste products could leach into ground water if rain water passes through them and into the ground. For this reason, FPC has selected as disposal areas parcels that held waste clays during the mining operation (except for the Phosphoria area). During normal mine reclamation, the waste clays in these areas will be consolidated into a thick layer which will be virtually impermeable to water should it leach through the solid wastes. This clay liner will thus retard leachate from passing into the ground water. The Phosphoria area has not been mined completely; it is anticipated that the area will be mined before the end of the century. FPC can arrange to have waste clays deposited in this area after it is mined to allow for its development as a SWDA, if Case B is selected. If further design indicates this area would not be required as a SWDA, it would remain part of the water cropping/surface water management system.

Solid waste disposal areas will be designed to hold stormwater with no discharge off-site. This design will include maintaining the dams at their existing elevations and slopes. Because of the weather expected in the site vicinity, confirmed through historical data, net evaporation from these areas is expected to exceed net rainfall. At any given time, only one of these parcels will be receiving solid waste. The others will be used to minimize groundwater withdrawals through water cropping. Because the dams will retain storm water within these areas, it will be possible to recycle excess storm water as makeup to the cooling pond.

A detailed description of the solid waste handling system is presented in Section 3.7. The solid waste disposal areas are shown on Figure 3.2.2-2.

Brine Pond

Two unique features of this site are the availability of waste clays, and the presence of structurally sound dams remaining from the previous phosphate mining activities. These features accommodate the use of an evaporative brine pond to receive concentrated wastewaters resulting from the zero-discharge design. The area designated as SA-9, comprising about 311 acres of the site area, will be utilized as the brine pond. As described above, waste clays will be consolidated into an impermeable liner along the bottom of this area. A synthetic liner will be used to make the interior slopes of the dams watertight. The brine pond location is shown on Figure 3.2.2-3.

Buffer Area

The remaining parcels on the Polk County Site have been reserved for use as a buffer area. These include the areas designated as N-11A, N-13, N-9B, Tiger Bay, and N-9. Negotiations and preliminary designs are underway to use portions of these areas for wildlife habitat enhancement. These areas were selected because they lie between the existing communities of Homeland and Fort Meade and the area of the site in which the actual generating and associated equipment will be placed, thus buffering those communities from the plant and its operations. The buffer area location is shown on Figure 3.2.2-4.

Buffer area parcel acreages are as follows:

Parcel	Acreage
N-11A	295
N-13	388
N-9B	362
Tiger Bay	417
Tiger Bay East	107
N-9	70
Total	1,649

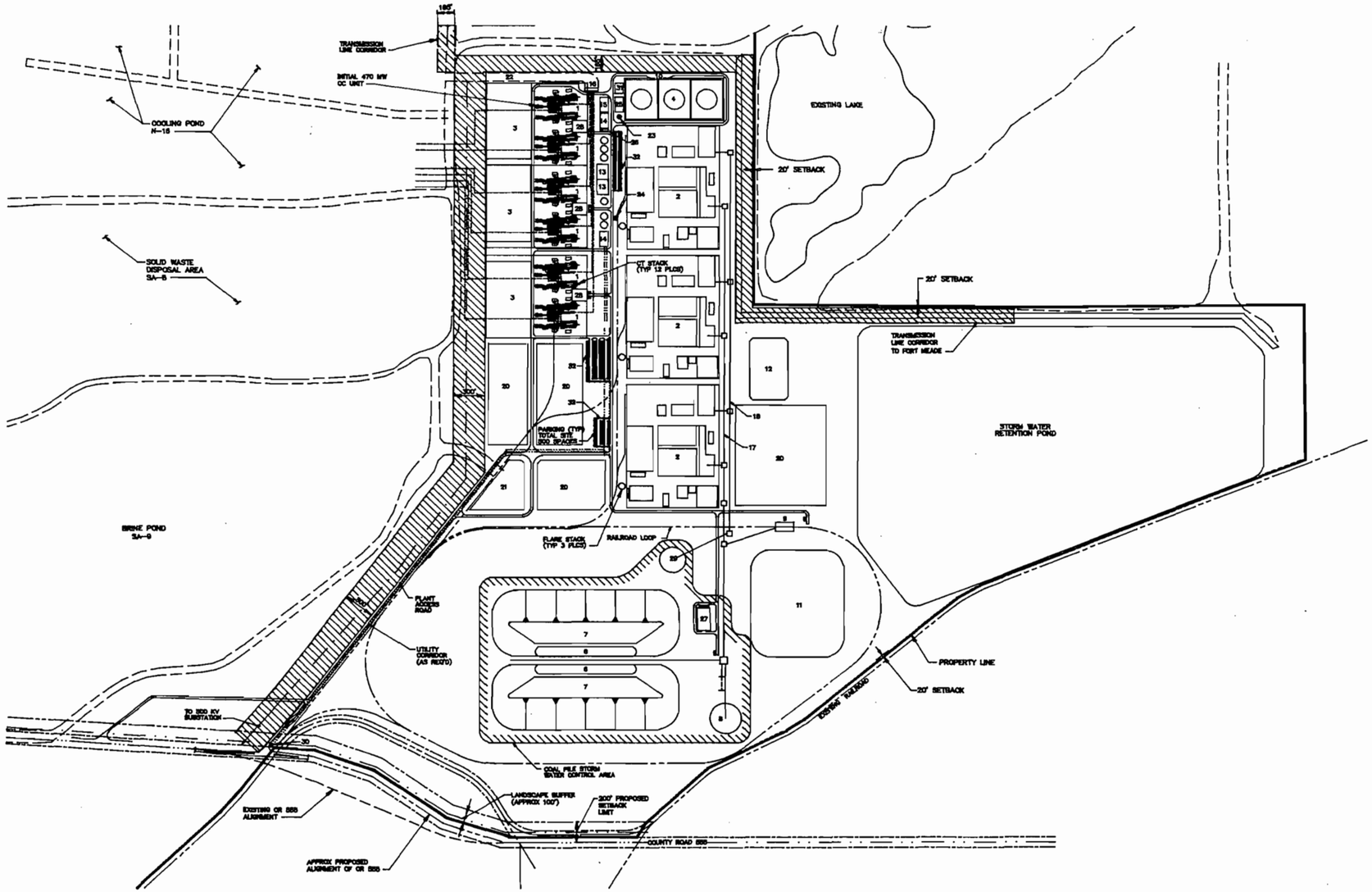
Triangle Lakes

The area surrounding the northern end of P-2, shown on Figure 3.2.2-5, is referred to as the Triangle Lakes area. It presently includes several water bodies which are surge ponds within the International Minerals & Chemical Corporation (IMC) Noralyn mine water recirculation system. It also includes the existing FPC Barcola Substation and 230 kV transmission line. In order to maintain the site zero discharge design, perimeter berms approximately 2 to 3 feet in height will be required. The area will serve as part of the FPC site surface water management system.

TABLE 3.2.2-1
COOLING POND PARCEL PHYSICAL CHARACTERISTICS

	Elevation (Ft MSL)	Water Depth (Ft)	Area (Ac)	Volume (Ac-Ft)
N-16				
Bottom Elevation	146	0	1,160	0
Minimum Water Level	156	10	1,195	11,775
Maximum Water Level	163	17	1,219	20,222
Top of Dam	172	26	1,250	30,969
N-15				
Bottom Elevation	155	0	828	0
Constant Water Level	165	10	844	8,360
Top of Dam	175	20	860	16,880
N-11B				
Bottom Elevation	155	0	186	0
Constant Water Level	165	10	193	1,895
Top of Dam	175	20	199	3,658
N-11C				
Bottom Elevation	155	0	326	0
Constant Water Level	165	10	335	3,305
Top of Dam	175	20	344	6,365

Source: Ebasco Environmental, 1992



LEGEND

1. COMBUSTION TURBINE COMBINED CYCLE UNIT
2. GASIFICATION PLANT
3. SWITCHYARD
4. FUEL OIL TANKS AND CONTAINMENT
5. NOT USED
6. ACTIVE COAL PILE
7. COAL PILE STORAGE
8. EMERGENCY COAL STOCKOUT
9. COAL CAR UNLOADING FACILITY
10. FUEL UNLOADING FACILITY (TRUCK)
11. COAL RUNOFF POND
12. RECYCLE BASIN
13. WATER TREATMENT BUILDING
14. WAREHOUSE
15. MAINTENANCE SHOP
16. CIRCULATING WATER INTAKE STRUCTURE
17. COAL CONVEYOR
18. SLAG CONVEYOR
19. NOT USED
20. CONSTRUCTION LAYDOWN AREA
21. CONSTRUCTION PARKING AREA
22. CIRCULATING WATER INLET CHANNEL
23. WATER SUPPLY WELL 1
24. WATER SUPPLY WELL 2
25. SEWAGE TREATMENT PLANT
26. VEHICULAR FUEL STORAGE
27. YARD MAINTENANCE BUILDING
28. CC CONTROL/ADMIN BUILDING
29. SLAG STOCKOUT
30. GUARDHOUSE
31. INITIAL CONSTRUCTION POWER FACILITIES
32. SECURITY FENCE

N E W

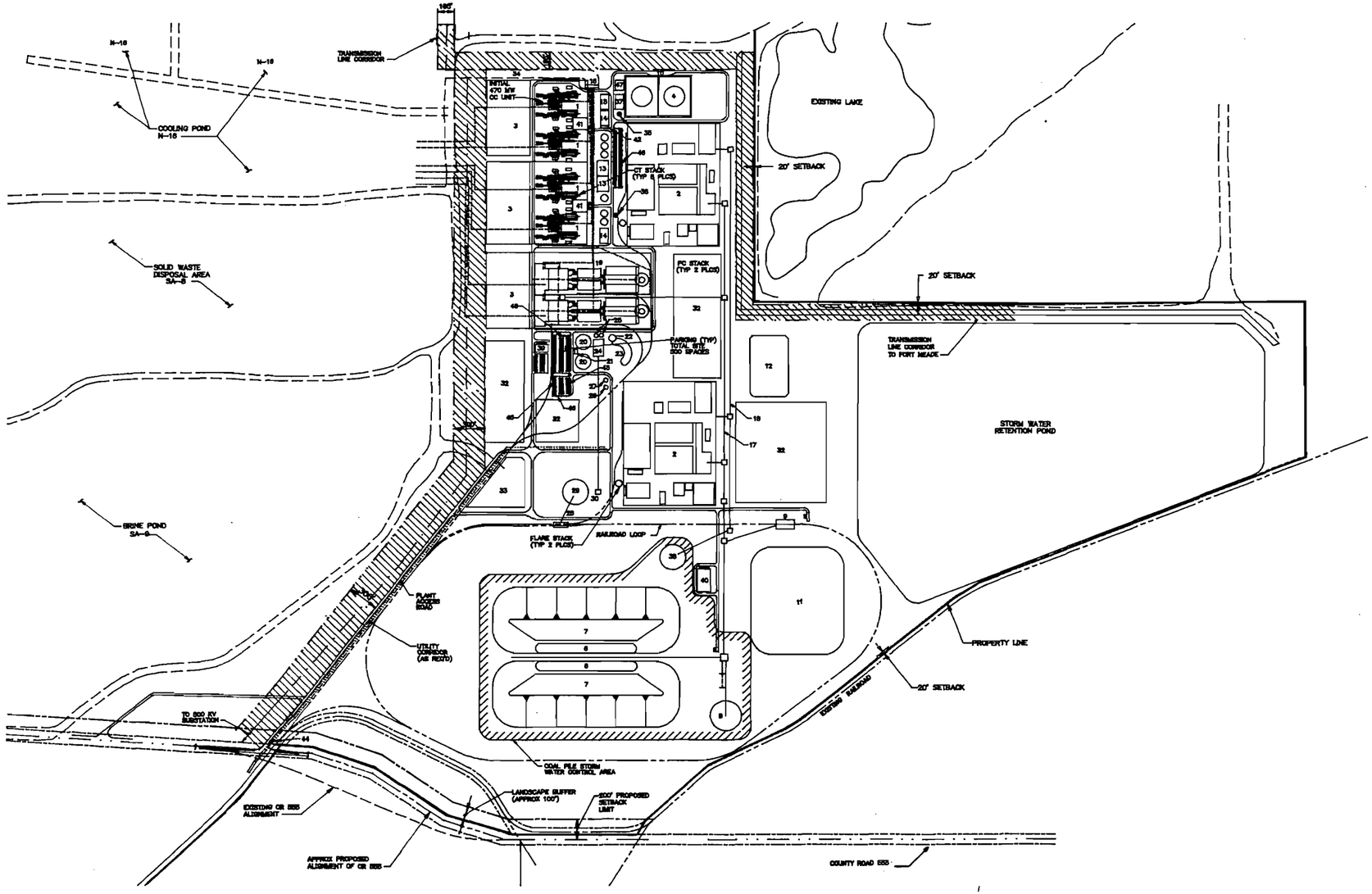
0 1200'

SOURCE: BLACK & VEATCH, 1992

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Polk County Site

FIGURE 3.2.1-1
PRELIMINARY ULTIMATE SITE ARRANGEMENT-CASE A
SIX COMBINED CYCLE UNITS



LEGEND

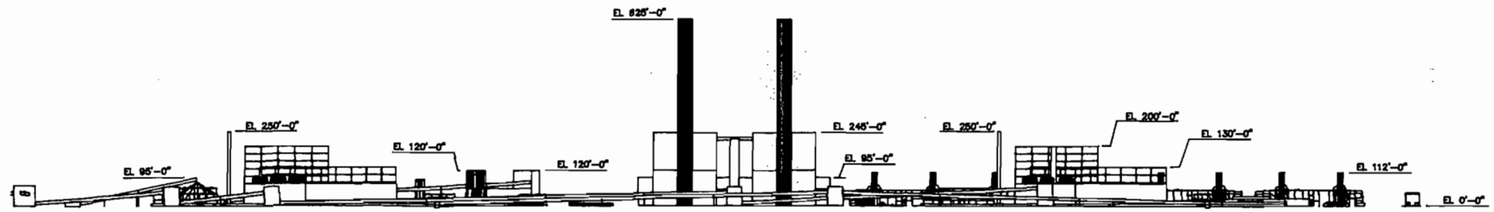
1. COMBUSTION TURBINE COMBINED CYCLE UNIT
2. GASIFICATION PLANT
3. SWITCHYARD
4. FUEL OIL TANKS AND CONTAINMENT
5. NOT USED
6. ACTIVE COAL PILE
7. COAL PILE STORAGE
8. EMERGENCY COAL STOCKOUT
9. COAL CAR UNLOADING FACILITY
10. FUEL UNLOADING FACILITY (TRUCK)
11. COAL RUNOFF POND
12. RECYCLE BASIN
13. WATER TREATMENT BUILDING
14. WAREHOUSE
15. MAINTENANCE SHOP
16. CIRCULATING WATER INTAKE STRUCTURE
17. COAL CONVEYOR
18. SLAG CONVEYOR
19. FC POWER MODULE
20. THICKENER
21. THICKENER BUILDING
22. EMERGENCY SLUDGE STOCKOUT
23. NORMAL SLUDGE STOCKOUT
24. SLUDGE CONDITIONING BUILDING
25. SCRUBBER ADDITIVE STORAGE TANKS
26. LIME STORAGE SILO
27. FLY ASH SILO
28. SCRUBBER ADDITIVE UNLOADING FACILITY
29. SCRUBBER ADDITIVE STOCKOUT
30. SCRUBBER ADDITIVE RECLAIM HOPPER
31. NOT USED
32. CONSTRUCTION LAYDOWN AREA
33. CONSTRUCTION PARKING AREA
34. CIRCULATING WATER INLET CHANNEL
35. WATER SUPPLY WELL 1
36. WATER SUPPLY WELL 2
37. SEWAGE TREATMENT PLANT
38. SLAG STOCKOUT
39. ADMINISTRATION BUILDING
40. YARD MAINTENANCE BUILDING
41. CC CONTROL/ADMIN BUILDING
42. VEHICULAR FUEL STORAGE
43. NOT USED
44. GUARDHOUSE
45. SCREEN FENCE
46. SECURITY FENCE
47. INITIAL CONSTRUCTION POWER FACILITIES

SOURCE: BLACK & VEATCH, 1992

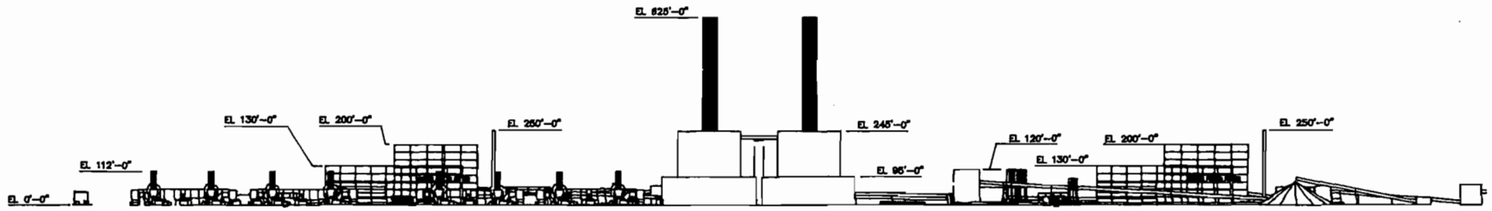
Florida Power CORPORATION

Polk County Site

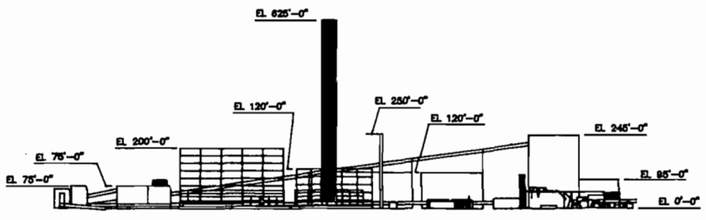
FIGURE 3.2.1-2
PRELIMINARY ULTIMATE SITE ARRANGEMENT-CASE B
FOUR COMBINED CYCLE AND TWO PULVERIZED COAL UNITS



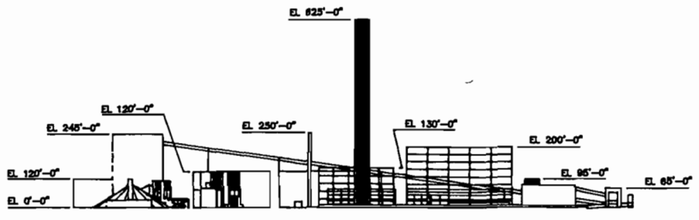
ELEVATION LOOKING NORTH



ELEVATION LOOKING SOUTH



ELEVATION LOOKING WEST



ELEVATION LOOKING EAST

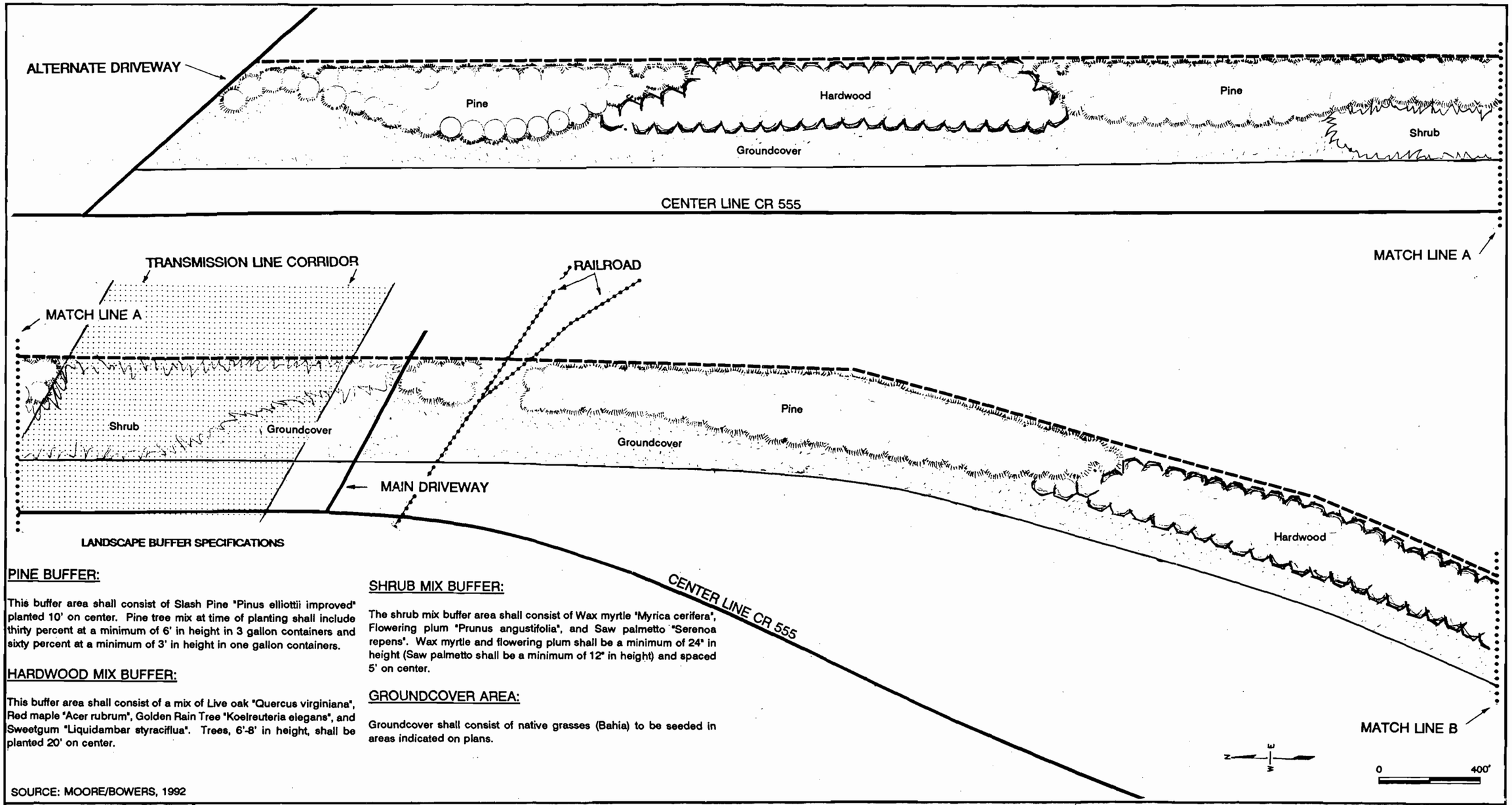
SOURCE: BLACK & VEATCH, 1992

0 500'

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Polk County Site

FIGURE 3.2.1-3
CASE B ELEVATION VIEWS



LANDSCAPE BUFFER SPECIFICATIONS

PINE BUFFER:

This buffer area shall consist of Slash Pine "Pinus elliottii improved" planted 10' on center. Pine tree mix at time of planting shall include thirty percent at a minimum of 6' in height in 3 gallon containers and sixty percent at a minimum of 3' in height in one gallon containers.

HARDWOOD MIX BUFFER:

This buffer area shall consist of a mix of Live oak "Quercus virginiana", Red maple "Acer rubrum", Golden Rain Tree "Koelreuteria elegans", and Sweetgum "Liquidambar styraciflua". Trees, 6'-8' in height, shall be planted 20' on center.

SHRUB MIX BUFFER:

The shrub mix buffer area shall consist of Wax myrtle "Myrica cerifera", Flowering plum "Prunus angustifolia", and Saw palmetto "Serenoa repens". Wax myrtle and flowering plum shall be a minimum of 24" in height (Saw palmetto shall be a minimum of 12" in height) and spaced 5' on center.

GROUNDCOVER AREA:

Groundcover shall consist of native grasses (Bahia) to be seeded in areas indicated on plans.

SOURCE: MOORE/BOWERS, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 3.2.1-4A
LANDSCAPE BUFFER
LANDSCAPE PLAN
SHEET A

LANDSCAPE BUFFER SPECIFICATIONS

PINE BUFFER:

This buffer area shall consist of Slash Pine "Pinus elliottii improved" planted 10' on center. Pine tree mix at time of planting shall include thirty percent at a minimum of 6' in height in 3 gallon containers and sixty percent at a minimum of 3' in height in one gallon containers.

HARDWOOD MIX BUFFER:

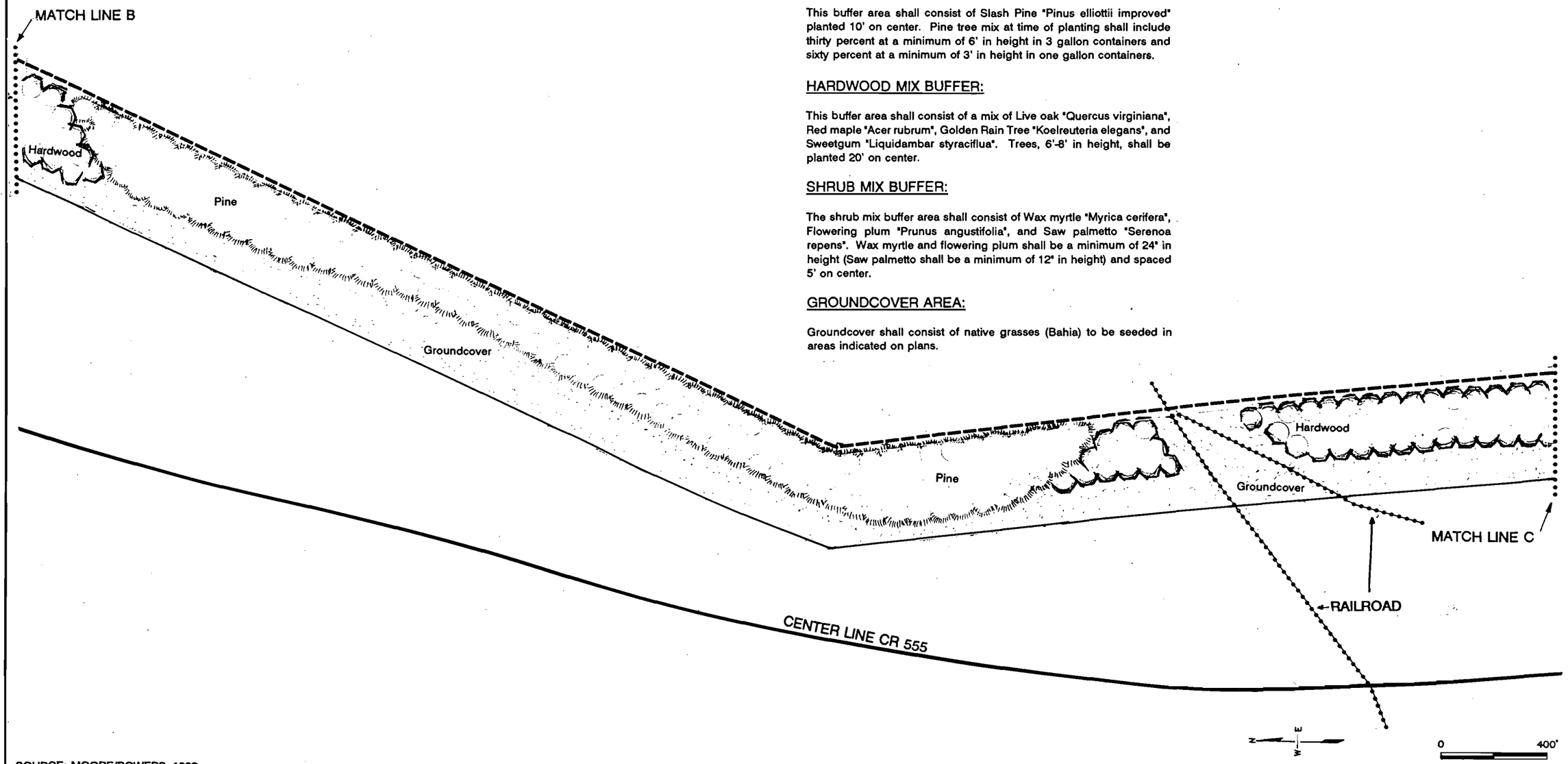
This buffer area shall consist of a mix of Live oak "Quercus virginiana", Red maple "Acer rubrum", Golden Rain Tree "Koelreuteria elegans", and Sweetgum "Liquidambar styraciflua". Trees, 6'-8' in height, shall be planted 20' on center.

SHRUB MIX BUFFER:

The shrub mix buffer area shall consist of Wax myrtle "Myrica cerifera", Flowering plum "Prunus angustifolia", and Saw palmetto "Serenoa repens". Wax myrtle and flowering plum shall be a minimum of 24" in height (Saw palmetto shall be a minimum of 12" in height) and spaced 5' on center.

GROUNDCOVER AREA:

Groundcover shall consist of native grasses (Bahia) to be seeded in areas indicated on plans.

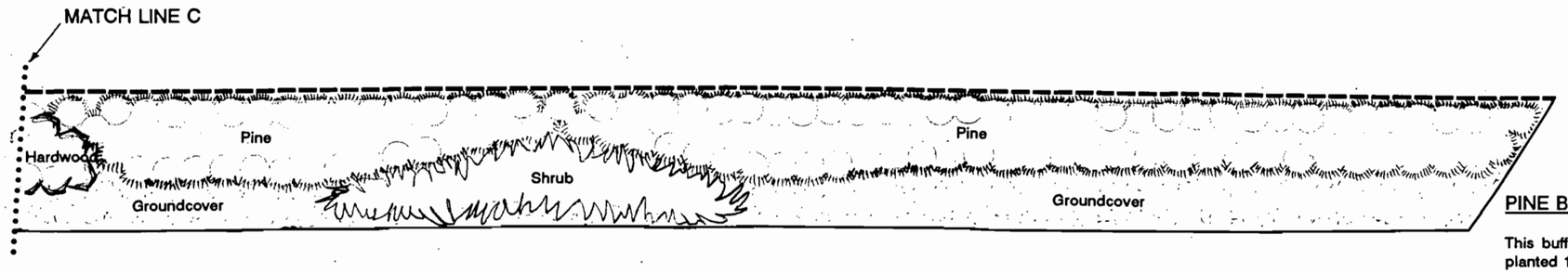


SOURCE: MOORE/BOWERS, 1992

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Polk County Site

FIGURE 3.2.1-4B
LANDSCAPE BUFFER
LANDSCAPE PLAN
SHEET B



CENTER LINE CR 555

SOURCE: MOORE/BOWERS, 1992

LANDSCAPE BUFFER SPECIFICATIONS

PINE BUFFER:

This buffer area shall consist of Slash Pine "Pinus elliottii improved" planted 10' on center. Pine tree mix at time of planting shall include thirty percent at a minimum of 6' in height in 3 gallon containers and sixty percent at a minimum of 3' in height in one gallon containers.

HARDWOOD MIX BUFFER:

This buffer area shall consist of a mix of Live oak "Quercus virginiana", Red maple "Acer rubrum", Golden Rain Tree "Koelreuteria elegans", and Sweetgum "Liquidambar styraciflua". Trees, 6'-8' in height, shall be planted 20' on center.

SHRUB MIX BUFFER:

The shrub mix buffer area shall consist of Wax myrtle "Myrica cerifera", Flowering plum "Prunus angustifolia", and Saw palmetto "Serenoa repens". Wax myrtle and flowering plum shall be a minimum of 24" in height (Saw palmetto shall be a minimum of 12" in height) and spaced 5' on center.

GROUNDCOVER AREA:

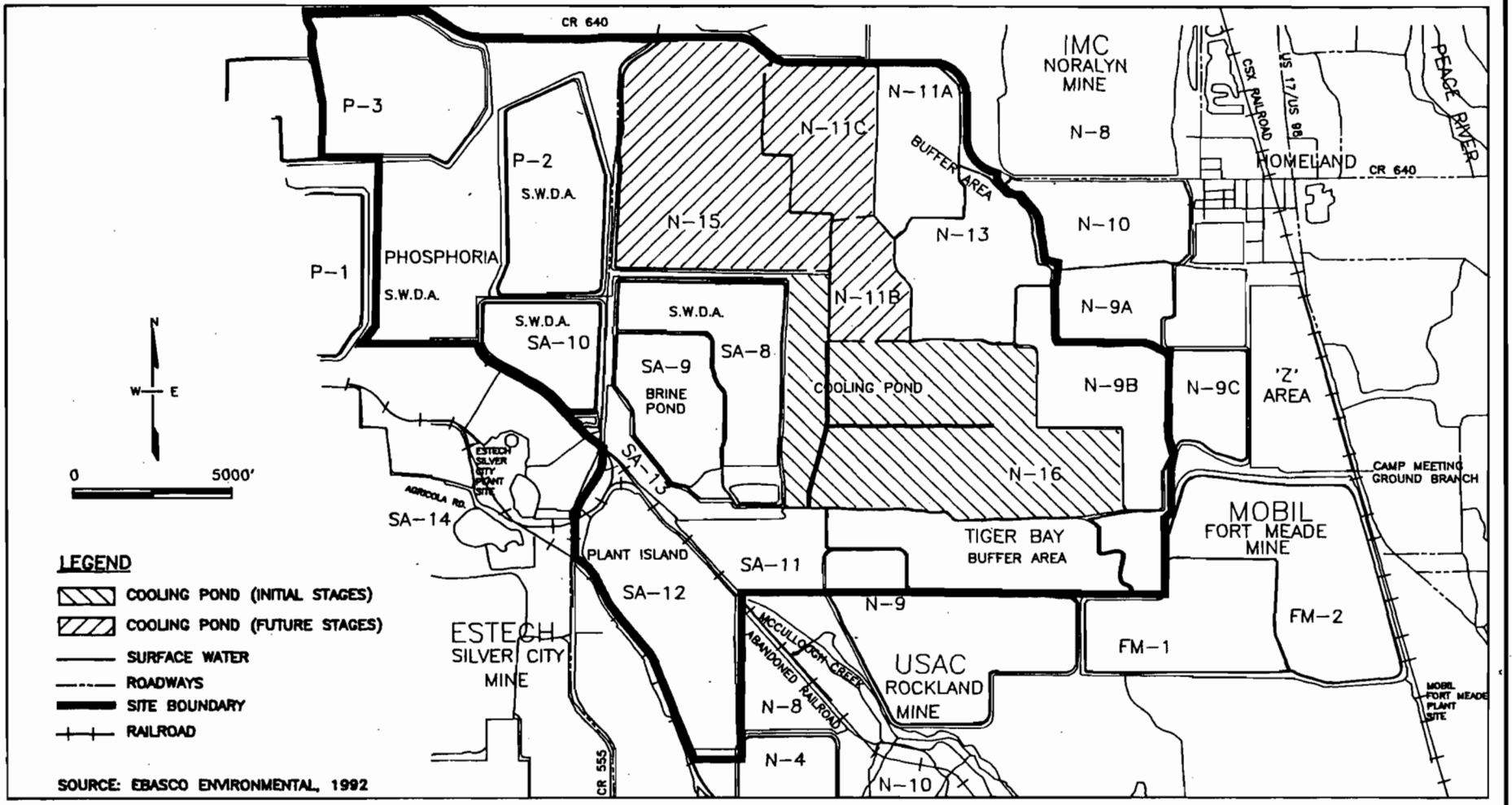
Groundcover shall consist of native grasses (Bahia) to be seeded in areas indicated on plans.



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Polk County Site

FIGURE 3.2.1-4C
LANDSCAPE BUFFER
LANDSCAPE PLAN
SHEET C

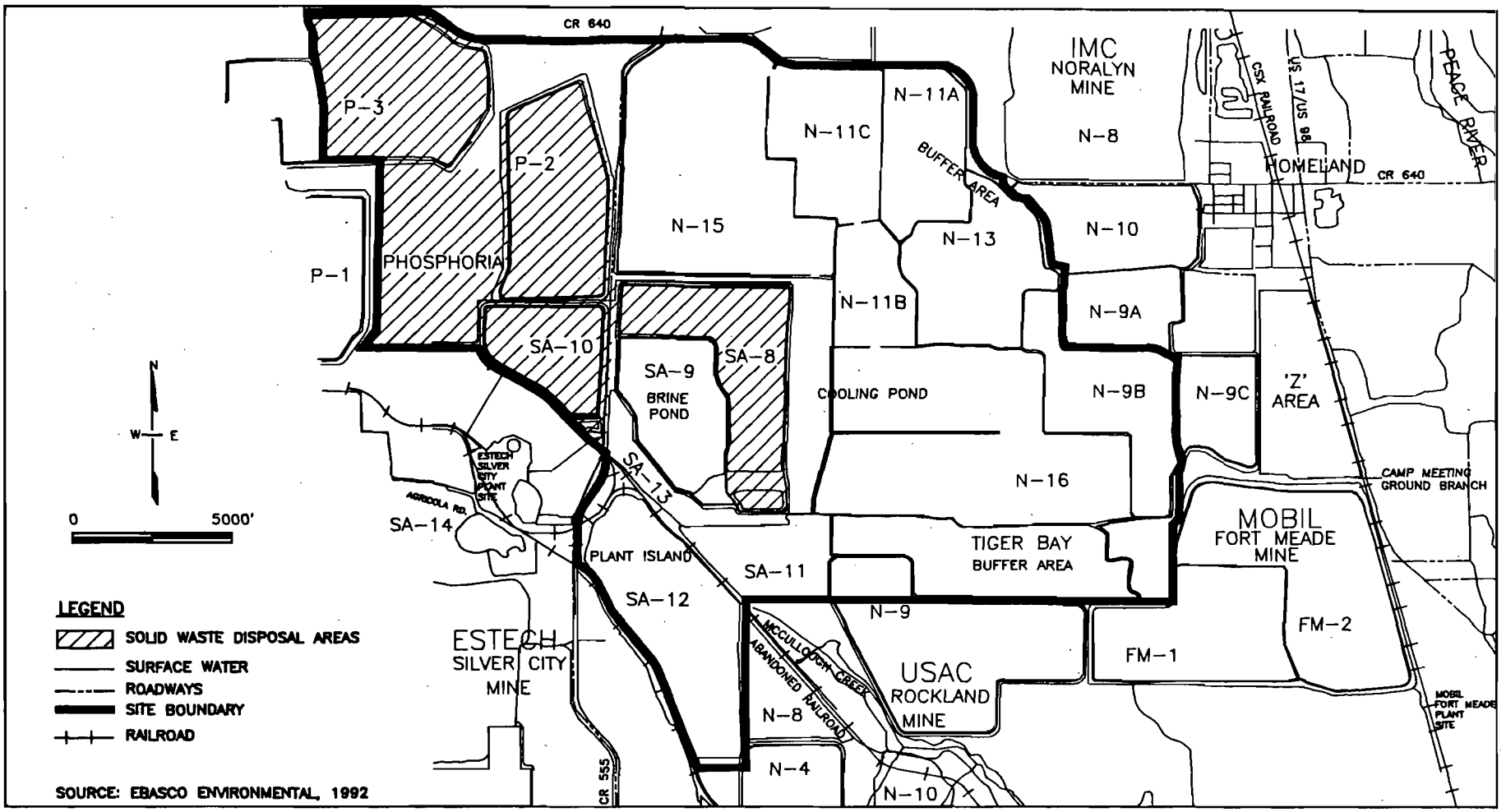


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Polk County Site

FIGURE 3.2.2-1

COOLING POND AREA

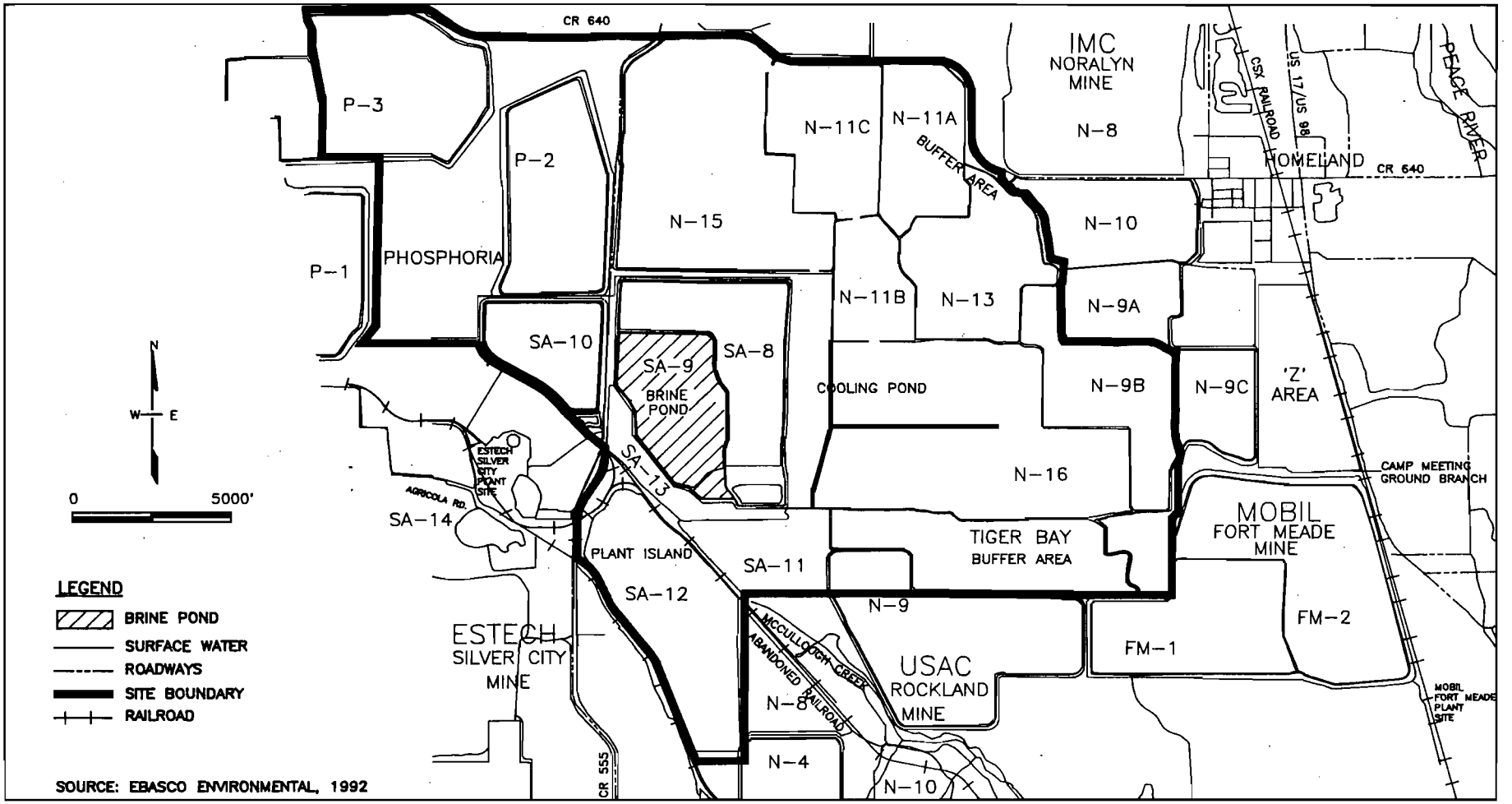


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Polk County Site

FIGURE 3.2.2-2

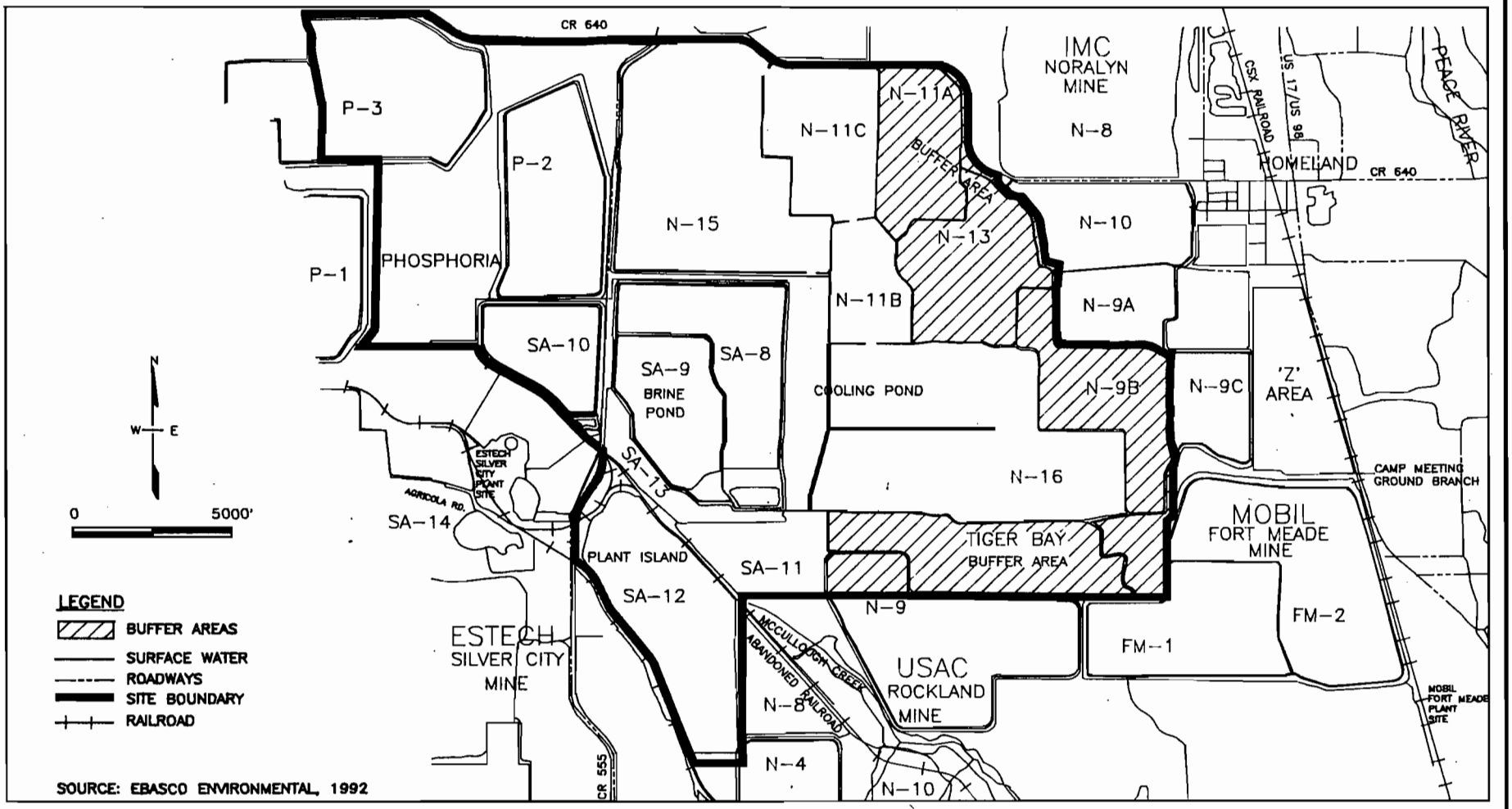
SOLID WASTE DISPOSAL AREA



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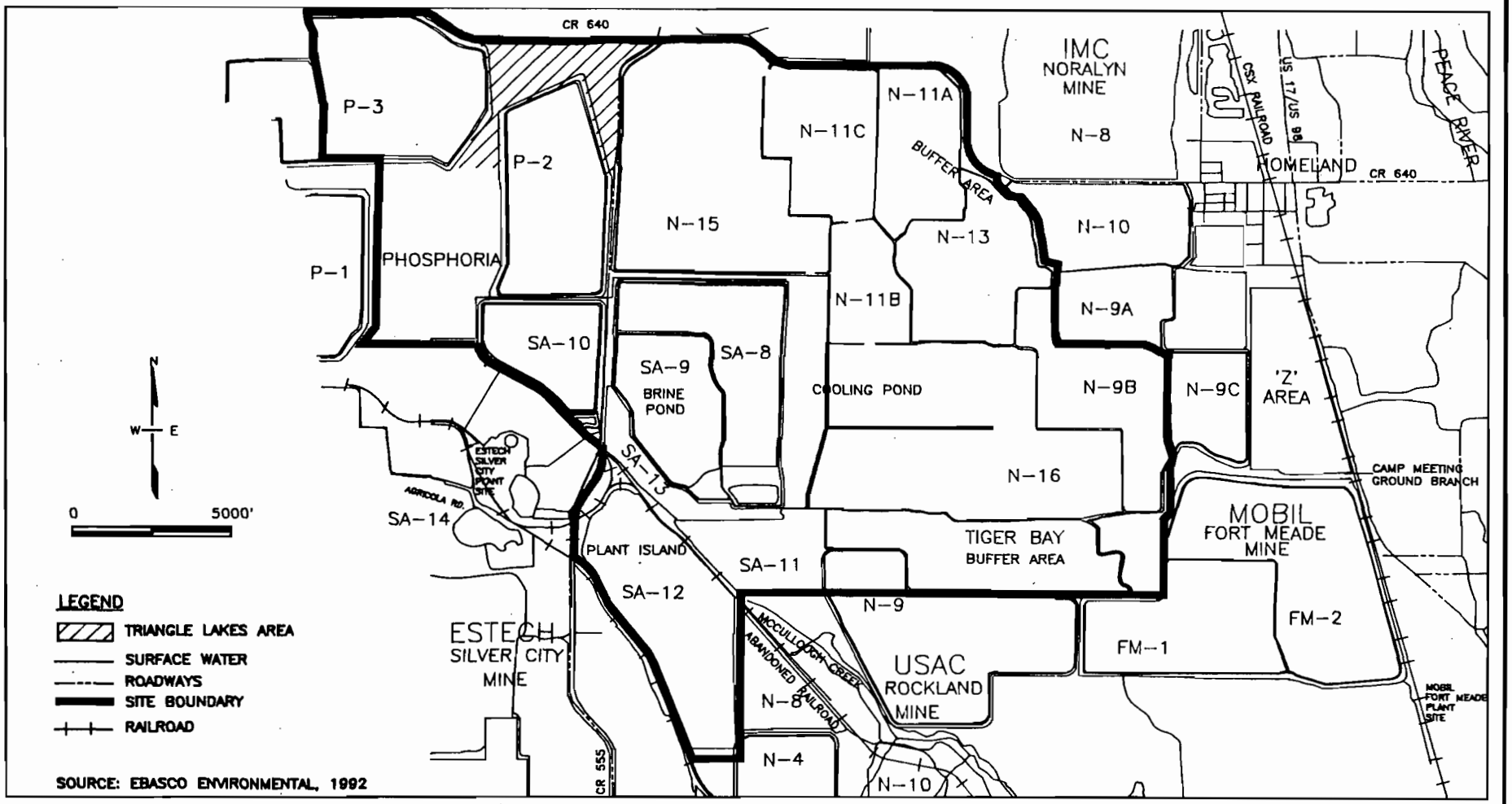
FIGURE 3.2.2-3
BRINE POND AREA



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FIGURE 3.2.2-4
SITE BUFFER AREA



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Polk County Site

FIGURE 3.2.2-5

TRIANGLE LAKES AREA

3.3 FUEL AND FUEL HANDLING CHARACTERISTICS

The first phase of the Polk County Site will utilize natural gas as the primary fuel and low sulfur fuel oil as the backup fuel. Later phases of the ultimate site development may involve additional natural gas/fuel oil-fired CC units, conversion of these units to burn coal-derived gas, installation of coal gasification units, and/or the installation of PC steam electric generating units.

Following is a description of the fuel characteristics, supply considerations, and storage concepts associated with each of the fuels proposed for use at the Polk County Site.

3.3.1 Natural Gas

The CC units will use natural gas at an approximate rate of 1,433,000 standard cubic feet per hour per CT at full load and at an ambient temperature of 40°F. A typical fuel gas analysis is shown in Table 3.3.1-1.

Natural gas will be supplied via a pipeline to the Polk County Site under one of two options. In the preferred option, this gas pipeline will be constructed and licensed separately by a gas pipeline company under appropriate federal and state approval processes. A back-up option consists of a maximum 30-inch gas pipeline lateral connecting to an approved Florida Gas Transmission pipeline in eastern Hillsborough County. The latter option is presented in Section 6.2 as an associated linear facility. In either event, an on-site service lateral will be used to connect the pipeline to the CTs.

3.3.2 Fuel Oil

Low sulfur fuel oil will be used as a backup fuel for the CC units at the Polk County Site. A total of approximately 13,180 gallons of fuel oil will be consumed per hour per CT at full load and an ambient temperature of 40°F. A typical fuel oil analysis is shown in Table 3.3.2-1.

Fuel oil will be delivered to the site by truck and unloaded by fuel oil unloading pumps. All fuel oil handling and storage facilities, including unloading areas, the pump areas, piping system, storage tanks, and the tank containment area, will meet the requirements of the Florida Department of Environmental Regulation (FDER) in Chapter 17-762, F.A.C., and the applicable National Fire Prevention Association (NFPA) codes.

For each 940 MW block of CC units, a 4 million gallon (nominal) storage tank will be provided. Therefore, at ultimate site development, there will be either two or three of these 4-million gallon fuel oil storage tanks on-site. This arrangement will provide approximately 3 days of fuel oil storage, if the combined cycle units operate at full load and an ambient temperature of 40°F. Fuel oil tank locations are shown on the site arrangement drawings in Section 3.2. The fuel oil tanks, containment measures, and related piping systems will be designed, constructed, and operated in accordance with federal, state, and local standards.

3.3.3 Coal

Numerous coal sources will be considered in the determination of a source of coal to supply the Polk County Site. Consequently, a range of coal properties is presented in Table 3.3.3-1. Coal selection will be based on economic, engineering and environmental factors. The same coal will likely be used by both the PC units and CGCC facilities.

Each CG plant will use 8,860 tons of 12,100 Btu/lb coal per day at full load and 40°F to supply coal-derived gas for a 940 MW block of CC units. Each 600 MW PC unit will use 5,900 tons of 12,100 Btu/lb coal per day at full load. Consequently, the 3,000 MW CGCC ultimate site capacity (Case A) will use about 26,600 tons of coal per day. The ultimate site capacity consisting of two 600 MW PC units plus roughly 2,000 MW of CGCC capacity (Case B) will use about 29,500 tons of coal per day. Under the worst case scenario, the annual tonnage requirement for full-load operation (ultimate site capacity) of the Polk County Site will be approximately 10.1 million tons.

Coal will be delivered by rail to the Polk County Site. Depending on delivery schedules, three to four 100-car unit trains will be required per day to support plant operations. Once on site, coal will be transported along a rail loop surrounding the storage area to a car unloading system, and subsequently relayed to receiving hoppers. Proposed on-site rail loop locations are shown on Figures 3.2.1-1 and 3.2.1-2, which depict proposed site arrangements.

From the hoppers, the coal will be conveyed to the coal storage piles which will include a 3-day active area and a 90-day inactive area. The coal will be placed by a traveling stacker. Piles will have a maximum height of 60 feet for coal pile maintenance purposes and an average height of 35 feet. Reclaiming of the active pile will be by traveling stacker/reclaimers.

The coal will be conveyed from the coal pile to the coal preparation area of the coal gasification units and/or PC units. In the coal preparation area, the raw coal will be crushed, ground, and/or dried prior to being conveyed to the gasifier facilities or PC units. The design fuel analysis for the resulting coal-derived gas is presented in Table 3.3.3-2.

3.3.4 Groundwater Protection/Runoff Collection and Treatment

The coal pile area will have a runoff collection and treatment system, as well as groundwater protection measures. The coal pile runoff pond area will be sized to collect and contain all runoff from a 10-year, 24-hour precipitation event. Rainfall in excess of this amount will follow drainage patterns to the recycle basin. A liner will be provided under the coal pile area, in the bottom of the coal pile runoff pond, in the bottom of the recycle basin, and in the bottom of connecting conveyances to prevent coal pile runoff from infiltrating into the underlying soils and ground water. The liner system will be constructed completely above the seasonal high water table and will consist of a flexible membrane liner.

The liner will be designed to accommodate the stresses, pressures, weather exposure, and potential abrasion associated with its intended use. A typical liner material would be high density polyethylene (HDPE). A prepared subgrade material (e.g., sand) will be provided under the liner to protect it from tearing or perforation. The liner under the coal pile will also include geotextile and geonet under-liners.

The liner system for the coal pile area will be covered by a minimum of 24 inches of permeable drainage material that will also serve to protect the liner from abrasion and weather exposure. The leachate/runoff collection and removal system will be designed to prevent stormwater from exceeding a depth of 1 foot above the liner. The runoff pond system for the coal storage area and the plant recycle basin will have liner systems similar to that for the coal pile areas, except that the geotextile and geonet layers will not be used. The bottom of the runoff pond and recycle basin will be built above the seasonal water table.

Precipitation entering the coal pile runoff pond will be pumped at a controlled rate to the recycle basin and then used in the coal gasification units or the flue gas desulfurization systems for the PC units. Untreated coal pile runoff will not be mixed with uncontaminated runoff, discharged off-site, nor conveyed or stored in unlined portions of the surface water management system.

Groundwater protection measures for the solid waste disposal areas are described in Section 3.7.

3.3.5 Alternative Fuels

The Polk County Site will have the capability to use multiple fuels. The initial CC units will be designed to burn either natural gas or fuel oil as a back-up fuel. The CC units will also have the ability to be converted to burn coal-derived gas to provide security against escalation in the cost or the unavailability of gas. Alternatively, steam electric generating units may be added that are designed to use pulverized coal as fuel.

In the normal course of business, alternative fuels such as low grade coal or oil based fuels will be evaluated for use at the site based on overall economic and environmental acceptability. No such alternative fuels are being considered for the Polk County Site at this time.

TABLE 3.3.1-1
TYPICAL NATURAL GAS ANALYSIS

ANALYSIS	MOLE (%)
Carbon Dioxide	0
Ethane	9.665
Hexanes Plus	0.05
Iso-Butane	0.19
Methane	81.11
Nitrogen	5.15
Normal-Butane	0.24
Pentanes Plus	0.09
Propane	3.505
Total:	100.000
Specific Gravity (air at 1)	.71
Quality Information	**Parameters**
Heating Value (LHV)	21,515 Btu/lb
Total Sulfur (Maximum)	Neg.
Hydrogen Sulfide (Maximum)	Neg.

Source: EPA, 1973

TABLE 3.3.2-1
TYPICAL NO. 2 FUEL OIL ANALYSIS

NO. 2 DISTILLATE OIL	PERCENT (BY WEIGHT)
Carbon	85.5
Hydrogen	12.7
Nitrogen	0.2
Oxygen	1.5
Sulfur	0.05
Ash	0.01

Lower Heating Value: 18,550 Btu/lb
Higher Heating Value: 19,200 Btu/lb

Source: FPC, 1992

TABLE 3.3.3-1
ULTIMATE COAL ANALYSIS

PARAMETER	TYPICAL PERCENT	RANGE PERCENT	DESIGN CASE PERCENT
Moisture	8.50	8.00 to 12.00	9.50
Carbon	65.85	60.00 to 70.00	61.20
Hydrogen	4.70	4.00 to 5.10	4.30
Nitrogen	1.15	1.00 to 1.60	1.30
Sulfur	3.00	2.50 to 3.50	3.50
Chlorine	0.16	0.09 to 0.29	0.29
Oxygen (by difference)	5.14	4.00 to 10.00	4.91
Ash	11.50	6.50 to 13.00	13.00
Heating Value	11,700 Btu/lb	11,000 to 12,100	12,100

Source: Black & Veatch, 1992

TABLE 3.3.3-2
DESIGN FUEL ANALYSIS
COAL-DERIVED GAS

PARAMETER	VOLUME PERCENT
Carbon Monoxide	44.88
Hydrogen	38.46
Carbon Dioxide	15.48
Methane	0.16
Inert Gases	1.02
Sulfur Bearing Compounds (H_2S+COS)	0.03

Lower Heating Value (LHV) = 4,650 Btu/lb

Source: Ebasco Environmental, 1992

3.4 AIR EMISSIONS AND CONTROLS

Ultimate development of the Polk County Site will include up to 3,200 MW of power generating capacity. The total installed capacity will be constructed in phases. The first phase of development will consist of four natural gas fired CC units capable of producing approximately 940 MW. Specific information about the initial units is presented in the Prevention of Significant Deterioration (PSD) application included as Appendix 10.1.5. The PSD application encompasses the impacts of the 470 MWs of CC unit generating capacity for which the PSC has determined the need and an additional 470 MWs of CC unit generating capacity which are scheduled for construction and therefore are an appropriate subject of review. The PSD permit for the scheduled 940 MWs of CC unit generating capacity is sought independent of the site certification.

The remainder of this section will address the air emissions and control for the ultimate development cases.

3.4.1 Air Emission Types and Sources

Following is a description of the sources and types of air emissions at the Polk County Site for Case A (3,000 MW CGCC) and Case B (3,200 MW CGCC and PC). For the purposes of this SCA, CG plant performance is assumed to be similar to that of the Cool Water Coal Gasification Program (EPRI, 1990) initiated by Southern California Edison Company and Texaco Incorporated. The gasification process at Cool Water was licensed by Texaco Development Corporation, the Claus process for sulfur recovery was licensed by Amoco Oil Company, and the tail gas treating process was licensed by Shell Development Company.

3.4.1.1 Sources

The primary sources of air emissions for Case A (3,000 MW CGCC) will be the CGCC units and the CG plant thermal oxidation units. The CGCC units will burn coal-derived gas as the primary fuel, with fuel oil for the emergency back-up fuel. For Case B, in addition to these sources, there would also be the PC boilers. The PC boilers will burn a medium sulfur eastern bituminous coal. The locations of the HRSG, PC boiler, and thermal oxidation unit stacks have been identified previously on Figure 3.2.1-3. The best available control technology (BACT) for these sources is presented in Section 3.4.3 of this SCA.

The secondary air emission sources of the Polk County site will be as follows:

- Auxiliary boiler
- Bulk material handling systems (fugitive emissions)
- Emergency diesel generator
- Emergency flares

The auxiliary boiler will operate only during cold start-up of a CGCC unit, PC boiler, or gasifier unit, and only if no other steam generating units are operating. Therefore, the auxiliary boiler will not operate concurrently with any of the primary sources under normal load operation. When needed, steam from the auxiliary boiler will be used to pre-heat a cold unit. However, if any other steam generating unit is operating, then steam will be used from the operating unit rather than from the auxiliary boiler. As the ultimate site development progresses and additional sources of steam are installed, use of the auxiliary boiler is expected to be reduced. The bulk material handling system will be used to unload, transport, and store the coal and limestone which will be used in the PC units and CG process. Fugitive dust emissions may result from the storage and handling of these bulk materials. Good engineering design and operating practices will be incorporated in the bulk material handling systems to minimize the fugitive emissions. A preliminary BACT analysis for emissions from these sources is presented in Section 3.4.

The emergency diesel generator will be used only for those rare periods when in-plant power is lost. The emergency diesel generator will burn only low sulfur (0.05 percent) fuel and will be equipped with advanced design combustors in order to minimize pollutant emissions. The emergency flares will operate only during gasifier start-up and shut-down, and during infrequent, unanticipated interruptions of the CG plant operating cycles. CG plant start-up and shut-down procedures will minimize flare operation in order to reduce potential pollutant emissions from these sources. The flares will most likely be non-assisted flares with 98 to 99 percent combustion efficiency. Given the infrequent and/or emergency mode of operation of the emergency diesel generator and emergency flares, emissions from these secondary sources are not considered in the BACT analysis.

3.4.1.2 Emissions

Estimated maximum emissions from each of the air emission point sources noted in Section 3.4.1.1 are tabulated in Tables 3.4.1-1 through 3.4.1-8. The estimated emissions represent full load operating conditions and are not inclusive of background ambient concentrations introduced into the particular processes. It is anticipated that higher emission rates will occur for short periods of time when a unit is started from a cold start or possibly during a malfunction. The significant emission rate thresholds given in Table 3.4.1-9. A comparison demonstrates that the project is subject to PSD BACT review for nitrogen oxides (NO_x), sulfur dioxide (SO_2), sulfuric acid mist (H_2SO_4), carbon monoxide (CO), particulate matter (PM and PM_{10}), volatile organic compounds (VOC), lead (Pb), mercury (Hg), beryllium (Be), and total fluorides. Arsenic (As), benzene (C_6H_6), and radionuclides will also be emitted from air emission sources at the Polk County Site. Although significant emission rates have not been promulgated for these pollutants, they are regulated and subject to PSD BACT review if emitted in any concentration.

3.4.1.3 Emissions Inventory

For source specific emissions, DER Form 17-1.202(1), "Application to Operate/Construct Air Pollution Source", has been completed for the first phase of 940 MW; a copy is included in Appendix 10.1.5. These emissions are based on a 100 percent capacity factor at full load.

3.4.2 Air Emission Controls

The proposed control technologies and associated emission rates for the regulated pollutants emitted from each of the primary sources on the site are tabulated in Tables 3.4.2-1 through 3.4.2-3. The proposed control technologies and associated emission rates for the regulated pollutants emitted from the auxiliary boiler and bulk material handling systems are tabulated in Tables 3.4.2-4 and 3.4.2-5, respectively. A preliminary BACT analysis considering technical, energy, and environmental factors for each of these sources is presented in Section 3.4.3. A detailed BACT analysis, including an economic evaluation, will be performed for each phase of development at the site when supplemental air emission permit applications for that particular phase are submitted.

3.4.3 Best Available Control Technology (BACT)

3.4.3.1 Introduction

This BACT discussion provides a preliminary "worst case" scenario of generation alternatives and the corresponding analysis of the air quality control alternatives for controlling pollutant emissions from the Polk County Site. The total generating capacity for the site will be up to 3,200 MW. The ultimate site development will include coal-derived gas fired CC units, CG plants, and possibly two PC boilers.

Under the federal Clean Air Act (CAA), BACT represents an emission limitation based on the maximum degree of pollutant reduction determined on a case-by-case basis considering technical, economic, energy, and environmental considerations. However, BACT cannot be less stringent than the emission limits established by the applicable New Source Performance Standards (NSPS) for stationary sources.

This BACT analysis follows the general requirements of the EPA's draft "top down" BACT guidance document (EPA, 1990), which requires that the BACT analysis start by assuming the use of the most stringent control alternative. Other, less efficient emission control technologies are evaluated if this most stringent alternative is determined to be technologically infeasible or unreasonable considering economic, energy, and environmental factors. This BACT presents a general discussion of control technology options available for the Polk County Site. Current control technologies will be evaluated based on technical, energy, and environmental considerations. Since the ultimate development will occur over a long period of time, it is expected that changes will occur in pollution control technologies available for later phases, especially with regard to coal gasification. These changes are expected to alter the relative economics of current technologies for CG and PC. Because of these anticipated changes, this BACT analysis is restricted to qualitative discussions and represents a "worst case" that can be utilized in support of the requested ultimate site capacity certification. No cost effectiveness discussion of the various control technologies is presented in this SCA BACT discussion.

As shown in Section 3.4.1, the following regulated pollutants at ultimate capacity exceed the PSD significant emission rate thresholds and are, therefore, subject to PSD review:

- Carbon Monoxide (CO)
- Nitrogen oxides (NO_x)
- Sulfur dioxide (SO_2)
- Particulate (PM and PM_{10})
- Volatile organic compounds (VOC)
- Lead (Pb)
- Beryllium (Be)
- Mercury (Hg)
- Fluorides (F)
- Sulfuric acid mist (H_2SO_4)
- Benzene (C_6H_6)
- Arsenic (As)
- Radionuclides

Consequently, this BACT analysis addresses the control of emissions of these pollutants. Also included are discussions of the effects of the BACT systems selected on the emissions of other regulated pollutants emitted below de minimis levels and unregulated hazardous air pollutants. Control technology evaluations for specific trace element emissions from the primary sources will be presented in detail in the PSD BACT applications for those sources.

3.4.3.2 Requirements and Assumptions

This "worst case" BACT analysis assumes that the ultimate development of the Polk County Site will include 2,000 MW of CGCC units, 1,200 MW of PC unit generating capacity and two coal gasification plants. Each coal gasification plant will consist of four gasification units and two thermal oxidation units to control process tail gases from the gasification units.

3.4.3.3 Nitrogen Oxides

NO_x will be emitted from the CGCC units, PC boilers, thermal oxidation units, and the auxiliary boiler. NO_x are formed in combustion sources by either the thermal oxidation of nitrogen in the combustion air (thermal NO_x), or the reduction and subsequent oxidation of the nitrogen contained in the fuel (fuel NO_x). Virtually all NO_x emissions exit the stack as nitric oxide (NO). The reaction requires that both nitrogen and oxygen dissociate into atomic form at high combustion temperatures and then recombine to form NO. A minor fraction of the NO, approximately 5 percent, further oxidizes in the flue gas to form NO_2. The majority of NO_x emissions from the sources being considered in this BACT analysis are the result of the thermal NO_x process.

The rate of formation of thermal NO_x is a function of the residence time, free oxygen, and peak flame temperature in the combustion zone. Therefore, most combustion control techniques for thermal NO_x are aimed at minimizing one or more of these variables. Post-combustion NO_x control methods remove NO_x from the exhaust gas stream.

CGCC UNITS

The project will use CGCC units equipped with the most technically advanced low NO_x combustors available. The low NO_x combustors will be capable of limiting NO_x emissions to the lowest levels attainable for combustion control.

Currently, 40 CFR 60 Subpart GG of the NSPS establishes a NO_x emission limitation for CT units of 75 parts per million on a dry volume basis (ppmvd) corrected to 15 percent oxygen, before a correction for fuel nitrogen content and turbine heat rate. A review of the latest control technology determinations (CARB, 1991 and 1992; EPA, 1985 and 1990) did not reveal any emission limit determinations for CGCC units. Recent CGCC unit permit decisions in the state of Florida have limited NO_x emissions to 42 ppmvd. These emission rates were achieved using combustion controls and water injection. The lowest NO_x emission limits listed in Clearinghouse documents for all types of CC units are achieved using standard turbine combustors with steam or water injection, low NO_x combustors and selective catalytic reduction (SCR) systems. The only stationary sources required to meet the most stringent emission limits are those new sources being located in non-attainment areas or sources which have other unique circumstances which require exceedingly stringent pollution control.

TECHNICAL ANALYSIS. Following is a summary of the technical analysis performed for the alternative CGCC NO_x emission control technologies including SCR.

Selective Catalytic Reduction. SCR is a post-combustion method for control of NO_x emissions. The SCR process combines vaporized ammonia with NO_x in the presence of a catalyst to form nitrogen and water. The vaporized ammonia is injected into the exhaust gases prior to passage through the catalyst bed. The performance and effectiveness of SCR systems is directly dependent on catalyst operating temperatures. The optimum flue gas temperature range for SCR operation is approximately 650°F to 750°F. At temperatures lower than 600°F, the ammonia reaction rate with NO_x is ineffective, resulting in large quantities of ammonia slipping through the system unreacted (ammonia slip). At temperatures greater than 800°F, permanent damage to the catalyst occurs.

Flue gas from a CT will typically be 950°F to 1,100°F. Accordingly, an SCR device would be installed at an intermediate point of the HRSG after several rows of tubes, where a temperature of approximately 700°F occurs. The narrow SCR temperature window dictates that the SCR catalyst be precisely located in the HRSG. A recent report indicated that effective SCR operation becomes very difficult for units that see a variation in gas flow and temperature through the HRSG due to load changes or ambient temperature swings (Boericke, 1990). Another recent report indicates that maintaining the catalyst in the narrow SCR temperature window over the entire CC unit operating load range can be difficult (Shorr, 1991). Therefore, SCR performance will be difficult to maintain if the CGCC unit load varies or if significant ambient temperature swings occur.

Catalyst NO_x reduction efficiency will be affected by the type of fuel being burned. When firing coal-derived gas or fuel oil, the SCR catalyst will oxidize approximately three percent of the sulfur in the flue gas to SO_3. Catalytic reduction efficiency will be reduced when available reaction sites are occupied by sulfur compounds. Additionally, the ammonia present in the flue gas will react with the SO_3 to form ammonia sulfate salts and the water in the flue gas will react with the SO_3 to form sulfuric acid mist. The formation of ammonia sulfate salts will reduce the amount of ammonia available for reaction with the NO_x. Ammonium bisulfate, one of the ammonia salts formed, will also reduce the combined cycle thermal efficiency by coating the heat transfer surfaces of the HRSG and potentially limit unit availability due to forced outages for HRSG cleanup. Both the ammonia sulfate salts and the sulfuric acid mist will increase the

amount of particulate matter emitted in the flue gas. This particulate will predominantly consist of matter less than 10 microns in size (PM_{10}).

Catalyst life expectancy can also be affected by the type of fuel burned. Catalyst poisoning can be caused by such trace elements as arsenic, cadmium, chromium, copper, lead, and manganese, all of which can be found in coal-derived gas and fuel oil.

SCR systems are also relatively complex chemical reaction systems to operate and control. Continuous emissions monitoring (CEM) systems used to trim ammonia injection to minimize ammonia slip have proven unreliable and relatively insensitive to the low concentrations being measured. SCR system users cited by a recent report experienced problems of enough technical complexity to require frequent vendor representative assistance to repair and service the equipment (Radian, 1991).

Selective Non-Catalytic Reduction. Nitrogen oxide emissions from other combustion sources, such as PC boilers, also have been controlled through installation of selective non-catalytic reduction (SNCR) systems such as Thermal DeNO$_x$ and NO$_x$OUT. SNCR systems require gas temperatures of at least 1,500°F for NO$_x$ reduction. Temperatures below 1,300°F result in ammonia slipping through the system unreacted without any corresponding reduction in NO$_x$ emissions. The temperature at the outlet of a CT unit is too low (950°F to 1,100°F) for such systems. Accordingly, this alternative is judged not to be technically feasible for application on a CGCC unit.

Combustion Controls. Use of water or steam injection in the combustion zones of a CGCC unit can limit the amount of NO$_x$ formed. Thermal NO$_x$ formation is avoided due to lower combustion temperatures resulting from the water or steam injection. The degree of reduction in NO$_x$ formation is somewhat proportional to the amount of water or steam injected into the turbine.

As cited in recent General Electric CT performance data, advanced design low NO$_x$ combustors will be available for the Polk County Site. The CT's are targeted for combustor controlled NO$_x$ emissions of 25 ppmvd while burning coal-derived gas (water injection may be required) and 42 ppmvd while burning fuel oil with water injection. It should be noted that the GE emission estimates while burning coal-derived gas were based on preliminary fuel analyses from existing CG projects. CC integration with coal gasification technology is undergoing rapid development

worldwide. Nitrogen injection into the coal-gas stream has proven to be a feasible method of inhibiting thermal NO_x formation in CGCC units (Siemens, 1992). It is realistic to expect projected NO_x emissions from coal-gas fired CC units to decrease with future development of the CGCC unit technology.

ENERGY IMPACTS ANALYSIS. The use of an SCR system will require the use of additional energy. The SCR system requires energy to vaporize ammonia and energy to operate blowers or air compressors necessary to provide dilution air for injection of the additive. In addition, an SCR system will add approximately 4 inches water gauge gas pressure drop to the system as a result of the catalyst. This will reduce the output of the CGCC units by approximately 0.42 percent (8 MW for Case B). Since power demand will remain constant, this derate will be replaced by a combustion source that likely has higher NO_x emissions than the CGCC units at the Polk County Site.

ENVIRONMENTAL IMPACTS ANALYSIS. The use of ammonia in an SCR system introduces an element of environmental risk. Ammonia is listed as a hazardous substance under Title III Section 302 of the Superfund Amendments and Reauthorization Act of 1986 (SARA). Anhydrous ammonia is a hazardous material. Accordingly, this material must be handled and stored with extreme care. There is a potential for ammonia to be released during transportation, transfer, and storage.

Some ammonia slip (including a number of amine compounds) from the HRSG stack is unavoidable due to the imperfect distribution of the reactant and reaction inefficiencies associated with catalyst reactivity or operating temperatures. Although ammonia emissions are not regulated nationally, the Northeast States for Coordinated Air Use Management (NESCAUM) has recommended an ammonia emissions limit of 10 ppmvd, unless that limit is shown to be inappropriate. At least one air pollution control district in California has set an ammonia emissions limit of 10 ppmvd. Unreacted ammonia emissions from an SCR system could average 5 to 10 ppmvd. However, excursions due to ammonia injection control problems could result in ammonia slips in excess of 40 ppmvd. The U.S. Occupational Safety and Health administration has adopted an ammonia short term exposure limit of 35 ppmvd.

Monitoring ammonia slip emissions has also proven to be difficult. To date, there is not a reliable, accurate ammonia slip monitor available. Poor monitor system response and accuracy

can make proper ammonia injection difficult. This can lead to excessive ammonia slip emissions.

The most common commercial SCR catalysts are vanadia/titania based, where vanadium pentoxide (V_2O_5) is used as the active catalyst compound. Vanadium is classified by the EPA as a hazardous material, and as such would require disposal in a RCRA hazardous waste (Subtitle C) landfill. Because of the requirements associated with such disposal, some manufacturers have stated they will accept return of deactivated vanadia based catalyst which they manufactured. However, it is uncertain if this alternative will be available in the future when the quantity of spent catalyst requiring disposal becomes significant and the associated costs and liability for disposal are realized. This issue is further complicated by transportation of hazardous wastes through third party states or internationally. Although existing federal laws prohibit states from outlawing such transportation, there continues to be a political and public concern regarding the transportation of hazardous wastes across state lines.

SUMMARY OF EVALUATED TECHNOLOGIES. The following control technologies are ranked according to their control effectiveness.

- Low NO_x combustors with SCR and water injection achieving NO_x emissions of 6 ppmvd (80 percent reduction) while firing coal-derived gas, and 15 ppmvd while burning fuel oil with water injection.

- Low NO_x combustors achieving NO_x emissions of 25 ppmvd and 42 ppmvd while firing coal-derived gas (water injection may be required) and fuel oil with water injection, respectively.

RATIONALE FOR PROPOSED CGCC UNIT NO_x BACT. Use of an advanced design low NO_x combustor unit (with water injection, if required) to control NO_x emissions to 25 ppmvd represents BACT for the Polk County site. The project is not located in an ozone non-attainment area. The NO_x emissions from the proposed low NO_x CGCC units are lower than recent permit decisions for similar CGCC projects in the state of Florida. The FPL Martin CGCC project recently proposed NO_x emissions of 42 ppmvd using combustor design and steam injection as control technologies. The lowest NO_x emission limit listed in the EPA's Clearinghouse documents for the state of Florida is 42 ppmvd. However, several sites within the state have recently been permitted for NO_x emissions of 25 ppmvd (natural gas fired) and one project has proposed 15 ppmvd while firing natural gas.

The use of an SCR system could result in adverse environmental effects due to unreacted ammonia being released to the atmosphere or accidental release of ammonia during transport or storage causing a potential human health hazard. Use of an SCR system would also require frequent transfers of ammonia increasing the risk of accident and exposure. An SCR system would trade potential small decreases in ambient NO_x concentrations for potential health and safety problems due to ammonia exposure.

Based on the foregoing site specific technical, energy, and environmental considerations, use of low NO_x advanced design CGCC units (with water injection, if required) to achieve NO_x emissions of 25 ppmvd and 42 ppmvd while burning coal-derived gas and fuel oil, respectively, represents BACT for the Polk County Site.

PC BOILERS

Case B (3,200 MW) involves 1,200 MW of PC units, and assumes the use of PC boilers equipped with the most technically advanced low NO_x burners available. By using low NO_x burners, the Polk County Site will be able to reduce NO_x formation to the lowest levels possible before utilizing potentially hazardous NO_x reduction technologies.

Subpart Da of the NSPS 40 CFR 60 establishes a NO_x emission limitation for bituminous coal fired boilers of 0.60 lb/mmBtu. A review of the latest control technology determinations (U.S. EPA, 1985 and 1990) indicates that the lowest NO_x emission limit established to date for a PC unit is 0.10 lb/mmBtu for the Chambers Cogeneration Project located in New Jersey. This project's NO_x determination was predicated on the fact that it is located in an ozone non-attainment area. The Chambers Cogeneration Project will use low NO_x burners and SCR to limit NO_x emissions. The Chambers permit has provisions to increase the NO_x limit to a maximum of 0.17 lb/mmBtu should SCR performance fail certain criteria.

TECHNICAL ANALYSIS. Following is a summary of the technical analysis performed for the alternative PC Boiler NO_x emission control technologies including SCR.

Selective Catalytic Reduction. SCR systems for PC boilers are very similar to those used on CC units. A downflow catalyst is typically housed in a reactor vessel located between the economizer outlet and the air heater inlet. An economizer bypass may be required to maintain

the reactor temperature during low load operation. This will reduce boiler efficiency at lower loads.

SCR systems were first used on coal fired power plants in Japan during the 1970s. Soon after, in response to acid rain legislation, German utilities retrofitted many of their larger coal fired plants. Through 1990, there were approximately 169 coal-fired power plants in both Japan and Germany that were fitted with SCR systems. Most of the German SCR systems are operated to achieve 70 to 80 percent NO_x reduction to meet a NO_x emission limit of approximately 100 ppm while maintaining ammonia slip emissions to below 5 ppm. SCR fitted boilers in both countries typically burn coals that have low sulfur (0.7 to 1.2 percent) and ash (5 to 8 percent) contents.

To date, there are no coal fired boilers operating in the United States which use SCR systems. However, the Chambers Project 140 MW PC fired boiler was recently permitted in New Jersey with SCR and low NO_x burners. The facility will not begin operations for two to three years. Therefore, it is not possible to presently evaluate the effectiveness of SCR at facilities burning US coals. However, since the precedent has been established for use of SCR on a PC fired plant, this BACT analysis will evaluate SCR. The analysis will be based on the use of low NO_x burners followed by an SCR system.

The Japanese and European experiences with SCR cannot be blindly applied to US facilities. There remain two significant uncertainties about design, performance, operating parameters, and cost of SCR systems. First, US utility power plants tend to be load following units which operate under variable loads. Foreign utility coal fired plants tend to operate at constant load levels. Second the amounts and types of sulfur, ash, and trace elements in US coals are different from those in coals consumed in Japan and Europe.

Variable load conditions result in variable temperatures in the SCR reactor. At low temperatures, SCR reaction efficiencies drop off markedly resulting in either lower NO_x reduction or additional ammonia slip emissions.

Japanese and German SCR experience has been with coals with relatively low sulfur and ash contents. Combustion of higher sulfur coals will result in the emission of larger quantities of sulfur trioxide (SO_3). In addition, SCR catalysts oxidize SO_2 resulting in at least a 100 percent increase in SO_3 emissions.

Similar to CC units, sulfur trioxide in the presence of ammonia will form ammonia sulfate and ammonia bisulfate salts. Resultant particle diameters are on the order of 1 to 3 microns (potentially increasing plant PM_{10} emissions). Ammonia bisulfate can foul the catalyst's micropore structure, limiting reactivity. In addition, ammonia bisulfate is a sticky substance which can deposit on downstream equipment. Ammonia bisulfate will tend to liquefy at a temperature of about 410°F in the intermediate baskets of the air heater. Once liquefied, it solidifies in nodules in the space between the intermediate and cold end baskets. The result can be increased pressure drop, and eventual plugging of the air heater. Cold-end soot blowers are not generally effective in reaching and removing these deposits on-line. Therefore, an outage would be required to clean the air heater, resulting in decreased unit reliability. Off-line water washings are necessary to remove the soluble deposits. To alleviate this problem in Japan and Germany, recent SCR designs have limited ammonia slip emissions to between 3 and 5 ppm. In order to lower ammonia slip below 5 ppm, additional catalyst volume and tight control of the gas flow across the catalyst face is required. These factors further increase the system costs.

Increased SO_3 concentrations lead to an increase in the flue gas acid dew point. In order to prevent corrosion of downstream equipment, higher air heater exit temperatures are required. These higher temperatures result in decreased boiler thermal efficiency, thus decreasing unit capacity.

A number of alkali metals and trace elements (especially arsenic) poison the catalyst significantly affecting reactivity and life. Average arsenic concentrations for US coals are three times the worldwide average. Other elements such as sodium and potassium can also poison the catalyst by neutralizing the active catalyst sites. Poisoning of the catalyst does not occur immediately but is a continual process over the life of the catalyst. As the catalyst becomes deactivated, more ammonia must be injected to compensate and meet NO_x emission limits. This will result in an increased amount of ammonia slip. Increased ammonia slip will in turn result in additional ammonia salt formation and fouling of downstream equipment.

A significant quantity of ammonia slip from an SCR system will condense onto fly ash. The ammonia content of the fly ash can have an impact on waste disposal practices or on viability for fly ash reuse as concrete admixture. At elevated pH, ammonia in the fly ash will be released possibly leading to odorous emissions. Fixation of wet scrubber or spray dryer reaction products will result in spontaneous ammonia releases.

It is reasonable to expect that an SCR system could be designed to limit NO_x emissions to 0.10 lb/mmBtu. An SCR system designed for higher NO_x reductions would have a higher SO_2 to SO_3 conversion rate that could lead to increased unit forced outages, thus decreasing unit availability. Unit availability has direct economic consequences due to utility obligations to supply power to its customer base.

Selective Non-Catalytic Reduction. Selective non-catalytic NO_x reduction systems rely on the appropriate reagent injection temperature and good reagent/gas mixing rather than a catalyst to achieve NO_x reductions. SNCR systems can use either ammonia (Thermal $DeNO_x$) or urea (NO_xOUT) as reagents.

Ammonia for a Thermal $DeNO_x$ system is stored as a liquid. Subsequently, the ammonia is vaporized and injected into the flue gas using either compressed air or steam as a carrier. The ammonia then reacts with the NO_x to form nitrogen and water. Reagents for SNCR systems are injected in the backpass (convective portion) of the boiler.

Urea for a NO_xOUT system is stored as a 50 percent solution in water. This solution is atomized at the injection point to optimize mixing. In the flue gas, the urea molecule dissociates to form two molecules of ammonia. The ammonia reacts with NO_x to form nitrogen and water. Urea would be injected at a similar location to an ammonia based SNCR system.

In general, SNCR systems on PC fired boilers will be capable of between 40 and 50 percent NO_x reduction. The major site specific considerations that establish the NO_x emission reduction efficiency of SNCR systems include boiler temperature profile, the coal's sulfur and chlorine contents, and the geometry of the boiler as it affects additive distribution.

The optimum temperature range for injection of ammonia or urea is 1,550°F to 1,900°F. The NO_x reduction efficiency of the SNCR system decreases at temperatures outside this range. A PC boiler operates at a temperature of between 2,500°F and 3,000°F. Therefore, the optimum temperature window in a PC boiler occurs somewhere in the backpass of the boiler. This temperature location will change as a function of unit load.

As previously described for SCR systems on the CGCC units, ammonia is a hazardous material. Accordingly, this material for a Thermal $DeNO_x$ type SNCR must be handled and stored with

great care. Working on and around ammonia equipment may cause operational personnel to be less productive than under normal working conditions.

A review of information contained in the BACT/LAER Clearinghouse (1985 and 1990 editions) provided a number of California circulating fluidized bed projects that were required to use SNCR systems. However, because of the non-attainment status and California's unique air quality problems, these limitations are more representative of a most stringent control technology than a BACT determination. Recent NO_x emission permit decisions for PC units in the state of Florida (Indiantown Cogeneration and OUC Stanton Unit 2) have established emission limits achievable using SNCR post-combustion controls.

Combustion Controls. The commercial installation of low NO_x burners over the last several years represents an advance in the control of NO_x emissions from PC fired boilers. Low NO_x burners reduce NO_x formation in the boiler by maintaining a reducing atmosphere at the coal nozzle and diverting additional combustion air (to complete combustion) to secondary air registers. This staged combustion primarily inhibits the formation of thermal NO_x. A NO_x emission rate of 0.30 lb/mmBtu is achievable, based on current PC combustion controls utilizing advanced design burners and associated peripherals.

ENERGY IMPACTS ANALYSIS. An SCR system consumes electrical energy for SCR auxiliary operation and for incremental induced draft fan demand to overcome SCR draft losses. This represents approximately 0.45 percent (5.4 MW) of total projected output from the PC units.

An SNCR system also consumes electrical energy. An ammonia based SNCR system would require approximately 0.48 percent (5.8 MW) of total projected output from the PC units .

Similar to SCR systems on CC units, catalysts for PC boiler SCR systems are considered to be hazardous materials. Spent catalyst will require proper disposal procedures. As the quantity of spent catalyst requiring disposal becomes significant, it is uncertain what costs might be imposed on the project to dispose of these wastes.

ENVIRONMENTAL IMPACTS ANALYSIS. Operation of an SCR system to meet a NO_x emission limitation of 0.10 lb/mmBtu will result in ammonia slip emissions of between 2 and 5 ppm. Catalyst manufacturers will guarantee ammonia slip emissions during the first two years of operation. When catalyst surfaces are relatively new, ammonia slip will be very low. However,

as the catalyst ages and becomes either deactivated or blinded, ammonia slip emissions will increase.

Use of SCR results in at least a 100 percent increase in SO_3 emissions. Unreacted ammonia and SO_3 can react to form ammonia bisulfate and ammonia sulfate salts. These particulates will generally be smaller than 10 microns, and thereby, potentially increase PM_{10} emissions. Sulfur trioxide emissions that do not react with ammonia will most likely react with moisture in the flue gas and exit the unit as H_2SO_4 mist emissions.

Ammonia is a hazardous material. Therefore, ammonia used in either SCR or SNCR systems must be handled and stored with great care. Storage and use of ammonia on-site may increase the likelihood of hazardous or fatal accidents. Recent projects in California required to use ammonia have had difficulty obtaining local permits allowing ammonia use.

SUMMARY OF EVALUATED TECHNOLOGIES. The following control technologies are ranked according to their control effectiveness.

- Low NO_x burners with SCR designed to reduce NO_x emissions to 0.10 lb/mmBtu.
- Low NO_x burners with SNCR designed to reduce NO_x emissions to 0.17 lb/mmBtu.
- Low NO_x burners designed to reduce NO_x emissions to 0.30 lb/mmBtu.

RATIONALE FOR PROPOSED NO_x BACT. Based on recent permit decisions by the Florida DER and EPA Region IV, it is assumed that NO_x emissions from the PC boilers at the Polk County Site will be controlled using low NO_x burners and a post-combustion NO_x reduction ammonia injection control technology. SNCR systems require less equipment, are simpler to operate, and do not have catalyst disposal problems like SCR systems. However, SNCR systems will have higher ammonia slip. Neither system has a history of operation on PC boilers burning US coal. The choice of post-combustion control technology for the Polk County Site will depend on installation and maintenance trends established by the generation of air quality control equipment being designed and installed during the next decade. However, it is expected that BACT for NO_x emissions control on the PC boilers will be the use of low NO_x burners and a post-combustion NO_x control system to achieve an emission rate of 0.17 lb/mmBtu or less.

CG PLANT THERMAL OXIDATION UNITS

The thermal oxidation units will oxidize the tail gas from the CG facility immediately following the tail gas sulfur recovery process. The majority of NO_x emissions from the oxidation system will be formed by thermal oxidation of the nitrogen in the combustion air. Thermal oxidation units can operate with as high as 200 percent excess air. Thus, combustion controls will be the primary form of NO_x control.

NSPS standards have not been established for gasification-based power plants. However, 40 CFR 60 Subpart J (Standards of Performance for Petroleum Refineries) establishes emission standards for Claus sulfur recovery plants which process gases produced within petroleum refineries. Although the CG plant thermal oxidation units upon which this SCA is based oxidize tail gases from Claus sulfur recovery plants, a CG plant is not a petroleum refinery. For demonstration purposes only, the emission standards established in 40 CFR 60 Subpart J will be presented in the SCA when discussing NSPS for the CG plant thermal oxidation units.

As with most combustion units, low NO_x burners are being developed to limit NO_x emissions from thermal oxidation units. The low NO_x burners limit thermal NO_x formation by staging combustion and lowering flame temperatures to the lowest level possible. Typical flame temperatures are in excess of 3,000°F.

40 CFR 60 Subpart J does not establish NO_x emission limits for Claus sulfur recovery plants. Typical NO_x emissions cited at the Cool Water CG Program were 35 ppmvd (EPRI, 1990). Total NO_x emissions from the thermal oxidation unit will be small relative to emissions from the electrical power generating sources at the Polk County site. NO_x emissions from the thermal oxidation units are estimated to be 57 lb/hr per unit. Therefore, BACT for NO_x emissions from the CG plant thermal oxidation units is assumed to be combustion controls.

AUXILIARY BOILER

The NSPS governing air emissions from the auxiliary boiler are contained in 40 CFR 60 Subpart Dc (Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units). No NSPS criteria have been established regarding NO_x emissions in Subpart Dc. The auxiliary boiler is expected to have NO_x emissions of 9.9 lb/hr and 19.8 lb/hr while firing natural gas and fuel oil, respectively. These emission rates will be achieved using low NO_x

burners and combustion controls. The low NO_x burners on the auxiliary boiler will operate in a manner similar to the low NO_x combustors on the CGCC units.

Flue gas recirculation is another method of controlling NO_x formation. Flue gas recirculation has historically been used to control steam temperature. Flue gas is taken from the economizer outlet and reintroduced into the wind box of the burner utilizing a fan and ductwork. The recirculation of flue gas to the furnace area lowers the flame temperature. The lowered flame temperature reduces thermal NO_x formation in the furnace.

NO_x emissions from the auxiliary boiler can also be limited using post-combustion control technologies. Both, SCR and SNCR systems can be used on auxiliary-type boilers. NO_x emission reduction efficiencies using SCR and SNCR systems on an auxiliary such a the one at the Polk County Site would be approximately 70 percent and 40 percent, respectively. As previously discussed in the CGCC unit and PC boiler NO_x control sections, SCR and SNCR systems reduce NO_x emissions by introducing an ammonia reagent into the flue gas to react with the NO_x particles. Both processes are temperature sensitive. The optimum flue gas temperature ranges for SCR and SNCR operation are approximately 650°F to 750°F and 1,550°F to 1,900°F, respectively. Both of these temperature ranges occur somewhere in the convective or backpass portion of the boiler. Since auxiliary-type boilers are typically packaged designs, the boiler manufacturer would be required to alter the standard design to accommodate post-combustion NO_x control systems. For SCR systems, the boiler backpass could be shortened to provide a flue gas exit temperature in the required range. This would reduce the boiler thermal efficiency due to reduced heat transfer surface area in the boiler backpass. An economizer could be added after the SCR catalyst to recover a portion of this lost thermal efficiency. For SNCR systems, operation below the optimum temperature window will result in excessive ammonia emissions (slip) with no corresponding reduction in NO_x emissions. Operation above the optimum temperature window will result in increased NO_x emissions. The exact location of this temperature range will occur at different locations within the boiler, dependent on boiler load and inlet air temperatures. Therefore, multiple sets of injection nozzles would be required in order to follow the optimum temperature location.

Post-combustion NO_x control systems will require additional power for ammonia vaporization and injection. In addition, additional fan power will be required on an SCR system in order to overcome draft loss due to the catalyst. Both systems also use ammonia. As discussed in the CGCC unit NO_x emissions control section, ammonia is listed as a hazardous substance under

Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA) and must be handled with caution. Also, since the auxiliary boiler will only be operated for 100 hours per year, the total NO_x emissions reduced will be small. It is estimated that the total annual NO_x emissions reduced using SCR and SNCR systems on the auxiliary boiler while firing natural gas will be 0.35 tons and 0.20 tons, respectively. Clearly, the incremental cost effectiveness of post-combustion NO_x emission control systems on the auxiliary boiler (dollars per ton of NO_x removed) will be extremely high for this project. Therefore, it is expected that low NO_x burners and combustion controls will be BACT for NO_x emissions control on the auxiliary boiler.

3.4.3.4 Sulfur Dioxide

CGCC UNITS

The NSPS established by EPA for emissions from CC units sets a maximum SO_2 level in the flue gas of 150 ppmvd or a maximum fuel sulfur content of 0.8 percent by weight (40 CFR 60, Subpart GG). Current BACT/LAER Clearinghouse documents do not list any coal-derived gas or fuel oil fired CC units that are required to use flue gas desulfurization (FGD) systems to meet SO_2 emission requirements.

Coal-derived gas and fuel oil sulfur contents are controlled through fuel-production process controls. Sulfur removal and recovery in CG units usually involve three processes:

- Acid gas removal
- Sulfur recovery
- Tail gas treating

Acid gas removal systems remove hydrogen sulfide, carbonyl sulfide, and carbon dioxide from the fuel gas using an acid gas absorbent solution. The resulting clean fuel gas is burned in the CGCC units. The acid gases are stripped from the absorbent solution and supplied to the sulfur recovery unit. A Claus sulfur recovery unit converts hydrogen sulfide to high purity elemental sulfur using a catalytic reaction. The reaction is performed in two stages. The first stage thermally oxidizes approximately one third of the hydrogen sulfide in the feed gas to SO_2. The SO_2 is then catalytically reduced along with the remaining feed gas. The products of the catalytic reaction are a vapor containing water and elemental sulfur. The sulfur is condensed

out of the gas and stored in a collection vessel. The remaining tail gases are sent to a tail gas cleaning system which converts the remaining sulfur products to hydrogen sulfide using another catalytic reaction. The hydrogen sulfide is again stripped from the gases and recycled back to the Claus system. The gases leaving the tail gas treatment system are fed to the CG thermal oxidation units. The sulfur removal efficiency in the acid gas removal system is approximately 98.5 percent. The overall sulfur removal efficiency for the tail gases going to the thermal oxidation units is approximately 99.9 percent.

Recent coal-gas fired CC unit performance tests on eastern bituminous coals resulted in CGCC unit SO_2 emission rates of 15 parts per million by volume wet (ppmvw) (EPRI). Recent permits for fuel oil fired CC units have included limits on maximum allowable fuel sulfur contents and fuel firing times. The CGCC units at the Polk County Site will burn fuel oil for back-up purposes only. Expected SO_2 emissions from the CGCC units while firing fuel oil (with a sulfur content of 0.05 percent by weight) will be 11 ppmvw. Therefore, BACT for SO_2 emissions from the CGCC units is assumed to be good sulfur removal efficiencies in the CG plant and low sulfur content fuels.

PC BOILERS

The NSPS established by EPA for emissions from large PC units (40 CFR 60 Subpart Da) sets a maximum SO_2 level in the flue gas of 0.60 lb/mmBtu as determined on a 30-day rolling average basis. FGD for PC fired boilers can be accomplished by either a wet lime or limestone scrubbing system, or a lime spray dryer system. A review of information contained in the EPA BACT/LAER Clearinghouse indicates that the most restrictive SO_2 removal permit requirement for a PC unit is 95 percent for a proposed installation in Nevada. FGD at that facility will be provided by a wet lime scrubber. Therefore, the most stringent SO_2 emissions control alternative for a PC fired source such as the PC boilers at the Polk County site would be a wet lime scrubber.

TECHNICAL ANALYSIS. A number of post-combustion FGD processes have demonstrated SO_2 removal capabilities for use downstream of a PC fired boiler. However, wet scrubber and spray dryer systems are the most widely used FGD systems.

Wet lime or limestone scrubbing and lime spray drying FGD systems have the advantage over other scrubbing systems because they use low cost widely available calcium based additives.

FGD alternatives using sodium based additives are not practical since the cost of sodium delivered to the Polk County site (approximately $250 to $300 per ton) would be prohibitive compared to the cost of lime or limestone ($70 and $15 per ton, respectively). In addition, the use of sodium based additives increases the complexity and cost of waste disposal due to the high solubility of sodium wastes (increased potential for groundwater contamination due to leachate problems). Considering economic as well as environmental issues, sodium based FGD alternatives are not feasible for use at the Polk County site.

Currently, 118 utility units in the United States with a combined capacity of 53,800 MWs are in operation with wet scrubbers using either lime or limestone. In addition, 17 utility units with a combined capacity of 10,500 MWs are under construction or under contract to use these wet scrubbing technologies. Lime and limestone wet scrubbers represent about 80 percent (MW basis) of the FGD system capacity in operation, under construction, or under contract in the United States.

During the last decade, the lime spray dryer process has been used on a number of new PC boiler installations burning low to moderate sulfur fuels. This FGD process absorbs SO_2 through the use of a spray absorber dryer module followed by a fabric filter. A benefit of the spray dryer process compared to wet scrubber FGD systems is the dry waste product, resulting in less complicated and less expensive waste disposal.

Both wet scrubbers and spray dryers are capable of SO_2 removal efficiencies greater than 95 percent. Because of the highly alkaline nature of lime, wet lime scrubbers are capable of up to 98 percent SO_2 removal. Considering an adequate control margin of 2 to 3 percent (to ensure reliability during process control upsets), a wet lime scrubber should be capable of meeting an outlet emission requirement of 0.29 lb/mmBtu (95 percent removal using worst case, 3.5 percent sulfur coal). Wet limestone scrubbers are capable of 96 to 97 percent SO_2 removal. Considering a 2 percent control margin, wet limestone scrubbers should be capable of meeting SO_2 emission requirements of 0.29 to 0.35 lb/mmBtu (95 to 94 percent removal using worst case coal).

The lime spray drying technology is capable of short term 96 percent removal using worst case coal (3.5 percent sulfur). Considering a control margin of 2 percent, lime spray dryers should be capable of maintaining compliance with an outlet emission requirement of 0.35 lb/mmBtu (94 percent removal).

Wet Lime. With a wet lime FGD system, flue gas exiting the air heater passes through a fabric filter and is directed by ID fans to the absorber modules (spray towers). The ID fans are located between the fabric filter and the absorber modules to minimize particulate erosion and water vapor condensation on fan internals.

Wet lime absorber modules serve as the contact zone where the alkaline additive absorbs the SO_2 from the flue gas. Recycle pumps spray the lime slurry counter-current to the direction of the flue gas flow. The resultant reaction products flow downward through the spray tower into the reaction tank while the flue gas flows out of the absorber module and into the stack.

The preparation of lime slurry is accomplished by the additive storage and preparation system. With this system, pebble lime is stored in silos to protect it from moisture. Lime from storage silos is hydrated in a slaker/classifier system for feed to the slurry storage tanks (24-hour capacity). Additive from the slurry storage tank is transported to absorber module reaction tanks by additive feed pumps.

To convert the liquid waste to a solid waste product for disposal, blowdown from the absorber module reaction tanks is pumped to a thickener for primary dewatering. The decanted water from the thickener is reused in the reaction tanks and to slurry additional lime, while the underflow from the thickener is pumped to vacuum filters for additional dewatering. Thickened sludge from the vacuum filters is mixed with fly ash to form a product suitable for transport and disposal. Wastes are transported by trucks to an on-site disposal area. If the waste products are sufficiently free of impurities (ie. chlorides and heavy metals) a salable wallboard grade gypsum may be produced.

Wet Limestone. With the exception of additive preparation, a wet limestone system is very similar to a wet lime system. Additive preparation differences are due to the low solubility of limestone allowing on-ground bulk storage and requiring ball mills for preparing additive slurry.

Spray Dryer Absorber. The lime spray dryer FGD system is a two-stage process that removes both sulfur dioxide and particulate from the flue gas through the use of a spray dryer/absorber followed by a fabric filter. The absorber modules serve as the initial contact zone where alkaline additive and SO_2 in the flue gas react to form dry reaction products. The majority of reaction products formed in the spray dryer flow out of the absorber modules and onto the fabric

filter for removal with the fly ash. The ID fans are located between the fabric filters and the stack to minimize particulate erosion on fan internals.

The absorber modules are sized on the basis of gas flow rate and residence time. Residence times of approximately 10 seconds have proved sufficient to ensure adequate reaction product drying. The atomizers, which disperse the additive slurry, are sized on the basis of additive and tempering water feed necessary to achieve the required SO_2 removal level and outlet gas temperature. Flue gas temperatures at the fabric filter inlet must be sufficiently high to avoid corrosion in the fabric filter and in other downstream equipment. Low flue gas temperatures can also cause condensation of cementatious fly ash materials on the filter bags, severely affecting bag life and fabric filter operation. Adjustment of the spray dryer module approach temperature (number of degrees that the spray dryer operates above the saturation temperature) determines the spray dryer module outlet gas temperature. The amount of water added to the slurry is adjusted to control the spray dryer module outlet gas temperature. For the same SO_2 removal efficiency, a higher approach temperature results in greater lime consumption. Lime consumption increases as a result of a reduction in the SO_2 removal reaction efficiency at the higher approach temperature. An approach temperature of 38°F results in a fabric filter inlet gas temperature of approximately 165°F. An inlet gas temperature of 165°F is sufficiently high to protect the fabric filter and other downstream equipment.

The preparation of lime for use as additive in a spray dryer FGD system is accomplished by the additive storage and preparation system. With this system, pebble lime is stored in silos to protect it from moisture. Lime from storage silos is hydrated in a slaker/classifier system for feed to the slurry storage tanks (24-hour capacity). Additive from the slurry storage tank is pumped to the additive feed tank.

Since a significant portion of the lime feed does not initially react with the SO_2 in the flue gas stream, a portion of the solids collected in the fabric filter are returned and mixed with fresh lime slurry so that unreacted lime or alkalinity contained in the fly ash can be utilized. The lime and recycled solids are blended in a recycle slurry mix tank and pumped to the additive feed tanks.

The solids collected in the fabric filter, which are not recycled, are collected in the solids storage silo and subsequently transported by trucks to an on-site disposal area.

ENERGY IMPACTS ANALYSIS. The lime spray dryer FGD system has the lowest energy demand of the FGD alternatives. At peak demand, this difference represents 1 to 2 percent of the total plant output. In the wet lime/limestone processes, the majority of energy consumption is attributed to reagent preparation and the higher pumping power requirements dictated by the liquid to gas (L/G) ratio required for these processes.

ENVIRONMENTAL IMPACTS ANALYSIS. One drawback common to each of the FGD processes evaluated is the large site requirement for by-product disposal. The wet lime and wet limestone processes produce a sludge that must be dewatered before disposal. However, if the waste sludge is sufficiently free of contaminants, a salable wallboard grade gypsum may be produced. Waste disposal from lime spray dryer systems are somewhat simpler than lime/limestone wet processes since spray dryer wastes are in a dry state. Unlike wet lime/limestone processes, dewatering and stabilization of scrubber sludge is not required.

SUMMARY OF EVALUATED TECHNOLOGIES. The following control technologies are ranked according to their control effectiveness

- Wet lime scrubber designed to achieve an SO_2 emission rate of 0.29 lb/mmBtu (95 percent SO_2 reduction) on a 30-day rolling average basis.
- Wet limestone scrubber system designed to achieve an SO_2 emission rate range between 0.29 and 0.35 lb/mmBtu (95 to 94 percent SO_2 reduction) on a 30-day rolling average basis.
- Lime spray dryer system designed to achieve an SO_2 emission rate of 0.35 lb/mmBtu (94 percent SO_2 reduction) on a 30-day rolling average basis.

RATIONALE FOR PROPOSED SO_2 BACT. The selection of BACT for SO_2 emissions will be based primarily upon the relative economics, environmental, and energy considerations of each system when the units are permitted. Recent permit decisions in the state of Florida have required 95 percent SO_2 removal for facilities burning coals similar to those proposed at the Polk County Site. In order to achieve comparable removal efficiencies and emission limits, wet scrubbers must be considered. Accordingly, it is assumed at this point that BACT for SO_2 emissions from the PC boilers is a wet scrubber system limiting SO_2 emissions to 0.29 lb/mmBtu.

CG PLANT THERMAL OXIDATION UNITS

The NSPS (40 CFR 60, Subpart J) to this project for Claus sulfur recovery plants at petroleum refineries, although not applicable, sets a maximum SO_2 level in the flue gas of the thermal oxidation unit at 250 ppmvd, corrected to zero percent excess air. The SO_2 emissions will be directly related to the sulfur removal efficiency of the Claus system and the tail gas treatment process. Recent experience with CG demonstration plants indicates that they can maintain at least a 96 percent overall sulfur removal efficiency during normal operation. The tail gas treatment process has typical sulfur removal efficiencies over 98 percent. This represents an overall sulfur removal efficiency of over 99.9 percent for the gases entering the thermal oxidation units. Estimated SO_2 emissions from the Polk County Site thermal oxidation units are 26 lb/hr per unit. Good sulfur collection and removal efficiencies in the Claus and tail gas treatment processes are assumed to be BACT for SO_2 emissions on the CG plant thermal oxidation units.

AUXILIARY BOILER

Subpart Dc of the NSPS limits SO_2 emissions to 0.5 lb/mmBtu for oil fired sources. BACT/LAER Clearinghouse documents (CARB, 1991 and 1992; U.S. EPA, 1985 and 1990) list the most stringent SO_2 determination for this source category as 0.05 lb/mmBtu for a proposed project in California. This facility burns residual fuel oil with a sulfur content of approximately 1.0 percent. Caustic scrubbers will be used at this facility to remove 95 percent of the SO_2. The Clearinghouse documents do not list any SO_2 emission limitations for Subpart Dc classification boilers that burn natural gas.

Emissions of SO_2 can be controlled by either limiting the sulfur content of the fuel, or by a post combustion flue gas desulfurization (FGD) system. Since the primary fuel for this facility will be natural gas and the unit will only operate for 100 hours per year, the addition of an FGD system to control emissions during fuel oil firing would be an excessive method of SO_2 control. Additionally, the fuel oil used at the Polk County Site will be low sulfur fuel oil (0.05 percent). SO_2 emissions from the auxiliary boiler while firing natural gas are expected to be negligible. SO_2 emissions while firing low sulfur fuel oil are expected to be 5.1 lb/hr. Therefore, use of natural gas, limited unit operation, and use of low sulfur fuel oil (0.05 percent) for back-up purposes only is BACT for SO_2 emissions control on the auxiliary boiler.

3.4.3.5 Sulfuric Acid Mist

CGCC UNITS

A review of BACT/LAER Clearinghouse documents did not reveal any post-combustion sulfuric acid mist (H_2SO_4) control technologies being used on CGCC units. Post combustion control technologies such as a FGD system could be used to reduce H_2SO_4 emissions. However, due to inherently low H_2SO_4 emissions, addition of an FGD system would be an extremely costly method of emission control. H_2SO_4 formation is directly proportional to the amount of sulfur in the fuel. As previously discussed in the CGCC SO_2 BACT section, the sulfur content of the fuel is controlled by the fuel-production process. The acid gas removal process is expected to remove 98.5 percent of the sulfur from the coal derived gas. The backup fuel oil will have a low sulfur content (0.05 percent). The H_2SO_4 emissions are estimated to be 21.7 lb/hr and 9.7 lb/hr per unit while burning coal-derived gas and fuel oil, respectively. Therefore, burning low sulfur fuels is BACT for sulfuric acid mist emissions on the CGCC units.

PC BOILERS

Sulfur trioxide, a precursor to H_2SO_4, is an acid and as such should react with either the $Ca(OH)_2$ or $CaCO_3$ available in the scrubber modules. A removal efficiency of approximately 50 percent can be expected from a wet scrubber. Acid mist emissions from the PC boilers are expected to average 260 lb/hr per unit. Therefore, SO_2 scrubbers are assumed to be BACT for sulfuric acid mist emissions on the PC boilers.

CG PLANT THERMAL OXIDATION UNITS

To date, no sulfuric acid mist control technologies have been used on tail gas thermal oxidation units. The Claus sulfur removal system and the tail gas treating process remove almost all of the sulfur from the gases going to the thermal oxidation units. Therefore, efficient sulfur collection in the upstream sulfur recovery processes is assumed to be BACT for the thermal oxidation units. Sulfuric acid mist emissions from the thermal oxidation units are estimated to be less then 0.4 lb/hr per stack.

AUXILIARY BOILER

Sulfuric acid mist emissions will be present only when fuels containing sulfur are being burned in the auxiliary boiler. BACT/LAER Clearinghouse documents do not list any emission limitations for sulfuric acid mist from Subpart Dc classification boilers. Sulfuric acid mist emissions from the auxiliary boiler are estimated to be 0.00099 lb/hr and 0.076 lb/hr while firing natural gas and low sulfur fuel oil (0.05 percent), respectively. Emission controls for sulfuric acid mist are the same as those used for SO_2. Therefore, use of natural gas, limited unit operation, and use of low sulfur fuel oil (0.05 percent) for back-up purposes only is BACT for sulfuric acid mist emissions from the auxiliary boiler.

3.4.3.6 Carbon Monoxide and Volatile Organic Compounds

CO and VOC's are formed by incomplete combustion of fossil fuels. Combustion controls such as high combustion temperatures, excess air, and good fuel/air mixing will minimize CO and VOC formation. NO_x formation, however, is increased by combustion control efforts to minimize CO and VOC emissions. Because of this inverse relationship, NO_x emission control technologies must always be considered when determining CO and VOC emission controls. Post-combustion control technologies such as an oxidation catalyst could reduce both CO and VOC emissions. The oxidation catalyst reduction efficiency for VOC's, however, is highly dependent upon the type of fuel burned and the temperature of the application. Ten percent or less of the higher molecular weight VOC's produced from fuel oil and coal combustion will oxidize in the presence of an oxidation catalyst.

CGCC UNITS

CGCC units have inherently low CO and VOC emissions. A review of control technology determinations (CARB 1991 and 1992, EPA 1985 and 1990) indicates that the lowest CO emission limit established to date for a CC unit is 2.0 ppmvd for a CC unit located in a non-attainment area in California. That permit value was based on the use of an oxidation catalyst system. The lowest VOC emission limit for a CC unit is 4.1 ppmvw for a unit in Rhode Island which is an ozone non-attainment area. An alternative to the oxidation catalyst system is to use combustion controls to limit CO and VOC emissions. Recent permit decisions for CGCC units in the state of Florida have required efficient combustion to control CO and VOC emissions.

TECHNICAL ANALYSIS. The CO and VOC oxidation catalyst process is based on a straight catalytic reaction requiring no additives. The reactions and catalysts used (platinum based) are similar to the catalytic oxidation technology used for automotive emission control. Products from the reaction include carbon dioxide and water. Catalytic oxidation systems are capable of CO reductions of between 50 and 80 percent. However, this reduction potential will be somewhat influenced by initial concentrations of the pollutants. VOC reduction efficiencies, as discussed previously, vary between 5 and 50 percent depending on the type of fuel being burned.

ENERGY IMPACTS ANALYSIS. Similar to the SCR system, use of a CO catalyst would result in a derate of approximately 0.42 (8 MWs) percent of CGCC output. Since power demand will remain constant, this derate will be replaced by a combustion source that likely has higher CO emissions than the CGCC units at the Polk County Site.

ENVIRONMENTAL IMPACTS ANALYSIS. A catalyst which oxidizes CO to CO_2 will also oxidize SO_2 to SO_3. While firing coal-derived gas or fuel oil, 50 to 60 percent of the SO_2 in the flue gas will be converted to SO_3. When found in high enough concentrations and when the SO_3 comes in contact with moisture, it will form sulfuric acid mist which can cause corrosion damage to downstream plant equipment and damage to surrounding vegetation. The sulfuric acid mist created will also increase particulate emissions from the facility.

Although CO has been well documented as a hazardous pollutant, significant international pressure is now being exerted to reduce CO_2 emission levels in response to the suspected contributions of the gas to global warming. A CO oxidation catalyst could increase the CO_2 emissions from the CGCC units by over 125 lb/hr per unit.

SUMMARY OF EVALUATED TECHNOLOGIES. The following control technologies are ranked according to their control effectiveness:

- Oxidation catalyst to reduce CO emissions by approximately 80 percent - VOC emissions will be reduced by less than 10 percent for coal-derived gas and fuel oil emissions.

- Combustion control to assure proper fuel mixing and complete fuel combustion

RATIONALE FOR PROPOSED CO AND VOC BACT. No NSPS limits have been set for CO or VOC emissions from CC units. In addition, the Polk County site is located in a CO

attainment area. To date, no precedent has been set in the state of Florida requiring CO catalysts on CGCC units. A CO catalyst will cause downstream equipment corrosion and increase particulate emissions due to sulfuric acid mist formation during coal-derived gas operation. A CO catalyst will also increase CO_2 emissions when burning any fuel. Estimated CO and VOC emissions from the CGCC units while firing coal-derived gas and fuel oil using combustion controls are only 100 and 12 lb/hr per unit, respectively, for coal-derived gas and only 96 and 11 lb/hr per unit, respectively, for fuel oil. Combustion controls are therefore assumed as BACT for the CGCC units.

PC BOILERS

No NSPS limits have been set for CO or VOC emissions from PC boilers.

Lower CO and VOC emissions are possible if boiler temperatures are increased. However, NO_x formation would increase. Therefore, consistent with the approach of evaluating BACT for CGCC units, increasing combustion temperatures to limit CO and VOC emissions is not an option.

As explained in the previous section, a catalytic CO and VOC emissions reduction method is available for use on the exhaust from CC units; however, this process has never been applied to a coal fired power plant. The catalytic reaction is effective at a temperature of approximately 700°F. In PC boilers, a temperature of 700°F is available prior to particulate removal, just upstream of the air heater. However, because of the potential for erosion and pluggage of the platinum catalyst by abrasive combustion products, and poisoning of the catalyst by trace metals in the fly ash, this process is unsuited to coal fired applications, and is, therefore, considered not technically feasible for the boilers. Estimated CO and VOC emissions from the PC boilers while using combustion controls are 0.15 lb/mmBtu and 0.015 lb/mmBtu, respectively. Combustion controls are, therefore, assumed as BACT for CO and VOC for the PC boilers.

CG PLANT THERMAL OXIDATION UNITS

No NSPS limits have been set for CO or VOC emissions from Claus sulfur recovery units.

CO emissions from the thermal oxidation units at the Polk County Site will be approximately 5 lb/hr per unit. VOC emissions are expected to be negligible. These emission rates are low enough to consider the thermal oxidation process as BACT.

AUXILIARY BOILER

No NSPS limits have been set for CO or VOC emissions from Subpart Dc classification sources.

As noted in the previous evaluations of CO and VOC emissions control, CO and VOC's are formed as a result of incomplete combustion of the fuel. Therefore, the control determination for NO_x must be taken into consideration when evaluating CO and VOC controls since NO_x formation is reduced by incomplete combustion. CO and VOC emissions are estimated to be 4.9 lb/hr and 0.5 lb/hr, respectively, while firing natural gas using low NO_x burners and combustion controls.

Catalytic oxidation is the primary post-combustion method for controlling CO and VOC emissions. The optimum flue gas temperature range for CO and VOC catalyst operation on a gas or oil fired boiler is between 850°F and 1,100°F. However, flue gas from the auxiliary boilers will typically be between 475°F to 620°F in the areas of the auxiliary boilers in which the catalyst can be located. Therefore, a CO and VOC catalyst is not technically feasible for use on the auxiliary boilers. Good combustion controls, therefore, represent BACT for CO and VOC emissions on the auxiliary boiler.

3.4.3.7 Particulate Matter (PM_{10}) Emissions.

CGCC UNITS

The fuels to be used in the proposed CGCC units will only contain trace quantities of noncombustible material. Therefore, emission of particulate matter from the facility will be controlled by filtering the turbine inlet air and ensuring as complete combustion of the fuel as possible. The NSPS for CC units does not establish an emission limit for particulate matter. A review of BACT/LAER Clearinghouse documents did not reveal any post-combustion particulate matter control technologies being used on CC units. The manufacturer's standard operating procedures will ensure as complete combustion of the fuel as possible. Particulate emissions from each CGCC unit will be 36 lb/hr and 17 lb/hr for coal-derived gas and fuel oil

firing, respectively. Accordingly, combustion control is assumed as BACT for particulate matter and PM_{10}.

PC BOILERS

The NSPS 40 CFR 60, Subpart Da limits particulate emissions from PC boilers to 0.03 lb/mmBtu, and opacity to a maximum of 20 percent. A review of information contained in the BACT/LAER Clearinghouse (1985 and 1990 editions) indicates that the most stringent particulate emission limit issued to date is a requirement of 0.012 lb/mmBtu for a proposed coal-fired project located in a particulate non-attainment area in California. This project will use a fabric filter to control particulate emissions. Recent permit decisions in the state of Florida have limited particulate emissions from PC boilers to 0.018 lb/mmBtu.

Two particulate removal systems have demonstrated removal efficiencies adequate to achieve NSPS emission requirements on PC fired boilers: electrostatic precipitators and fabric filters. Precipitators are very sensitive to coal properties and ash loadings. A precipitator sized to accommodate the range of coal quality and ash loadings anticipated for the source would be prohibitively expensive, and would not provide any advantage over fabric filters. In addition, fabric filters are more effective at limiting PM_{10} emissions. Since a significant number of trace element pollutants either form particles within this size range or are condensed onto particles within this size range, fabric filters will reduce toxic air emissions more effectively than precipitators. Therefore, as a result of the fabric filters' superior fuel flexibility and particulate collection capabilities, electrostatic precipitators are not considered for use at the Polk County site.

Fabric filters are effective in meeting NSPS particulate emission requirements. Fabric filters have been the control technology of choice on projects where the most stringent emission control is required. In addition, fabric filters are efficient at removing small particles (PM_{10}). Unlike precipitators, fabric filter design is not based on any physical properties of the fly ash.

Fabric filters use fabric bags as filters to collect particulate. The particulate-laden flue gas enters a fabric filter compartment and passes through a layer of particulate and filter bags. The collected particulate forms a cake on the bag which enhances the bag's filtering efficiency. Fabric filters are capable of limiting particulate emissions from the PC boilers to 0.018

lb/mmBtu. This emission rate is consistent with recent permit decisions in the state of Florida. Therefore, fabric filters are considered BACT for the PC boilers.

CG PLANT THERMAL OXIDATION UNITS

No NSPS limits have been set in Subpart J for particulate emissions from Claus sulfur recovery units.

The CG process uses ceramic filters to remove ash from the dry fuel in order to protect processing equipment and operating efficiency. In addition, a liquid absorption process is used to strip hydrogen sulfide in the tail gas system. This process assures that a negligible amount of particulate will enter the thermal oxidation units. Particulate emission rates from the thermal oxidation units are estimated to be 1.5 lb/hr per unit. No particulate control is required.

AUXILIARY BOILER

NSPS limits oil fired steam generating units with heat input capacities of 30 mmBtu/h or greater to an opacity limit of 20 percent. NSPS has no mass emission limits for particulate. BACT/LAER Clearinghouse documents (CARB, 1991 and 1992; U.S. EPA, 1985 and 1990) do not list any particulate emission limitations or control equipment requirements for Subpart Dc classification boilers that burn natural gas or distillate fuel oil.

The natural gas fuel to be used in the auxiliary boiler will contain only trace quantities of noncombustible material and fuel oil use will be limited to backup purposes only. Also, the auxiliary boiler will only be used for 100 hours per year. The emission of particulates from the auxiliary boiler can be controlled by ensuring as complete combustion of the fuel as possible. The use of a post-combustion particulate control device would be excessively expensive. Estimated particulate emissions from the auxiliary boiler will be 0.5 lb/hr and 5.0 lb/hr for natural gas and fuel oil firing, respectively. Accordingly, combustion control is proposed as BACT for particulate matter and PM_{10}.

BULK MATERIAL HANDLING SYSTEMS

Fugitive dust emissions may result from storage and handling of coal and limestone. Sources of fugitive dust emissions arise from the delivery and unloading, conveying, processing, and

storage of the bulk materials. Good engineering design and operating practices will be incorporated in the bulk material handling systems to minimize the fugitive emissions. These design and operating features include minimizing the number of material transfer points, enclosing conveyors and material drop points, using wet suppression systems or crusting agents to control emissions when materials are handled or stored in non-enclosed areas, and installing particulate collection devices, such as baghouses. Total coal and limestone fugitive dust emissions are estimated to be 15 lb/hr for the worst-case ultimate site development. Therefore, good engineering design and operating practices are assumed to be BACT for the bulk material handling systems.

3.4.3.8 Trace Pollutant Emissions

An additional requirement of BACT analyses is the evaluation of control technologies for lead, PSD noncriteria pollutants, and other trace air pollutants that may occur. It should be noted that there is still a great deal of uncertainty in estimating a number of the trace element emissions. Test requirements have only been dictated for a limited number of installations over the last several years. Therefore, it is difficult to estimate these emissions with a great deal of confidence. However, based on limited fuel quality and test data, and general chemical properties, it is possible to estimate potential emissions.

CGCC UNITS

Tables 3.4.3-1 and 3.4.3-2 present uncontrolled emission estimates for hazardous pollutants not listed with lead and the noncriteria pollutants in Tables 3.4.1-1 and 3.4.1-2. These pollutants will be emitted from the CGCC units when burning coal-derived gas and fuel oil. For coal-derived gas, the trace pollutants were originally in the solid coal ash and either volatilized with the carbon or carried to the CGCC units with the ash in the gas. For fuel oil, these pollutants are either contained in the fuel oil ash or dissolved in the liquid oil. A review of BACT/LAER Clearinghouse documents did not reveal any CC projects which have been required to install supplemental pollution control equipment to specifically reduce trace pollutant emissions. Almost all of the trace pollutants identified as potential emissions from the CGCC units are non-organic. These pollutants will either be volatilized upon combustion or carried in the turbine exhaust gas as PM_{10} particulate matter. The volatilized trace elements, metals in particular, may condense onto the fine particulate as the flue gas temperature decreases. The only identified methods of controlling the emission of these pollutants from the CGCC units are trace element

removal in the CG process and complete combustion of the fuel. Accordingly, combustion control and good CG facility performance is assumed as BACT for the listed pollutants. This will be consistent with the BACT determination for particulate emission control.

PC BOILERS

Table 3.4.3-3 presents controlled emission estimates for other hazardous pollutants likely to be emitted from the PC boilers. These trace pollutants were not listed with lead and the noncriteria pollutants in Table 3.4.1-3. These trace pollutants are contained in the fuel and are either volatilized in the combustion chamber or carried with the fine particulate in the flue gas.

Trace emissions from the PC boilers will likely include many of the non-organic emissions expected to be emitted from the CGCC units. However, the PC boilers are also likely to emit organic compounds such as formaldehyde. Organic pollutants are predominately controlled by ensuring complete fuel combustion.

In addition to the organic pollutants, the PC boilers are also likely to emit acidic trace pollutants. The acidic trace pollutants, such as hydrogen fluoride, will be removed when contacted with alkaline based reagents in the flue gas desulfurization system.

The majority of the trace metals listed in Table 3.4.3-3 condense from the flue gas onto fly ash particles at air heater outlet temperatures. As mentioned previously, these elements preferentially condense onto fine particulate. This is due to the higher relative surface area available. Therefore, to a large degree, heavy metal trace pollutant emissions can be controlled by control of fine particulate emissions. A fabric filter with properly conditioned bags can attain removal efficiencies greater than 99 percent for particulate in the size range from 0.01 to 100 microns. Accordingly, fabric filters are an effective control technology for trace pollutants found in the fine particulate.

Of all the regulated trace pollutants emitted from PC units, mercury is the most difficult to control. Test data from wet scrubber systems on municipal solid waste (MSW) fired facilities indicate that mercury removal efficiencies can range from 70 percent, to as high as 95 percent (Getz et al.). However, mass balances around tested systems have occasionally failed to close; indicating additional mercury could be entering the system from such sources as the water or combustion air. Also, tests on European and U.S. MSW facilities equipped with spray dryers

have documented additional mercury removal from the flue gas by injection of activated carbon prior to the spray dryers (White et al.). However, there is no experience with this technology on coal fired boilers and uncertainties exist with respect to the speciation of mercury in coal fired power plants. These differences do not allow for a direct comparison of control efficiencies between the two combustion sources.

In summary, good combustion, particulate removal, and FGD system performance are the only technically feasible methods of controlling hazardous air pollutants in utility coal fired boilers. Accordingly, complete combustion of the coal and use of a fabric filter followed by a FGD system is assumed as BACT for trace pollutant emissions.

CG PLANT THERMAL OXIDATION UNITS

Table 3.4.3-4 presents uncontrolled emission estimates for other regulated and hazardous pollutants from the thermal oxidation units. As with the other sources at the Polk County Site, trace pollutant emissions from the thermal oxidation units will predominantly depend on the gas entering the units. The only viable technology for controlling trace pollutant emissions from the thermal oxidation units is efficient design and operation of the gasification process. Therefore, efficient process design and control are assumed to be BACT for trace pollutant emissions from the thermal oxidation units.

AUXILIARY BOILER

Table 3.4.3-5 presents uncontrolled emission estimates for hazardous pollutants not listed with lead and the noncriteria pollutants in Table 3.4.1-5. The trace pollutants are either contained in the fuel ash or, for fuel oil, dissolved in the liquid oil. Natural gas contains essentially no ash. Therefore, with the exception of benzene and formaldehyde, natural gas does not contain hazardous trace pollutants. Typically, trace pollutants in the fuel will either volatilize upon combustion or be carried as solid particles with the fine particulate (PM_{10}). If temperature and pressure conditions are suitable, the volatilized pollutants will condense onto the fine particulate in the flue gas. Therefore, the only feasible methods of controlling the emission of these trace pollutants is using the same technology used for controlling PM_{10} emissions. Accordingly, combustion control is considered BACT for trace pollutant emissions from the auxiliary boiler.

3.4.3.9 Summary

Tables 3.4.2-1 through 3.4.2-5 summarize the control technologies that are assumed to be BACT for the pollutants subject to PSD review at the Polk County Site.

3.4.4 Design Data for Control Equipment

Control equipment design information is included as part of the BACT analyses contained in Section 3.4.3. Pollutant emission rates and specific control technologies are summarized in Tables 3.4.2-1 through 3.4.2-5.

The CGCC units will be designed to minimize NO_x formation by the use of combustion controls and low NO_x burners. Water will be injected into the combustion zones to lower combustion temperatures and limit NO_x formation, when required. The annual emissions of other regulated pollutants which might be emitted from the CGCC units in quantities subject to PSD review (SO_2, CO, particulate matter [PM_{10}], VOCs, H_2SO_4, and beryllium) will be controlled by limiting the amount of fuel oil burned annually, limiting the sulfur content of the fuel, efficient operation of the CG facility, and utilizing good combustion control of the units.

The PC boilers will be designed to minimize NO_x formation by the use of combustion controls, low NO_x burners, and a post-combustion NO_x reduction system. CO and VOC emissions will be controlled by utilizing good combustion control of the units. SO_2, H_2SO_4, particulate matter [PM_{10}], and trace element pollutants will be controlled through the use of a fabric filter and wet FGD system.

The CG plant thermal oxidation units will be designed to minimize NO_x and CO formation through the use of good combustion controls and low NO_x burners. The annual emissions of other regulated pollutants which might be emitted from the thermal oxidation unit in quantities subject to PSD review (SO_2) will be controlled by ensuring good design and operation of the gasification process.

Annual pollutant emissions from the auxiliary boiler will be minimized by limiting the unit to 100 hours of operation per year. NO_x, CO, and VOC emissions will also be limited by using combustion controls and low NO_x burners. SO_2 and H_2SO_4 emissions will be limited by burning

natural gas or low sulfur fuel oil (0.05 percent sulfur). All other regulated pollutants will be limited through good combustion equipment design and operation.

Fugitive dust emissions from the bulk material handling systems will be controlled through good engineering design and operation of the respective system.

3.4.5 Design Philosophy

Air quality control system designs are determined based on conservative design parameters. The parameters are developed to ensure that the air quality control system performance meets or exceeds the requirements specified by state and federal regulatory NSPS. Critical equipment that may affect the overall system reliability will have spare units in place to assure continuous operation. In addition, the application of top-down BACT (i.e., the evaluation of technical/engineering, economic, and environmental considerations) is used to determine appropriate air emission control technologies. The BACT analysis, contained in Subsection 3.4.3, results in the selection of the best air quality control system for the particular site.

3.4.6 References

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TABLE 3.4.1-1
COAL GASIFICATION COMBINED CYCLE UNITS (3,000 MW)
POLLUTANT EMISSION RATES
(CASE A)

Pollutant	Coal-Derived Gas		Fuel Oil	
	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Carbon Monoxide	1,200	5,256	1,152	288
Nitrogen Oxides	1,956	8,567	3,816	954
Sulfur Dioxide	2,328	10,197	1,106	277
Particulate (PM/PM_{10})	432	1,892	204	51
Volatile Organic Compounds	144	631	134	34
Lead	3.3	14.45	0.192	0.048
Asbestos	N/A	N/A	N/A	N/A
Beryllium	0.0165	0.072	0.054	0.0135
Mercury	0.269	1.16	0.066	0.0165
Vinyl Chloride	N/A	N/A	N/A	N/A
Total Fluorides	Negligible	Negligible	Negligible	Negligible
Sulfuric Acid Mist	260	1,141	108	27
Hydrogen Sulfide	N/A	N/A	N/A	N/A
Total Reduced Sulfur	N/A	N/A	N/A	N/A
Benzene	Negligible	Negligible	N/A	N/A
Arsenic	0.19	0.83	0.091	0.022
Radionuclides	N/A	N/A	N/A	N/A

Notes:
1. Emission rates are based on performance data for twelve GE Frame 7F CC units operating at 100 percent capacity, 40°F, and 70 percent relative humidity with water injection. Other manufacturers' units may be utilized provided emission rates are equal to or less than those represented.
2. Coal-derived gas emission rates are based on 8,760 hours of operation per year burning an eastern bituminous coal-derived gas.
3. Fuel oil emission rates are based on 500 hours of operation per year, burning No. 2 fuel oil with a sulfur content of 0.05 percent by weight.
4. Worst case annual emissions for some pollutants are a combination of fuel usages.

N/A = Not applicable to this type of system

Source: Black & Veatch, 1992

TABLE 3.4.1-2
COAL GASIFICATION COMBINED CYCLE UNITS (2,000 MW)
POLLUTANT EMISSION RATES
(CASE B)

Pollutant	Coal-Derived Gas		Fuel Oil	
	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Carbon Monoxide	800	3,504	768	192
Nitrogen Oxides	1,304	5,712	2,544	636
Sulfur Dioxide	1,552	6,798	737	184
Particulate (PM/PM_{10})	288	1,261	136	34
Volatile Organic Compounds	96	420	90	22
Lead	2.2	9.64	0.128	0.032
Asbestos	N/A	N/A	N/A	N/A
Beryllium	0.011	0.048	0.036	0.009
Mercury	0.176	0.77	0.044	0.011
Vinyl Chloride	N/A	N/A	N/A	N/A
Total Fluorides	Negligible	Negligible	Negligible	Negligible
Sulfuric Acid Mist	174	760	72	18
Hydrogen Sulfide	N/A	N/A	N/A	N/A
Total Reduced Sulfur (including H_2S)	N/A	N/A	N/A	N/A
Benzene	Negligible	Negligible	Negligible	Negligible
Arsenic	0.13	0.56	0.061	0.015
Radionuclides	N/A	N/A	N/A	N/A

Notes:
1. Emission rates are based on performance data for eight GE Frame 7F CC units operating at 100 percent capacity, 40°F, and 70 percent relative humidity with water injection. Other manufacturers' units may be utilized provided emission rates are equal to or less than those represented.
2. Coal-derived gas emission rates are based on 8,760 hours of operation per year burning an eastern bituminous coal-derived gas.
3. Fuel oil emission rates are based on 500 hours of operation per year burning No. 2 fuel oil with a sulfur content of 0.05 percent by weight.
4. Worst case annual emissions for some pollutants are a combination of fuel usages.

N/A = Not applicable to type of system

Source: Black & Veatch, 1992

TABLE 3.4.1-3
PULVERIZED COAL UNITS (1,200 MW)
POLLUTANT EMISSION RATES
(CASE B)

Pollutant	Emission Rate (lb/hr)	Annual Emission (tpy)
Carbon Monoxide	1,784	7,814
Nitrogen Oxides	2,021	8,852
Sulfur Dioxide	3,448	15,103
Particulate (PM/PM_{10})	283	1,042
Volatile Organic Compounds	178	780
Lead	0.20	0.87
Asbestos	Negligible	Negligible
Beryllium	0.0013	0.0057
Mercury	0.12	0.52
Vinyl Chloride	Negligible	Negligible
Total Fluorides	0.914	4.00
Sulfuric Acid Mist	520	2,278
Hydrogen Sulfide	Negligible	Negligible
Total Reduced Sulfur (including H_2S)	Negligible	Negligible
Benzene	Negligible	Negligible
Arsenic	0.205	0.898
Radionuclides	1.31μ/Ci/hr	11.5mCi/yr

Notes:
1. Pollutant emission rates are based on two 600 MW PC steam electric power plants (5,945 mmBtu/hr per unit).
2. Pollutant emission rates based on eastern bituminous coal.
3. Emission rates listed are representative of emissions from similar types of facilities.

Source: Black & Veatch, 1992

TABLE 3.4.1-4
COAL GASIFICATION PLANT
THERMAL OXIDATION UNITS
POLLUTANT EMISSION RATES

Pollutant	Case A		Case B	
	Emission Rate (lb/hr)	Annual Emission (tpy)	Emission Rate (lb/hr)	Annual Emission (tpy)
Carbon Monoxide	27	118	18	78
Nitrogen Oxides	342	1,498	228	999
Sulfur Dioxide	153	670	102	447
Particulate	9	39	6	26
Volatile Organic Compounds	Negligible	Negligible	Negligible	Negligible
Lead	0.012	0.052	0.008	0.035
Beryllium	0.0002	0.0009	0.0001	0.0006
Mercury	0.039	0.17	0.026	0.11
Total Fluorides	Negligible	Negligible	Negligible	Negligible
Sulfuric Acid Mist	2.3	10.0	1.5	6.7
Benzene	Negligible	Negligible	Negligible	Negligible
Arsenic	0.007	0.031	0.005	0.021
Radionuclides	Negligible	Negligible	Negligible	Negligible

Notes:
1. Emission rates are based on published performance data from similar types of facilities (EPRI). Unit operation is assumed to be at 100 percent capacity, 8,760 hours per year.
2. Case A is based on six units supporting a 3,000 MW CG facility.
3. Case B is based on four units supporting a 2,000 MW CG facility.

Source: Black & Veatch, 1992

TABLE 3.4.1-5
AUXILIARY BOILER
POLLUTANT EMISSION RATES

Pollutant	FUEL			
	Natural Gas		Fuel Oil	
	(lb/hr)	(TPY)	(lb/hr)	(TPY)
Carbon Monoxide	4.9	0.25	4.9	0.25
Nitrogen Oxides	9.9	0.50	19.8	0.99
Sulfur Dioxide	0.0641	0.0032	5.27	0.26
Particulate	0.50	0.025	4.9	0.25
Volatile Organic Compounds	0.50	0.025	0.99	0.05
Lead	Negligible	Negligible	0.000881	0.000044
Asbestos	Negligible	Negligible	Negligible	Negligible
Beryllium	Negligible	Negligible	0.00025	0.000013
Mercury	Negligible	Negligible	0.000293	0.000015
Vinyl Chloride	Negligible	Negligible	Negligible	Negligible
Total Fluorides	Negligible	Negligible	Negligible	Negligible
Sulfuric Acid Mist	0.00099	0.0000495	0.082	0.0041
Hydrogen Sulfide	Negligible	Negligible	Negligible	Negligible
Total Reduced Sulfur (including H_2S)	Negligible	Negligible	Negligible	Negligible
Benzene	0.0067	0.00033	Negligible	Negligible
Arsenic	Negligible	Negligible	0.000415	0.00002
Radionuclides	Negligible	Negligible	Negligible	Negligible

Notes:
1. Pollutant emission rates are based on one 80,000 lb/hr, 99 mmtu/hr auxiliary boiler. Natural gas is assumed to be the primary fuel. Unit will be in compliance with FDER Rule 17-2.600.
2. Fuel oil sulfur content assumed to be 0.05 percent by weight.
3. Emission rates listed are representative of actual emissions from similar types of facilities.
4. Annual emissions are based on a maximum of 100 hours of operation per year.

Source: Black & Veatch, 1992

TABLE 3.4.1-6
DIESEL GENERATOR
POLLUTANT EMISSION RATES

Pollutant	Emission Rate	
	(lb/hr)	(tpy)
Carbon Monoxide	12	0.60
Nitrogen Oxides	53	2.65
Sulfur Dioxide	0.91	0.044
Particulate	0.48	0.024
Volatile Organic Compounds	0.27	0.014
Lead	0.00016	0.000008
Asbestos	Negligible	Negligible
Beryllium	0.000044	0.0000022
Mercury	0.000052	0.0000026
Vinyl Chloride	Negligible	Negligible
Total Fluorides	Negligible	Negligible
Sulfuric Acid Mist	0.014	0.00065
Hydrogen Sulfide	Negligible	Negligible
Total Reduced Sulfur (including H_2S)	Negligible	Negligible
Benzene	Negligible	Negligible
Arsenic	0.000073	0.0000037

Notes: 1. Pollutant emission rates are based on one 1,300 kW diesel generator operating at 100 percent capacity and a maximum of 100 hours per year.
2. Maximum fuel sulfur content assumed to be 0.05 percent by weight.
3. Emission rates listed are representative of emissions from similar types of facilities.

Source: Black & Veatch, 1992

TABLE 3.4.1-7
EMERGENCY FLARES
POLLUTANT EMISSION RATES

Pollutant	Emission Rate			
	Case A		Case B	
	(lb/h)	(tpy)	(lb/h)	(tpy)
Carbon Monoxide	327	1.3	327	0.87
Nitrogen Oxides	114.5	0.46	114.5	0.31
Sulfur Dioxide	2,874	11.5	2,874	7.7
Particulate (PM/PM_{10})	73	0.29	73	0.19
Volatile Organic Compounds	24	0.096	24	0.064
Lead	0.55	0.0022	0.55	0.0015
Asbestos	Negligible	Negligible	Negligible	Negligible
Beryllium	0.0028	0.000011	0.0028	0.000007
Mercury	0.047	0.00019	0.047	0.00013
Total Fluorides	Negligible	Negligible	Negligible	Negligible
Sulfuric Acid Mist	44	0.18	44	0.12
Hydrogen Sulfide	Negligible	Negligible	Negligible	Negligible
Total Reduced Sulfur (including H_2S)	Negligible	Negligible	Negligible	Negligible
Benzene	Negligible	Negligible	Negligible	Negligible
Arsenic	0.032	0.000128	0.032	0.000085
Radionuclides	Negligible	Negligible	Negligible	Negligible

Notes:
1. Emission rates based on one flare, typical startup/shutdown sequence, normalized to hourly rate.
2. Annual emissions based on one startup sequence per flare per year. Case A based on six flares. Case B based on four flares.
3. Emission rates listed are representative of emission levels from similar types of facilities.
4. Flare efficiency has been assumed at 98 percent.

Source: Black & Veatch, 1992

TABLE 3.4.1-8
BULK MATERIAL HANDLING SYSTEMS
FUGITIVE DUST EMISSION RATES

Dust Type	Total Suspended Particulate Emissions		PM_{10} Emissions	
	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Coal	13.3	23.4	0.78	1.37
Limestone	1.2	0.47	0.07	0.03

Notes: 1. Emission rates based on worst-case development scenarios of three CG plants and two PC boilers. Emission factors and control efficiencies from EPA reference document AP-42. Hourly rates are based on worst-case emissions. Annual emissions are based on nominal rates, 8,760 hours per year.

Source: Black & Veatch, 1992

TABLE 3.4.1-9
SIGNIFICANT EMISSION RATE THRESHOLDS

Pollutant	Rate (tons per year)
Carbon Monoxide	100
Nitrogren Oxides	40
Sulfur Dioxide	40
Particulate Matter (PM)	
TSP	25
PM_{10}	15
VOC	40
Lead	0.6
Asbestos	0.007
Beryllium	0.0004
Mercury	0.1
Vinyl Chloride	1
Total Fluorides	3
Sulfuric Acid Mist	7
Hydrogen Sulfide	10
Total Reduced Sulfur	10
Benzene	Any
Inorganic Arsenic	Any
Radionuclides	Any

Source: 40 CFR 51.24 Prevention of Significant Deterioration of Air Quality and Table 500-2 contained in F.A.C. 17-2500(2)(e)(2).

TABLE 3.4.2-1
COAL GASIFICATION COMBINED CYCLE UNITS
SUMMARY OF PRELIMINARY BACT ANALYSIS

Pollutant	Emission Rate (CG/FO) (lb/hr)		Control Technology
	Case A	Case B	
Carbon Monoxide	1,200/1,152	800/768	Advanced design combustion control.
Nitrogen Oxide	1,956/3,816	1,304/2,544	Advanced design combustion control and water injection when required while burning coal-derived gas and fuel oil. Limited annual fuel oil operation.
Sulfur Dioxide	2,328/1,106	1,552/737	Good design and operation of CG sulfur recovery process and low fuel oil sulfur content (0.05 percent).
Particulate	432/204	288/136	Advanced design combustion control and good CG facility performance.
Volatile Organic Compounds	144/134	96/90	Advanced design combustion control.
Lead	3.3/0.192	2.2/0.128	Advanced design combustion control and good CG facility performance.
Beryllium	0.0165/0.054	0.011/0.036	Advanced design combustion control and good CG facility performance.
Mercury	0.269/0.066	0.176/0.044	Advanced design combustion control and good CG facility performance.
Sulfuric Acid Mist	260/108	174/72	Good design and operation of CG sulfur recovery process and low fuel oil sulfur content (0.05 percent).
Arsenic	0.19/0.091	0.13/0.06	Advanced design combustion control and good CG facility performance.

Notes:

1. Emission rates based on G.E. Frame 7F CC units operating at 40° F and 80 percent relative humidity. Other manufacturers' units may be utilized provided emission rates are equal to or less than those represented. Case A includes 12 CGCC units. Case B includes 8 CGCC units.
2. The control technologies listed are assumed BACT for the CGCC units. The facility will be subject to actual PSD review at a later date.

Source: Black & Veatch, 1992

TABLE 3.4.2-2
PULVERIZED COAL UNITS
SUMMARY OF PRELIMINARY BACT ANALYSIS

Pollutant	Emission Rate (lb/hr)	Control Technology
Carbon Monoxide	1,784	Advanced design combustion control.
Nitrogen Oxides	2,021	Advanced design combustion control and post-combustion ammonia injection technology.
Sulfur Dioxide	3,448	Post-combustion FGD system.
Particulate	238	Fabric filter.
Volatile Organic Compounds	178	Advanced design combustion control.
Lead	0.20	Advanced design combustion control, post-combustion FGD system, and fabric filter.
Beryllium	0.0013	Advanced design combustion control, post-combustion FGD system, and fabric filter.
Mercury	0.12	Advanced design combustion control, post-combustion FGD system, and fabric filter.
Fluoride	0.914	Advanced design combustion control, post-combustion FGD system, and fabric filter.
Sulfuric Acid Mist	520	Post-combustion FGD system with fabric filter.
Arsenic	0.205	Advanced design combustion control, post-combustion FGD system, and fabric filter.
Radionuclides	1.31 μCi/hr	Advanced design combustion control, post-combustion FGD system, and fabric filter.

Notes: 1. Emission rates based on two 600 MW PC steam electric power plants (5,945 MBtu/hr per unit) burning eastern bituminous coal.
2. Emission rates listed are representative of emissions from similar types of facilities.

Source: Black & Veatch, 1992

TABLE 3.4.2-3
COAL GASIFICATION PLANT
THERMAL OXIDATION UNITS
SUMMARY OF PRELIMINARY BACT ANALYSIS

Pollutant	Emission Rate (lb/hr)		Control Technology
	Case A	Case B	
Carbon Monoxide	27	18	Advanced design combustion control.
Nitrogen Oxides	342	228	Advanced design combustion control.
Sulfur Dioxide	153	102	Good design and operation of CG sulfur recovery process.
Particulate	9	6	Good design and operation of CG facility.
Lead	0.012	0.008	Good design and operation of CG facility.
Beryllium	0.0002	0.0001	Good design and operation of CG facility.
Mercury	0.039	0.026	Good design and operation of CG facility.
Sulfuric Acid Mist	2.3	1.5	Good design and operation of CG sulfur recovery process.
Arsenic	0.007	0.005	Good design and operation of CG facility.

Notes:

1. Emission rates based on published performance data from similar types of facilities.
2. Case A emission rates based on six units supporting a 3,000 MW CG facility.
3. Case B emission rates based on four units supporting a 2,000 MW CG facility.

Source: Black & Veatch, 1992

TABLE 3.4.2-4
AUXILIARY BOILER
SUMMARY OF PRELIMINARY BACT ANALYSIS

Pollutant	Emission Rate (CG/FO) (lb/hr)	Control Technology
Carbon Monoxide	4.9/4.9	Advanced design combustion control.
Nitrogen Oxide	9.9/19.8	Low NO_x burners and advanced design combustion control.
Sulfur Dioxide	0.0641/5.27	Low fuel oil sulfur content (0.05 percent) and limited annual fuel oil operation.
Particulate	0.5/4.9	Advanced design combustion control.
Volatile Organic Compounds	0.5/0.99	Advanced design combustion control.
Lead	Negligible/0.000881	Advanced design combustion control.
Beryllium	Negligible/0.00025	Advanced design combustion control.
Mercury	Negligible/0.0030	Advanced design combustion control.
Sulfuric Acid Mist	0.00099/0.082	Low fuel oil sulfur content (0.05 percent) and limited annual fuel oil operation.
Benzene	0.00673/Negligible	Advanced design combustion control.
Arsenic	Negligible/0.000415	Advanced design combustion control.

Notes:

1. Pollutant emission rates are based on one 80,000 lb/hr, 99 mmBtu/hr auxiliary boiler. Natural gas is assumed to be the primary fuel. Unit will be in compliance with FDER Rule 17-2600.
2. Fuel oil sulfur content assumed to be 0.05 percent by weight.
3. The control technologies listed are assumed BACT for the auxiliary boiler. The facility will be subject to actual PSD review at a later date.

Source: Black & Veatch, 1992

TABLE 3.4.2-5
BULK MATERIAL HANDLING SYSTEMS
SUMMARY OF PRELIMINARY BACT ANALYSIS

Pollutant	Emission Rate (TSP/PM_{10}) (lb/hr)	Control Technology
Particulate		
Coal	13.3/0.78	Good engineering design and operating practice.
Limestone	1.2/0.07	Good engineering design and operating practice.

Notes:

1. Emission rates based on worst-case development scenarios of three CG plants and two PC boilers. Emission factors and control efficiencies from EPA reference document AP-42.

2. The control technologies listed are assumed BACT for the bulk materials handling systems. The facility will be subject to actual PSD review at a later date.

Source: Black & Veatch, 1992

TABLE 3.4.3-1
COAL GASIFICATION COMBINED CYCLE UNITS
OTHER REGULATED AND HAZARDOUS POLLUTANT EMISSIONS
(CASE A)

Pollutant	Coal-Derived Gas		Fuel Oil	
	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Antimony	0.0762	0.334	0.012	0.0029
Arsenic	0.19	0.83	0.091	0.022
Barium	0.743	3.25	0.00058	0.00015
Benzene	Negligible	Negligible	Negligible	Negligible
Beryllium	0.0165	0.072	0.054	0.0135
Boron	N/A	N/A	1.41	0.352
Cadmium	0.0762	0.334	0.238	0.0594
Chromium	2.76	12.1	1.04	0.259
Cobalt	0.105	0.459	0.35	0.086
Copper	0.733	3.21	6.05	1.51
Formaldehyde	Negligible	Negligible	8.86	2.22
Lead	3.3	14.45	0.192	0.048
Magnesium	N/A	N/A	5.01	1.25
Manganese	0.229	1.00	0.303	0.0757
Mercury	0.269	1.16	0.066	0.0165
Nickel	1.24	5.42	3.67	0.919
Selenium	0.314	1.38	0.526	0.132
Vanadium	N/A	N/A	1.50	0.358
Zinc	8.38	36.7	2.72	0.679

Notes: 1. Coal-derived gas annual emissions based on 12 CC units operating 8,760 hours per year firing coal-derived gas at 40° F and 80 percent relative humidity.

2. Fuel oil annual emissions are based on 12 CC units operating for 500 hours per year firing fuel oil at 40° F and 80 percent relative humidity.

N/A = Not Available

Sources: EPRI (Electric Power Research Institute). 1990. Cool Water Coal Gasification Program: Final Report. Palo Alto, California. December, 1990.

EPA (U.S. Environmental Protection Agency). 1988. Toxic Air Pollutant Emission Factors -- A Compilation for Selected Air Toxic Compounds and Sources. EPA/450/2-88/006a. October, 1988.

EPA. 1989. Estimating Air Toxics Emissions from Coal and Oil Combustion Sources. EPA/450/2-89-001. April, 1989.

TABLE 3.4.3-2
COAL GASIFICATION COMBINED CYCLE UNITS
OTHER REGULATED AND HAZARDOUS POLLUTANT EMISSIONS
(CASE B)

Pollutant	Coal-Derived Gas		Fuel Oil	
	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Antimony	0.051	0.223	0.0078	0.0020
Arsenic	0.13	0.56	0.061	0.015
Barium	0.495	2.17	0.00039	0.00010
Benzene	Negligible	Negligible	Negligible	Negligible
Beryllium	0.011	0.048	0.036	0.009
Boron	N/A	N/A	0.937	0.234
Cadmium	0.0508	0.223	0.158	0.0395
Calcium	N/A	N/A	10.76	2.69
Chromium	1.84	8.06	0.692	0.173
Cobalt	0.0698	0.306	0.23	0.058
Copper	0.489	2.14	4.034	1.009
Formaldehyde	Negligible	Negligible	5.908	1.477
Lead	2.2	9.64	0.128	0.032
Magnesium	N/A	N/A	3.34	0.835
Manganese	0.152	0.667	0.202	0.050
Mercury	0.176	0.77	0.44	0.011
Nickel	0.825	3.62	2.449	0.612
Selenium	0.210	0.918	0.351	0.0877
Vanadium	N/A	N/A	1.00	0.251
Zinc	5.59	24.5	1.81	0.453

Notes: 1. Coal-derived gas annual emissions based on eight CC units operating 8,760 hours per year firing coal-derived gas at 40°F and 80 percent relative humidity.

2. Fuel oil annual emissions are based on eight CC units operating for 500 hours per year firing fuel oil at 40°F and 80 percent relative humidity.

N/A = Not Available

Sources: EPRI (Electric Power Research Institute). 1990. Cool Water Coal Gasification Program: Final Report. Palo Alto, California. December, 1990.

EPA (U.S. Environmental Protection Agency). 1988. Toxic Air Pollutant Emission Factors – A compilation for Selected Air Toxic Compounds and Sources. EPA/450/2-88/006a. October, 1988.

EPA. 1989. Estimating Air Toxics Emissions from Coal and Oil Combustion Sources. EPA/450/2-89-001. April, 1989.

TABLE 3.4.3-3
PULVERIZED COAL UNITS
OTHER REGULATED AND HAZARDOUS POLLUTANT EMISSIONS

Pollutant	Emission Rates	
	(lb/hr)	(tpy)
Antimony	0.016	0.070
Arsenic	0.205	0.898
Barium	1.95	8.61
Benzene	Negligible	Negligible
Beryllium	0.0013	0.0057
Boron	N/A	N/A
Cadmium	0.019	0.083
Calcium	N/A	N/A
Chromium	0.025	0.111
Cobalt	0.639	2.80
Copper	0.285	1.248
Formaldehyde	0.302	1.323
Lead	0.20	0.87
Magnesium	N/A	N/A
Manganese	0.547	2.396
Mercury	0.12	0.52
Nickel	0.809	3.541
Selenium	0.449	1.97
Vanadium	1.74	7.62
Zinc	4.91	21.5

Notes: 1. Pollutant emission rates are based on two 600 MW PC steam electric power plants (5,945 MBtu/hr per unit).

2. Pollutant emission rates based on eastern bituminous coal.

N/A = Not Available

Sources: EPA (U.S. Environmental Protection Agency). 1989. Estimating Air Toxics Emissions from Coal and Oil Combustion Sources. EPA-450/2-89-001. April, 1989.

Valkovic, V. 1983. Trace Elements in Coal; Vol. I, CRC Press, Inc. Boca Raton, Florida.

TABLE 3.4.3-4
COAL GASIFICATION PLANT
THERMAL OXIDATION UNITS
OTHER REGULATED AND HAZARDOUS POLLUTANT EMISSIONS

Pollutant	Case A		Case B	
	Emission Rate (lb/hr)	Annual Emission (tpy)	Emission Rate (lb/hr)	Annual Emission (tpy)
Antimony	0.0012	0.0052	0.0008	0.0035
Arsenic	0.007	0.031	0.005	0.021
Barium	0.012	0.052	0.0079	0.035
Benzene	Negligible	Negligible	Negligible	Negligible
Beryllium	0.0002	0.0009	0.0001	0.0006
Boron	N/A	N/A	N/A	N/A
Cadmium	0.0048	0.021	0.0032	0.014
Calcium	N/A	N/A	N/A	N/A
Chromium	1.2	5.3	0.81	3.5
Cobalt	0.0071	0.031	0.0048	0.021
Copper	0.086	0.38	0.057	0.25
Formaldehyde	N/A	N/A	N/A	N/A
Lead	0.012	0.052	0.008	0.035
Magnesium	N/A	N/A	N/A	N/A
Manganese	0.18	0.79	0.12	0.53
Mercury	0.039	0.17	0.026	0.11
Nickel	0.81	3.5	0.54	2.4
Selenium	N/A	N/A	N/A	N/A
Vanadium	0.0095	0.042	0.0063	0.028
Zinc	0.57	2.5	0.38	1.7

Notes: 1. Emission rates are based on published performance data from similar types of facilities (EPRI). Unit operation is assumed to be at 100 percent capacity, 8,760 hours per year.
2. Case A based on six units supporting a 3,000 MW CG facility. Case B based on four units supporting a 2,000 MW CG facility.

N/A = Not Available

Source: Black & Veatch, 1992

TABLE 3.4.3-5
AUXILIARY BOILER
OTHER REGULATED AND HAZARDOUS POLLUTANT EMISSIONS

Pollutant	Emission Rates	
	(lb/hr)	(tpy)
Antimony	0.0022	0.00011
Arsenic	0.00042	0.000021
Barium	0.0019	0.000097
Benzene	0.0064	0.00032
Beryllium	0.00025	0.000012
Boron	0.0064	0.00032
Cadmium	0.00104	0.000052
Calcium	0.074	0.0037
Chromium	0.0048	0.00024
Cobalt	0.0009	0.000045
Copper	0.028	0.0014
Formaldehyde	0.022	0.0011
Lead	0.000881	0.000044
Magnesium	0.023	0.0011
Manganese	0.0014	0.00007
Mercury	0.0003	0.000015
Nickel	0.017	0.00084
Selenium	0.00023	0.000012
Vanadium	0.00689	0.00034
Zinc	0.0676	0.00338

Notes: 1. Pollutant emission rates are based on one 80,000 lb/hr 99 mmBtu/hr auxiliary boiler firing fuel oil, except for benzene and formaldehyde, which are based on natural gas.

2. Annual emissions are based on a maximum of 100 hours of operation per year.

Sources: EPA (U.S. Environmental Protection Agency). 1989. Estimating Air Toxics Emissions from Coal and Oil Combustion Sources. EPA-450/2-89-001. April, 1989.

Valkovic, V. 1978. Trace Elements in Petroleum. The Petroleum Publishing Company. Tulsa, Oklahoma.

3.5 PROJECT WATER USE

The FPC Polk County Site is being designed as a zero discharge facility with respect to the National Pollutant Discharge Elimination System (NPDES) program. This means it will have no point source discharges of wastewaters or contaminated stormwater to surface waters. The key feature of this design is the cooling pond which will serve not only as the heat dissipation device but also as a water storage device.

Based on the zero discharge design, uncontaminated stormwater runoff from the site (except for runoff from buffer areas which will be used to augment stream flows) will be collected and used as cooling pond makeup, thus minimizing ground water withdrawals. Potentially contaminated stormwater will be collected and used within plant process water systems. Cooling pond blowdown and other wastewater streams will be treated as necessary and recycled instead of being discharged. Finally, treated municipal wastewater will be reclaimed, as practicable, to supplement ground water as makeup.

3.5.1 Heat Dissipation System

As described above, the key feature of the plant water and wastewater systems will be the cooling pond system. Following is a description of that system.

3.5.1.1 System Design

HEAT DISSIPATED

A steady state energy balance computer model was used to simulate the expected thermal performance of the cooling pond, with respect to both temperature and evaporation effects. The model was originally described by Patterson, et al. (Ebasco Services Incorporated, 1971) at the American Power Conference (for model description, see Temperature Changes and Holdup Times below). Because the model is steady state, the heat dissipated by the cooling pond is always equal to the heat rejected to the cooling pond by the generating and associated units. Tables 3.5.1-1 and 3.5.1-2 tabulate the heat rejected during each ultimate development case, for each of 21 years and beyond. The heat rates estimated for each generating technology are as follows:

- Natural Gas CC - 2.50 million Btu/hr per MW
- CGCC - 3.75 million Btu/hr per MW
- PC - 4.58 million Btu/hr per MW

WATER WITHDRAWN

The site is comprised of approximately 8,200 acres of mined-out phosphate land which contains numerous clay settling ponds. Four of these ponds are to be converted into a cooling pond network to provide ultimate heat sink capacity for the power plant. Portions of the site will be used as rainfall collection basins to provide makeup to the cooling pond. Additional makeup is to be obtained from ground water via deep wells completed in the upper Floridan Aquifer. Sources for reclaimed water (recycled treated municipal wastewater) are also being investigated, including Polk County and the cities of Bartow, Lakeland, and Mulberry.

Recycling of blowdown is required for the "zero-discharge" characteristic of the facility. In addition, it will reduce the amount of ground water required for makeup to the cooling pond.

Case A (3,000 MW CGCC) and Case B (3,200 MW CGCC/PC), as previously described in Section 3.1, are the two generating arrangements that were modeled. A detailed description of the model is presented in Appendix 10.5.4.1. Each case was modeled for a 30-year period assuming build up to ultimate capacity by 200 to 600 MW steps. The first 235 MW generating unit is expected to come on line in 1998. A listing of the MW capacity and corresponding heat rejection rates for Cases A and B are shown in Tables 3.5.1-1 and 3.5.1-2, respectively. It was assumed that the plant would operate at full load and that the condenser rise would be 19.7°F. The maximum allowable monthly temperature for the condenser inlet water was set at 96°F. The corresponding circulating water flow rate for ultimate development is approximately 3,000 cubic feet per second (cfs) (1,346,400 gallons per minute [gpm]).

The yield of runoff from rainfall collection areas is expected to vary greatly from one area to another within the site. The conversion from rainfall to usable runoff is expected to be as high as 100 percent for completely impervious areas, to as low as 30 percent, over the long term, for some of the solid waste disposal areas, or future cooling pond areas within the early stages of the project. The 30 percent conversion will occur in the dry season when up to 70 percent of the rainfall will be lost to rehydration of the soils or evaporation. The following four scenarios were modeled for each case, since the exact availability of makeup water from rainfall upon water cropping areas is extremely difficult to estimate, and that from reclaimed water was not known.

- Scenario 1 - 100 percent conversion of area rainfall to makeup (no losses to ground infiltration) and zero reclaimed water
- Scenario 2 - 100 percent conversion of rainfall and 3 million gallons per day (MGD) flow of reclaimed water
- Scenario 3 - 30 percent conversion of rainfall and zero reclaimed water
- Scenario 4 - 30 percent conversion of rainfall and 3 MGD flow of reclaimed water

Operation of the model proceeded in a step-wise fashion from month to month over the 30-year period simulating 1998 to 2027. The combination of pond area, plant operating load and meteorological conditions was used to estimate the evaporation rate from the pond and its

monthly inlet and outlet temperatures. The model predicts the number of cycles of concentration at which the pond would operate, relative to the makeup water. This information can be used to estimate the dissolved solids level in the cooling pond so that performance of the condenser cooling system can be evaluated with respect to water chemistry, and so that water quality within the pond can be predicted.

The cooling pond network will include the body of water providing ultimate heat sink capacity for the power plant and various rainfall collection areas around the site. The site layout for the Polk County Site includes a two-stage cooling pond for ultimate development. This pond will be composed of N-16, N-15, N-11B and N-11C, areas presently utilized for clay settling (see Figure 3.5.1-1). Initially, however, only N-16 will serve as the cooling pond (see Figure 3.5.1-2). The water level in the pond will be allowed to fluctuate with plant and meteorological conditions with the following limitations:

- A minimum water depth of 10 feet is required to insure pump submersion and sufficient cooling pond retention time.
- A maximum water depth of 17 feet shall not be exceeded. This will allow about 9 feet of freeboard above that level (but below the top of the dam) for the probable maximum precipitation event and wave surges in the pond.

Initial modeling was performed utilizing N-16 only as the cooling pond for the entire 30-year period. Results indicated that this arrangement could operate below the maximum condenser inlet temperature of 96°F until coal gasification units come on line for each case. At that time (year 13), N-15, N-11C and N-11B will be added to the pond which will then operate in a 2-stage mode. Makeup for the cooling pond will be obtained from the following sources:

- Water cropping
- Reclaimed water (as available)
- Recycle of blowdown
- Ground water
- Treated low volume wastewaters

Water cropping is defined as the capture of rainfall runoff and the use of that water within the cooling pond system. Water cropping will occur continuously throughout the 30-year period modeled. Rainfall collection areas during the initial phase will include SA-11, SA-12, SA-13, SA-10, P-2, P-3, Phosphoria, the Triangle Lakes area, N-15, N-11B and N-11C. Upon ultimate site buildout, rainfall collection areas will include SA-11, SA-12, SA-13, SA-10, P-2, P-3, the Triangle Lakes area, and Phosphoria. The model calculated the amount of water crop available each month based on the corresponding acreage, the precipitation amount, and the conversion factor. As long as the pond operates below its maximum water level, the entire water crop amount will be added to the pond. If the pond reaches its maximum level, any water crop collected will be allowed to accumulate in P-2, P-3, SA-10 and Phosphoria (where it will experience evaporation) until it is needed as makeup. Based on information presented in Table 3.5.1-3, water crop was assumed to be at 0.25 cycles of concentration, relative to concentrations in the ground water.

Based on the current availability of treated wastewater from the City of Bartow, and in order to be conservative, the flow rate of reclaimed water was assumed to be 3 MGD and at 1 cycle of concentration for Scenarios 2 and 4 for both cases.

Blowdown will be taken from the cooling pond continuously in an amount sufficient to provide process water needs (which will escalate as the heat load grows). Additional blowdown will be removed, treated and returned to the pond, to lower the cycles of concentration at which the pond is operating and to minimize ground water use. In the model, recycled blowdown was initially set equal to process water (i.e. 50 percent of blowdown to be recycled). The percentage was adjusted until a maximum of 3 cycles of concentration in the cooling pond was obtained for each scenario. Corresponding percentages are as follows:

Case A (3,000 MW CGCC)	Scenario 1 - 24 percent of blowdown to be recycled
	Scenario 2 - 24 percent of blowdown to be recycled
	Scenario 3 - 71 percent of blowdown to be recycled
	Scenario 4 - 71 percent of blowdown to be recycled

Case B (3,200 MW CGCC and PC)	Scenario 1 - 33 percent of blowdown to be recycled
	Scenario 2 - 33 percent of blowdown to be recycled
	Scenario 3 - 75 percent of blowdown to be recycled
	Scenario 4 - 75 percent of blowdown to be recycled

It was assumed that the recycled blowdown is at 0.13 cycles of concentration (see Section 3.6).

Cooling pond storage will be utilized as much as possible to levelize the withdrawal rate of ground water, thereby minimizing the peak demand. The groundwater quality was selected as the basis for the cycles of concentration analysis and was therefore assumed to be at 1 cycle of concentration.

The majority of the monthly makeup volume will be either water crop or ground water. All available water crop will be utilized. The use of treated sewage effluent (when available) and recycled blowdown will minimize the amount of groundwater required for makeup. Maximum monthly requirement of ground water for each scenario is predicted to be as follows:

Case A (3,000 MW CGCC)	Scenario 1 - 27.4 MGD
	Scenario 2 - 24.4 MGD
	Scenario 3 - 27.4 MGD
	Scenario 4 - 24.4 MGD
Case B (3,200 MW CGCC and PC)	Scenario 1 - 31.6 MGD
	Scenario 2 - 28.6 MGD
	Scenario 3 - 31.6 MGD
	Scenario 4 - 28.6 MGD

Actual predicted monthly ground water withdrawals are presented in Appendix 10.5.4.1. The peak water withdrawal (worst case conditions) plotted against time is shown for Case A (3,000 MW CGCC) on Figure 3.5.1-3 and for Case B (3,200 MW CGCC and PC) on Figure 3.5.1-4. These worst cases include no reclaimed water. The addition of such reclaimed water as makeup would result in a one-for-one reduction in the ultimate peak demand. As a measure of the sensitivity of load factor, Case A Scenario 3 was run for 90 percent load instead of 100 percent. The resultant change in peak demand was a decrease of 2.2 MGD.

CONSUMPTIVE USE

Traditionally, a Consumptive Use Permit would be separated into surface and ground water withdrawals. The Polk County Site does not have a traditional surface water intake, but does make use of water cropping and groundwater.

Actual predicted monthly water crop quantities used for all cases and scenarios are shown in Appendix 10.5.4.1. For discussion purposes, Figure 3.5.1-5 illustrates predicted water crop usage for Case A, Scenarios 1 and 3. The peak monthly water crop quantity is around 62 MGD.

The combination of water crop and pumped ground water adds up to the total water used by the project. Actual monthly values are shown on Figure 3.5.1-6 for Case A, and Figure 3.5.1-7 for Case B, assuming no availability of recycled wastewater. On the latter figure, ultimate average use is on the order of 30 MGD (assuming 100 percent load).

SIZE AND LOCATION

Cooling system water for heat dissipation will be impounded in selected areas utilizing existing dams. Modifications to certain dam sections are required to provide adequate factors-of-safety for embankment slope stability; to control retention time and circulation flows; and to install erosion protection on interior slopes subject to wave impingement. To support the long-term expansion of facility generating capacity, the cooling pond system will be developed in a 2-stage approach.

INITIAL STAGE RESERVOIR AREA. The initial cooling reservoir area is designed to support generating capacities up to approximately 2,000 MW. Development of the initial stage area will

require the leveling of the bottom of N-16, the construction of new internal dividing dikes and the construction of an internal elevation control structure. Development also requires the raising and upgrading of some perimeter impoundment dams to provide necessary storage capacity and slope stability, respectively, and the installation of interior slope erosion protection.

The initial stage area design requires perimeter impoundment dam crest elevations constructed to at least elevation 172 ft MSL. Water will discharge from the plant into the southwest corner of N-16 with flow to the north and then east through an elevation control structure (controlled by stop logs) into the eastern portion of N-16. Cooling water in N-16 will circulate around an approximately 1-mile-long, east-west, internal dividing dike with a crest elevation of 163 ft MSL. Flow will be to the east in the northern half of the pool, around the east end of the embankment, and then back to the west. The plant intake canal will be located near the southwest corner of the eastern N-16 pool, adjoining the discharge structure. The crest of the interior, north-south, dividing dike between the upper and lower pool will be set at an elevation of 172 ft MSL.

ULTIMATE STAGE RESERVOIR AREAS. The cooling pond system expansion will be designed to support a facility generating capacity up to 3,200 MW. The cooling pond system will be expanded to include the N-15, N-11C and N-11B ponds, in addition to the N-16 area. These areas, along with the western portion of N-16, will form the upper pool of a 2-part pond system. The design of the upper pool will require perimeter impoundment dams to be constructed to at least elevation 175 ft MSL. Excavation of breaches in four existing dams will be required for circulation flow. Breaches will be excavated in the south N-15 dam, west N-11C dam, and north and south N-11B dams. The south N-11B breach will also include an elevation control structure to replace the function of the initial stage structure upon transition to the 2-part pond.

Cooling water will be discharged into the western side of N-16 and will flow north into the N-15 pond. Cooling water will pass into N-11C at the northwest corner and then flow south through N-11C and N-11B, back to the lower N-16 pool across the elevation control structure in the south dam of N-11B.

Development of the ultimate stage reservoir areas will require the upgrading of certain dam sections to provide adequate factors-of-safety for slope stability, as well as excavation and construction of required flow-through openings, an elevation control structure and slope protection for erosion control. Upper pool areas have been, or are currently being, utilized as

waste phosphatic clay or sand tailing disposal areas. Consolidation of waste clays in the N-15 and N-11B area (through standard reclamation techniques) is required to achieve a cooling water depth of 10 feet (minimum) at a design pond bottom elevation of 155 ft MSL. In N-11C, sand tailings fill a substantial portion of the pond. Their removal, and redistribution of portions of the waste phosphatic clays by dredging or other techniques, will be required to achieve design pond bottom elevations. The reclaimed consolidated clays in the upper pool will provide an impermeable barrier to the vertical seepage loss of cooling water from the ponds.

The ultimate buildout cooling pond will contain two water levels (pools) because the elevation of the pond bottom in the upstream stage (A) will be higher than that of the downstream stage (B). The upper pool (Stage A) of the two-stage pond will include the western portions of N-16, N-15, N-11C and N-11B. This stage will operate at a fixed water level elevation of 165 ft MSL. The lower pool (Stage B) will include the remainder of N-16 separated by an east-west splitter dike. The water level in Stage B will be allowed to fluctuate within the same constraints as for N-16 in the initial pond, i.e. between elevations 156 and 163 ft MSL. Final modeling runs were performed using N-16 for the first 12 years and switching to the 2-stage pond at the beginning of year 13 when the heat load for coal gasification facilities was added.

Pond parameters for the initial N-16 cooling pond were modeled as follows:

- Maximum surface area - 1,219 acres
- Minimum surface area - 1,195 acres
- Maximum volume - 20,222 ac-ft
- Minimum volume - 11,775 ac-ft
- Maximum water depth - 17 feet
- Minimum water depth - 10 feet
- Area available for water cropping - 4,379 acres (SA-11, SA-12, SA-13, N-11B, N-11C, N-15, P-3, P-2, SA-10 and Phosphoria)
- Percent of pond effective for cooling - 95 percent (non-effective area at northwestern corner)
- Total net seepage rate - 0.5 MGD

It was assumed that the pond will begin operation at its minimum operating level.

The 2-stage pond parameters modeled for years 13 to 30 were as follows:

- Maximum surface area - 2,596 acres
- Minimum surface area- 2,585 acres
- Maximum volume - 34,154 ac-ft
- Minimum volume - 26,910 ac-ft
- Maximum water depth - 17 ft
- Minimum water depth - 10 ft
- Area available for water cropping - 2,976 acres (SA-11, SA-12, SA-13, P-3, P-2, SA-10, undeveloped area, and Phosphoria)
- Percent of pond effective for cooling - 100 percent
- Total net seepage rate - 0.5 MGD

It was assumed that Stage A will begin (and maintain) operation at its maximum operating level. Stage B will begin operation at the water level existing in N-16 at the end of the 12th year.

A summary of information on the basins comprising the cooling pond network and associated water crop areas, as modeled, is shown in Table 3.5.1-3.

PHYSICAL CHARACTERISTICS AND BLOWDOWN VOLUME

PHYSICAL CHARACTERISTICS. Because of the evaporation that takes place in a cooling pond (which leaves dissolved solids behind), the cooling pond will operate with a level of dissolved solids which is higher than that of the makeup water source. Assuming a steady state condition, the following equation describes the mass balance of dissolved solids in a cooling pond:

(1) $M*Cm = B*Cb$

Where:
- M = Makeup flow rate
- Cm = Concentration of dissolved solids in the makeup
- B = Blowdown flow rate (in this equation blowdown represents all liquid water releases, including seepage and spillage)
- Cb = Concentration of dissolved solids within the blowdown

Assuming that the cooling pond is completely mixed, Cb = Cp, the concentration in the cooling pond. If cycles of concentration C is defined as Cp/Cm, then equation (1) can be rearranged as follows:

(2) $C = M/B$

From a mass balance on the water, the following relationship can be derived (again assuming a steady state):

(3) $M = E + B$
Where: E = Evaporation flow rate

Substituting equation (3) into equation (2), the following relation can be derived:

(4) $C = 1 + E/B$

From equation (4), and the evaporation and blowdown rates, the cycles of concentration C can be calculated. Then, using C and the makeup concentration (Cm) of any parameter, the cooling pond or release concentration can be calculated.

The model assumes that the pond will begin operation at 1 cycle of concentration. The model then calculates the monthly cycles of concentration value based on the amounts of various makeup source waters and their corresponding concentration parameters (e.g., 0.25 for water crop). The cycles slowly build in the pond for the first 12 years of operation. When the pond is expanded at year 13, it is assumed that Stage B is operating at the same cycles value as was N-16. Stage A is assumed to begin operation at 1 cycle of concentration. Therefore, a volume-weighted average of the cycles is calculated at the beginning of 2-stage pond operation, and the model proceeds as before.

To estimate the concentration of a particular constituent, the level of that constituent is multiplied by the number of cycles of concentration. Figures 3.5.1-8 through 3.5.1-11 show the estimated cycles of concentration for all of the cases and options modeled.

As expected, cycles are lower overall for Scenarios 1 and 3 during the first 12 years due to the higher inflow of water crop (which has a low solids level). The range of cycles values, sometimes broad during the first 12 years of operation, narrows considerably when the larger pond begins operation and the difference between 30 percent conversion and 100 percent conversion of water crop is less noticeable. Overall cycles values were lowered at that point since Stage B water was initially at 1 cycle. The pond appears to reach an equilibrium state around year 22 whereupon the cycles remain constant at about 3.

Estimation of water quality constituent concentrations by using the cycles of concentration requires estimates of the initial concentration values in the makeup source assumed to be at 1 cycle. In order to estimate the quality of ground water from the upper Floridan Aquifer, an analysis was performed on data for wells in the site vicinity at depths at the range for which the project wells are expected to be placed. The individual well data (including the Estech well sampled during the field program), and the minimum, maximum and average value for each constituent, are shown in Table 3.5.1-4.

Water quality constituent concentrations of the water crop areas were based on information developed by the USGS, comparing water quality within various features of phosphate mines (Huun and Seaber, 1986).

Results of the U.S. Geological Survey (USGS) studies indicate that an inactive settling pond would have much better quality (i.e., lower concentrations of all dissolved solids) than a settling pond actively being used in a mining operation. The supporting data are presented in Table 3.5.1-5. Based on these data, it was hypothesized that water quality in a reclaimed land and lakes area should be equally superior. Table 3.5.1-5 provides the data for N-15 (an active settling area) and for Tiger Bay (a reclaimed land and lakes area). The data bear out the hypothesis. Further, the table also displays the water quality data for the Upper Floridan wells. Based on a comparison of total dissolved solids in the Upper Floridan wells (280-520), in N-15 (428), and in Tiger Bay (122), it was estimated that the approximate cycles of concentration of makeup derived from water cropping would be on the order of 0.25 cycle relative to the Upper Floridan ground water.

Based on simple hydraulics, the cooling pond would be expected to operate between 1 and 3 cycles over the life of the project, assuming untreated ground water at one cycle was directly released into the cooling pond. Concentrations of individual constituents would likely be reduced by chemical interaction and precipitation as the cycling up of concentrations occurs. Analysis of this phenomenon has been performed using the metal speciation model MINTEQ, version MINTEQA2. A detailed description of MINTEQA2 is presented in Appendix 10.5.4.2.

The predictive operation of MINTEQA2 draws upon an extensive database of thermodynamic parameters that describe and govern chemical reactions among components that make up the model's list of input reactants. The predictive algorithms solve a set of simultaneous equations that are formulated according to thermodynamic principles. Model simulations produce concentration estimates which represent thermodynamic equilibrium conditions in the cooling pond.

Primary input to the model consisted of a list of water quality constituents and their estimated total concentrations in the makeup water to the pond. As stated earlier, ground water from the Upper Floridan Aquifer will serve as makeup. Water quality data from Table 3.5.1-4 were used as input data. Average and maximum values for the chemical parameters are considered representative of the long-term and peak values, respectively, expected from the Upper Floridan Aquifer at this site.

While water temperature affects the rate at which reactions occur, it does not necessarily exert a strong influence on which reactions occur. However, pH is a dominant factor in determining the nature of chemical reactions between metals and other reactants in the pond. Therefore, initial modeling was performed utilizing worst case (maximum) concentrations at both the minimum and maximum pH values for comparison. Results indicated that less precipitation occurred at the minimum pH value; therefore, it was utilized as the worst case in the final modeling runs.

Modeling was performed at one and three cycles of concentration to provide a range of expected values over initial to ultimate build-out of the site.

The results at one cycle of concentration are shown in Table 3.5.1-6, and in Table 3.5.1-7 at 3 cycles. Long-term concentrations are expected to lie somewhere between the average

concentrations at 1 cycle and at 3 cycles. Short-term concentrations could lie as high as between the maximum concentrations at 1 and 3 cycles.

BLOWDOWN VOLUME. In order to maximize water recycling and minimize groundwater withdrawal, the Polk County Site has been designed for reuse of the cooling pond system blowdown. This is accomplished by using the blowdown as influent for process water needs, and by treating and recycling as much blowdown back to the cooling pond system as is necessary to keep the cycles of concentration at or below three. The estimated process water use is shown on Figure 3.5.1-12 for Case A, and Figure 3.5.1-13 for Case B. The amount of blowdown required to keep the correct levels of concentration, along with the associated recycled blowdown, varies with the meteorological conditions as well as with the heat rejected to the pond, the percent of rainfall converted to water crop, and the amount of municipal sewage effluent utilized to replace ground water as makeup. Initially, the sewage effluent was assumed to be at about 1 cycle of concentration. FPC has analyzed effluent from several of the potential sources of reclaimed water and the results are presented in Table 3.5.1-8. Although TDS in the sample from the City of Bartow STP was higher than 1 cycle of concentration, the actual effluent which would be supplied by the City of Bartow STP will have TDS levels close to 1 cycle of concentration because the City is planning to install a sequencing batch reactor at their STP similar to the one at the City of Mulberry facility. TDS at the Mulberry facility, as shown in Table 3.5.1-8, were very close to the 1 cycle of concentration. Assuming reclaimed water to be at 1 cycle of concentration, the blowdown and recycled blowdown volumes are as shown on Figures 3.5.1-14 through 3.5.1-17 for Case A, and on Figures 3.5.1-18 through 3.5.1-21 for Case B.

Seepage through the dam along the southern end of N-16 has been proposed as a source of replenishing water to revitalize Tiger Bay. The flow rate of this seepage has been estimated at 30,000 gallons per day. Additional seepage information is provided later in Section 3.5.1.1.

TEMPERATURE CHANGES AND HOLDUP TIMES

Predicting the steady state temperatures in a cooling pond involves a quantitative determination of the energy transfer through a boundary between the atmosphere and the water. The processes involved in the heating and cooling of a water mass can be summarized as follows:

1. Absorption of shortwave radiation from the sun and the sky, H_s
2. Absorption of longwave radiation from the atmosphere, H_a
3. Heat rejected to the water by the plant, H_p
4. Convection of heat through the bottom of the water body from the interior of the earth
5. Transformation of kinetic energy heat
6. Heating due to chemical processes
7. Condensation of water vapor

1. Reflection of shortwave solar radiation by the water, H_{sr}
2. Reflection of longwave atmospheric radiation by the water, H_{ar}
3. Longwave radiation emitted by the water, H_{br}
4. Conduction of sensible heat to the atmosphere, H_c
5. Heat carried away by evaporation, H_e

In the heating process, terms 4 through 7 are small in comparison with terms 1 through 3 and, therefore, can be neglected. Thus, the following equation is solved within a steady state model:

$$H_s + H_a + H_p - H_{sr} - H_{ar} - H_{br} - H_c - H_e = 0$$

The model (Patterson, et al, 1971) requires three types of data for input: meteorological data, plant operating data, and data regarding the physical layout of the cooling pond. Meteorological data covering a 30-year period of record (July 1960 to June 1990) were obtained from the National Oceanic and Atmospheric Administration. The closest recording station to the site (Lakeland, Florida) had detailed records on ambient temperature and precipitation measurements. Barometric pressure and relative humidity levels (the latter used for calculating dew point temperatures) over the period of record were obtained from the Tampa, Florida, recording station. A complete listing of the meteorological data is in Appendix 10.5.4.1. Actual wind speed and percent sunshine data were obtained from the Lakeland, Florida, recording station.

Results of the temperature predictions, on a monthly average basis, are shown on Figures 3.5.1-22 for Case A, and 3.5.1-23 for Case B.

RATE OF EVAPORATION OF WATER

The rate of both natural and forced evaporation are both calculated by the cooling pond model. Forced evaporation is that extra evaporation above and beyond the natural evaporation that is caused by the heat rejected from the plant.

Natural evaporation data for the period of record modeled were obtained from the nearest National Weather Service Cooperative Station, which was Lisbon for years 1 through 4, and Lake Alfred for years 5 through 30. Recorded data (measured) and the model predictions (calculated) are both shown on Figure 3.5.1-24. Although the model does not predict extremes perfectly, the agreement is reasonable. Figure 3.5.1-25 shows the precipitation, the estimated (calculated) and measured natural evaporation, and the total estimated evaporation with the project. These quantities are all plotted cumulatively. Based on these plots and the 30 years of modeling, the average annual value for each parameter is as follows:

Parameter	Annual Average Value
Precipitation	48.13 inches
Measured Natural Evaporation	70.40 inches*
Estimated Natural Evaporation	63.63 inches
Estimated Total Evaporation	111.84 inches

* (6 months missing during the 30 years)

CONCEPTUAL INFORMATION ON DAMS

The conceptual information that follows consists of data on existing impoundment dams, initial stage N-16 area dams, ultimate stage dams, clay pond consolidation, and dam seepage and piping.

EXISTING IMPOUNDMENT DAMS - A primary benefit of this site is its ability to impound cooling system water in the existing site dams. Most of the dams have functioned without incident for many years as water retention structures during filling with waste phosphatic clays. The dams are constructed of silty to clayey fine sand overburden piles which were roughly

placed to the present alignments during mining operations. Bulldozed, rolled and compacted fill from interior overburden piles has been added to the piles to achieve the present dam configurations. To evaluate the adequacy of the existing dams, a program of field exploratory borings and test probes, and laboratory testing was performed. The details and results of the exploration program and testing are provided in Section 2.3.1.2 and Appendix 10.5.3. The scope of the field investigation and laboratory testing was established to provide an adequate representation of existing dam conditions. The investigations were performed to provide a data base for comparisons to previously published soil data developed for the dams during their original design and construction phases. The data base was used to verify soil design parameters used in stability assessments and seepage analyses of the dams. Design soil parameters were selected based on the compiled data base. Engineering assessments were made of the stability of existing dam sections and proposed modifications to the sections. The results of the assessments concluded that most of the older dams, predating 1972, require structural modifications to be raised to the required heights and to achieve adequate stability criteria. Dams associated with N-16, N-11C, and N-11B were all impacted by the assessments as subsequently detailed.

Development of the initial cooling stage N-16 area will require that perimeter impoundment dams be raised along the south and east sides of the cooling pond. The south, east, and north dams will be widened and reinforced with compacted fill sections constructed along interior existing dam slopes. Along the interior slope of the south N-16 dam, 100- by 100-foot pads will be constructed at 700-foot spacings to provide for the construction and maintenance of transmission line tower foundations. The pad area construction will be integrated with the upgraded dam construction. The east and north exterior dam slopes will be flattened by adding pumped sand tails to these areas. Development of the initial stage area will also require that interior overburden piles be leveled to below elevation 150 ft MSL. Two new internal dividing dikes and an elevation control structure will be constructed in internal pond areas for circulation control and retention.

Development of the ultimate stage cooling area will require that interior dividing dike slopes and interior and exterior slopes along the east perimeter dam be flattened. Removal of selected areas of existing interior dikes is required to provide for circulation flow and retention and an elevation control structure is proposed to be constructed in the south dam of N-11B. The north dam of N-11C will be reinforced by adding a downstream berm and excess sand tails and waste clays in the N-11C pond area will be removed to provide required cooling water depth. The

modified dam sections will provide a stable impoundment system for the retention and circulation of plant system cooling waters.

The design and construction of the existing impoundment dam areas has spanned 30 to 35 years and the dams can be segregated into two broad classifications:

- Category 1 - 17-672 Dam: Those dams designed and constructed subsequent to the implementation of F.A.C. 17-672

- Category 2 - Pre 17-672 Dam: Those dams designed and constructed prior to the implementation of F.A.C. 17-672

Florida Administrative Code 17-672 (formerly known as F.A.C. 17-9) imposed certain minimum requirements for the design, construction, inspection, surveillance and maintenance of earthen dams utilized in phosphate mining and processing operations. Category 1, 17-672, dams are required to be constructed in accordance with an engineered design and a set of detailed specifications prepared, sealed and signed by a professional engineer registered in Florida. Category 2, Pre 17-672, dams were not subject to such strict requirements, and may or may not have been designed and constructed under the review of a registered professional engineer. F.A.C. 17-672 imposes design procedures for evaluating dam stability for Category 1, 17-672, dams and established minimum factors-of-safety for design. Figure 3.5.1-26 presents the service history of the area mining operations. Pond areas placed into service subsequent to 1972 are classified as Category 1 dam areas, and pond areas placed into service prior to 1972 are classified as Category 2 dam areas. The classification of the common dam between two adjacent ponds is that of the earlier age pond unless the common dam section was modified and upgraded as part of a Category 1 assessment and design for the adjacent area. Classifications assigned to the various mining areas and dam sections are provided in Table 3.5.1-9.

Materials used to construct Category 1 and 2 dams consist primarily of the silty to clayey sand overburden soils remaining from mining activities. Detailed descriptions of the soils encountered in embankment areas can be found in Section 2.3.1.2, Detailed Site Lithologic Description. Dams typically were constructed of loosely placed or shaped cast overburden piles combined with sections of bulldozed or rolled or compacted structural fill. Older Category 2 dams typically comprised larger sections of shaped or cast overburden piles. Category 1 dams typically were much improved designs with significant portions of the upper embankment

sections constructed of compacted structural fill. Seepage control and collection drains were commonly incorporated within Category 1 dam sections. Category 1 dam designs were required to be designed to meet the minimum factors-of-safety provided in Table 3.5.1-10.

Category 1 dam designs also required that the soil shear strength values for cast overburden be reduced by 25 percent for use in engineering evaluations and analyses. This shear strength reduction was provided to account for the variability of cast overburden materials and strengths within piles and adds additional conservatism to the specified minimum factors-of-safety.

Verification of Soil Shear Strength Parameters. The specific location, details of the tests and the results of the field and laboratory investigation programs are provided in Section 2.3.1.2 and Appendix 10.5.3.

Effective soil friction values obtained from the field and laboratory studies are summarized on Figures 3.5.1-27 and 3.5.1-28. Test results indicate soil cohesion is negligible and is assumed to be zero for design purposes. Table 3.5.1-11 presents the analysis of the plotted data.

Several dams, including N-15 and N-16, have been investigated, designed and permitted in accordance with the requirements of F.A.C. 17-672. Table 3.5.1-12 presents effective soil friction angles utilized by various professionally registered soil consultants involved in the design and permitting of other on-site impoundment areas. These values are compared to selected site design values which were used for stability assessments.

The comparison of these values indicates that the effective soil friction angles for site design verification obtained from the investigation of as-built dam conditions correlate with, and are well representative of, the values used in the original designs of other dams in the various site impoundment areas.

DAM CROSS-SECTIONS. The following sections describe the as-built and conceptual designs of impoundment and circulation control dams for the cooling pond system. All dam cross-sections will be designed to meet the minimum factors-of-safety as developed from the requirements of F.A.C. 17-672 and listed in Table 3.5.1-13. Final designs will be prepared under the direction of a Florida registered professional engineer experienced in dam design and construction.

Initial Stage N-16 Area Dams. Figure 3.5.1-29 presents the initial stage dam plan and shows the cross-section locations. The N-16 area perimeter impoundment dams were originally designed in 1979 (Armac, 1979 and 1982) pursuant to the requirements of F.A.C. 17-672 to impound water to elevations of 180 and 160 ft MSL, respectively. The south dam section has been partially constructed. Present elevations along the perimeter N-16 dams range from 155 to 185 ft MSL. The south dam is constructed to an approximate elevation of 155 ft MSL. Only the east dam from the southeast corner of N-16 to the southeast corner of N-13 is at an approximate elevation of 165 ft MSL. The north dam along N-13, N-11B and N-15 is at an approximate elevation of 175 ft MSL. The N-16 west dam comprises the east wall of the SA-8 impoundment which is constructed to an elevation of 185 ft MSL.

Utilization of the N-16 mining area for initial stage cooling will require that all but the west dam be upgraded to provide adequate factors-of-safety against slope stability failure and/or elevation to provide necessary storage volume. Two new internal dividing dikes will be required to be constructed for circulation control. All interior dam and dike areas will require the installation of slope protection to prevent erosion by wave action. A conceptual design for slope protection of N-16 area dams and dikes is shown on Figure 3.5.1-30.

Slope stability analyses were performed using the computer program PCSTABL5M (Achilleos, 1988). PCSTABL5M is written in FORTRAN and calculates the factors-of-safety against slope failure using a two-dimensional, limiting equilibrium method. The program is capable of handling heterogeneous soil profiles, anisotropic soil strength parameters, excess pore-water pressure due to shear, and static ground water and surface water. The analytical methods available for use in the program include the simplified Bishop method (Bishop, 1955) applicable for circular-shaped failure surfaces; the simplified Janbu method (Janbu, 1954) applicable for failure surfaces of a general shape; and the Spencer method (Spencer, 1967) which is applicable for any surface. Circular, simplified, Bishop method failure surfaces were evaluated as part of the conceptual dam slope stability analysis. The Spencer method was used for base sliding and sliding wedge analysis of the toe of slopes subject to seepage.

Seepage analyses, required to support evaluations of dam slope stability, were performed using the microcomputer version of program SEEPN or were hand drawn. SEEPN (Tracy, 1983) is a finite element method computer program for solving plane and axisymmetric steady-state seepage problems. SEEPN uses LaPlace's Equation and Darcy's Law as the basis for the analysis. It can be used to solve confined or unconfined, homogeneous or nonhomogeneous, and

isotropic or anisotropic problems. Soil permeability values inputted to the program were determined from field and laboratory testing detailed in Section 2.3.1.2, Detailed Site Lithologic Description. Discussions of seepage through embankments and pond areas and impacts to ground water are contained in Section 5.3.2, Ground Water.

N-16 South Dam. Figure 3.5.1-31 presents the conceptual dam cross-section through the raised and upgraded south dam. The south N-16 dam was constructed to an elevation of 155 ft MSL. Subsurface borings along the section indicate that the dam fill consists primarily of very loose to loose, shaped cast overburden overlain by 5 feet or more of compacted surface fill. Slopes are relatively flat and on the order of 5H:1V upstream and 6H:1V downstream. Raising the dam to an elevation of 172 ft MSL is proposed and will require the construction of an interior 60-foot wide, shaped or cast overburden interior toe berm to an elevation of 145 ft MSL. Rolled, compacted structural fill will be placed on the constructed berm and existing interior dam slope such that a 3.5H:1V interior slope and a 3H:1V exterior slope are achieved in the added compacted fill sections.

Slope stability factors-of-safety at an average operating water level elevation of 160 ft MSL, exceed 1.8 and 1.5 for upstream and downstream slopes, respectively, using circular slope failure analyses. The end-of-construction interior slope stability factor-of-safety is in excess of 1.7 for an interior dewatered condition, with an elevation of 120 ft MSL.

N-16 East Dam. The east N-16 dam includes the west wall of the N-9B impoundment area and was constructed to an elevation of approximately 165 ft MSL. This dam section will be upgraded to provide an adequate slope stability factor-of-safety and will be raised to provide needed volume storage capacity. Borings indicate that the upper 10 feet of the dam were compacted somewhat. This area is underlain by very loose to loose cast overburden to an elevation of approximately 115 ft MSL. Slope stability analysis of the existing dam with slopes of 2.75H:1V indicates that factors-of-safety slightly exceed 1.3 on the exterior slope and approximately 1.1 on the interior slope, using the reduced effective soil friction value of 25 degrees for cast overburden. Using an uncorrected soil friction value of 32 degrees, the interior slope stability factor-of-safety improves to 1.3 for the temporary construction dewatered condition.

The conceptual modified dam design for the east N-16 dam is shown on Figure 3.5.1-32. The proposed design provides a shaped cast overburden berm constructed at an elevation of 130 ft

MSL along the interior toe. Rolled compacted structural fill will be placed over the constructed berm and existing dam slope with 2.75H:1V interior slopes. Circular slope stabilities for the modified upstream slope under a 160 ft MSL average operating water level will exceed 1.6.

Evaluation of the downstream slope under operating water level conditions indicates that the factor-of-safety for slope stability will be less than 1.5 with 2.75H:1V exterior slopes. The analysis assumed an N-9B clay pond elevation consolidated to as low as 150 ft MSL.

Correspondingly, it will be necessary to reinforce the exterior dam section by pumping sand tails along the downstream slope. Pumped sand tails will be shaped to a 4H:1V or flatter slope from the top of the existing dam to an elevation of 160 ft MSL and then on a 10H:1V or flatter slope thereafter to the clay surface. Reinforcement of the downstream dam with sand tails will increase the downstream slope stability factor-of-safety in excess of 1.9 under operating conditions.

N-16 North Dam. The north N-16 dam is primarily composed of the south dam of N-13 and south and southwest dams of N-11B. A small section of the initial stage area also includes the south dam of N-15 near the southeast N-15 corner. The adequacy of the short N-15 section will be discussed as part of the ultimate stage system description for N-15. Figure 3.5.1-33 details a section through the existing dams which has been constructed with 2.75H:1V interior slopes and exterior slopes.

Slope stability analysis for operating conditions using reduced soil friction values for the cast overburden indicates the existing 2.75H:1V downstream slope (N-11B and N-13 side) has a factor-of-safety of 1.3 for the condition where exterior clay levels are 155 ft MSL. This low factor-of-safety will require the downstream embankment slopes to be flattened and reinforced with pumped sand tails. Flattening of the downstream slopes to 4H:1V with pumped sand tails increases the slope stability factor-of-safety to greater than 1.5 and 1.7 under end-of-construction and operating conditions, respectively with corrected soil friction values.

Slope stability analysis for the existing interior (N-16 side) 2.75H:1V slope indicates the factor-of-safety for existing slopes is slightly greater than 1.3 under initial stage operating conditions with end-of-construction conditions in excess of 1.2 using uncorrected soil friction values. For remediation of the interior N-16 dam slope, a 60-foot wide compacted dam section with a 30-foot wide, 3-foot thick sand tailing drain at an elevation of 160 ft MSL will be added. A

proposed detail for the sand tailing drain and collection system is shown on Figure 3.5.1-34. The compacted section will be constructed on a bulldozed 100-foot-wide berm constructed at an elevation of 140 ft MSL along the toe of the dam. Provision of this interior compacted section increases the slope stability factor-of-safety in excess of 1.7 and 2.0 for the ultimate stage operating and end-of-construction conditions, respectively. Under ultimate stage operating conditions, the dam section would be subject to a 5-foot head differential with seepage flow through the dam from N-11B to N-16.

N-16 West Dam. The west impoundment dam will be the existing common wall with SA-8 constructed at an elevation of 185 ft MSL. Figure 3.5.1-35 provides the existing dam section for this wall (Ardaman, 1978) which was designed and constructed as a Category 1 dam. Evaluation of the dam slopes for stability under construction and operating conditions indicates that factors-of-safety in excess of 1.75 will be achieved. No modifications to this dam section are considered necessary, other than the addition of surface wave erosion protection as planned for all interior dam sections. A new section of the initial stage cooling pond west dam will have to be constructed to extend the SA-8 dam to the north. This will close off an approximate 300 feet north-south opening from the northeast corner of SA-8 to the south dam of N-15. The new embankment will be constructed to an elevation of 172 ft MSL. Its design is presented in the ultimate stage dams subsection under N-15.

N-16 North-South Interior Dividing Dike. To provide for circulation flow in N-16 and expansion to the ultimate stage areas, a new north-south dividing dike will be constructed approximately 1,200 feet east of the west dam. The new dividing dike will be constructed to an elevation of 172 ft MSL and will contain an elevation control structure. Two elevation control structures will be constructed within the cooling pond system. These structures will allow head loss across the structure in a safe manner. Water levels in the lower pond areas will be allowed to fluctuate with an average elevation of 160 ft MSL during operation.

An integral requirement for the initial stage cooling pond to be capable of being expanded to the ultimate stage is the ability to control the flow within N-16. During the initial stage when N-16 is the entire cooling pond, it is necessary to be able to control the water level in the western part of N-16 independently of the eastern part to support from one to eight CC generating units. A structure capable of such control has been designed conceptually and is shown on Figure 3.5.1-36. This structure is also capable of being closed completely during the ultimate stage of the project when the two-part pond becomes operational. The concrete control structure has

18 bays of stop logs. Each bay is nominally 6-feet wide in the opening and each stop log is 1 foot high.

The new dividing dike will be constructed of compacted rolled fill on leveled cast overburden piles. Figure 3.5.1-37 provides a conceptual cross-section for the new north-south dike. The conceptual dike design has upstream and downstream slopes of 3H:1V. A drainage layer will be incorporated within the dike to control and collect seepage forces. Details of the drainage blanket have been provided on Figure 3.5.1-34. Factors-of-safety for slope stability of the upstream and downstream slopes are greater than 1.6 for operating conditions and greater than 1.5 for end-of-construction using reduced soil fraction values.

N-16 East-West Interior Dividing Dike. Circulation flows in the lower pool will be controlled by construction of a new east-west dividing dike approximately one mile long in the central N-16 area. The dike will be constructed of compacted fill on leveled cast overburden piles with a crest elevation of at least 163 ft MSL. Slopes of 2.75H:1V will obtain factors-of-safety against slope stability failures of 1.7 and 1.6 for the operating and end-of-construction conditions, respectively. Figure 3.5.1-38 provides the conceptual design east-west cross-section for the new dividing dike.

ULTIMATE STAGE DAMS. Figure 3.5.1-39 presents the ultimate phase dam plan and shows the cross-section locations. Existing elevations of the dams are all on the order of 175 ft MSL. Perimeter impoundment is provided by the south, west and north dams of N-15, the north and east dams of N-11C and the east dam of N-11B. The common dams between N-15 and N-11C/11B will serve as interior dividing dikes. Three flow-through structures will be constructed within the cooling pond system. Openings for circulation flow will be excavated in the south N-15 dam near the southeast corner; in the N-15/N-11C common dams near the northwest N-11C corner; and in the common interior dam between N-11C/N-11B. The flow-through structures will be used to convey water between the reservoir areas where the pool levels are approximately the same elevation of 165 ft MSL. Locations of flow-through structures are also shown on Figure 3.5.1-39. Information related to the conceptual design of flow-through structures is as follows:

Flow-Through Structure Hydraulic Design:

Assumptions:

1. Q = Maximum Design Flow Rate - 2,674 cfs
2. V = Allowable Velocity - 1 fps
3. H = Water Depth - 10 feet
4. Minimized Head Loss across the structure
5. Flow is Computed based on Weir Equations

Equations of Flow:

1. $Q = VA$	Continuity Equation (Streeter, 1979)
2. $Q = CA\sqrt{H}$	Weir Equation (Brater, 1976)
3. $Q_F = C H_1^{1.5}$	Trapezoided Weir Equation(Brater, 1976)
3. $Q_s = Q_F [1- (H2/H1)^{1.5}]^{.385}$	Submerged Weir Adjustment (Streeter, 1979)

Where:

A	=	Area of Opening (ft^2)
Q_F	=	Free Discharge (cfs)
Q_s	=	Discharge of Submerged Weir, (cfs)
H1	=	Upstream Depth (ft)
H2	=	Downstream Depth (ft)
C	=	Contraction Coefficient (dimensionless)

Structure Geometry:

Cross-Sectional Configuration - Trapezoid
Side Slopes: 4 Horizontal:1 Vertical

A conceptual design for the breach is shown on Figure 3.5.1-40. All interior upper pool dams will include slope protection to prevent wave erosion of the dam face. Details of conceptual erosion protection are provided on Figures 3.5.1-41 and 3.5.1-42.

N-15 Area Dams. Figures 3.5.1-43 and 3.5.1-44 present cross-sections through the south, north, and west dams of N-15. The original dams were designed as Category 1 dams (Pittsburgh Testing Laboratory, 1973) to resist a hydrostatic head of water on the interior slope to an elevation of 170 ft MSL during filling of the area with waste phosphatic clays. During the ultimate stage reservoir operation, the dams will be subject to a lower water level (165 ft MSL) and will have the additional benefit of an impermeable waste clay blanket deposited in the interior dam areas. The impermeable clays will limit leakage from the reservoir areas to horizontal seepage within a limited zone through exposed dam side slopes. Impacts of seepage are discussed in Section 5.3.2, Ground Water. The dam designs provide for compacted rolled fill above the original ground surface elevation. Base conditions for the upper rolled fill consist of either unmined in-situ soil or shaped cast or rolled overburden. The dams are provided with an interior, seepage-collection, chimney drain constructed of clean fine sand tailings. The vertical drain discharges from the central dam area via a horizontal drain blanket, approximately 3 feet in height, constructed at or near the original ground surface. The horizontal sand tailing drain exits into the side of a shallow V-shaped surface ditch which parallels the dam sections at the toe of the slope. The drain material exits directly in the side of the ditch; no toe drain collection system was provided. Seepage entering the drain which discharges into the ditch will be collected and pumped back into the reservoir area.

The N-15 north, west and east dams were designed and constructed with 2.5H:1V upstream and downstream slopes. Slope stability factors-of-safety under both operating and end-of-construction conditions exceed 1.6. Only minor modifications are proposed for the N-15 dams, which include the addition of interior slope erosion protection and construction of seepage collection piping at the toe of the exterior dam slope. A proposed detail for the exterior seepage collection system piping is shown on Figure 3.5.1-45. Seepage collected by the interior dam drain will be collected and pumped back into the cooling pond system.

As was shown on Figure 3.5.1-39, a new short dam section is required at the northeast corner of SA-8 to close the opening between SA-8 and N-15. This new dam will be on unmined ground between the two existing dams. Construction of the new section will conceptually be the same design as for the south N-15 dam, as was shown on Figure 3.5.1-44 with a foundation base on unmined matrix. The interior drain will exit to the west and be modified to include a seepage collection drain at the toe of the slope.

North N-11C Dam. The tallest dam at the site is the north N-11C section. This dam is constructed of very loose to loose, shaped, cast overburden from its crest elevation of 175 ft MSL to the bottom of the underlying mined area. The dam is constructed at a 2.5H:1V downstream slope and the downstream toe varies in elevation from 145 to 150 ft MSL. This dam section is classified as a Category 2, Pre 17-672 dam.

Initial slope stability evaluation of the existing downstream slope under operating water level elevations of 165 ft MSL yielded a "failure" factor-of-safety of 0.95 using a corrected effective soil friction value for cast overburden of 25 degrees. Utilizing an uncorrected value of 32 degrees, the factor-of-safety improves to 1.3. No design information is available and, considering the age of the mine, it is probable that the dam was constructed without any internal seepage collection system.

Due to the low factor-of-safety against slope stability failure, this dam section will be modified and reinforced to add a downstream toe berm of reinforced earth fill with a seepage collection system. A schematic of the conceptual cross-section of the north embankment of the N-11C dam is shown on Figure 3.5.1-46. Construction of the downstream toe berm and drainage blanket improves the slope stability factor-of-safety to greater than 1.4 at end-of-construction and to 1.6 or greater under operating conditions using reduced soil friction values for cast overburden.

The design slope of the interior upstream face is not known, but can be similarly assumed to be 2.5H:1V or slightly steeper. The north area of the N-11C pond has been infilled with sand tailings in the northeast quadrant area. Some sand tails have also been placed along the interior northern portion of the west wall. To utilize the N-11C pond for cooling, it will be necessary to remove and redistribute a large amount of materials from within the N-11C pond area, which is subsequently discussed in the section entitled "Clay Pond Consolidation." During and subsequent to the removal of the excess material, the interior N-11C slope will be shaped and graded to 4H:1V from an elevation of 155 ft MSL to the embankment crest. Construction of the interior slope to this grade with shaped, cast overburden soils will provide operating and end-of-construction factors-of-safety against slope stability in excess of 1.7 and 1.5, respectively.

East N-11C/N-11B Dams. The east side of the upper pool reservoir area will be formed by the east dams of N-11C and N-11B. These dams are classified as Category 2 and little is known of their original design and construction. Subsurface borings indicate that the dams were constructed of very loose to loose, cast overburden beneath a compacted surface fill layer

approximately 10 feet thick. Assuming 2.5H:1V side slopes, stability analysis indicates factors-of-safety will be less than 1.5 for operating upstream and downstream slopes using reduced soil friction values for cast overburden. It is proposed to reinforce these dams by pumping and shaping sand tails on the downstream slope at a 4H:1V or flatter slope to an elevation of 160 ft MSL. Sand tails will be flattened to at least 10H:1V for slopes below an elevation of 160 ft MSL to the elevation of the waste phosphatic clays in the exterior adjacent ponds. For the interior upstream slope, it appears that sufficient crest width is available to regrade and flatten the interior slopes to 4H:1V above an elevation of 160 ft MSL. Dam material on slope areas above an elevation of 160 ft MSL would be bulldozed downslope into the interior pond area to provide 4H:1V slopes to an elevation of 155 ft MSL. Alternately, pumped sand tails may be used to flatten the slopes. The conceptual design of these dams is shown on Figure 3.5.1-47. Flattening of the dam slopes in this manner will provide factors-of-safety against slope failure for the upstream and downstream slopes under operating water levels of 2.0 and 1.9, respectively. Factors-of-safety under end-of-construction conditions are evaluated on the order of 1.5 for the 4H:1V slope condition for cast overburden using the reduced, effective soil friction value.

Interior N-11B/N-11C Dividing Dikes. The common dikes between N-11C and N-11B and those within the N-15 pond will serve as internal dividing dikes. The dikes are for circulation control purposes only and are not perimeter impoundment dikes. Breach of these dikes would not pose a hazard to the surrounding general public, but may cause a temporary operational concern with regard to the circulation and retention cooling time in the ponds. Review of the subsurface boring logs performed in these areas indicates that the dikes are comprised of very loose to loose, cast overburden beneath 5 feet or more of compacted rolled fill at the dam crest. Factors-of-safety for slope stability under operating conditions and 2.5H:1V slopes are on the order of 1.2 for a reduced value of cast overburden soil friction of 25 degrees and slightly exceed 1.4 for an unreduced value of 32 degrees. The low factors-of-safety may require that these sections be upgraded by flattening of the slopes to 4H:1V. In the west N-11C section sufficient crest width exists to accomplish flattening of the existing slopes by pushing excess crest area material downslope into the ponds. In the common section of N-11B with N-15, the crest is narrower and flattening of the slopes would be accomplished with pumped sand tails if insufficient crest widths exist to flatten slopes and maintain a 25-foot wide access road. The conceptual design of these dike sections is shown on Figure 3.5.1-48.

Factors-of-safety against slope stability with flattened 4H:1V improve to greater than 1.6 for operating conditions and 2.0 for end-of-construction conditions with empty ponds.

SPILLWAY STRUCTURES. The original design of the clay settling areas typically required overflow spillways at select locations around the clay settling areas. Figures 3.5.1-29 and 3.5.1-39 indicate the approximate location of known spillway structures and Figure 3.5.1-49 provides the details of a typical spillway through the N-15 embankment. All existing spillway structures will be decommissioned by grouting of the entire length of the spillway with concrete.

CLAY POND CONSOLIDATION. Development of the proposed cooling pond system requires consolidation of the waste phosphatic clays contained in settling areas N-11B, N-11C and N-15 to achieve adequate water depth for cooling. Consolidation techniques will be typical of normal reclamation activities in the industry, in which the clays are dewatered by surface ditching and draining and the clays are consolidated under their own weight. The results of the consolidation analysis of these areas is presented in this section. Figure 3.5.1-50 shows the location of waste clay deposits within the proposed reservoir areas. Mining area N-16 contains clays in a limited area in the northeast section of the pond. The present clay elevation in the N-16 area is below an elevation of 150 ft MSL and, thus, below the maximum allowed elevation for cooling pond operation. Therefore, consolidation of the N-16 clays is not required; however, some degree of consolidation will take place during dewatering. Consolidation of waste clays in the proposed buffer areas N-11A, N-13 and N-9B east of the cooling pond area will impact cooling pond development by producing elevation and water head differentials along the eastern exterior dams of the ponds.

Clay consolidation in the cooling pond and buffer areas will also be accomplished using standard reclamation techniques common to the Florida phosphate mining industry. The amount and rate of consolidation was predicted by using the computer model SLURRY (Ardaman, 1989) in combination with manual calculations utilizing standard one-dimensional infinitesimal strain theory (Terzaghi, 1943). Program SLURRY is a finite difference computer program developed to predict self-weight consolidation of clays during deposition at arbitrary rates and subsequent consolidation. The program uses a Crank-Nicholson finite difference scheme to obtain a solution to Terzaghi's differential equation of consolidation, implicitly accounting for the effects of non-uniform, large strains, by using an incremental approach combining infinitesimal strain theory and numerical simulation of large strains. The compression is assumed to occur in the vertical direction, i.e., the program models one-dimensional conditions. Predictions of the SLURRY

program were compared with other large-strain consolidation modeling programs available in the industry (Ardaman, 1989) and the results found comparable. The comparison demonstrated that the wide variety of programs available for predicting consolidation yielded similar total consolidation estimates usually within a 10 percent range. A limitation of program SLURRY is that the model was not developed to handle a variable initial solids content distribution with typically high values. Because of this limitation, manual calculations using standard consolidation theory were performed as an alternative verification approach to the model results, or in some cases instead of the computer model.

Investigation of the present conditions in the various clay ponds was accomplished through a comprehensive drilling and laboratory testing program. Details of the program were presented in Appendix 10.5.3. Typical profiles of solids content with depth for the various pond areas are presented on Figures 3.5.1-51 to 3.5.1-53 for the cooling pond areas N-15, N-11B, and N-11C, and on Figures 3.5.1-54 to 3.5.1-56 for the N-11A, N-13, and N-9B buffer areas. Profiles of solids contents in all clay pond borings are provided in Appendix 10.5.3.

Consolidation of Cooling Pond Areas. Clay consolidation properties for the modeling of the proposed cooling pond areas N-15, N-11B and N-11C were based on empirical correlations with the clay's plasticity index (Ardaman, 1989). The plasticity index is a measure of the soils moisture content range over which it behaves in a plastic or pliable manner. The plasticity index is determined by subtracting the moisture content at which the clays begin to crack and crumble in a friable manner from the moisture content at which they begin to flow in a fluid manner. Such tests are designated as the plastic limit and liquid limit respectively, and are determined in accordance with standardized testing methodology (ASTM, 1992). The results of plasticity index tests on samples from the proposed cooling pond areas are presented on Figure 3.5.1-57. Based on an average plasticity index of 147 percent, the following clay compressibility and permeability relationships are obtained:

$$e = 23.0\ (\sigma)^{-0.265}$$

$$k = 1.22E\text{-}06\ (e)^{4.0}$$

where

e = Void Ratio

σ = Effective Soil Stress (psf)

k = Coefficient of Soil Permeability (ft/day)

Prediction of the rate of consolidation in area N-15 using Program SLURRY is presented on Figure 3.5.1-58. N-15 is presently receiving slurried clays and, therefore, model assumptions directly apply. This prediction assumes that pumping of clays into the N-15 area will stop at the beginning of 1994 and that reclamation activities will take place commencing in 1995. Single-layer drainage conditions were conservatively assumed in all the consolidation analyses. The single slayer drainage condition assumes that drainage of water from the clays occurs vertically upward to the surface. The single-layer drainage assumption will tend to underpredict the amount of consolidation in the early years of settlement. Comparison of measurements of actual clay area settlements versus consolidation predictions using double and single-layer drainage conditions (Bromwell, 1982) concluded that the predictions based on double-layer drainage were more representative of actual measurements. Settlement predictions using single-layer drainage conditions would be less than predictions based on double-layer drainage conditions. Based on these results, the modeling is considered conservative. The required consolidated clay elevation of 155 ft MSL should be achieved in the N-15 pond area by the year 2010.

Prediction of consolidation levels in area N-11B also was performed using Program SLURRY, assuming a uniform initial solids content profiles equal to the average values measured at two boring locations during the investigation. For the prediction, it was assumed in the analysis that no further consolidation would take place until 1997 to 1998 when reclamation activities are planned to start. The results of the SLURRY consolidation modeling are presented on Figure 3.5.1-59, which shows that the required clay consolidation and pond bottom elevation of 155 ft MSL is achievable in this area at the time filling of the ultimate phase reservoir area is scheduled to start in 2007.

Development of pond area N-11C, requiring consolidation of the existing clays, cannot be achieved due to excessively high ground surface elevations within the pond. It has been reported by the mining company that 4 to 5 million cubic yards of sand tails were pumped into the north section of the pond primarily in the northeast quadrant. Two borings were performed in the sand tail disposal area which recorded excessively high elevations even above the perimeter impoundment dam elevations. These borings did not disclose the presence of phosphatic clays underlying the tailings. The phosphatic clays were most likely displaced laterally by mudwaving under the uncontrolled slurry placement of the sand tails. This development also explains the high elevation of clays around the tailings.

A cursory prediction of the potential for N-11C clay consolidation was performed using a similar approach to the analysis of pond N-11B, based on solids content data obtained from two clay pond borings in the southern half of the pond. The results, presented on Figure 3.5.1-60, show that very little additional consolidation is achievable under self-weight consolidation. Predicted clay levels by the year 2006 are 16 to 26 feet higher than the required elevation of +155 ft MSL. The sand tails and excess clay must be excavated to reach the required cooling pond depth. It is proposed that the sand tails be pumped out of the pond and used to reinforce the eastern cooling pond dams, as well as in the reclamation and development of the eastern buffer areas. It is also proposed to overexcavate the sand tail deposits in the north N-11C pond area and then to refill these areas with excess clay redistributed from the southern area of the pond. Refilling of the overexcavated sand tail areas with clay will seal the pond bottom with an impervious clay blanket similar to ponds N-15 and N-11B. Excess clays which cannot be redistributed within the pond will be deposited in other on-site buffer or waste storage areas or will be pumped off-site for deposition in non-project area settling ponds.

Consolidation of Buffer Areas. The consolidation analysis of the buffer areas N-11A, N-13 and N-9B was performed using a closed form, small-strain hand solution based on laboratory consolidation test data and traditional Terzaghi consolidation theory. Clays within the buffer areas were sufficiently consolidated that good undisturbed samples were obtained for laboratory testing purposes. The results of this approach were compared at one location against predictions using the SLURRY model and the results found to be comparable and acceptable. The present and predicted clay elevations (final in the year 1997 when reclamation planting is to start) at seven boring locations considered to be typical of the buffer areas are summarized in Table 3.5.1-14. The analysis assumed a single drainage condition and that the early reclamation dewatering and consolidation of these areas would start in 1993.

DAM SEEPAGE AND PIPING. Dam failures can result from slope stability failures or from seepage-related conditions including internal erosion of dam material (piping) or by heave of a large body of soil near the downstream dam toe. Internal erosion piping occurs when water picks up soil particles and moves them through an unprotected exit face, developing unseen channels or "pipes" in the embankment. As the piping process continues, more soil is lost through internal erosion which can eventually lead to an unstable dam condition. Blowup or heave occurs if seepage pressures become greater than the effective weight of the soil near seepage exits in the downstream dam toe.

In addition to designing embankments with appropriate safety factors against shear failure, they are designed to prevent failure by piping and heave. Results of the seepage analyses are used to evaluate the potential for piping failures within the proposed embankments where significant head differentials and gradients are anticipated.

The factor-of-safety with respect to heave is computed by comparing the actual exit seepage gradient, evaluated from a flow net analysis, with the critical gradient required for the seepage force to equal the submerged soil weight. When the critical gradient is developed, a "quick" soil condition occurs, in which the soil moves or flows in the area where the critical gradient is developed.

The potential for internal piping can be reduced by covering seepage discharge surfaces with filter material that permits water to escape freely, but holds soil particles firmly in place. To prevent infiltration of the dam soils being drained into the filter material, the following soil gradation conditions must be met (ACOE, 1983):

$$R_F = \frac{\text{15 percent grain size of filter material}}{\text{85 percent grain size of material being drained}} \leq 5$$

and

$$R'_F = \frac{\text{50 percent grain size of filter material}}{\text{50 percent grain size of material being drained}} \leq 25$$

In the preceding, the grain size is the soil particle size in millimeters at which the listed percentage of the total soil particles are smaller.

Initial Phase N-16 Area Dams and Dikes. Seepage analyses were performed for the typical sections of the conceptually designed dams along the perimeter dams of N-16 and the north-south interior dividing dike. The analysis for the east side dam was considered representative for the north and west dams of N-16 during initial operations due to exterior clay elevations in the adjacent pond. Flow rates are estimated to be on the order of 40,000 gpd along the south N-16 dam with an estimated 30,000 gpd flowing into Tiger Bay, 34,000 gpd for the east side, 34,000 gpd for the west side, and 40,000 gpd for the north side. Seepage vertically from the pond bottom is estimated at about 400,000 gpd. Head differentials and resulting seepage gradients across the east-west interior dividing dike are not anticipated to be significant, and are not a concern.

Results of the heave analyses indicate that factors-of-safety of 6.1 and 9.2 are provided for the south dam and north-south interior dividing dike, respectively. These factors-of-safety neglect the impacts of the construction of interior slope erosion protection, which will tend to reduce seepage quantities. Depending on the selected final erosion protection system, seepage gradients and forces through the dams may be greatly reduced, particularly, if an impervious revetment blanket of concrete is applied to the interior dam slopes. The computed factors-of-safety are well in excess of the required 1.5 minimum value.

The proposed sand tails to be pumped on the downstream slope of the east and north dams will effectively create a drainage path which results in a negligible exit gradient. Grain size analysis from samples obtained from site sand tail deposits and the existing dam material is reported in Section 2.3.1.2. The tests indicate that the sand tails meet the filter requirements necessary to prevent the dam soils from being eroded into the sand tails. Table 3.5.1-15 provides a summary of the grain size analysis of tested samples from site sand tail deposits and from dam areas. The sand tails proposed for the downstream slope will provide adequate protection against internal piping and wedge failure.

Water migrating through the south N-16 dam indicates the potential for a relatively small area of exposed seepage at the downstream toe of the dam, however, most of the seepage will enter Tiger Bay below the water level in Tiger Bay. Any seepage water exiting from exposed slopes at the toe of the N-16 dam will be collected in a surface ditch and pumped back into N-16. Due to the flat slopes and long drainage paths, the exit gradients in this area are negligible.

Ultimate Phase Dam Areas. Heave analyses were performed for the conceptually designed dam along the north side of N-11C and the as-built dams along the north side of N-15. The analysis for the north dam of N-15 was considered representative and conservative for the west and south N-15 dams, since the west and south dams are smaller due to higher exterior ground surface elevations.

Results of the analyses indicate that factors-of-safety against heave of 3.8 and 6.6 are provided for the N-11C and N-15 dams, respectively. These values are also well in excess of the required value of 1.5. Head differentials across the remaining perimeter dam section are not anticipated to be significant, ranging from 0 to 5 feet. Construction of the exterior pumped sand tail slopes along the east side of N-11C and N-11B will provide a filtered exit gradient for any seepage in

these areas. This seepage is estimated to be about 35,000 gpd. Construction of interior slope protection will also reduce seepage along the east impoundment dams.

The N-15 embankments contain an interior sand-tailings chimney drain that discharges through a horizontal sand drain located near the original ground surfaces. The horizontal sand drain discharges into the side of a shallow V-shaped roadway surface ditch that runs along the toe of the embankments. This drainage system serves to reduce the exit gradient and also provides protection against internal piping. The exit face of the sand tail drain of the surface ditch will be protected by installation of the seepage collection system proposed for the N-15 dams as was shown on Figure 3.5.1-45. This seepage is estimated to be on the order of 71,000 gpd and will be returned to the cooling pond system.

The seepage analysis for the N-11C embankment indicates that seepage through the embankment will exit through an unprotected face into an existing ditch located between the toe of the existing embankment and CR 640. The proposed modifications to this embankment include the addition of a downstream toe berm constructed of reinforced earth fill with a seepage collection system. Although exit gradients in this area are relatively small, a sand tail filter on the surface of the ditch in this area is proposed to be added as a way of providing additional protection against internal piping in the ditch area. This seepage is estimated at about 23,000 gpd and will be returned to the cooling pond system.

DAM CONSTRUCTION INSPECTION. Approximately 9 miles of upgraded or new dam will be constructed including 5.5 to 6 miles of exterior dams and 3 to 3.5 miles of interior dividing dikes. These will be earth fill sections designed to withstand water depths of 10 feet or more on the upstream face of the dam. Quality control during dam construction will consist of engineered fill placement, whereby the quality of fill materials and placement operations are inspected and tested for conformance with project plans and specifications. Inspection would consist of surveillance by qualified personnel and testing by experienced technicians using calibrated equipment. Testing would include, but not be limited to, grain size analyses, laboratory proctor testing and in-place density testing in accordance with American Society for Testing and Materials (ASTM) and/or U.S. Army Corps of Engineers (ACOE) standards.

CONCEPTUAL DESIGN/LOCATION OF INTAKE STRUCTURES

The Polk County Site will have no intake structures within any waters of the state or U.S. Based on circulating water rate estimates, it is likely the CC units and gasifier modules would have one pump each, with one spare for each two pumps. The PC units would likely have two pumps each, plus one spare each. Pump submergence will be a minimum of 10 feet and a maximum of 17 feet. Design velocity will be 2 feet per second maximum.

MAXIMUM PREDICTED DISCHARGE TEMPERATURE AT POD

The project does not have a Point of Discharge (POD). Consequently, this section is not applicable.

TRAVEL TIME FROM CONDENSER INLET TO POD

The project does not have a POD. Consequently, this section is not applicable.

INSPECTION DURING FILLING AND OPERATION

Prior to filling operations the dams will be instrumented to measure water levels and movement of the section. Instrumentation will consist of piezometers, slope inclinometer casing and surface settlement markers along the embankment. The criteria for installation will conform with ACOE guidelines for instrumentation of earth and rock-fill dams (ACOE, 1971).

Reservoir filling operations may require up to 18 months for completion. During that time, all instrumentation shall be monitored and reported monthly together with monthly dam inspections that would be performed in accordance with project plans and specifications, F.A.C. 17-672, and ACOE guidelines. Inspections during filling will conform with the above guidelines as a minimum. Additional inspections during operation will be completed in accordance with the operation and maintenance manual to be developed for the project.

3.5.1.2 Source of Cooling Water

The source of cooling water will be the closed cycle cooling pond. The original source of water to fill the pond will be a combination of runoff from future cooling pond and solid waste

disposal areas, dewatering effluent from reclamation activities, and Upper Floridan Aquifer water, as needed. Another source under consideration is reclaimed water (municipal sewage plant effluent) from the City of Bartow and other potential regional sources. These sources are discussed in Sections 2.3.2, 2.3.4, and in 3.5.1.1 above under Blowdown Characteristics.

There are no minimum water quality requirements for using these waters for cooling. When utilizing a controlled heat dissipation device like a cooling tower or cooling pond, the water quality can be controlled by treatment of either the makeup water or a side stream from the device itself. The water within the cooling pond itself needs to be maintained within the narrow quality window between being scale-forming and being corrosive.

To accomplish this control, two indexes have been defined. The theoretically based Langelier Index is defined as the difference between the actual pH and the pH at which a given water would be saturated with calcium carbonate. When the index is positive, the system has a tendency to deposit scale, but when it is negative, the system is considered to be corrosive. The desirable range for operation is between 0.5 and 1.0. The second index, the empirically based Ryznar Index, is defined as the difference between two times the pH at which a given water (in terms of total dissolved solids [TDS] and temperature) would be saturated with calcium carbonate and the actual pH of the water. Values of 6 or less indicate scaling, and 7 or greater would be corrosive. The range from 6 to 7 is desired.

Limits in cooling waters for other dissolved materials have been established by experience and are presented in Table 3.5.1-16.

3.5.1.3 Dilution System

The project has no dilution system.

3.5.1.4 Blowdown, Screened Organisms, and Trash Disposal

The project does not have a blowdown system with an off-site discharge. Organic debris and trash collected in the circulating water pump structure will be disposed of in the solid waste disposal area. Disposal of debris and trash from coarse bar screens is described in Section 3.7. There are no off-site makeup water pumps. Pumps for runoff collection from inactive solid waste disposal areas have no screens.

3.5.1.5 Injection Wells

The project has no injection wells for waste disposal.

3.5.1.6 References

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TABLE 3.5.1-1
HEAT REJECTION
CASE A (3,000 MW CGCC)

HEAT REJECTION RATE: (Btu/MW/hr)	CC 2,500,000	CG 3,750,000			
YEAR	MW	FUEL	HEAT REJECTION RATE (Btu/MW/hr)	HEAT DISSIPATED (Million Btu/hr)	YEAR #
1998	235	NATURAL GAS	2,500,000	588	1
1999	705	"	2,500,000	1,763	2
2000	940	"	2,500,000	2,350	3
2001	940	"	2,500,000	2,360	4
2002	1,190	"	2,500,000	2,975	5
2003	1,190	"	2,500,000	2,975	6
2004	1,440	"	2,500,000	3,600	7
2005	1,440	"	2,500,000	3,600	8
2006	1,690	"	2,500,000	4,225	9
2007	1,690	"	2,500,000	4,225	10
2008	1,940	"	2,500,000	4,850	11
2009	1,940	"	2,500,000	4,850	12
2010	1,940	COAL-GAS	3,750,000	7,275	13
2011	1,940	"	3,750,000	7,275	14
2012	2,190	"	3,750,000	8,213	15
2013	2,190	"	3,750,000	8,213	16
2014	2,440	"	3,750,000	9,150	17
2015	2,440	"	3,750,000	9,150	18
2016	2,690	"	3,750,000	10,088	19
2017	2,690	"	3,750,000	10,088	20
2018 and beyond	3,000	"	3,750,000	11,250	21

Source: Ebasco Environmental, 1992

TABLE 3.5.1-2
HEAT REJECTION
CASE B (2,000 MW CGCC + 1,200 MW PC)

HEAT REJECTION RATE: (Btu/MW/hr)	MEGAWATTS				COMPOSITE HEAT REJECTION RATE (Btu/MW/hr)	HEAT DISSIPATED (Million Btu/hr)	YEAR #
YEAR	CC 2,500,000	CG 3,750,000	PC 4,583,000	TOTAL			
1998	235			235	2,500,000	588	1
1999	705			705	2,500,000	1,763	2
2000	940			940	2,500,000	2,350	3
2001	940			940	2,500,000	2,350	4
2002	940			940	2,500,000	2,350	5
2003	940			940	2,500,000	2,350	6
2004	940		600	1,540	3,311,558	5,100	7
2005	940		600	1,540	3,311,558	5,100	8
2006	940		600	1,540	3,311,558	5,100	9
2007	940		600	1,540	3,311,558	5,100	10
2008	940		600	1,540	3,311,558	5,100	11
2009	940		1,200	2,140	3,668,037	7,850	12
2010		940	1,200	2,140	4,217,103	9,025	13
2011		940	1,200	2,140	4,217,103	9,025	14
2012		1,190	1,200	2,390	4,168,243	9,962	15
2013		1,190	1,200	2,390	4,166,243	9,962	16
2014		1,440	1,200	2,640	4,128,636	10,900	17
2015		1,440	1,200	2,640	4,128,636	10,900	18
2016		1,690	1,200	2,890	4,095,882	11,837	19
2017		1,690	1,200	2,890	4,098,582	11,837	20
2018 and beyond		2,000	1,200	3,200	4,062,375	13,000	21

Source: Ebasco Environmental, 1992

TABLE 3.5.1-3
COOLING POND BASINS AND ASSOCIATED WATER CROP AREAS

	Elevation (ft MSL)	Water Depth (ft)	Area (ac)	Volume (ac-ft)
N-16				
Bottom Elevation	146	0	1,160	0
Minimum Water Level	156	10	1,195	11,775
Maximum Water Level	163	17	1,219	20,222
Top of Dam	172	26	1,250	30,969
N-15				
Bottom Elevation	155	0	828	0
Constant Water Level	165	10	844	8,360
Top of Dam	175	20	860	16,880
N-11B				
Bottom Elevation	155	0	186	0
Constant Water Level	165	10	193	1,895
Top of Dam	175	20	199	3,658
N-11C				
Bottom Elevation	155	0	326	0
Constant Water Level	165	10	335	3,305
Top of Dam	175	20	344	6,365
Water Crop Areas				
SA-11			200	
SA-12			601	
SA-13			163	
SA-10			294	
P-2			448	
P-3			483	
Phosphoria			523	
Triangle Lakes			264	

Source: Ebasco Environmental, 1992

TABLE 3.5.1-4
Well Water Quality Data

	Map Ref. No.	2			3	4		6		9	16				
	Well Name:	USGS #144			USGS #93	USGS		City Well Ft Meade		VC Corp Homeland	USGS #242	Estech			
Parameter (mg/l unless otherwise indicated)	Date:	3-14-62	2-27-63	3-26-63	12-10-75	12-4-64	3-22-63	5-8-59	6-11-59	5-6-59	6-28-65	11-27-92	Min	Max	Avg
Temp Water (Deg C)		26.5		36		27		25	26	25.5			25	36	27.67
Color (PT-CO Units)		2		5	0			3		3	15	<5	0	0	4.71
Specific Conductance (US/CM)		428	397	390		288	310	373	340	315	522	696	288	696	405.90
pH (field)(Standard Units)		7.8		8.2				7.6		7.9	8		7.60	8.2	7.95
pH (lab)												7.61	7.61	7.6	7.61
Alkalinity WAT WH (Total), FET Field (as CaCO3)					60			175		106		154	60	175	123.75
Aluminum												<0.1	0.099	0.099	0.099
Antimony												<0.01	0.0099	0.0099	0.0099
Beryllium												<0.01	0.0099	0.0099	0.0099
Boron												<0.1	0.099	0.099	0.099
Cyanides (Total)												<0.01	0.00495	0.00495	0.00495
Fecal Coliform (Cfu/100 ml)												<1	1	1	1
Molybdenum												<0.05	0.0495	0.0495	0.0495
Nickel												<0.01	0.0099	0.0099	0.0099
Nitrogen, Ammonia												0.22	0.22	0.22	0.22
Nitrogen, Nitrate, Dissolved (as NO)		0.1					0.02			0	0.3	<0.03	0	0.3	0.09
Nitrite												<0.03	0.0297	0.0297	0.0297
Oil & Grease												<1	0.99	0.99	0.99
Phenolics												<0.01	0.00495	0.00495	0.00495
Phosphate, Ortho (Dissolved)				0									0	0	0.00

TABLE 3.5.1-4
Well Water Quality Data

Parameter (mg/l unless otherwise indicated)	Map Ref. No.	2			3	4		6		9	16				
	Well Name:	USGS #144			USGS #93	USGS		City Well Ft Meade		VC Corp Homeland	USGS #242	Estech			
	Date:	3-14-62	2-27-63	3-26-63	12-10-75	12-4-64	3-22-63	5-8-59	6-11-59	5-6-59	6-28-65	11/27/92	Min	Max	Avg
Phosphorus (Total)												0.06	0.06	0.06	0.06
Surfactants												<0.1	0.099	0.099	0.099
Vanadium												<0.05	0.0495	0.0495	0.0495
Hardness, Total (as CaCO3)		210	210	200	84		150	170		150	240	380	84	380	199.33
Hardness, Noncarb WH WAT (Total) Field		80		68	24			0		50	100		0	100	53.67
Calcium, Dissolved (as Ca)		55	56	55	20			40		44	58	105	20	105	54.13
Magnesium, Dissolved (as Mg)		17	17	16	8.2			16		11	23	28.5	8.2	28.5	17.09
Sodium, Dissolved (as Na)		6.1		6	3.8			18		4.5	23	9.9	3.8	23	10.19
Potassium, Dissolved (as K)		0.7		1	0.2			1.3		0.7	0.8	2.15	0.2	2.15	0.98
Chloride, Dissolved (as Cl)		9		8	9.7	10	9	12		8	18	12.5	8	18	10.92
Sulfate, Dissolved (as SO4)		71		61	4.1		19	10		45	120	238	4.1	237.5	70.95
Fluoride, Dissolved (as F)		0.4			0.4	0.6	0.5	1	0.9	0.3	1.2	0.28	0.282	1.2	0.62
Silica, Dissolved (as Si)		16			11			31		13	11	16.5	11	31	16.41
Arsenic, Dissolved (UG/L as As)					<1							<10	0.99	9.9	5.45
Barium, Dissolved UG/L as Ba)												<100	99	99	99
Cadmium, Dissolved (UG/L as Cd)												<5	4.95	4.95	4.95
Strontium, Dissolved (UG/L as Sr)					20							1700	20	1700	860.00
Zinc, Dissolved (UG/L as Zn)					<20							<50	19.8	49.5	34.65
Selenium, Dissolved (UG/L as Se)												<5	4.95	4.95	4.95

TABLE 3.5.1-4
Well Water Quality Data

	Map Ref. No.	2			3	4		6		9	16				
	Well Name:	USGS #144			USGS #93	USGS		City Well Ft Meade		VC Corp Homeland	USGS #242	Estech			
Parameter (mg/l unless otherwise indicated)	Date:	3-14-62	2-27-63	3-26-63	12-10-75	12-4-64	3-22-63	5-8-59	6-11-59	5-6-59	6-28-65	11-27/92	Min	Max	Avg
Depth of Well, Total (Ft)		957	957	957	900	950		900		746	739		739	957	888.25
Bicarbonate Water, FET-Lab, (as CO3)		160		170	73			210			170	154	73	210	156.17
Carbonate Water, FET-Lab, (as CO3)					0						0	<2	0	1.98	0.66
Total Dissolved Solids		272.24		228.1	95.7			228.1			338.47	526	95.65	526.00	281.43
Total Suspended Solids												<5	4.95	4.95	4.95
Chromium, Dissolved (UG/L as Cr)					0							<10	0	9.9	4.95
Copper, Dissolved (UG/L as Cu)					ND							<10	9.9	9.9	9.9
Iron, Dissolved (UG/L as Fe)			0		<10							<100	0	99	36.3
Lead, Dissolved (UG/L as Pb)					2							<5	2	4.95	3.48
Manganese, Dissolved (UG/L as Mn)					<10							<30	9.9	29.7	19.8
Silver, Dissolved (UG/L as Ag)												<10	9.9	9.9	9.9
Radium 226, Dissolved Radon Method (pCi/l)					0.26							2.1	0.26	2.1	1.18
Radium 228 (pCi/l)												<0.7	0.69	0.69	0.69
Gross Alpha (pCi/l)												0.9	0.898	0.898	0.898
Mercury, Dissolved (UG/L as HG)												<0.2	0.198	0.198	0.198
Sulfide, Dissolved (as S)												3.75	3.75	3.75	3.75

Note: The organics and pesticides listed in Table 2.3.4-4 were not detected in the Estech well samples.

Sources: As noted above and Ebasco Environmental, 1992

TABLE 3.5.1-5
REPRESENTATIVE PHOSPHATIC WASTE SETTLING POND WATER QUALITY

PARAMETER (mg/l unless noted otherwise)	N-15 (1991)	Tiger Bay (1991)	Settling Pond #9 (Active) (7/10/80)	Settling Pond #4 (Inactive) (4/2/80)	Upper Floridan Aquifer (Seven Wells Sampled) Avg	Max
Alkalinity (as $CaCO_3$)	89	82.5	57	102	123.8	175
Aluminum	0.36	<0.1	270	0.16	0.099	0.099
Ammonia (as N)	<0.1	<0.1	0.68	0.05	0.22	0.22
Antimony (dissolved)	<0.01	<0.01	0.001	0	0.0099	0.0099
Arsenic	<0.01	<0.01	0.004	0.001	0.00545	0.0099
Fecal Coliform, #/100 ml	<1	18				
Total Coliform, #/100 ml	>200	++				
Barium	<0.1	<0.1	4	0.05	0.099	0.099
Benzene	<0.001	<0.001				
Beryllium	<0.01	<0.01	0.03	0	0.0099	0.0099
Bicarbonate (as HCO_3)	78.2	82.5	70	124	156.17	210
Boron	<0.1	<0.1	0.08	0.04	0.099	0.099
Bromide (dissolved, as Br)			0.2	0.1		
Cadmium	<0.005	<0.005	0.028	0	0.00495	0.00495
Calcium (dissolved)	49	15	36	22	54.13	105
Carbonate	13	<2			0.66	1.98
Chloride	16.1	8.04	13	9.5	10.92	18
Chromium (total)	<0.01	<0.01	0.67	0.013	0.00495	0.0099
Cobalt			0.018	0		

TABLE 3.5.1-5
REPRESENTATIVE PHOSPHATIC WASTE SETTLING POND WATER QUALITY

PARAMETER (mg/l unless noted otherwise)	N-15 (1991)	Tiger Bay (1991)	Settling Pond #9 (Active) (7/10/80)	Settling Pond #4 (Inactive) (4/2/80)	Upper Floridan Aquifer (Seven Wells Sampled) Avg	Max
COD				30		
Color (color units)	40	30			4.71	15
Copper	<0.01	<0.01	0.22	0	0.0099	0.0099
Cyanide	<0.005	<0.005			0.00495	0.00495
Detergent	<0.1	<0.01		0	0.099	0.099
1,2-Dicholorethane	<0.001	<0.001				
Ethylene Dibromide	<0.00002	<0.00002				
Fluoride	2.84	1.99	2.7	1.4	0.62	1.2
Hardness (as $CaCO_3$)	235	110	150	110		
Hardness, Noncarbonate (as $CaCO_3$)			94	7		
Iodide (dissolved, as I)			0.14	0.04		
Iron	<0.1	0.19	84	0.21	0.0363	0.099
Lead	<0.01	<0.01	0.04	0.002	0.00348	0.00495
Lithium (dissolved, as Li)			0	0.01		
Magnesium (dissolved)	22	11	15	13	17.09	28.5
Manganese	<0.03	<0.03	0.52	0.04	0.0198	0.0297
Mercury	<0.0002	<0.0002	0.0001	0.0001	0.000198	0.000198
Molybdenum (total recoverable)	<0.05	<0.05	0.019	0.001	0.0495	0.0495
Nickel	<0.01	<0.01	0.075	0	0.0099	0.0099

TABLE 3.5.1-5
REPRESENTATIVE PHOSPHATIC WASTE SETTLING POND WATER QUALITY

PARAMETER (mg/l unless noted otherwise)	N-15 (1991)	Tiger Bay (1991)	Settling Pond #9 (Active) (7/10/80)	Settling Pond #4 (Inactive) (4/2/80)	Upper Floridan Aquifer (Seven Wells Sampled) Avg	Max
Nitrate (as N)	0.04	<0.03	0.15	0	0.09	0.3
Nitrite	<0.03	<0.03	0.04	0.01	0.0297	0.0297
Nitrogen, Total			4.67	2.16		
Oil and Grease						
Dissolved	4.2	<1			0.99	0.99
Free			0	0		
Ortho-Phosphate (as P)			0.45	2.1		
PCBs	ND	ND				
Pesticides & Herbicides	ND	ND				
pH (std units)	8.9	7.5	6.7	7.2	7.9	8.2
Phenols	<0.005	<0.005	0.007	0	0.00495	0.00495
Phosphorus	0.741	0.102	420	2.5	0.062	0.062
Potassium (dissolved)	3.6	<1	1.1	6.8	0.98	2.15
Radioactive Substances (pCi/l)						
Radium 226+228	1	ND	301.6	2	0.898	0.898
Alpha	9.5	<0.5				
Tritium	0	2				
Selenium	<0.005	<0.005	0.007	0	0.00495	0.00495
Silica	5.41	3.83			16.41	31
Silica (as SiO_2)			11	0.2		
Silver	<0.01	<0.01	0.005	0	0.0099	0.0099

TABLE 3.5.1-5
REPRESENTATIVE PHOSPHATIC WASTE SETTLING POND WATER QUALITY

PARAMETER (mg/l unless noted otherwise)	N-15 (1991)	Tiger Bay (1991)	Settling Pond #9 (Active) (7/10/80)	Settling Pond #4 (Inactive) (4/2/80)	Upper Floridan Aquifer (Seven Wells Sampled) Avg	Max
Sodium	47	7.1	22	6.8	10.19	23
Specific Conductance (umho/cm)	670	205	346	242	405.9	696
Strontium (dissolved)	0.2	<0.01	0.04	0.07	0.86	1.7
Sulfate	213	<1	120	9.7	70.95	237.5
Sulfide	0.11	<0.01			3.75	3.75
Temperature (°C)	30.4	30.6	31	19.8	27.7	36
Tetrachloroethene	<0.001	<0.001				
Total Dissolved Solids	428	122	256	70	281.4	526
1,1,1-Trichloroethane	<0.001	<0.001				
Trichloroethene	<0.001	<0.001				
Trihalomethanes	<0.001	<0.001				
Turbidity (NTU)	9.5	1.6				
Vanadium (dissolved)	<0.05	<0.05	0.008	0.001	0.0495	0.0495
Vinyl Chloride	<0.001	<0.001				
Zinc	<0.05	<0.05	0.35	0.01	0.03465	0.0495
Acidity (as $CaCO_3$)			15	5		
Acidity (Total)			0.3	0.1		
Dissolved Solids			253	140		
Total Organic Nitrogen			3.8	2.1		

TABLE 3.5.1-5
REPRESENTATIVE PHOSPHATIC WASTE SETTLING POND WATER QUALITY

PARAMETER (mg/l unless noted otherwise)	N-15 (1991)	Tiger Bay (1991)	Settling Pond #9 (Active) (7/10/80)	Settling Pond #4 (Inactive) (4/2/80)	Upper Floridan Aquifer (Seven Wells Sampled) Avg	Max
Total Kjeldahl Nitrogen			4.48	2.15		
Total Organic Carbon, as C (dissolved)			13	12		
Tannin and Lignin			0.7	1.2		

Note: ++ = not measured due to matrix interference
ND = not detected

Source: USGS

TABLE 3.5.1-6
WATER QUALITY MODELING RESULTS
ONE CYCLE, DISSOLVED CONSTITUENTS

Parameter (mg/l)	Maximum Well Water Concentrations	Average Well Water Concentrations
Calcium	51.7	48.2
Magnesium	24.3	17.1
Sodium	23.0	10.2
Potassium	2.2	1.0
Chloride	18.0	10.9
Sulfate	237.5	71.0
Fluoride	1.2	0.6
Strontium	1.7	0.9
Ammonia	0.2	0.2
Sulfide	3.8	3.8
Silica (as H_4SiO_4)	13.8	10.5
Carbonate/Bicarbonate	61.2	70.0

Note: Species not listed remain unchanged from Table 3.5.1-4.

Source: Ebasco Environmental, 1992

TABLE 3.5.1-7
WATER QUALITY MODELING RESULTS
THREE CYCLES, DISSOLVED CONSTITUENTS

Parameter (mg/l)	Maximum Well Water Concentrations	Average Well Water Concentrations
Calcium	68.4	41.6
Magnesium	31.6	21.2
Sodium	69.0	30.6
Potassium	6.5	2.9
Chloride	54.0	32.8
Sulfate	712.5	212.9
Fluoride	3.5	1.9
Strontium	5.1	2.6
Ammonia	0.7	0.7
Sulfide	11.3	11.3
Silica (as H_4SiO_4)	13.7	10.5
Carbonate/Bicarbonate	68.3	99.3

Note: Species not listed remain unchanged from Table 3.5.1-4.

Source: Ebasco Environmental, 1992

TABLE 3.5.1-8
MUNICIPAL SEWAGE EFFLUENT QUALITY

PARAMETER (mg/l unless noted otherwise)(1)	City of Bartow	City of Mulberry	City of Lakeland
Alkalinity (as $CaCO_3$)	133	151	142
Aluminum	2.4	<0.1	0.16
Ammonia, as N	14.9	0.31	0.15
Antimony	<0.01	<0.005	<0.005
Arsenic	<0.01	<0.005	<0.005
Barium	<0.1	<0.1	<0.1
Beryllium	<0.01	<0.01	<0.01
Bicarbonate	133	151	138
Boron	0.15	0.15	0.49
Cadmium	<0.005	<0.005	<0.005
Calcium	79	49	63
Carbonate	<2	<2	4.36
Chloride	139	111	118
Chromium	0.038	<0.01	<0.01
Color (PCU)	60	10	40
Copper	0.052	<0.01	<0.01
Cyanides (total)	0.011	<0.005	<0.005
Fecal Coliform (#/100 ml)	>20,000	>2,000	<1
Fluoride	0.264	0.51	1.6
Gross Alpha (pCi/l)	3.7	3.3	5.7
Iron	<0.28	<0.1	<0.1
Lead	<0.005	<0.005	<0.005
Magnesium	21	15	19
Manganese	0.037	<0.03	<0.03
Mercury	<0.0002	<0.0002	<0.0002
Molybdenum	<0.05	0.84	<0.05
Nickel	<0.04	<0.04	<0.04

TABLE 3.5.1-8
MUNICIPAL SEWAGE EFFLUENT QUALITY

PARAMETER (mg/l unless noted otherwise)(1)	City of Bartow	City of Mulberry	City of Lakeland
Nitrate, as N	1.46	1.57	<0.03
Nitrite, as N	<0.03	<0.03	<0.03
Oil & Grease, Grav.	5.8	<1	<1
pH	6.92	6.00	7.56
Phenolics	0.008	<0.005	<0.005
Potassium	8.5	8	7.6
Radium 226 (pCi/l)	<0.2	<0.2	0.5
Radium 228 (pCi/l)	<0.7	<0.7	<0.7
Selenium	<0.005	<0.005	<0.005
Silica-Dissolved	19.2	24.2	4.1
Silver	<0.01	<0.01	<0.01
Sodium	95	73	90
Specific Conductance (umho/cm)	1,100	850	1,050
Strontium	1.7	0.33	0.14
Sulfate	240	(3)	(3)
Strontium 90 (pCi/l)	0	(3)	(3)
Surfactants	2.64	<0.1	<0.1
TDS	652	406	530
Total Coliform (#/100 ml)	(2)	3,000	<10
Total Hardness (as $CaCO_3$)	290	180	230
Total Phosphorus	1.01	2.11	2.29
Total Sulfide	0.17	<0.1	<0.1
Tritium (pCi/l)	7	(3)	(3)
TSS	15.5	<5	<5
Turbidity (NTU)	12	6.4	2.1
Vanadium	<0.05	<0.05	<0.05
Zinc	0.065	0.094	<0.05

Notes: (1) Organics and pesticides listed in Table 2.3.4-4 were not detected except for slight traces of bromodichloromethane and dibromochloromethane at the City of Mulberry.
(2) Matrix interference
(3) Not yet available
Source: Ebasco Environmental, 1992

TABLE 3.5.1-9
CLASSIFICATION OF MINE AREA DAMS

Mine Area	Service Date	Category 1 (1)	Category 2 (1)	Cooling Pond Stage
N-9B (All Walls)	1961		X (2)	Initial/Ultimate
N-11A (All Walls)	1965		X	Ultimate
N-11B (All Walls)	1964		X (2)	Ultimate
N-11C (All Walls)	1965		X	Ultimate
N-13	1969			
West Wall			X	Ultimate
South Wall			X (2)	Initial
N-15	1975	X		
East Wall			X	Ultimate
Other Walls				Ultimate
		X		
N-16	1982	X		
West Wall				Initial/Ultimate
South Wall				Initial/Ultimate
East Wall			X (2)	Initial/Ultimate
North Wall			X (2)	Initial/Ultimate

Note: (1) Category 1 dams are F.A.C. 17-672 and Category 2 dams are pre F.A.C. 17-672 regulations.

(2) Category 2 common dam walls with N-16 were redesigned to Category 1 criteria (Armac, 1979) to accommodate a pond level of +180 ft-MSL, however, the modified dam sections have not been constructed.

Source: Dames & Moore, 1992

TABLE 3.5.1-10
CATEGORY 1 DAMS - MINIMUM DESIGN FACTORS-OF-SAFETY

Engineering Analysis	Minimum Factor-of-Safety
Slope Stability (Circular Arc in Upstream and Downstream Slopes)	1.5
Horizontal Base Shear	1.75
Sliding Wedge (with Seepage on Slope)	1.5
Bearing Capacity	1.5

Source: F.A.C., 17-672 (1972)

TABLE 3.5.1-11
EFFECTIVE SOIL FRICTION ANGLES (Ø)

Description	Range	Avg (Ø)	Ø (1)	Ø Site Design	Cohesion
Partially Compact to Compact Overburden	32-40°	35°	34°	37° (Compacted)	0
				32° (Partially Compacted)	0
Cast Overburden	21-42.5°	32°	31°	32° (2)	0

Note: (1) Design soil friction angles determined per Corps of Engineers Procedure (Dept. of Army, 1970).

(2) Soil friction angles for design purposes are reduced to an effective value of 25° to account for the 25% reduction in shear strength required by Category 1 dam design criteria.

Source: Dames & Moore, 1992

TABLE 3.5.1-12
COMPARISON OF SOIL FRICTION ANGLES

Description	Site Design	N-15 (P.T.L, 1973)	N-16 (Armac, 1979, 1982)	SA-8 (Armac, 1978)	SA-9 (Ardaman, 1979)	SA-10 (Ardaman, 1981)	P-2 (Armac, 1977)	P-3 (Armac, 1979)
Cast Overburden								
• In Situ	32°	-	-	33°	33.5°	33°	32°	32°
• Reduced	25°	26.5°	25.5°	26°		26°	25°	25°
Partially Compacted Overburden (Dozed)	32°	-	32°	-	26°	-	-	32°
Structural Compacted Overburden (Rolled)	37°	36°-38°	37°	36°	36°	36°	33°	37°
Sand Tails Drains	33°	36°	-	32°-34°	34°	34°	-	-

Source: Dames & Moore, 1992

TABLE 3.5.1-13
MINIMUM FACTORS-OF-SAFETY FOR PERIMETER DAMS

	Operation		Construction	
	Upstream	Downstream	Upstream	Downstream
Circular Slope Stability Failure	1.5	1.5	1.2 (1)	1.2 (1)
Horizontal Base Shear	1.75		1.75	
Sliding Wedge (with Seepage at Toe of Slope)	1.5		1.5	
Bearing Capacity	1.5		1.5	
Rapid Drawdown	1.0		-	

(1) Factors computed using uncorrected soil friction values

Source: Dames & Moore, 1992

TABLE 3.5.1-14
SUMMARY OF BUFFER AREA CONSOLIDATION

		Clay Elevation (ft MSL)		
Area	Boring	Present	Year 1997 Prediction	Final Prediction
N-11A	C-3	171.5	169.9	167.4
N-13	C-4	164.7	163.4	160.5
	C-6	166.5	165.0	162.1
	C-7	164.5	163.1	160.9
N-9	C-8	161.2	159.9	156.2
	C-9	155.0	154.2	148.5
	C-10	156.3	155.1	151.2

Source: Dames & Moore, 1992

TABLE 3.5.1-15
SUMMARY OF GRAIN SIZE ANALYSES FOR EVALUATION OF SAND TAIL FILTER SUITABILITY

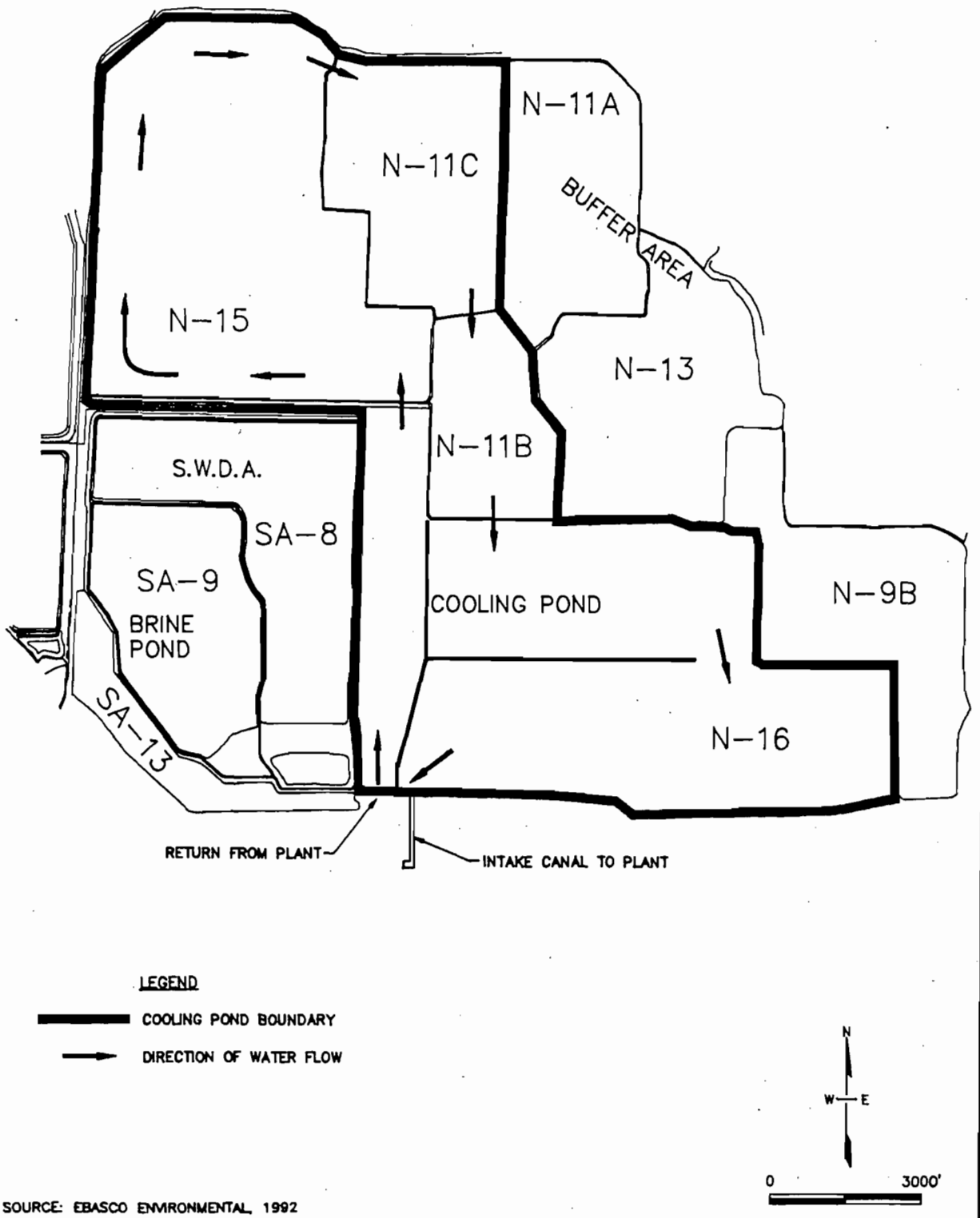
Description	Particle Size (mm)			Ratios			
	MAX	MIN	AVG	MAX	MIN	AVG	Filter Criteria
R_F = 15% Grain Size of Sand Tailings / 85% Grain Size of Dam Material	0.18 / 1.55	0.13 / 0.16	0.15 / 0.53	1.1	0.1	0.3	≤5
R_F = 50% Grain Size of Sand Tailings / 50% Grain Size of Dam Material	0.36 / 0.20	0.24 / 0.06	0.32 / 0.12	5.9	1.2	2.7	≤25

Source: Dames & Moore, 1992

TABLE 3.5.1-16
DESIRABLE LIMITS ON COOLING WATER QUALITY

Parameter (mg/l unless noted otherwise)	Limit
pH	6.8 - 7.5 (S.U.)
Calcium Hardness (as $CaCo_3$)	20 - 300
Sum of Calcium and Sulfate Concentrations (as $CaCO_3$)	<1500
Product of Calcium and Sulfate Concentrations	<400,000
Silica (as SiO_2)	<150
Iron	<0.5
Manganese	<0.5
Aluminum	<1
Sulfides	<5
Total Dissolved Solids	<2,500
Total Suspended Solids	<100
Product of Magnesium and Silica Concentrations	<30,000

Source: Ebasco Environmental and Black & Veatch, 1992

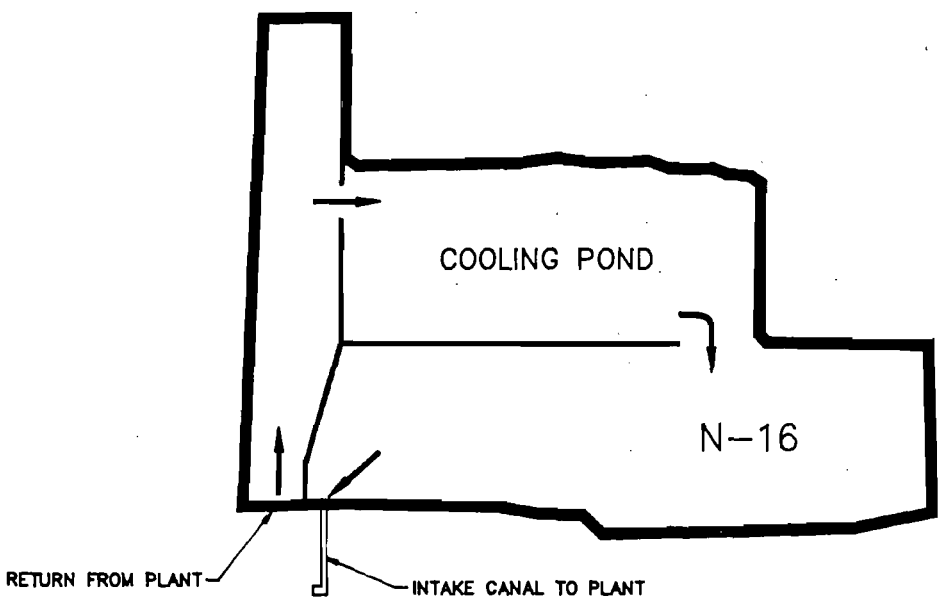


SOURCE: EBASCO ENVIRONMENTAL, 1992

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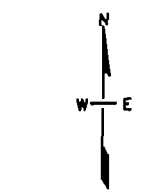
FIGURE 3.5.1-1
ULTIMATE COOLING POND CONFIGURATION



LEGEND

COOLING POND BOUNDARY

DIRECTION OF WATER FLOW



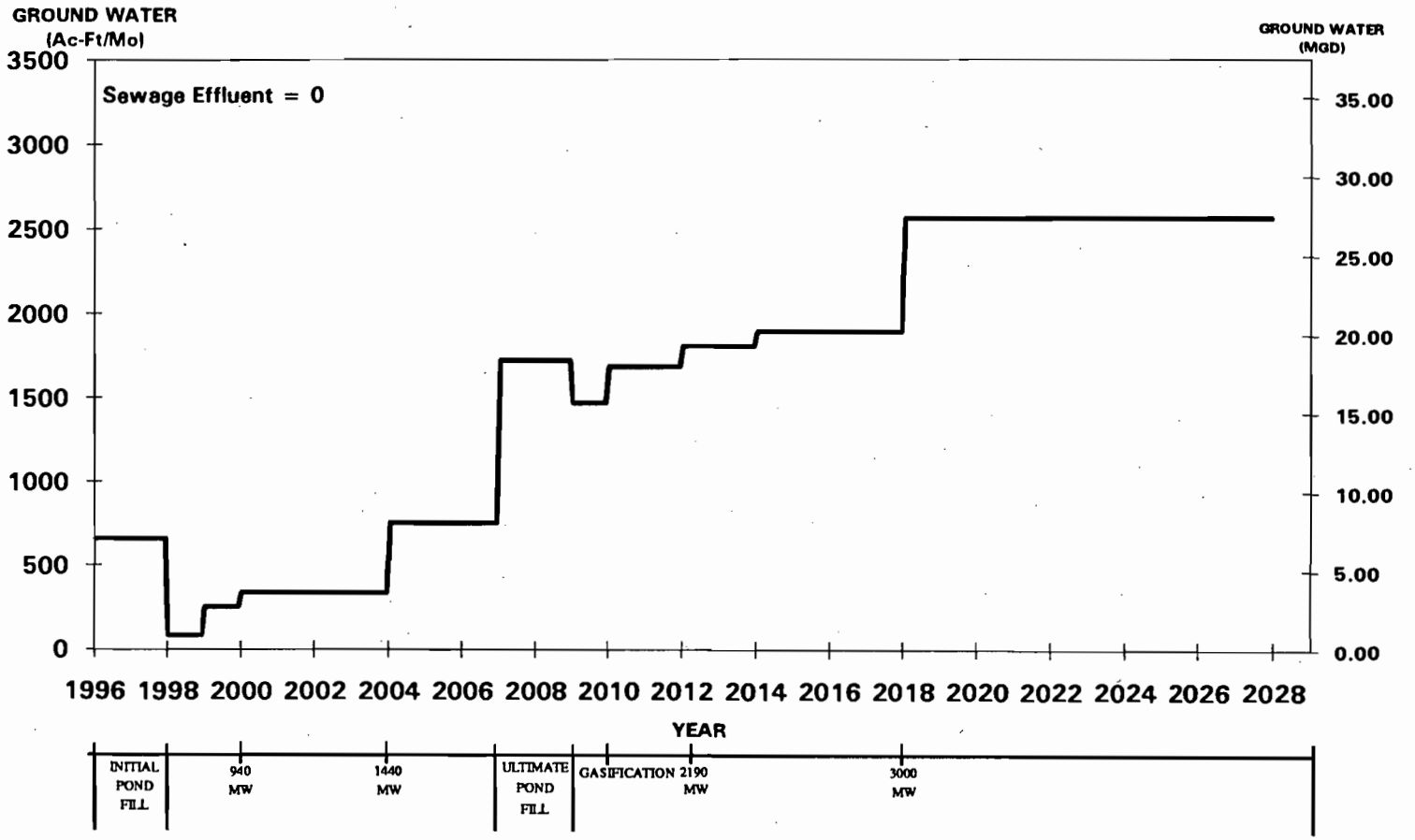
0 3000'

SOURCE: EBASCO ENVIRONMENTAL, 1992

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FIGURE 3.5.1–2
INITIAL COOLING POND CONFIGURATION (N–16 ONLY)

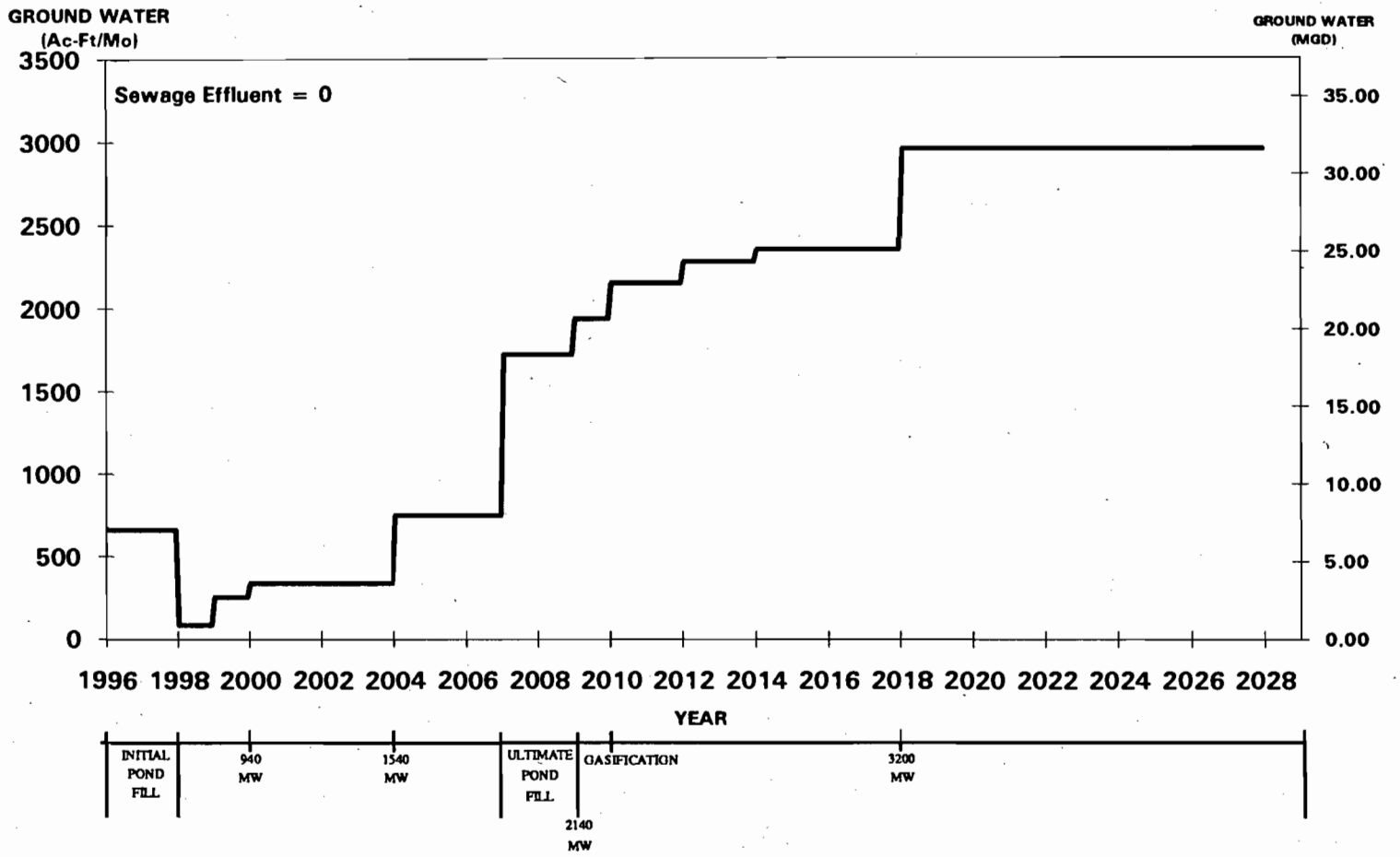


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-3
PEAK GROUND WATER WITHDRAWAL
CASE A

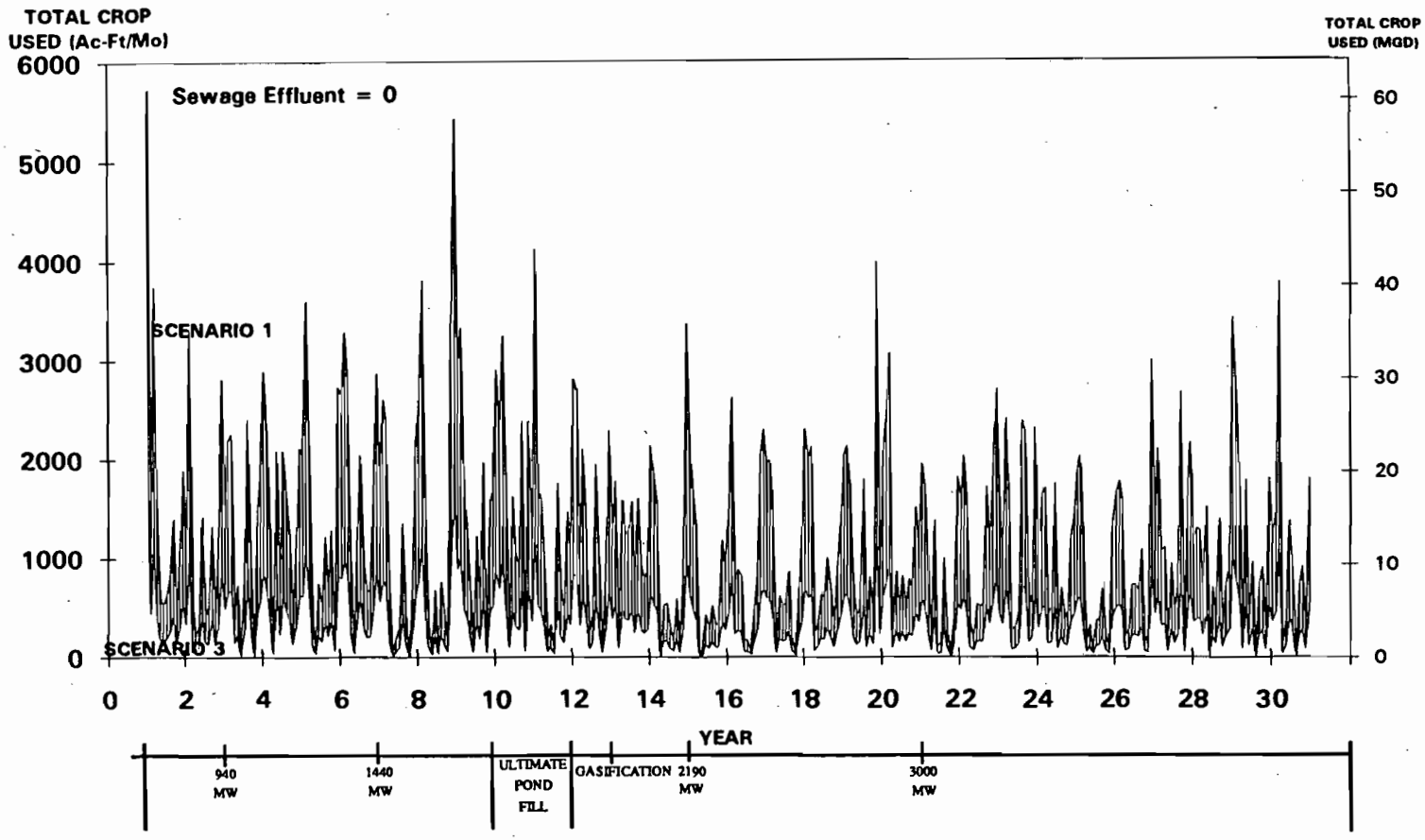


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-4
PEAK GROUND WATER WITHDRAWAL
CASE B

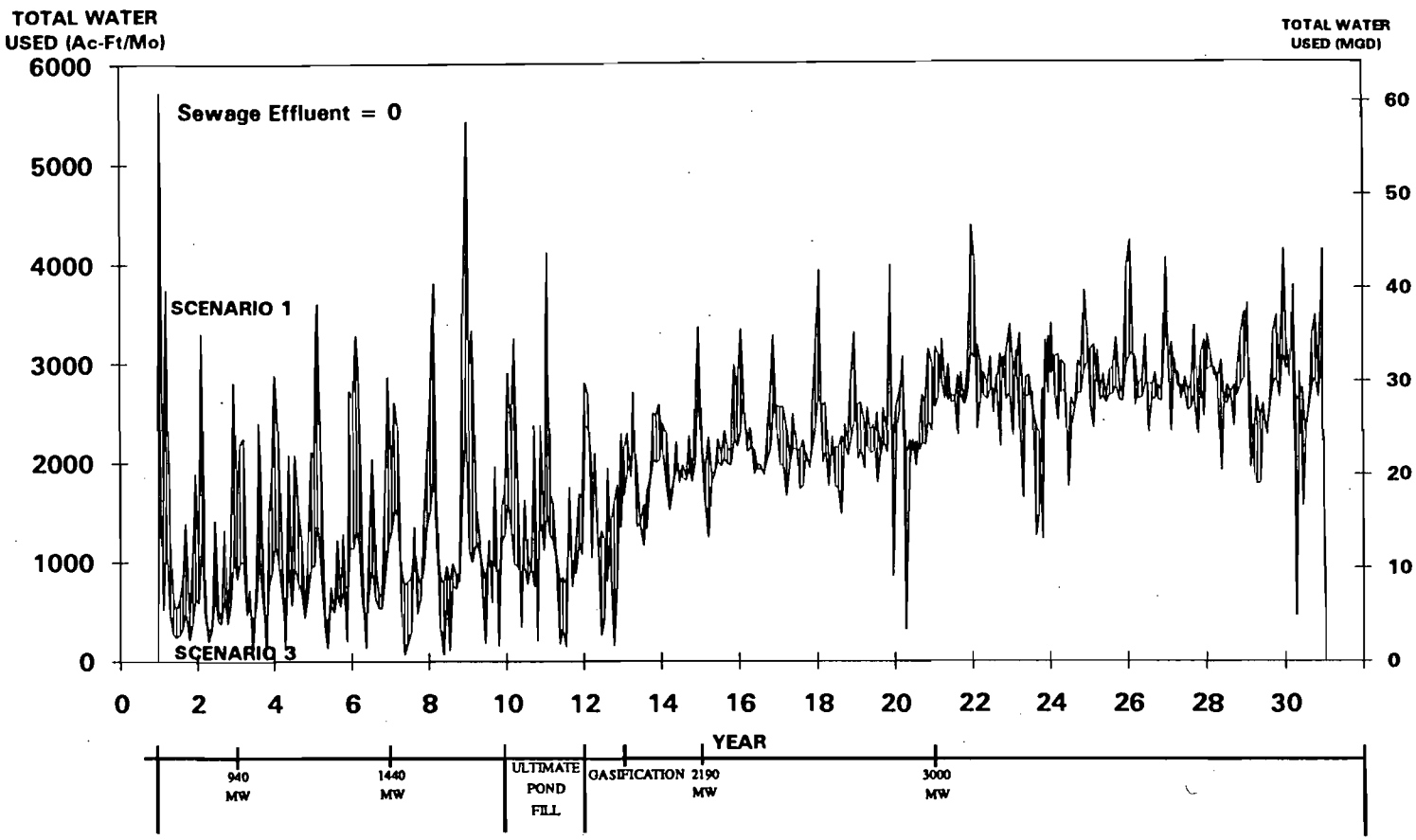


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-5
TOTAL WATER CROP USED
CASE A - SCENARIOS 1 AND 3

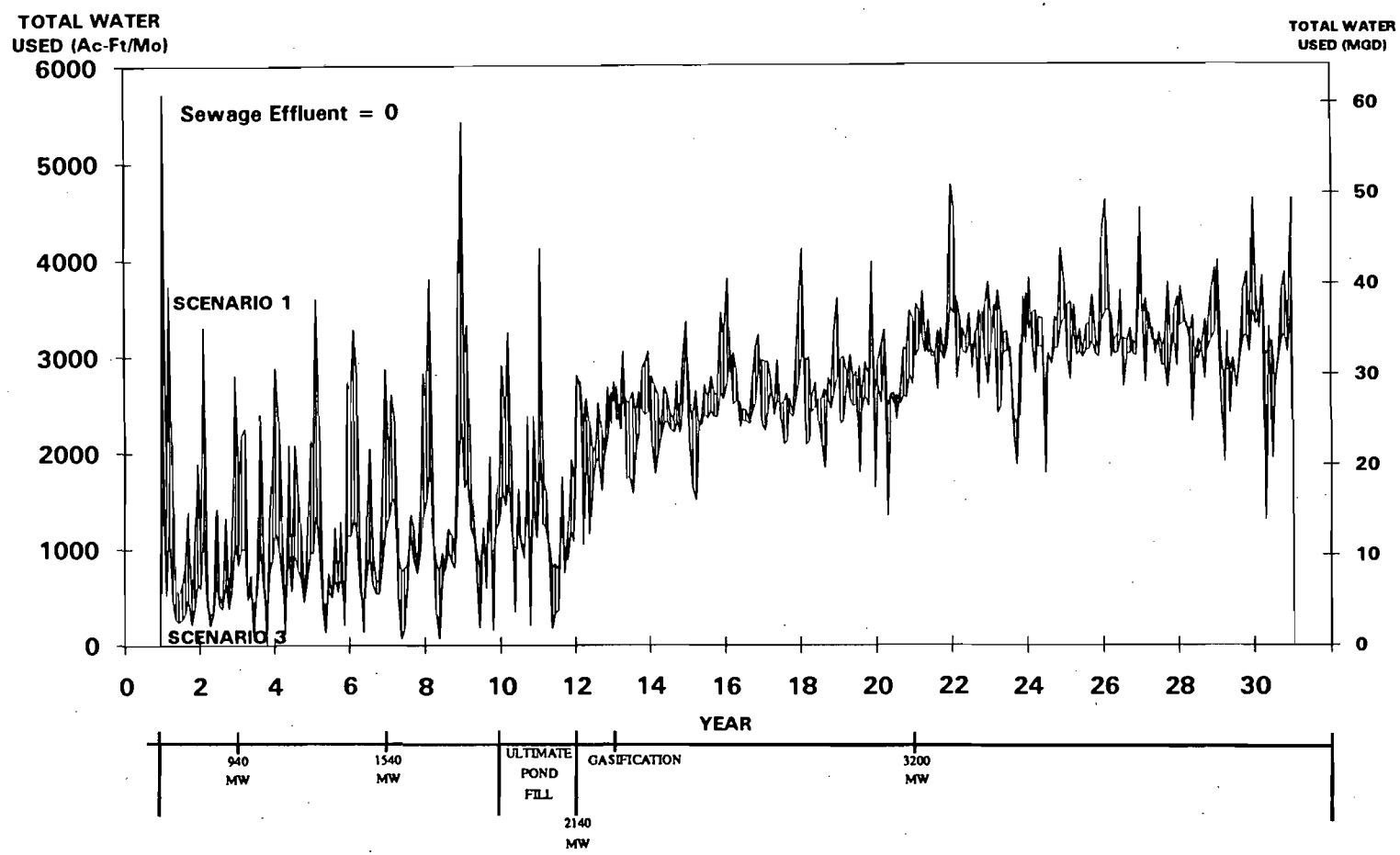


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-6
TOTAL WATER CROP AND GROUND WATER USED
CASE A - SCENARIOS 1 AND 3

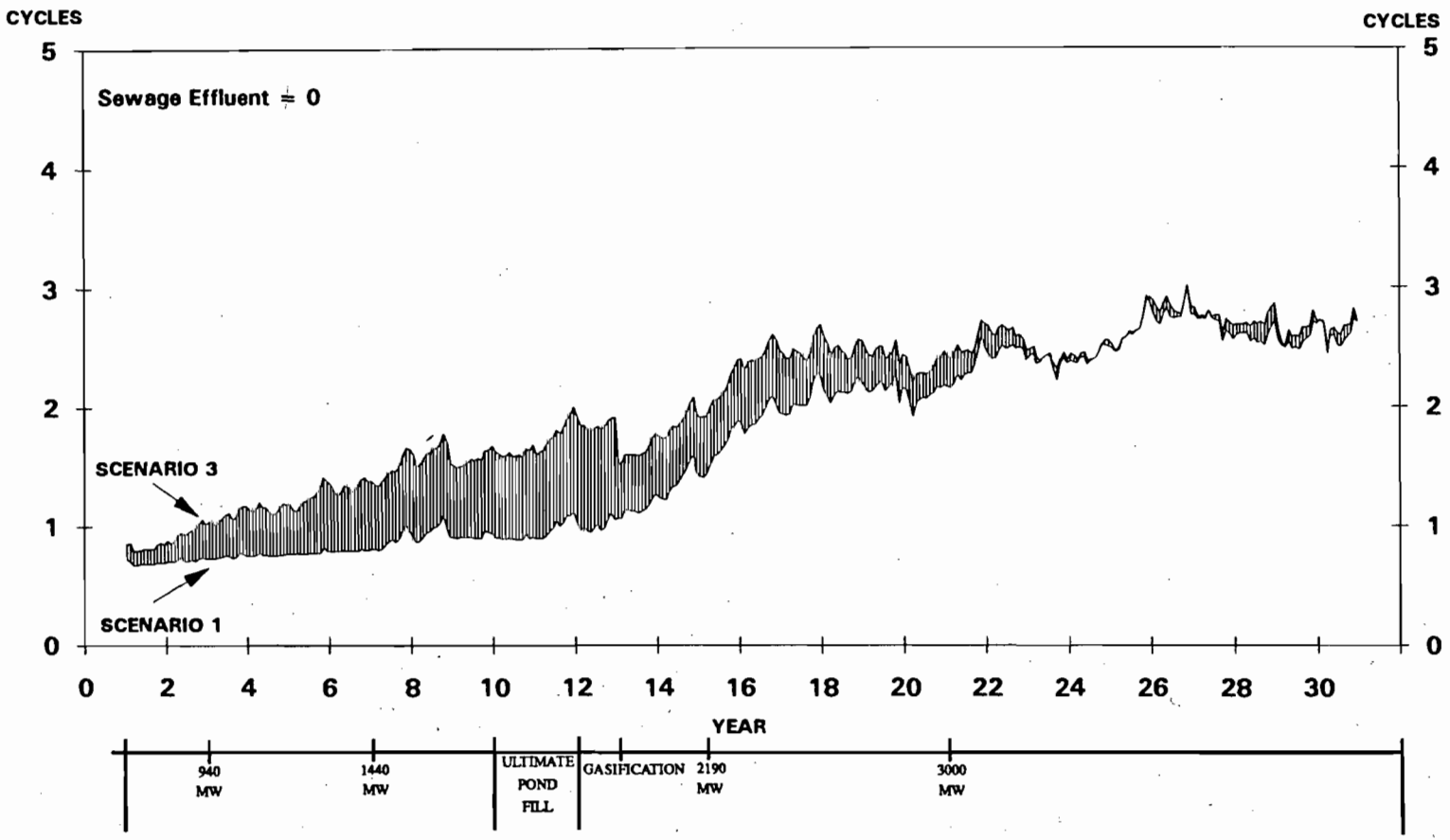


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-7
TOTAL WATER CROP AND GROUND WATER USED
CASE B - SCENARIOS 1 AND 3

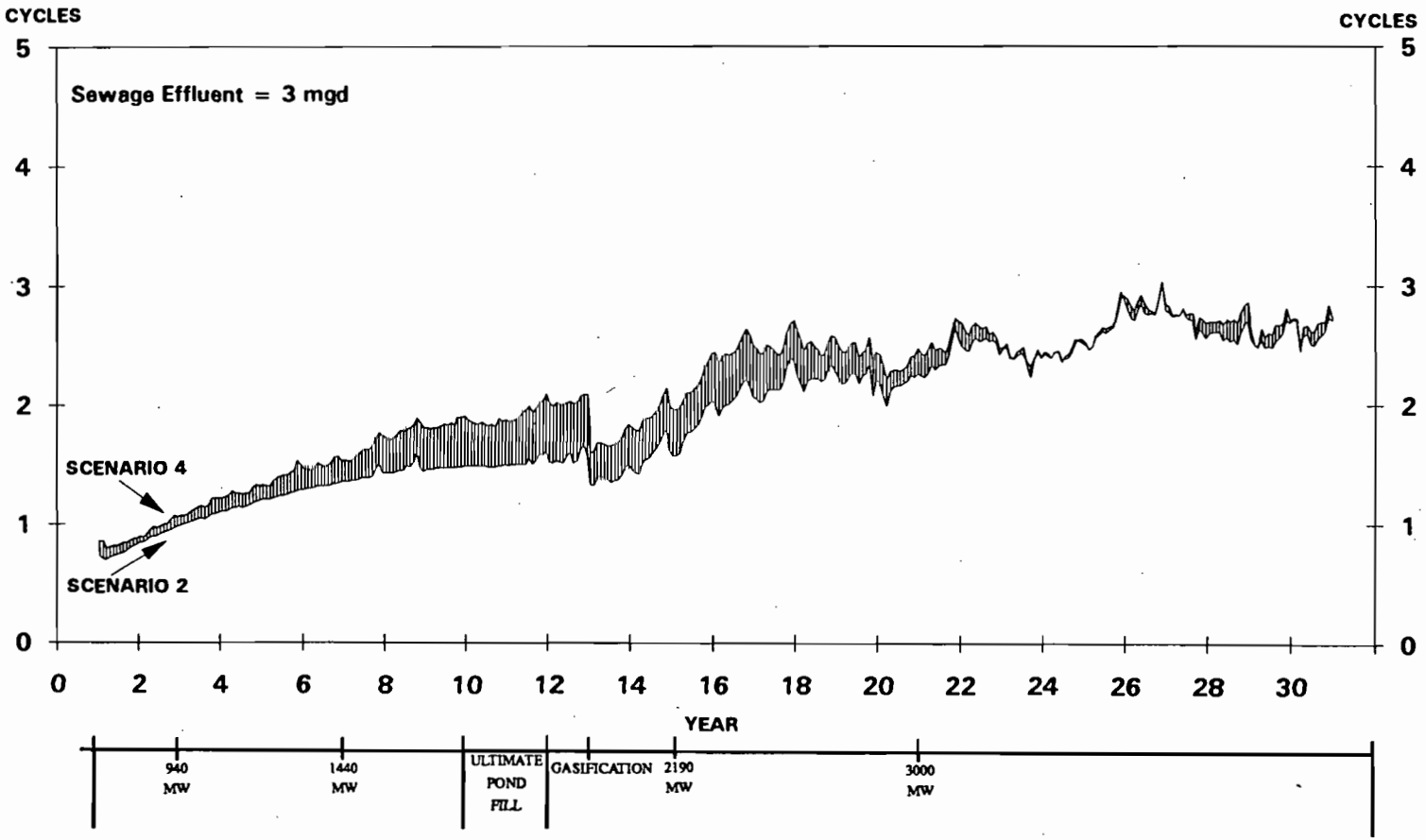


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-8
CYCLES OF CONCENTRATION
CASE A - SCENARIOS 1 AND 3

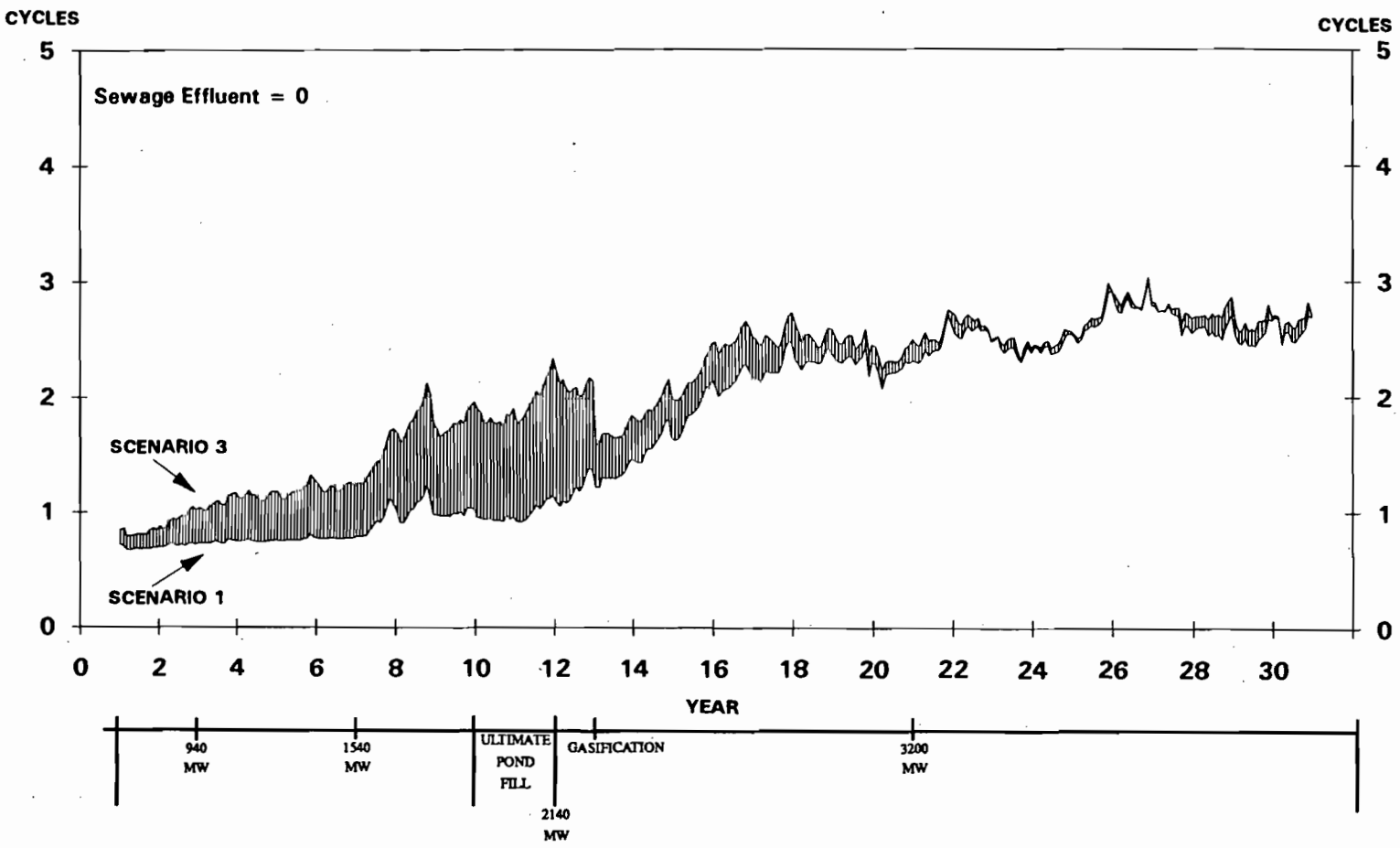


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-9
CYCLES OF CONCENTRATION
CASE A - SCENARIOS 2 AND 4

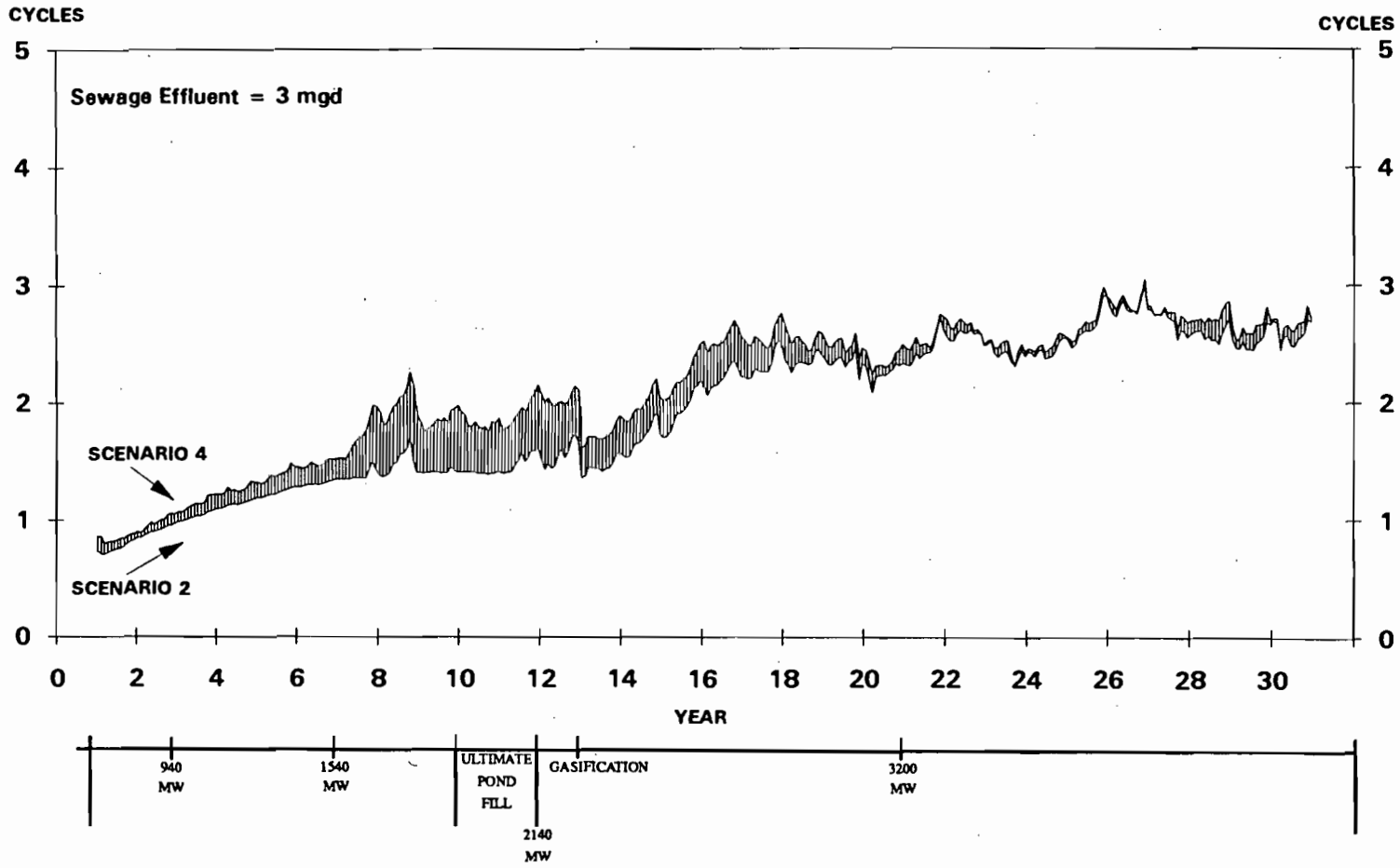


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-10
CYCLES OF CONCENTRATION
CASE B - SCENARIOS 1 AND 3

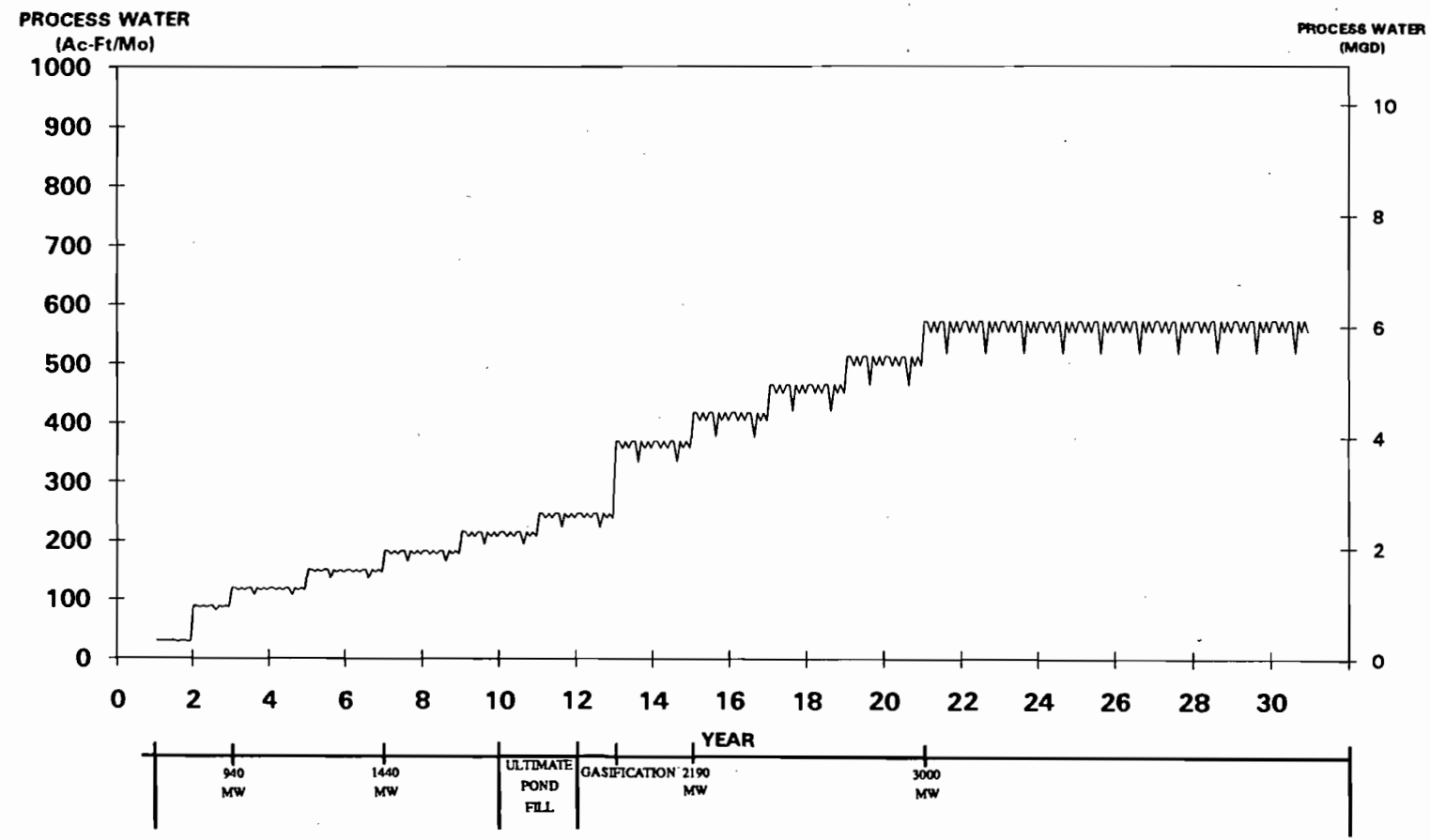


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-11
CYCLES OF CONCENTRATION
CASE B - SCENARIOS 2 AND 4

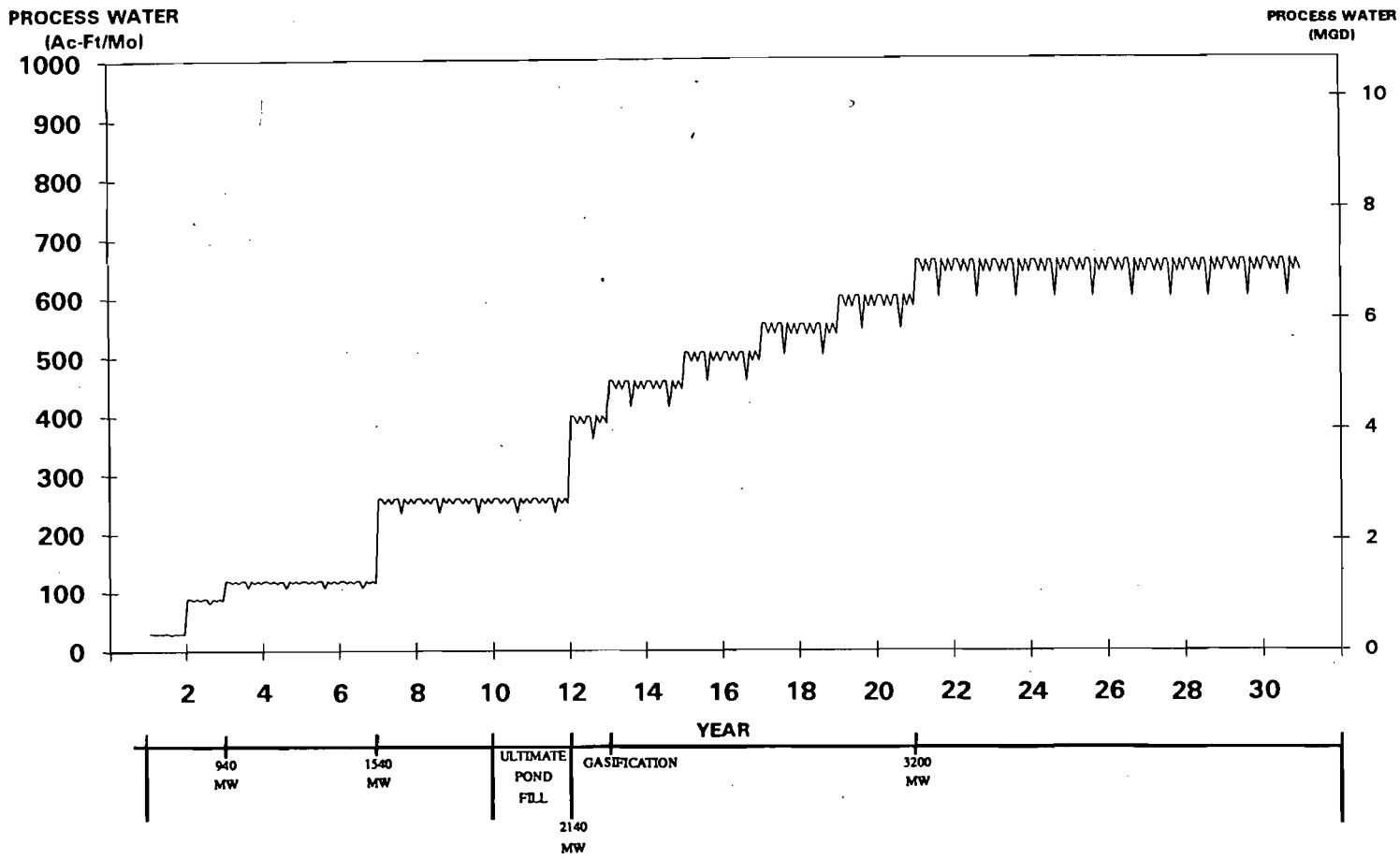


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-12
ESTIMATED PROCESS WATER USE
CASE A

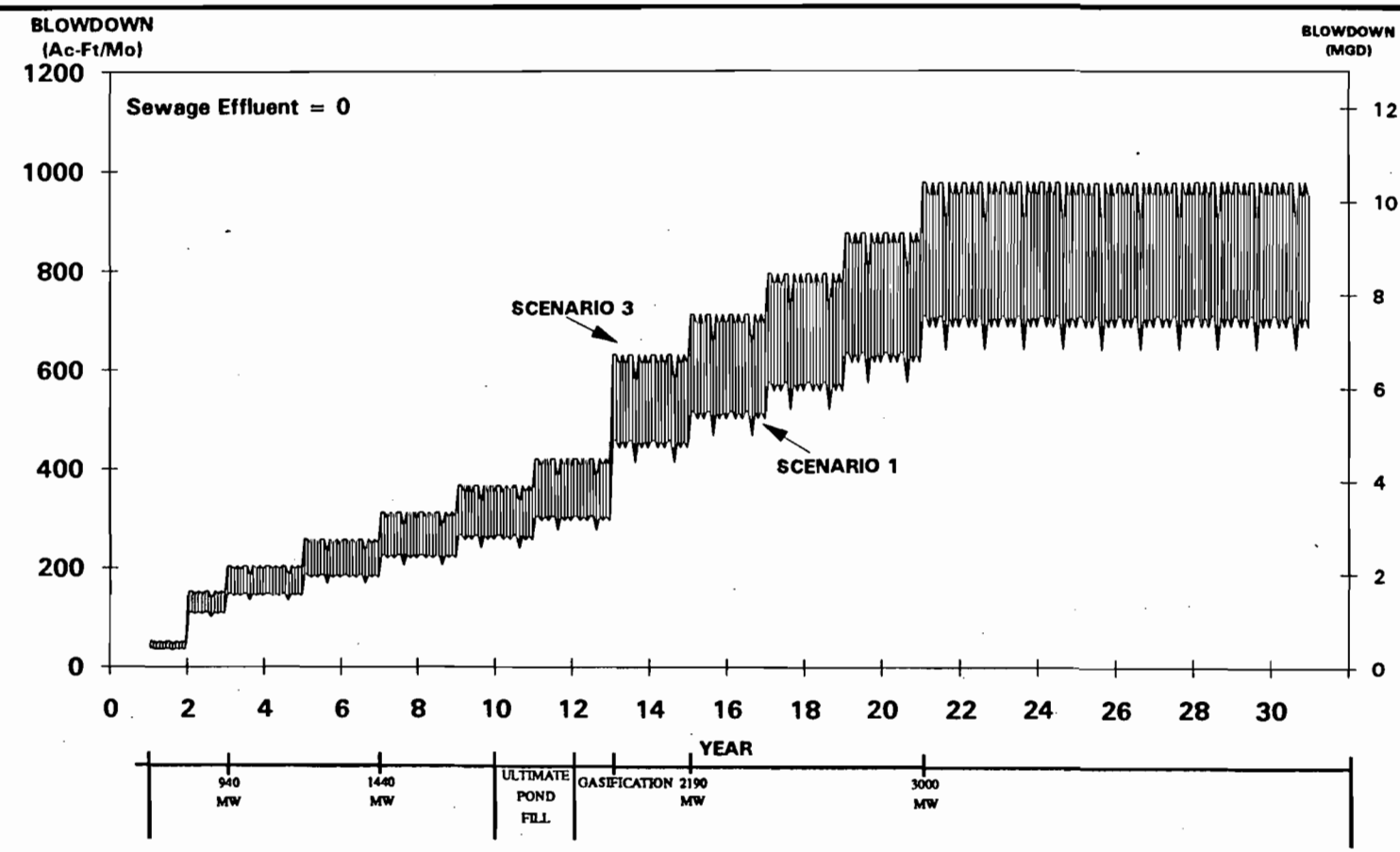


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-13
ESTIMATED PROCESS WATER USE
CASE B

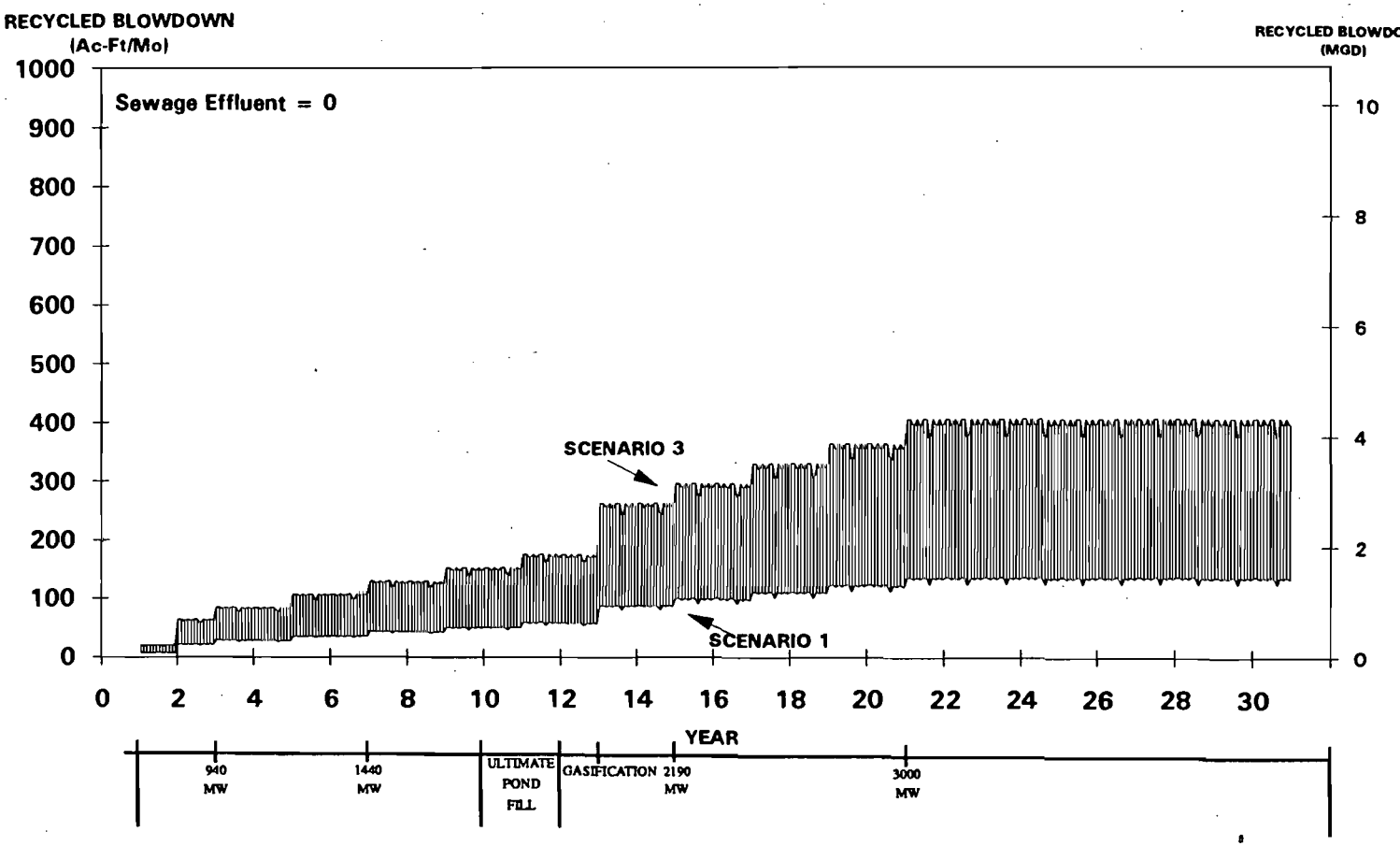


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-14
BLOWDOWN
CASE A - SCENARIOS 1 AND 3

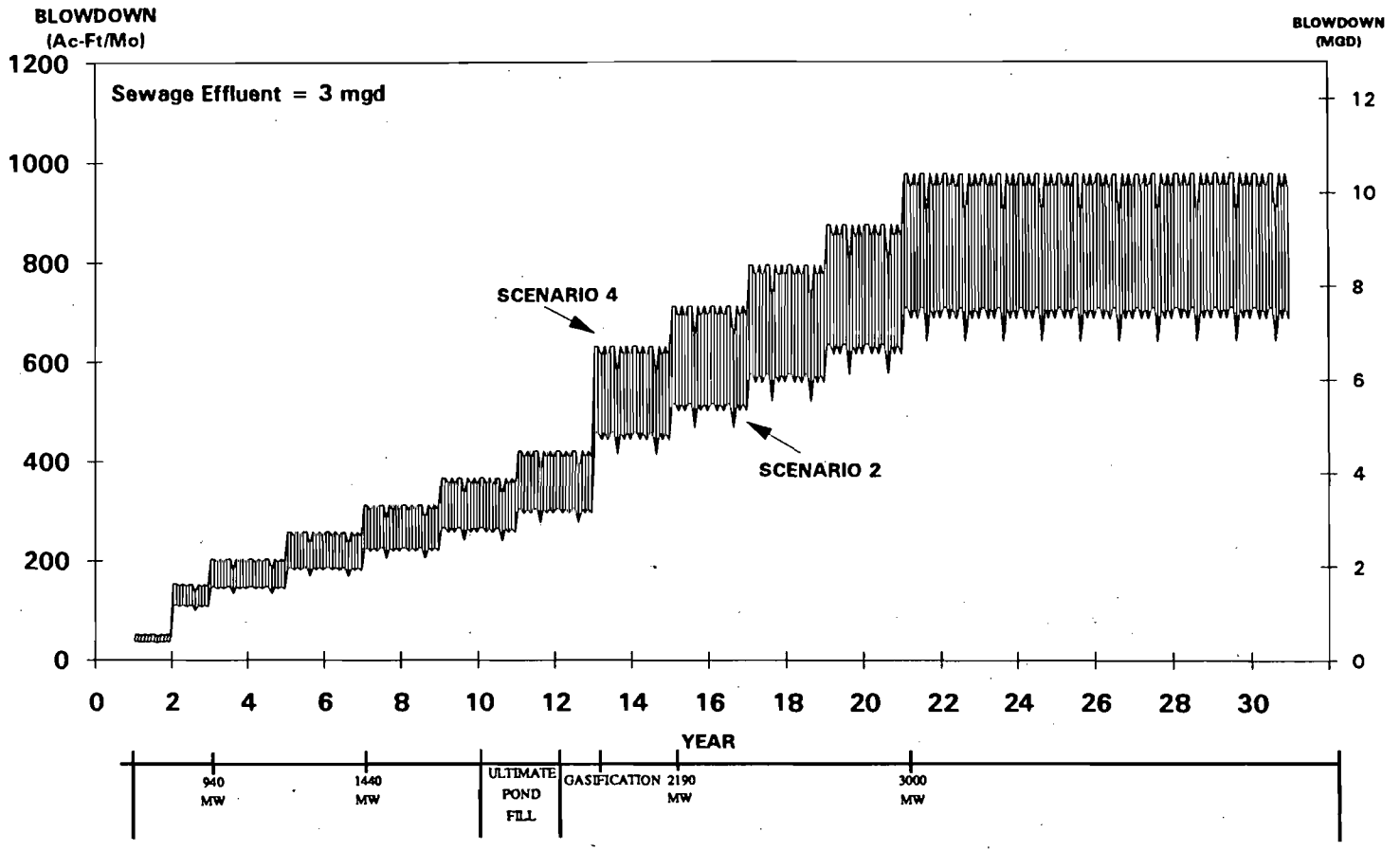


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-15
RECYCLED BLOWDOWN
CASE A - SCENARIOS 1 AND 3

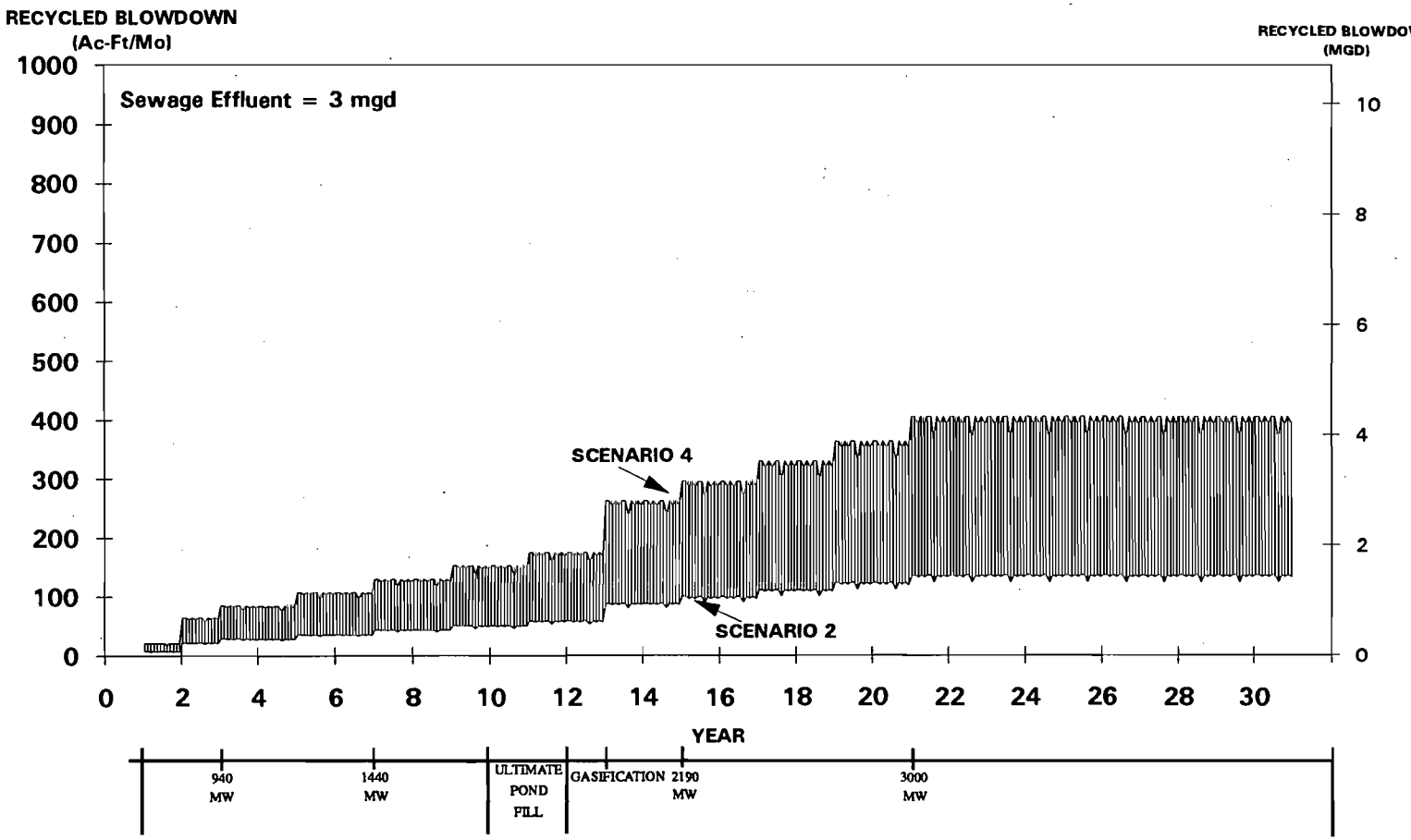


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-16
BLOWDOWN
CASE A - SCENARIOS 2 AND 4

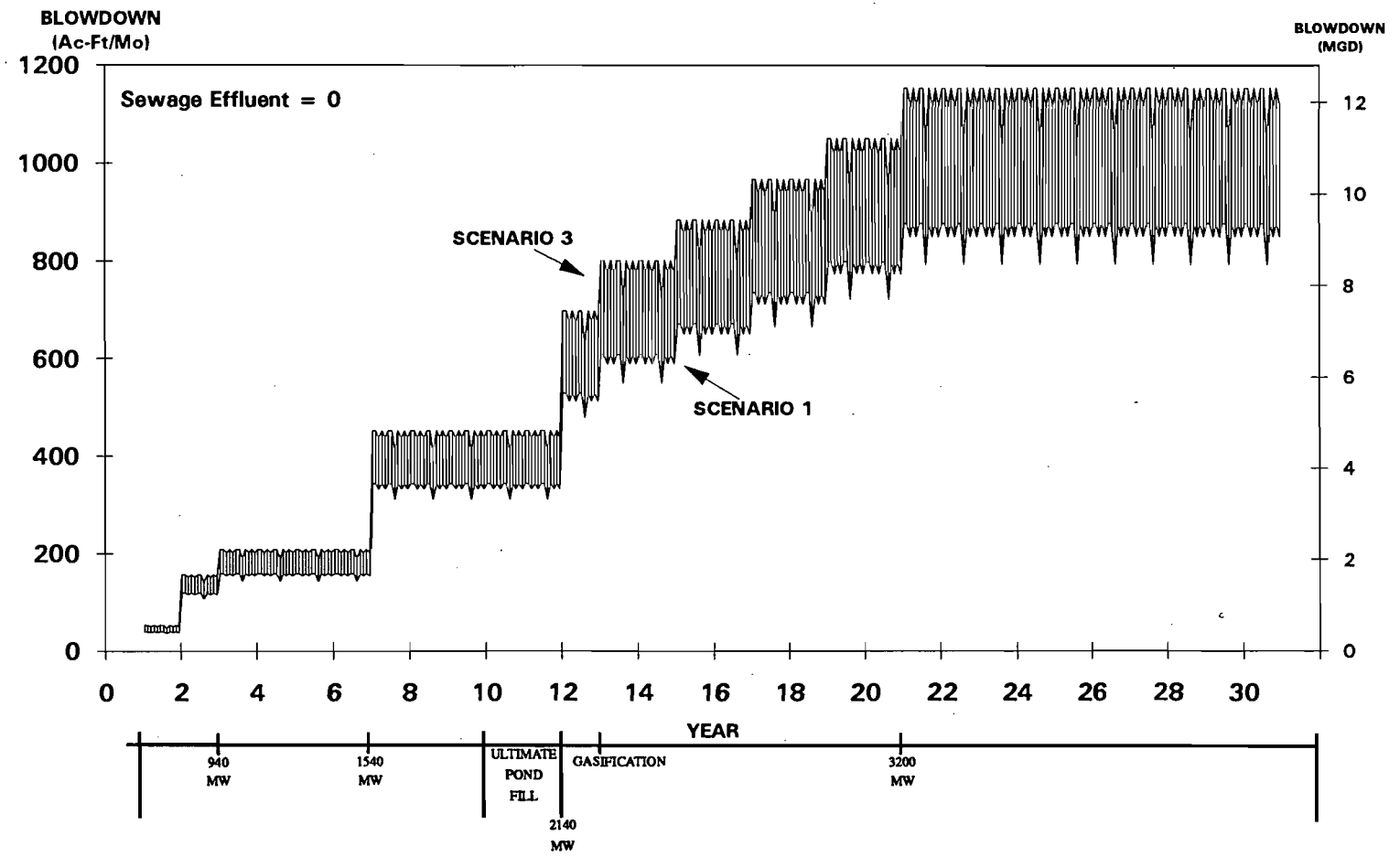


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-17
RECYCLED BLOWDOWN
CASE A - SCENARIOS 2 AND 4

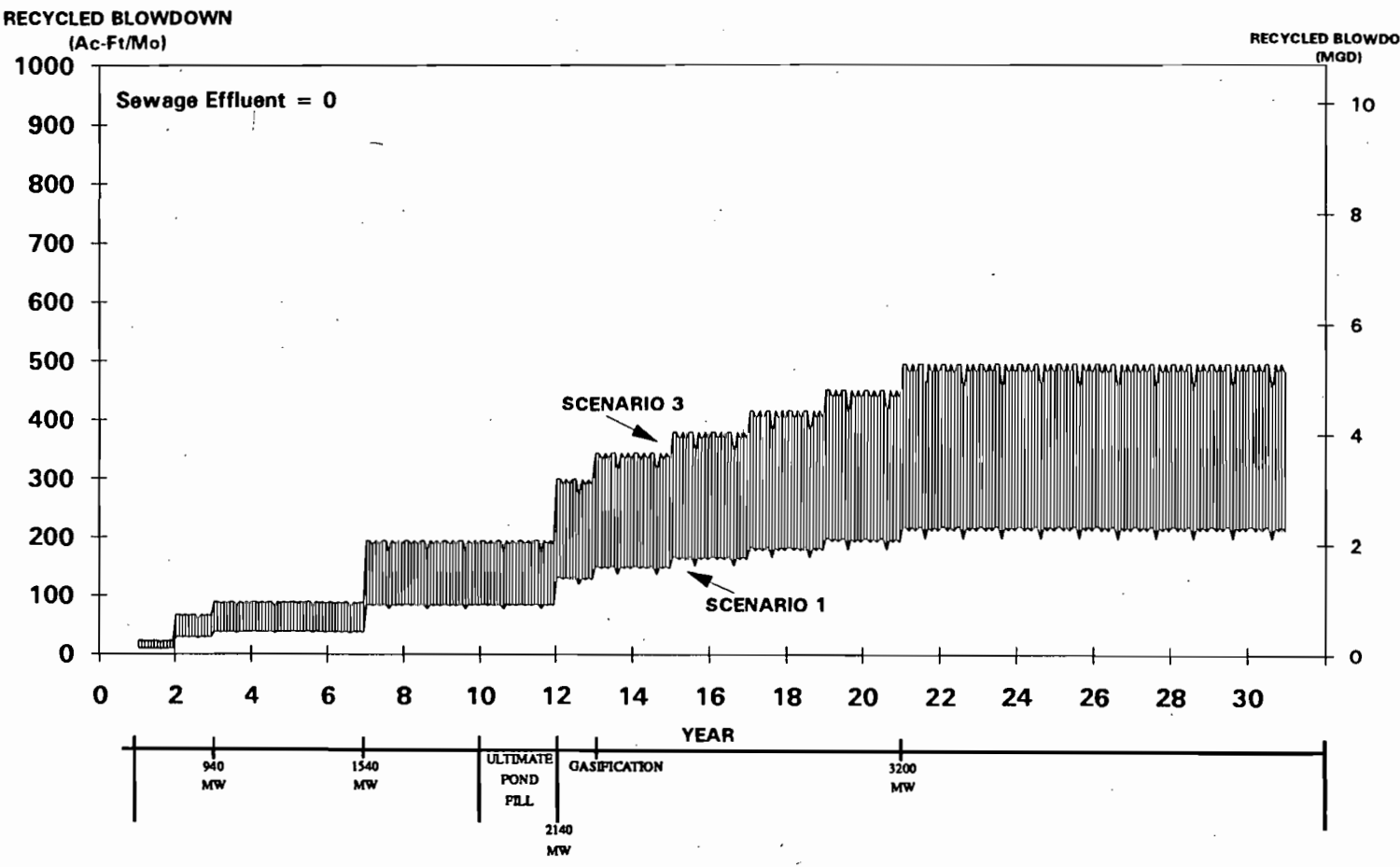


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-18
BLOWDOWN
CASE B - SCENARIOS 1 AND 3

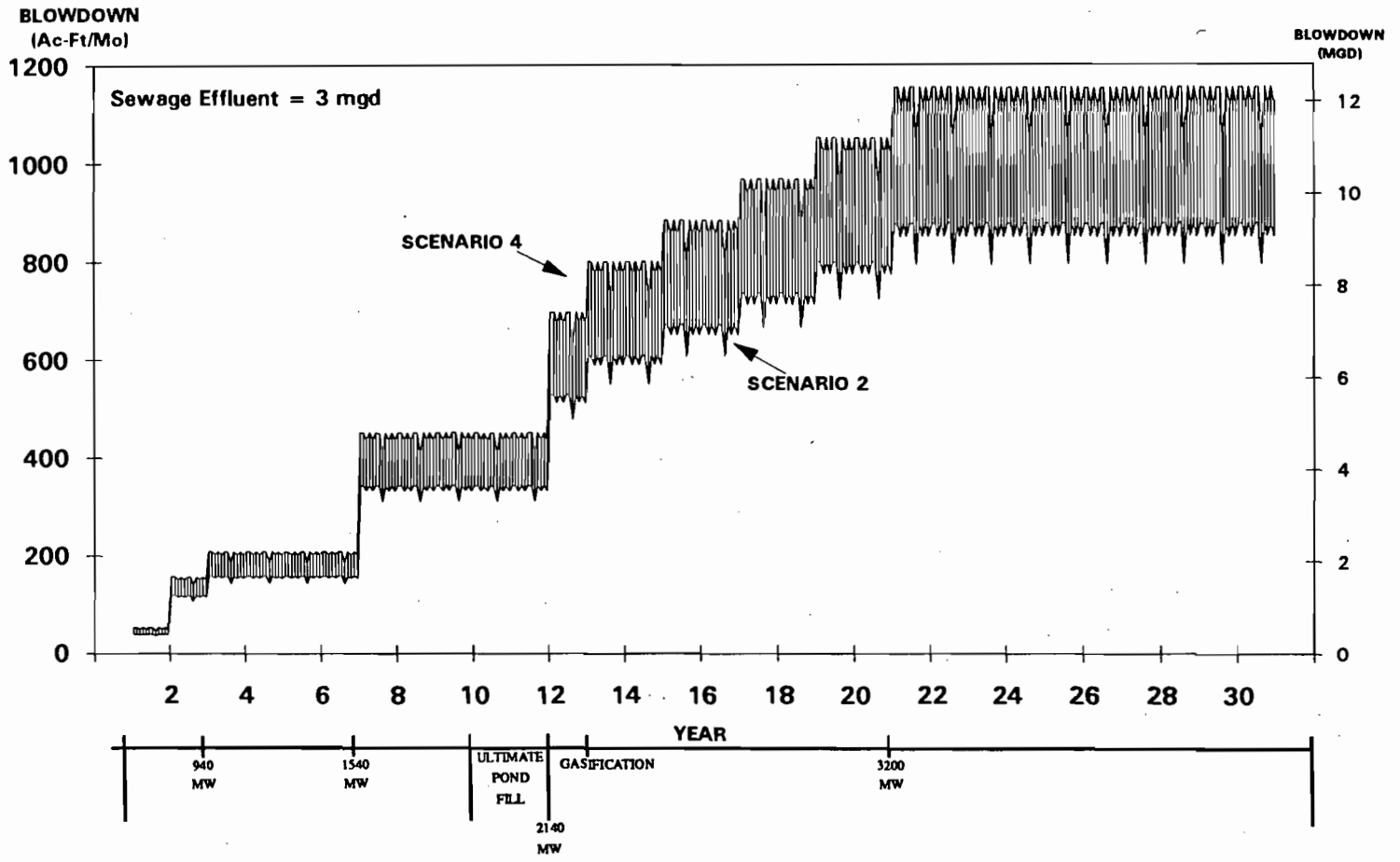


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-19
RECYCLED BLOWDOWN
CASE B - SCENARIOS 1 AND 3

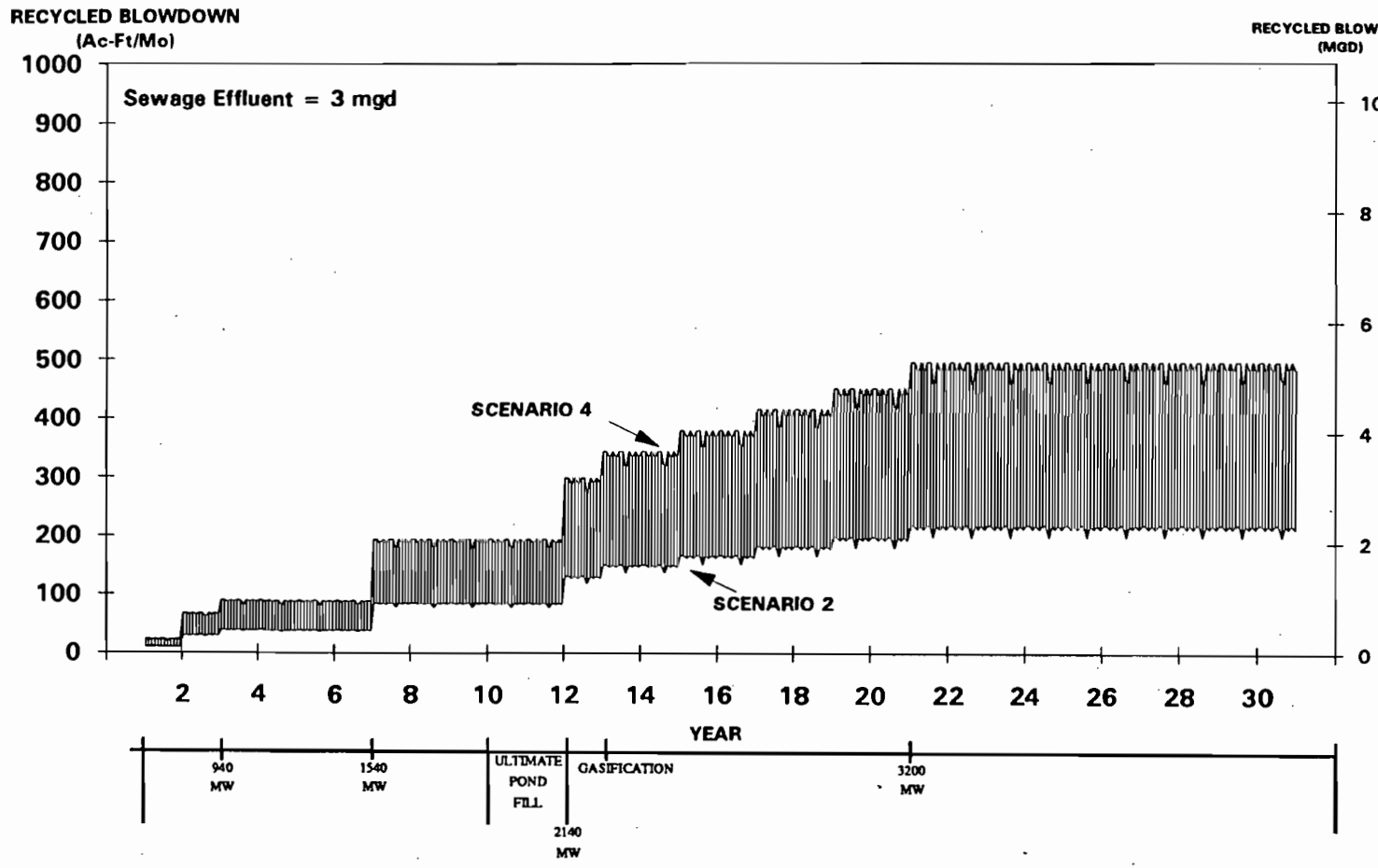


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-20
BLOWDOWN
CASE B - SCENARIOS 2 AND 4

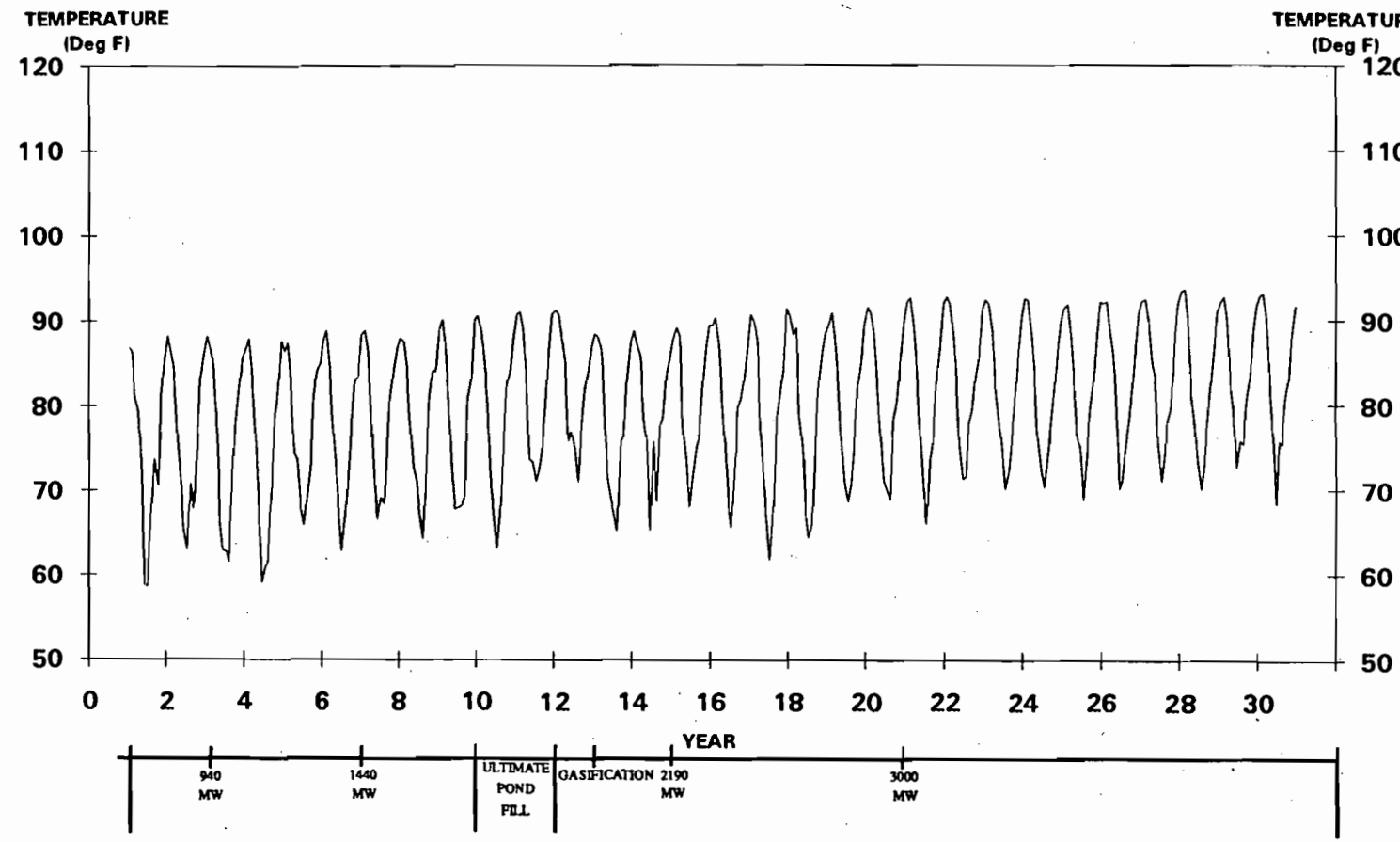


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-21
RECYCLED BLOWDOWN
CASE B - SCENARIOS 2 AND 4

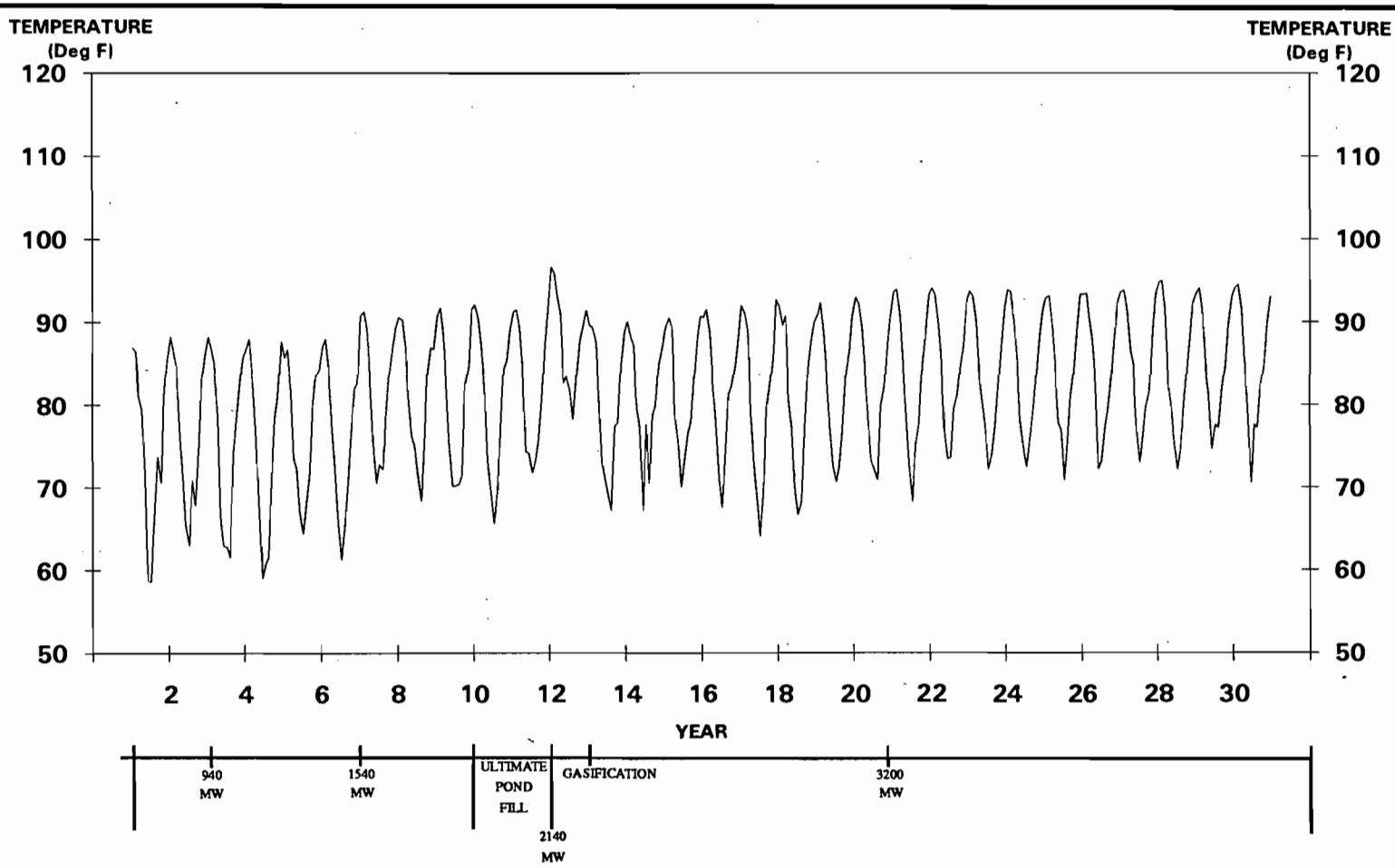


Source: Ebasco Environmental, 1992

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Polk County Site

FIGURE 3.5.1-22
CONDENSER INLET TEMPERATURE
CASE A (3,000 MW CGCC)

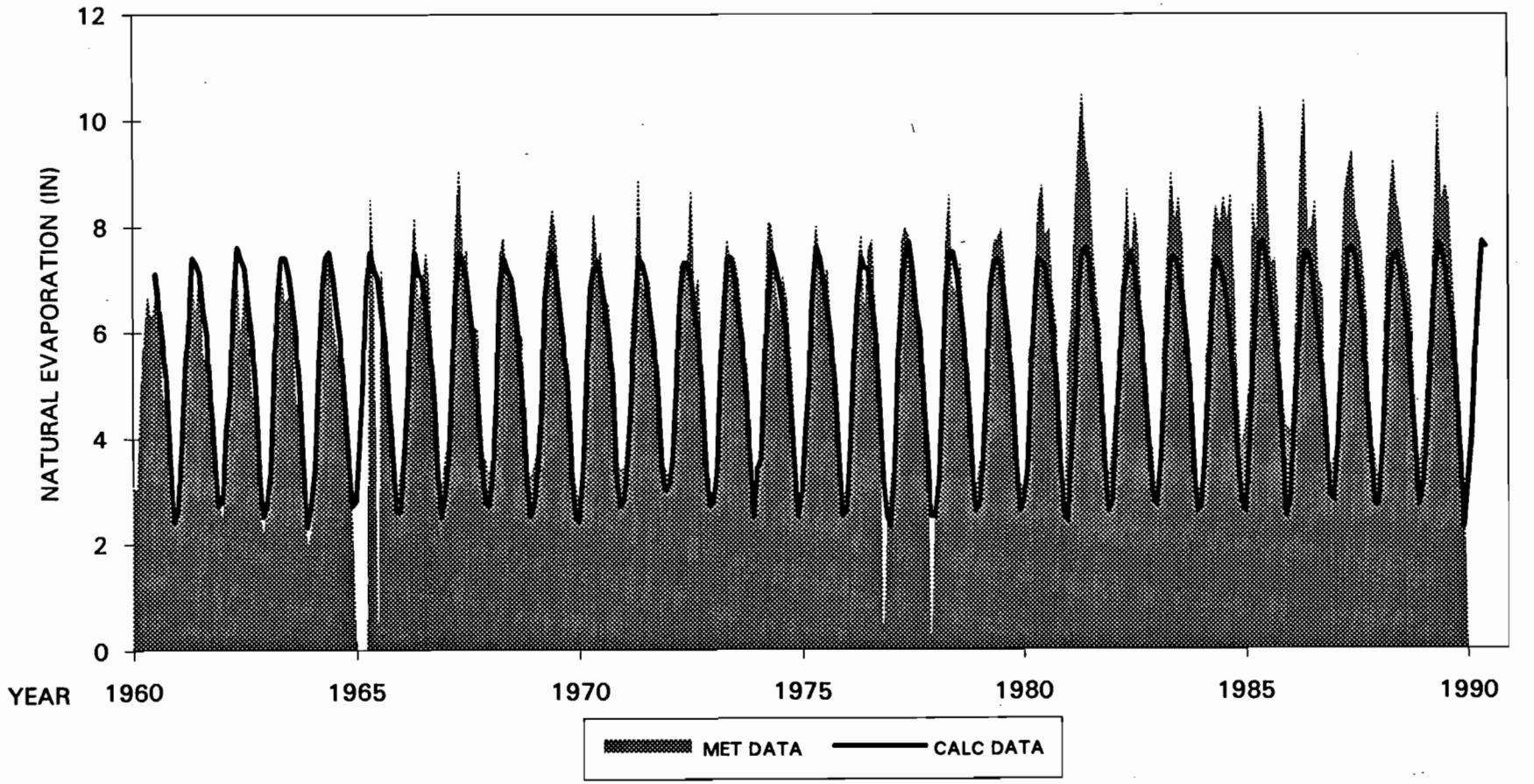


Source: Ebasco Environmental, 1992

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FIGURE 3.5.1-23
CONDENSER INLET TEMPERATURE
CASE B (3,200 MW CGCC)

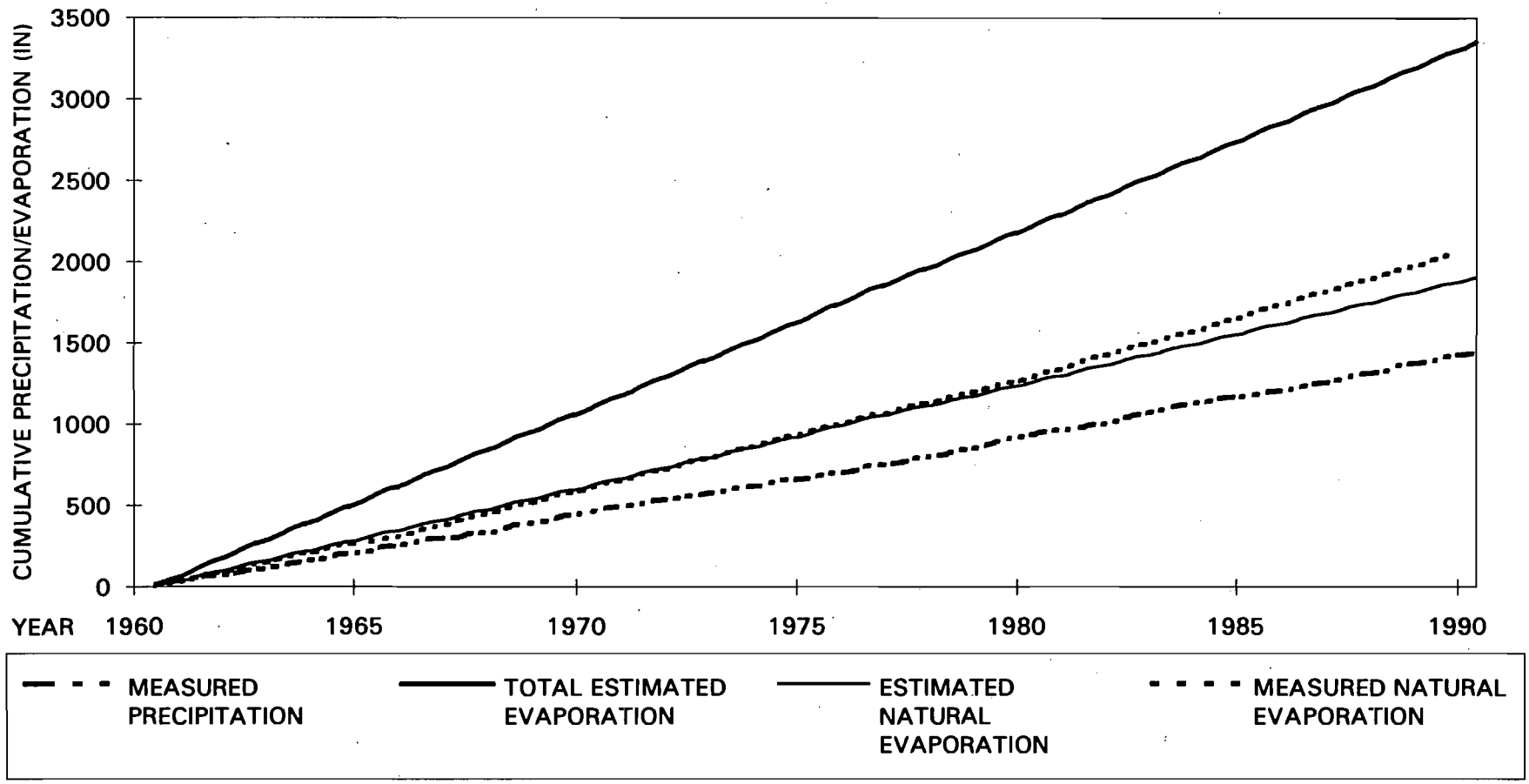


Source: National Weather Service, 1992

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Polk County Site

FIGURE 3.5.1-24
NATURAL EVAPORATION

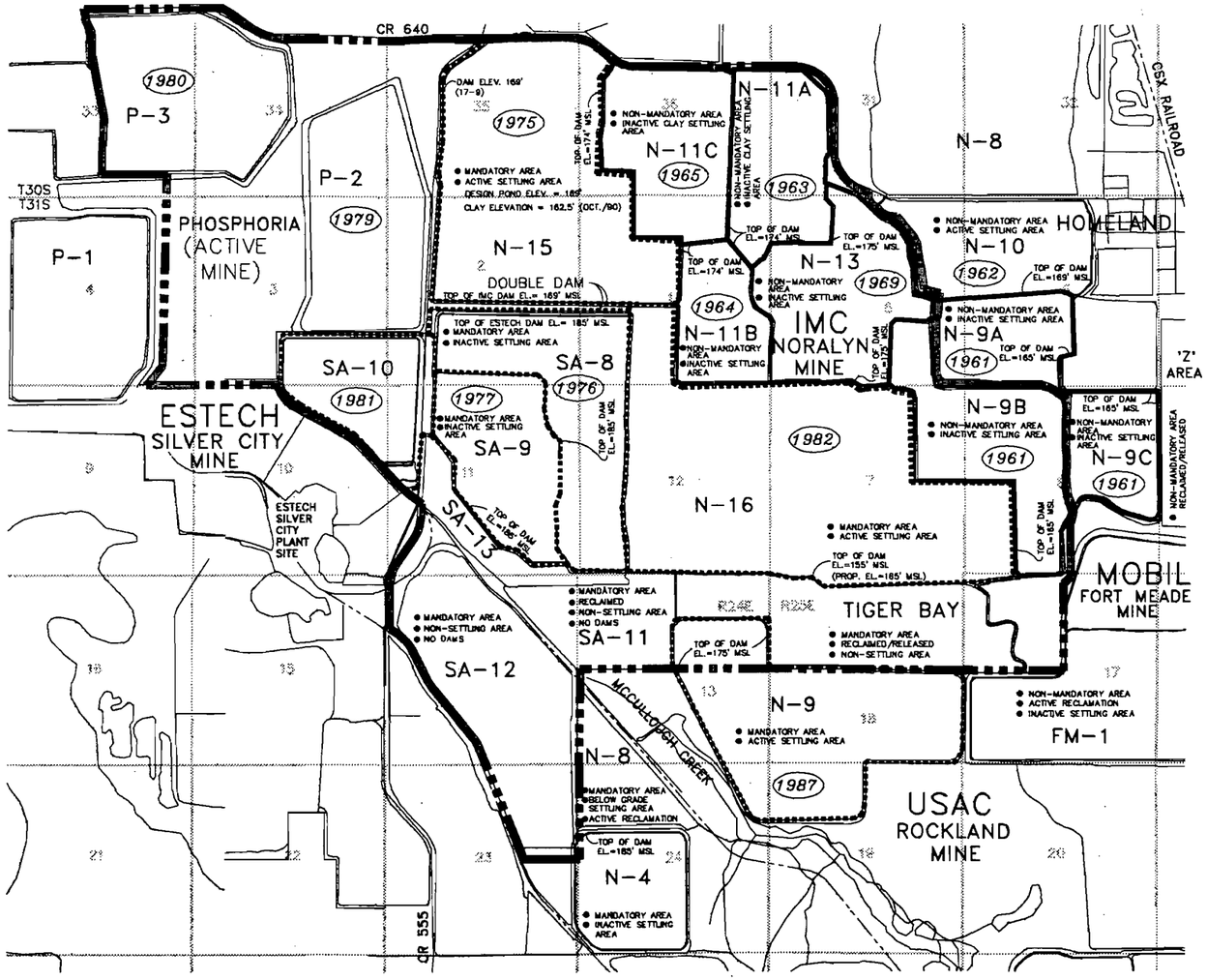


Source: National Weather Service, 1992

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FIGURE 3.5.1-25
CUMULATIVE PRECIPITATION AND EVAPORATION



KEY

(1962) YEAR INTO SERVICE ACCORDING TO DNR REPORT

LEGEND

- SURFACE WATER
- ROADWAYS
- SITE BOUNDARY
- RAILROAD
- 17-672 DAMS
- PRE 17-672 DAMS

N
W E

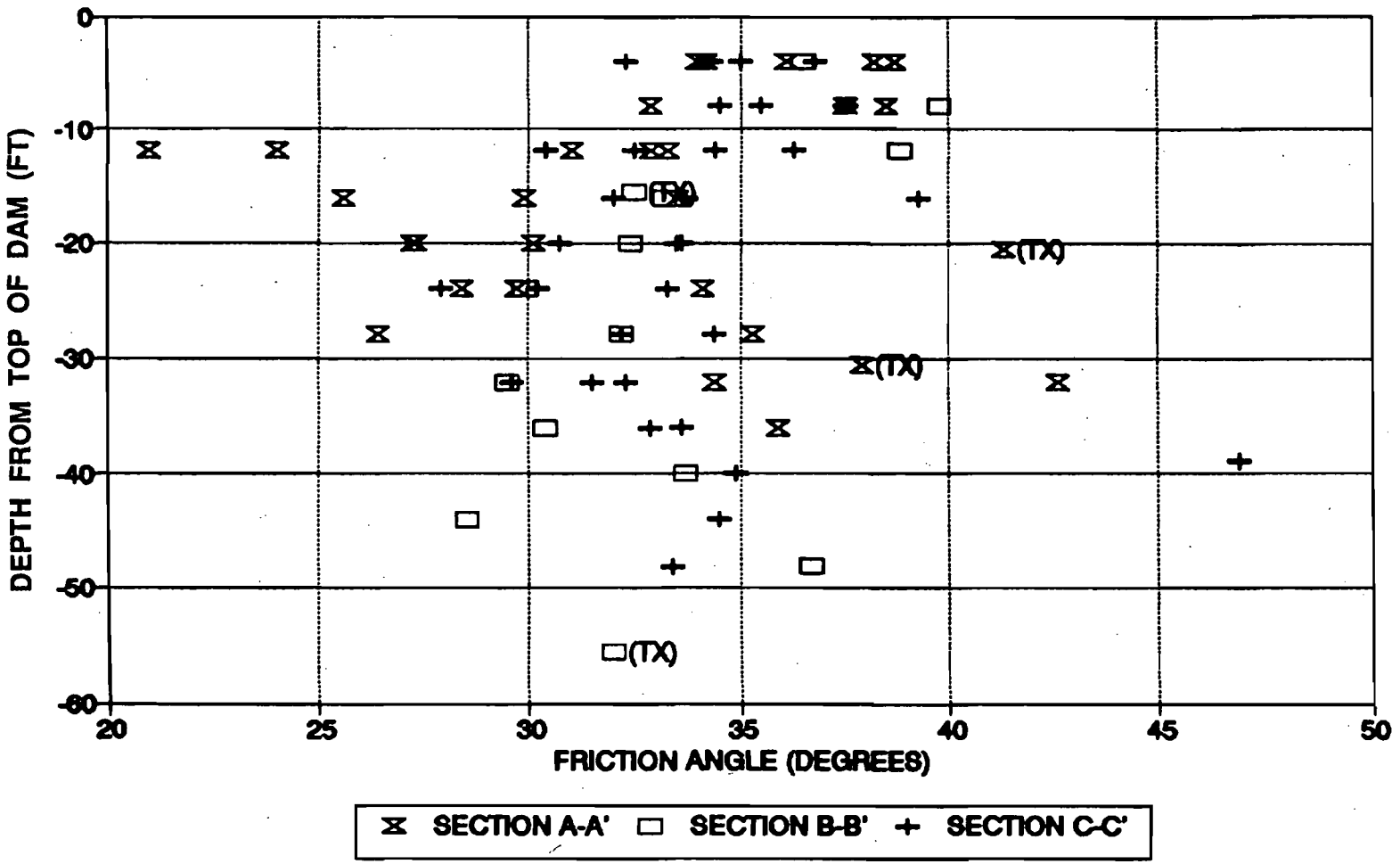
0 4000'

Source: Dames & Moore, 1992

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Polk County Site

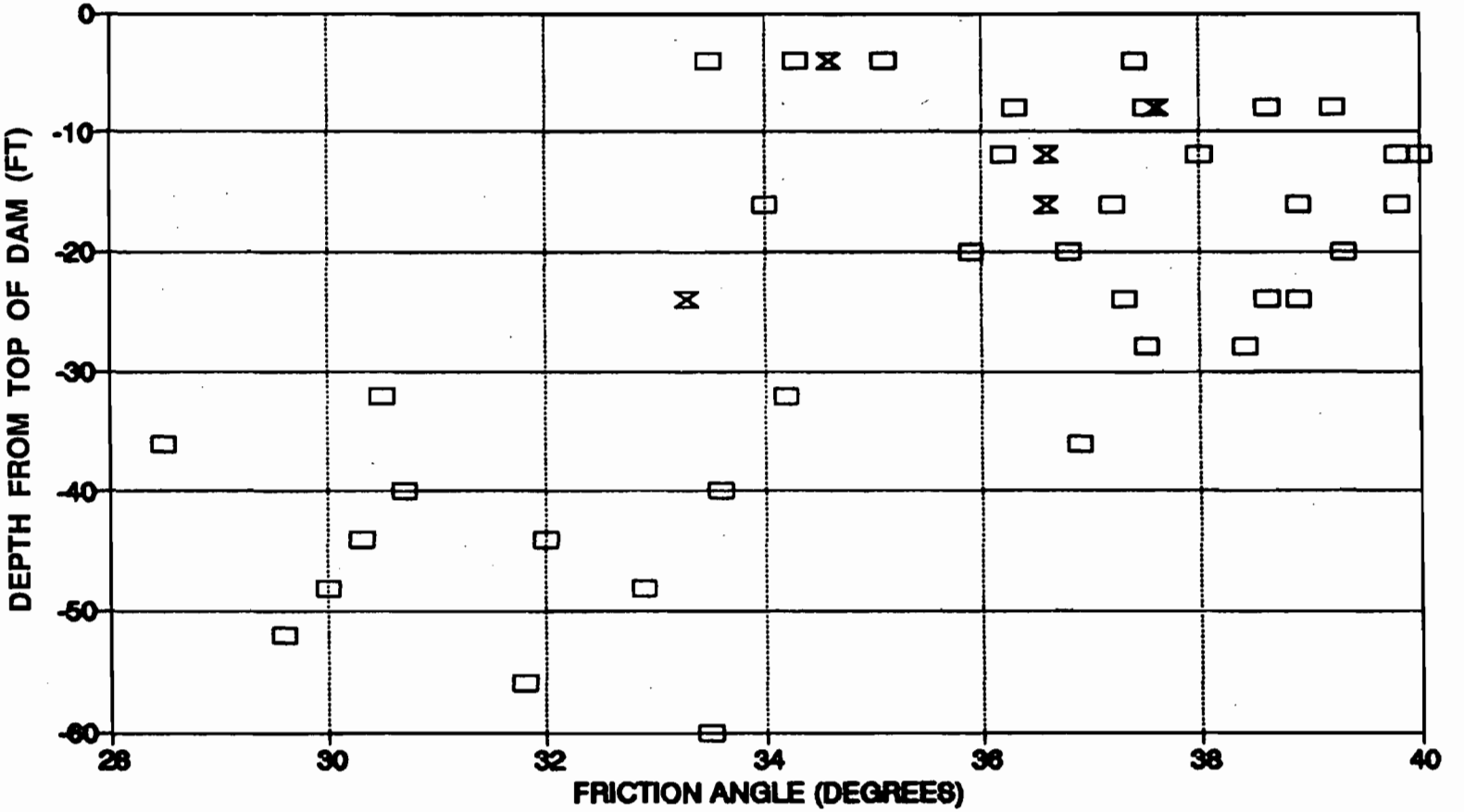
FIGURE 3.5.1-26
PRE 17-672 AND 17-672 DAMS
POND SERVICE HISTORY



Source: Dames & Moore, 1992

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Polk County Site

FIGURE 3.5.1-27
FRICTION ANGLE DATA
CLAY POND N-16 DAMS

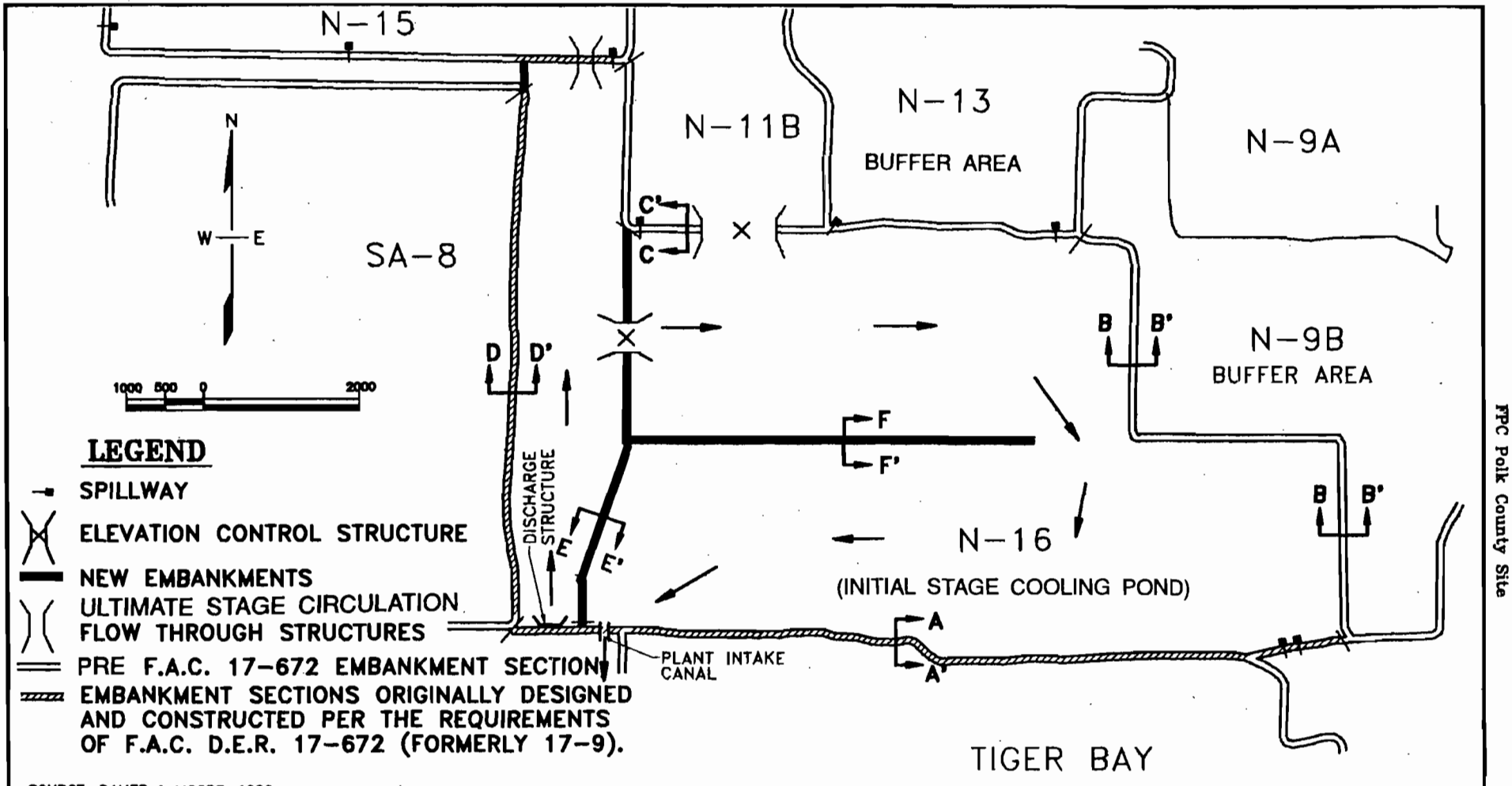


Source: Dames & Moore, 1992

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Polk County Site

FIGURE 3.5.1-28
FRICTION ANGLE DATA
CLAY POND N-15/N-11C DAMS

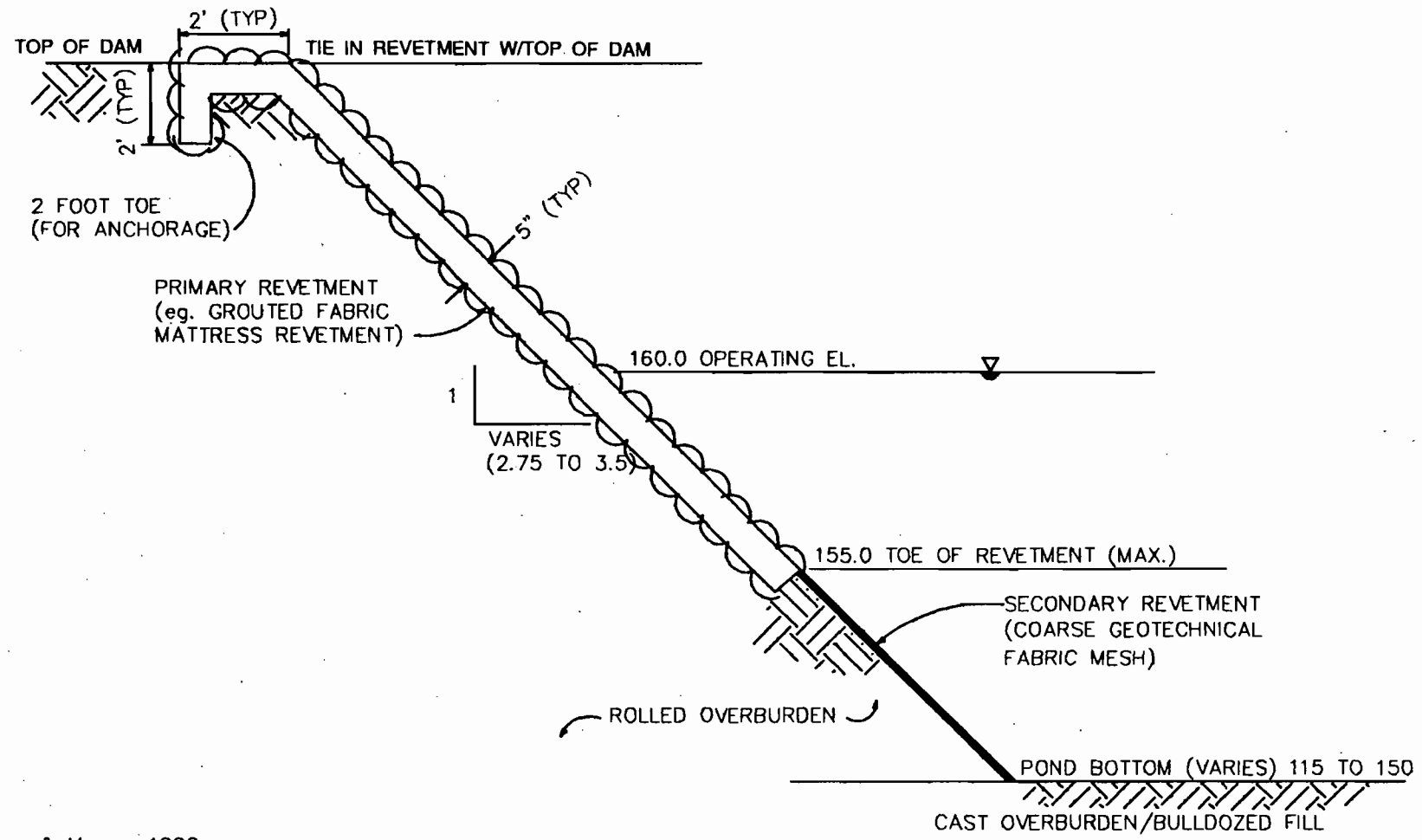


SOURCE: DAMES & MOORE, 1992

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Polk County Site

FIGURE 3.5.1-29
INITIAL STAGE COOLING EMBANKMENT PLAN N-16

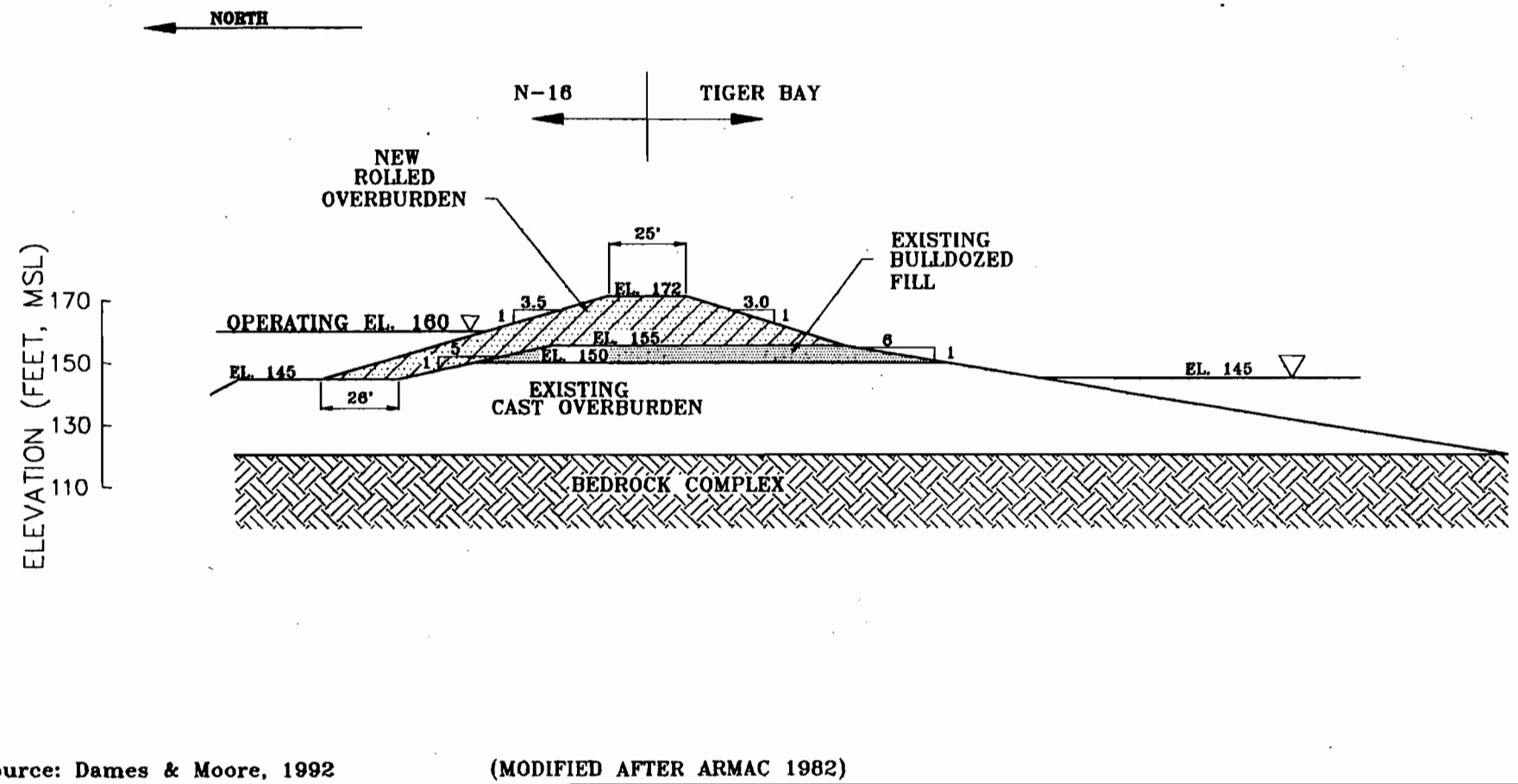


Source: Dames & Moore, 1992

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FIGURE 3.5.1-30
TYPICAL SLOPE REINFORCEMENT/ WAVE EROSION PROTECTION DETAILS
N-16

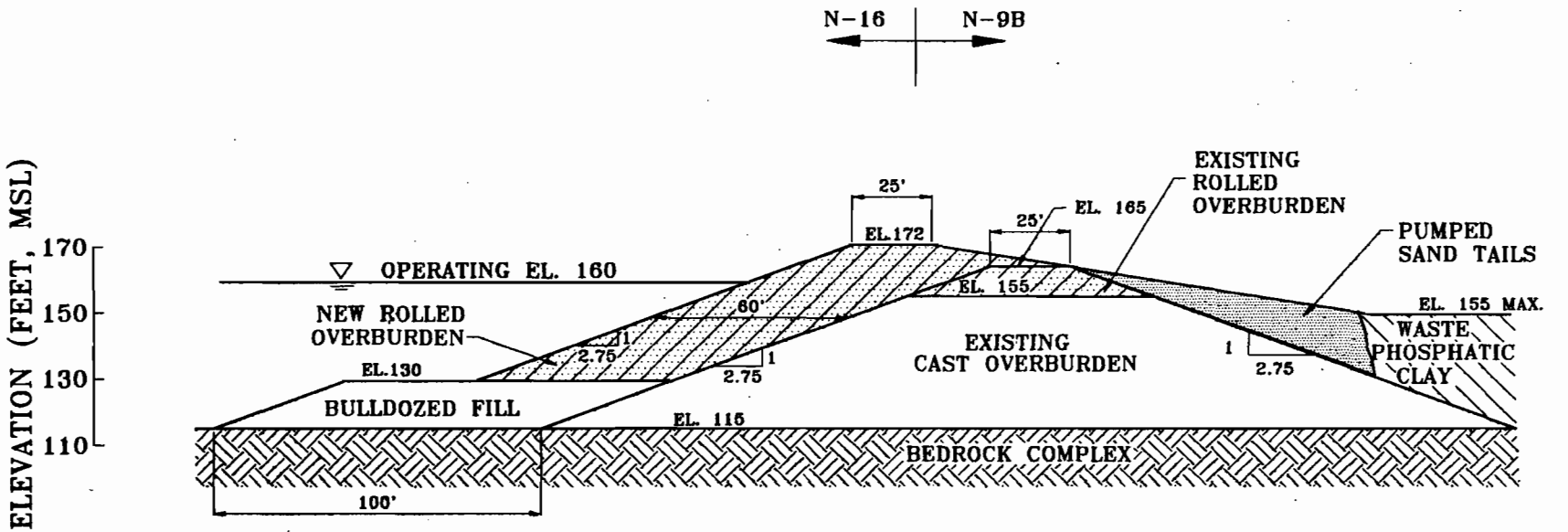


Source: Dames & Moore, 1992 (MODIFIED AFTER ARMAC 1982)

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Polk County Site

FIGURE 3.5.1-31
CONCEPTUAL CROSS-SECTION A-A'
SOUTH EMBANKMENT
N-16

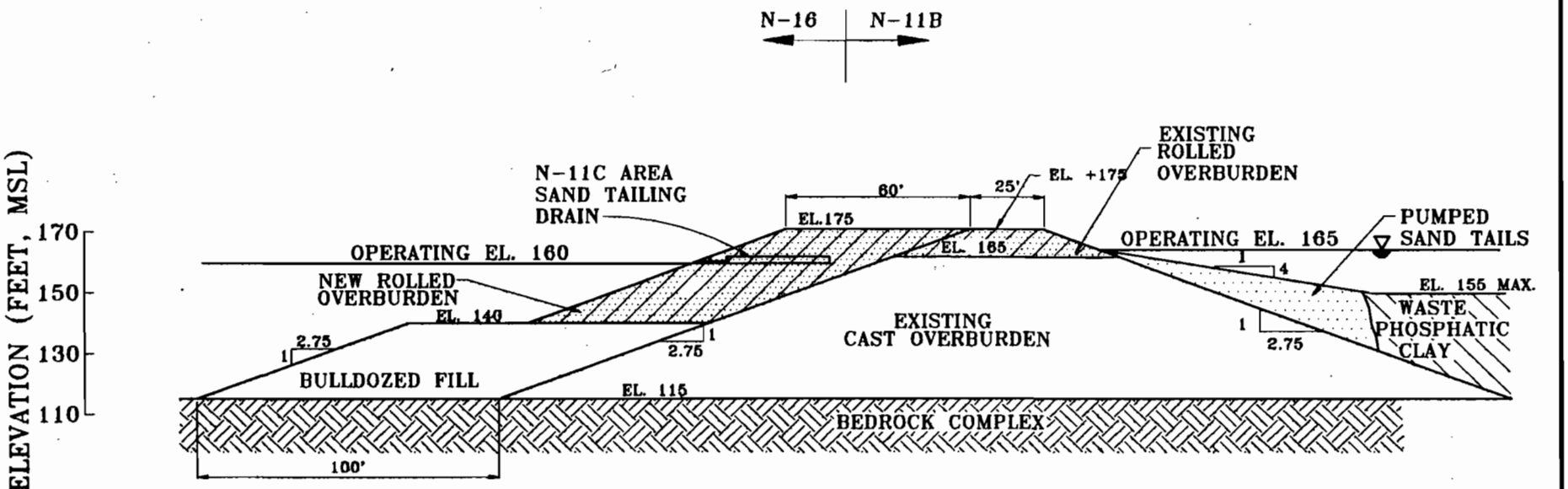


Source: Dames & Moore, 1992 (MODIFIED AFTER ARMAC 1979)

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FIGURE 3.5.1-32
CONCEPTUAL CROSS-SECTION B-B'
EAST EMBANKMENT
N-16

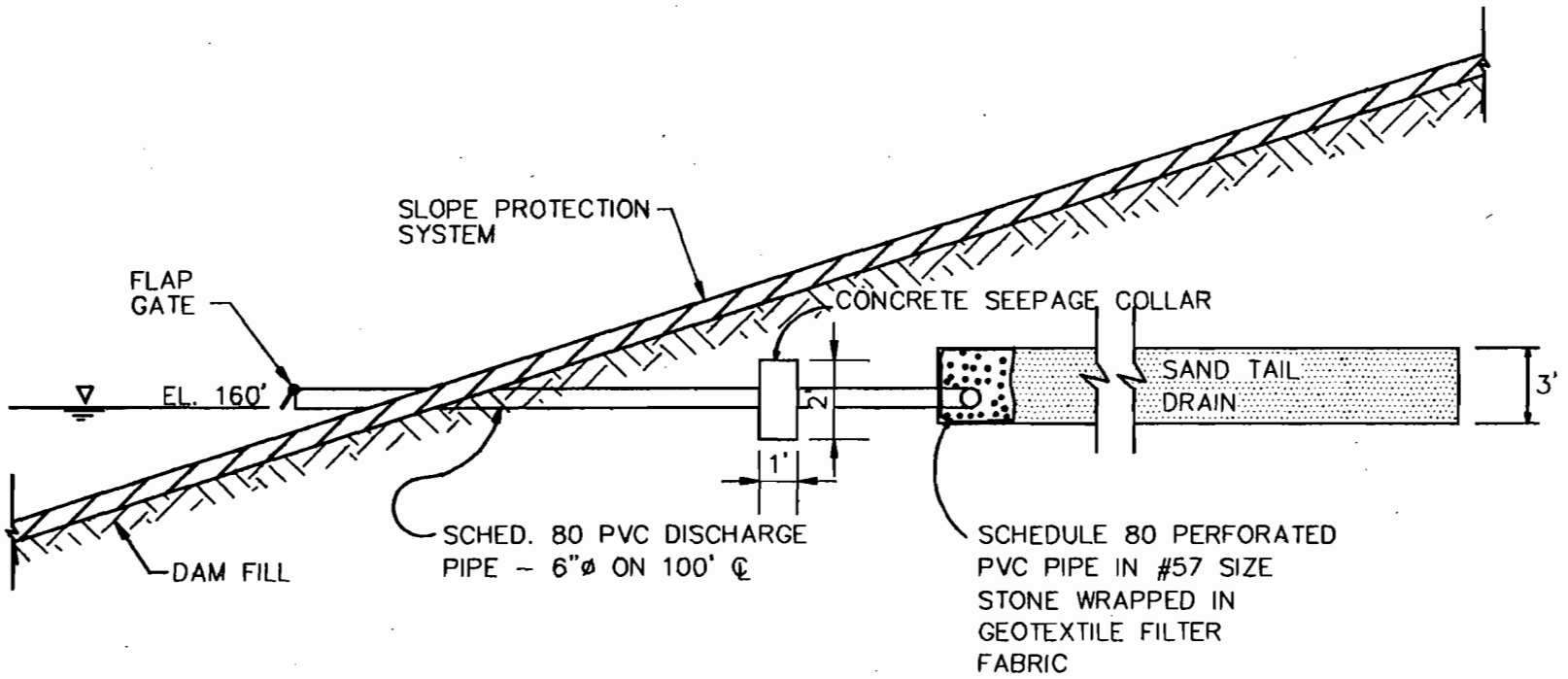


Source: Dames & Moore, 1992 (MODIFIED AFTER ARMAC 1979)

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FIGURE 3.5.1-33
CONCEPTUAL CROSS-SECTION C-C'
NORTH EMBANKMENT
N-16

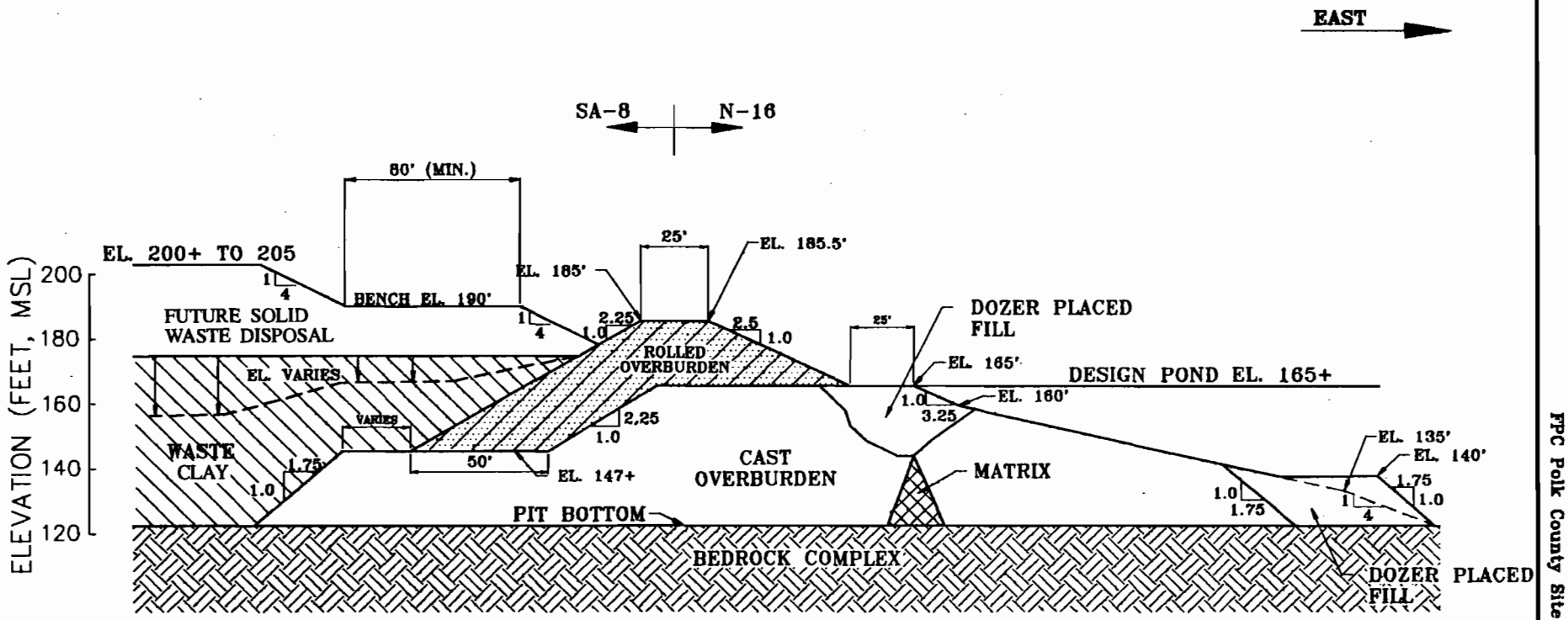


Source: Dames & Moore, 1992

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FIGURE 3.5.1-34
CONCEPTUAL DETAIL OF EMBANKMENT SEEPAGE COLLECTION AND DISCHARGE SYSTEM

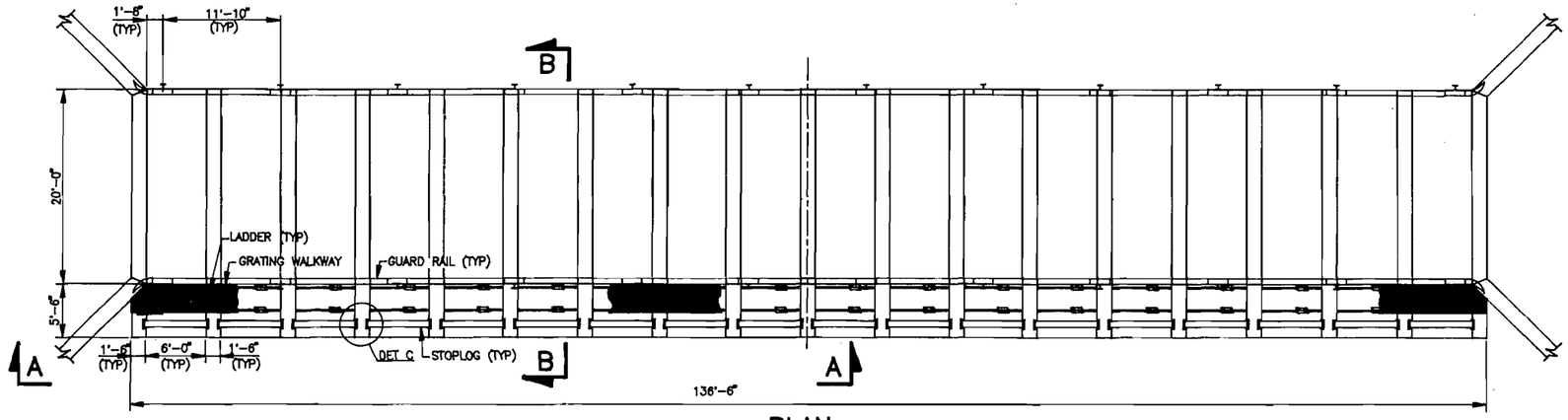


Source: Dames & Moore, 1992 (MODIFIED AFTER ARDAMAN 1978)

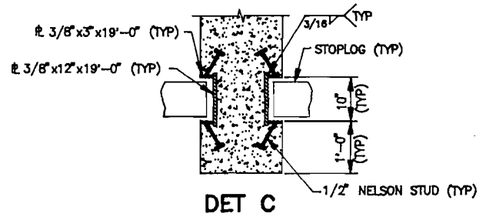
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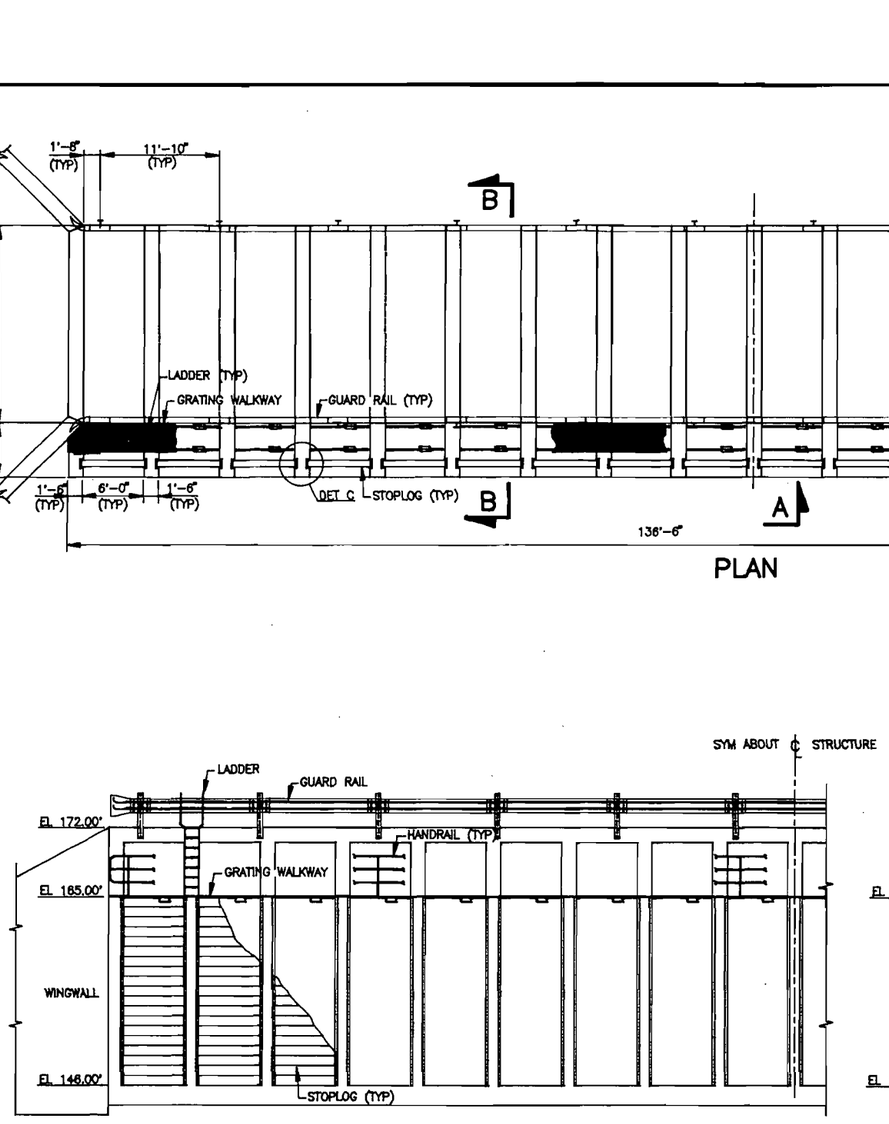
FIGURE 3.5.1-35
AS-BUILT CROSS-SECTION D-D'
WEST EMBANKMENT
N-16



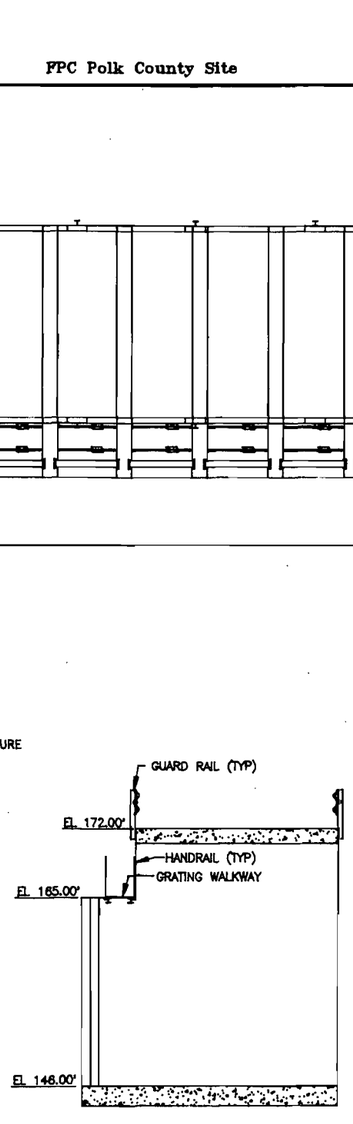
PLAN



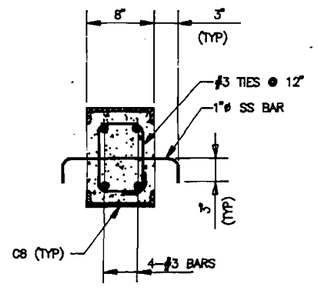
DET C



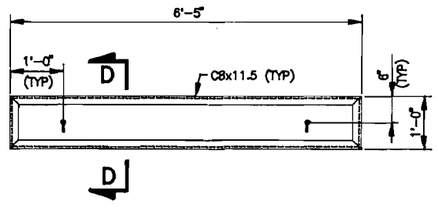
SECT A



SECT B



SECT D



STOPLOG DETAIL

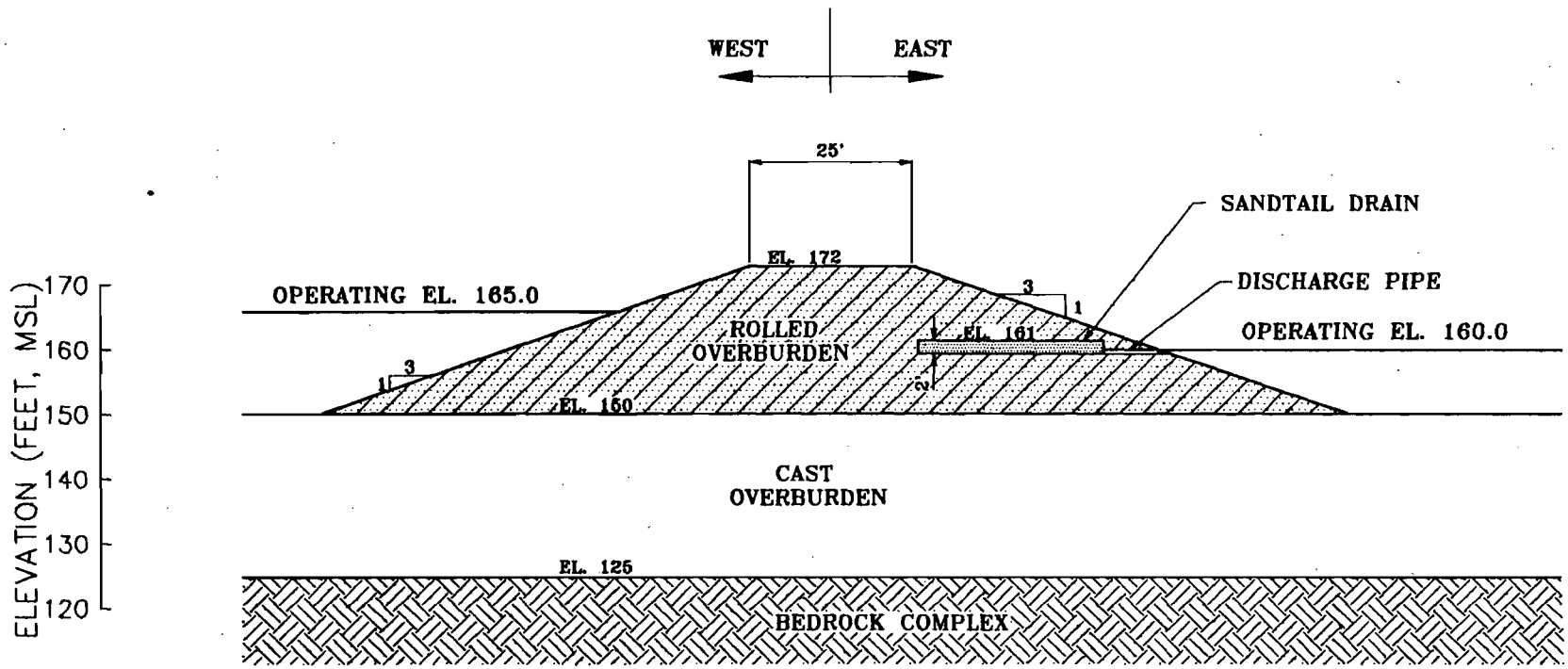
SOURCE: EBASCO ENVIRONMENTAL, 1992

NOT TO SCALE

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FIGURE 3.5.1-36
TYPICAL STOPLOG STRUCTURE

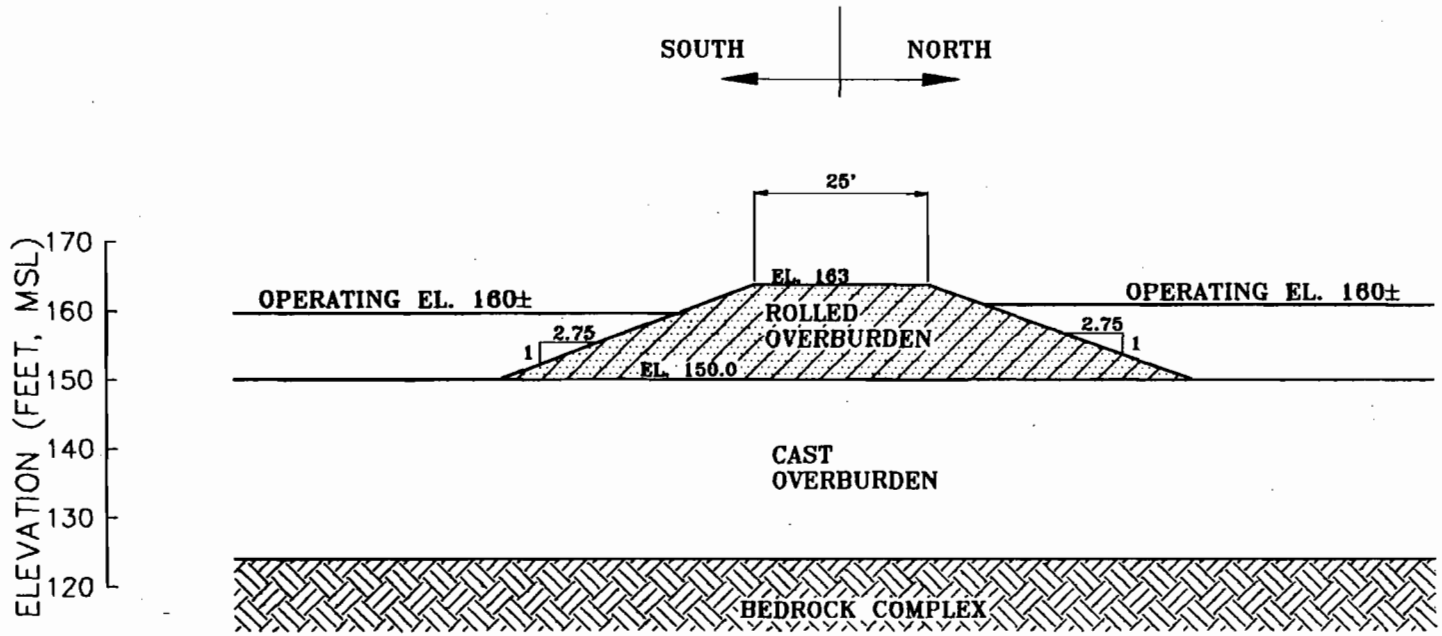


Source: Dames & Moore, 1992

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FIGURE 3.5.1-37
CONCEPTUAL CROSS-SECTION E-E'
NORTH-SOUTH DIVIDING EMBANKMENT
N-16

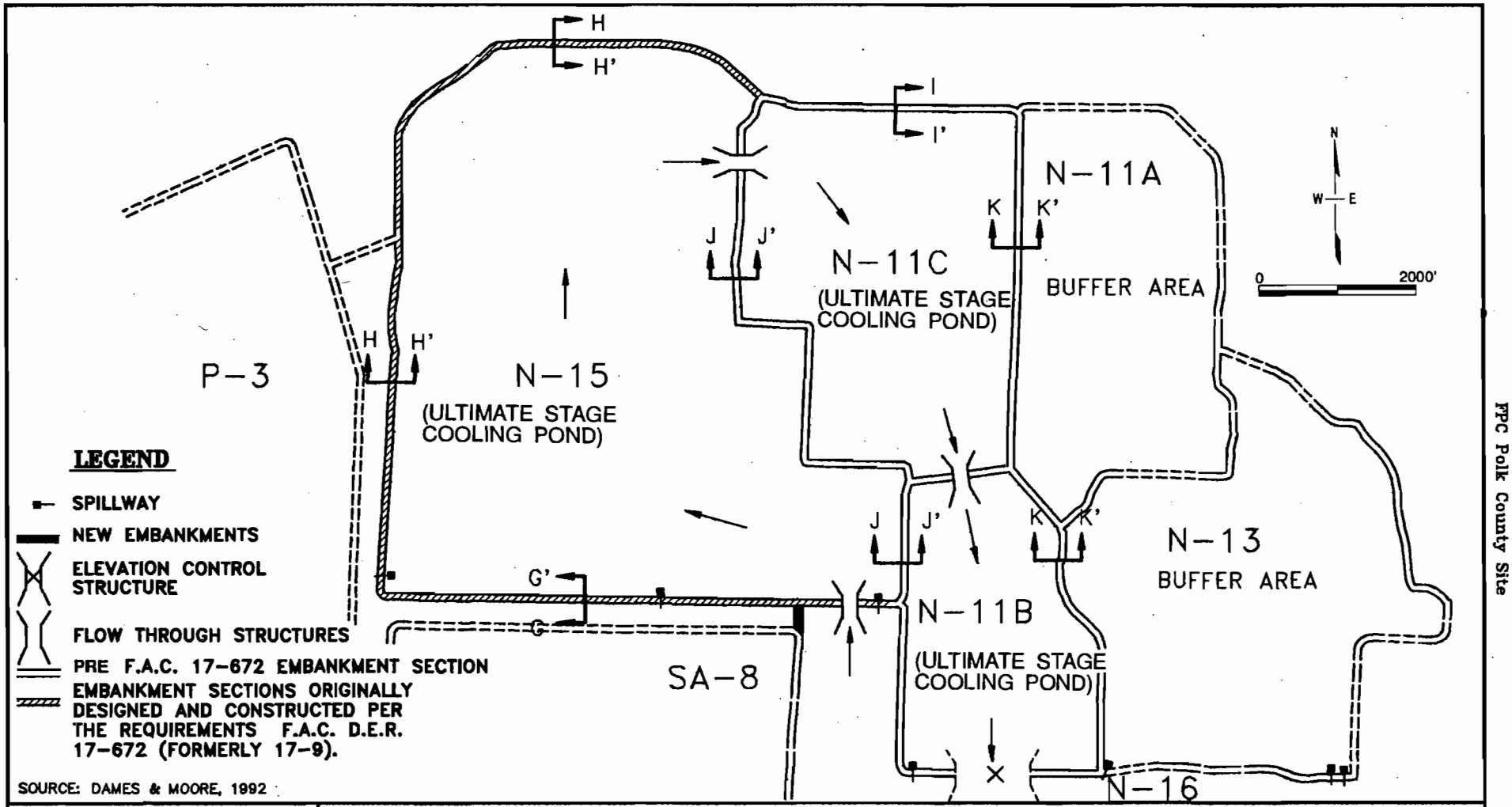


Source: Dames & Moore, 1992

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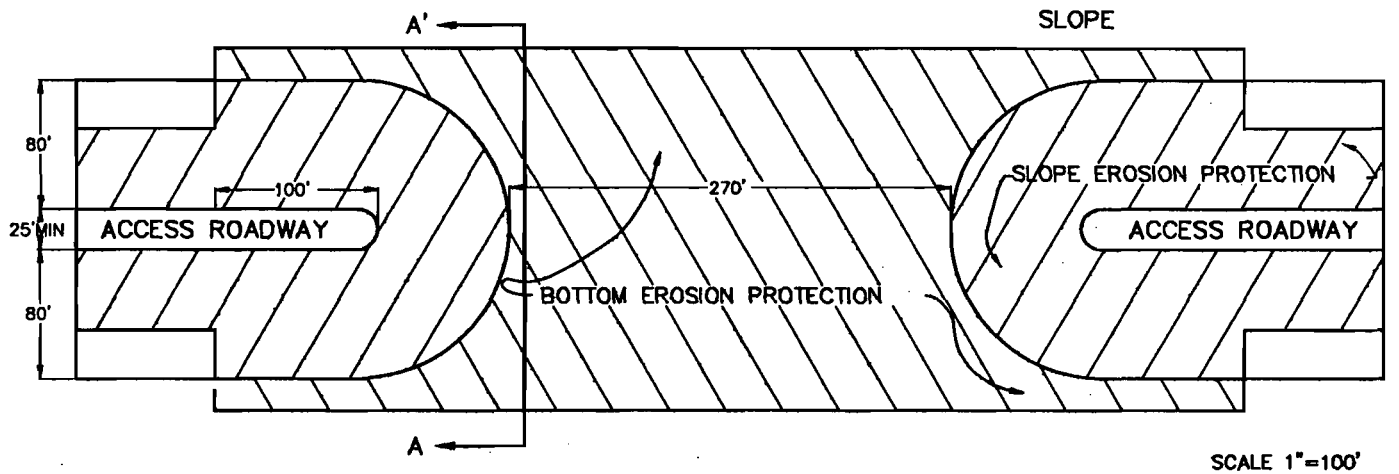
FIGURE 3.5.1-38
CONCEPTUAL CROSS-SECTION F-F'
EAST-WEST DIVIDING EMBANKMENT
N-16



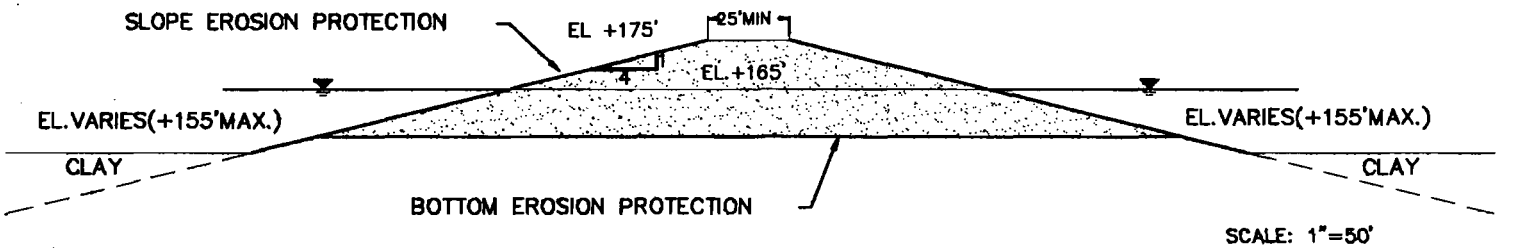
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FIGURE 3.5.1-39
ULTIMATE STAGE COOLING EMBANKMENT PLAN N-15, N-11B, N-11C



PLAN VIEW OF FLOW-THROUGH PENETRATION



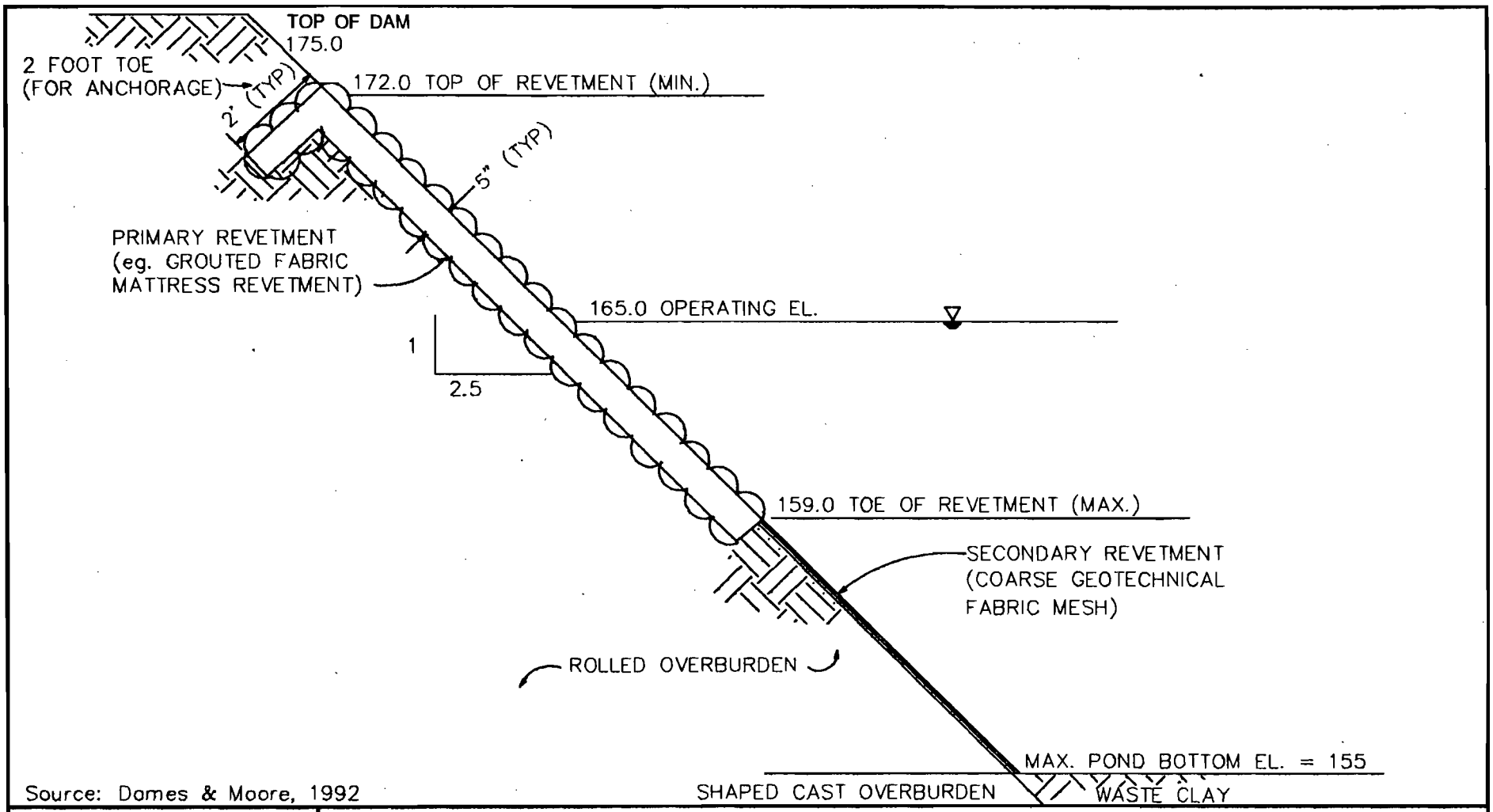
SECTION A-A' VIEW OF FLOW-THROUGH PENETRATION

Source: Dames & Moore, 1992

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FIGURE 3.5.1-40
CONCEPTUAL DESIGN OF FLOW-THROUGH PENETRATION

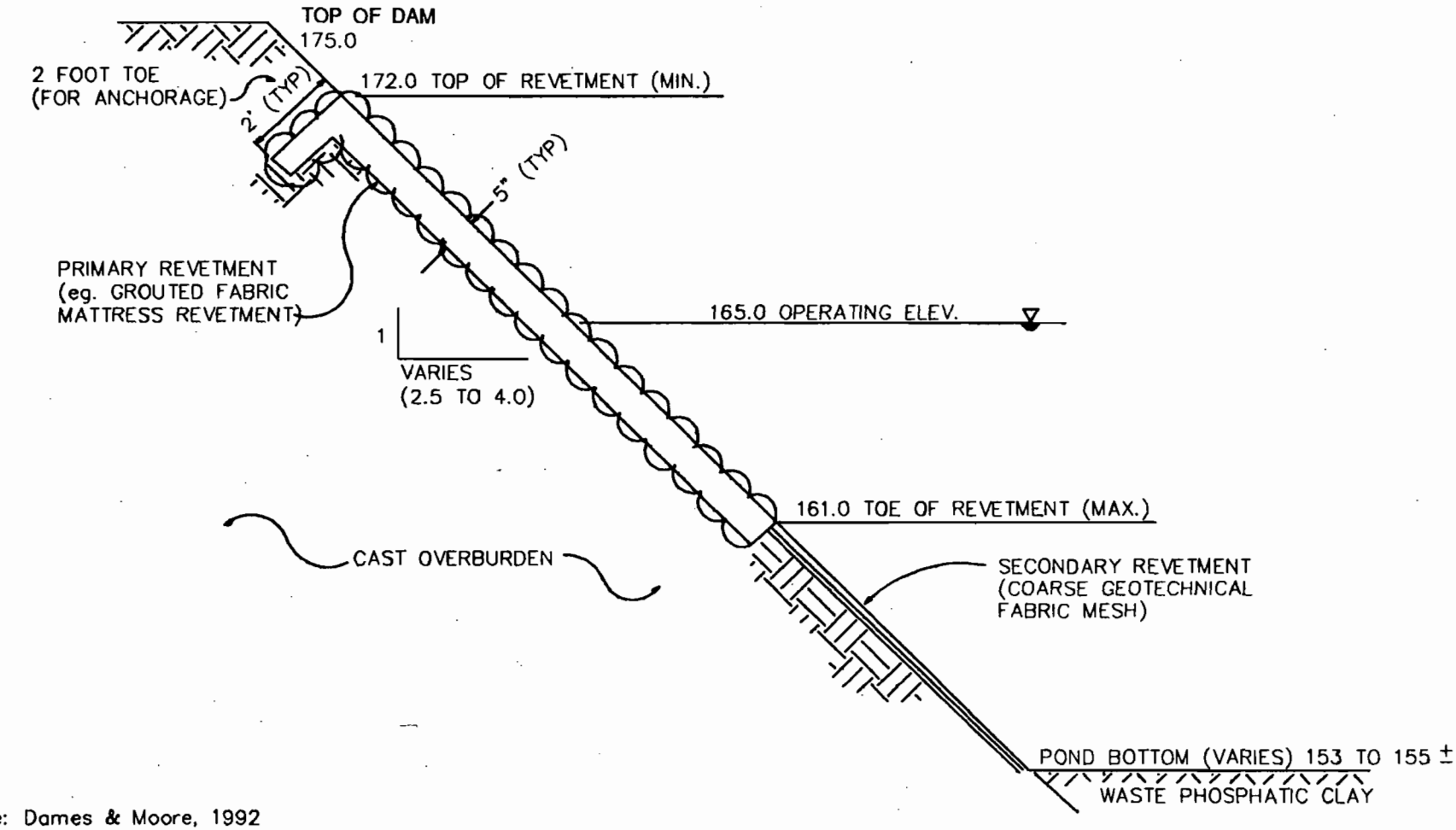


Source: Domes & Moore, 1992

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Polk County Site

FIGURE 3.5.1-41
TYPICAL SLOPE REINFORCEMENT/ WAVE EROSION PROTECTION DETAILS N-15

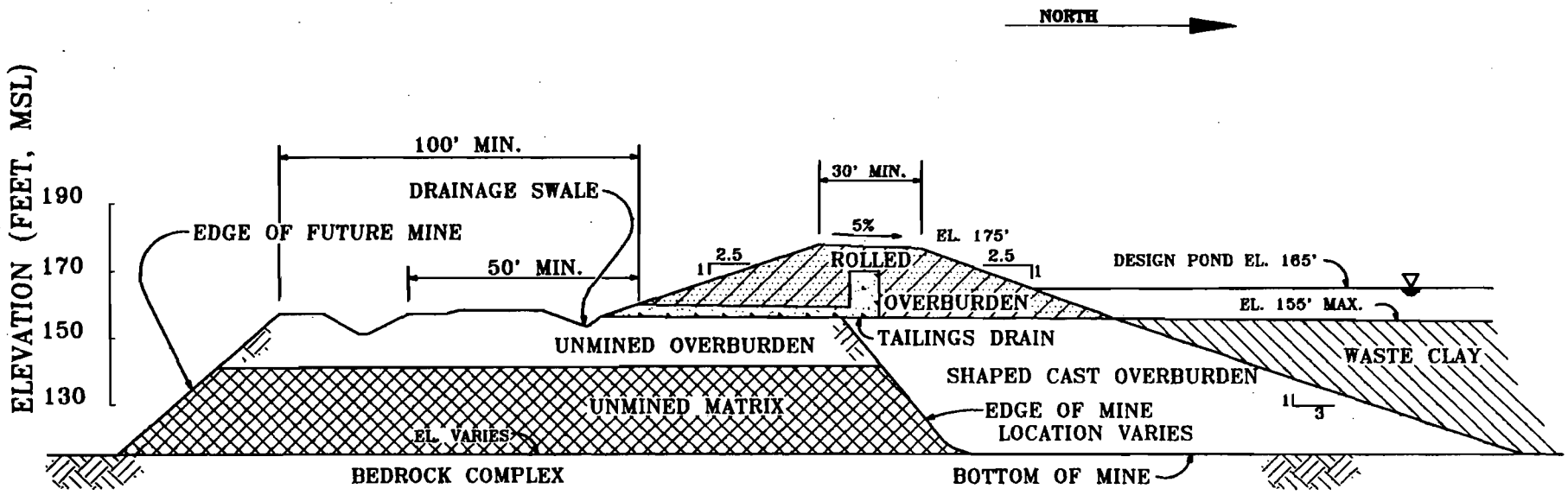


Source: Dames & Moore, 1992

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FIGURE 3.5.1-42
TYPICAL SLOPE REINFORCEMENT/ WAVE EROSION PROTECTION DETAILS N-11B, N-11C

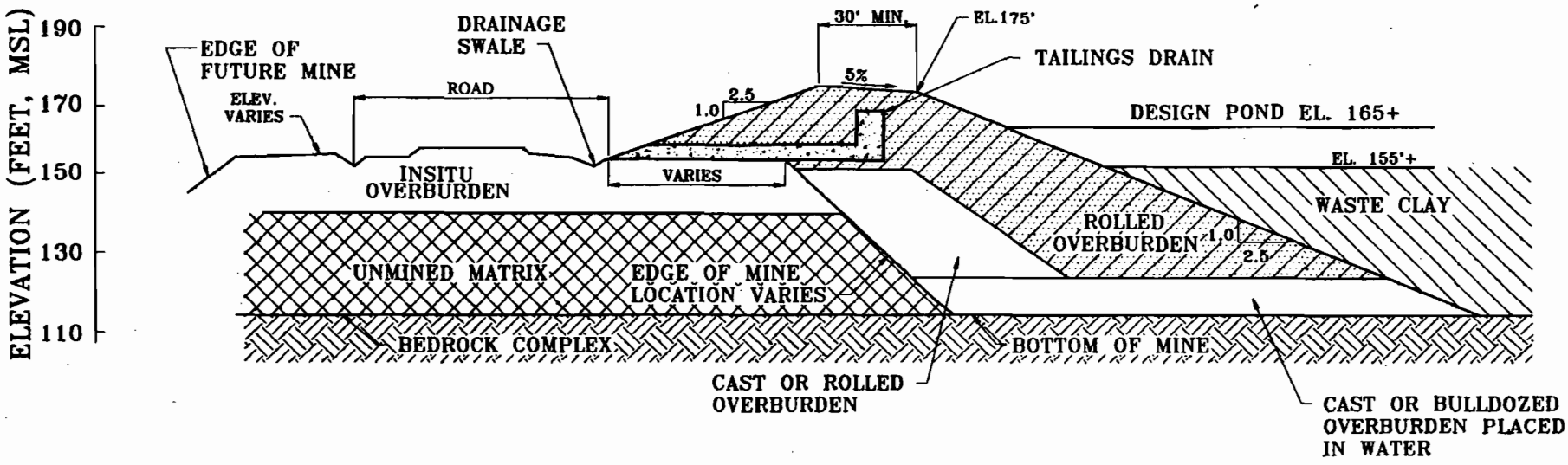


Source: Dames & Moore, 1992 (AFTER PITTSBURG TESTING LABORATORY 1973)

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FIGURE 3.5.1-43
AS-BUILT CROSS-SECTION G-G'
SOUTH EMBANKMENT
N-15

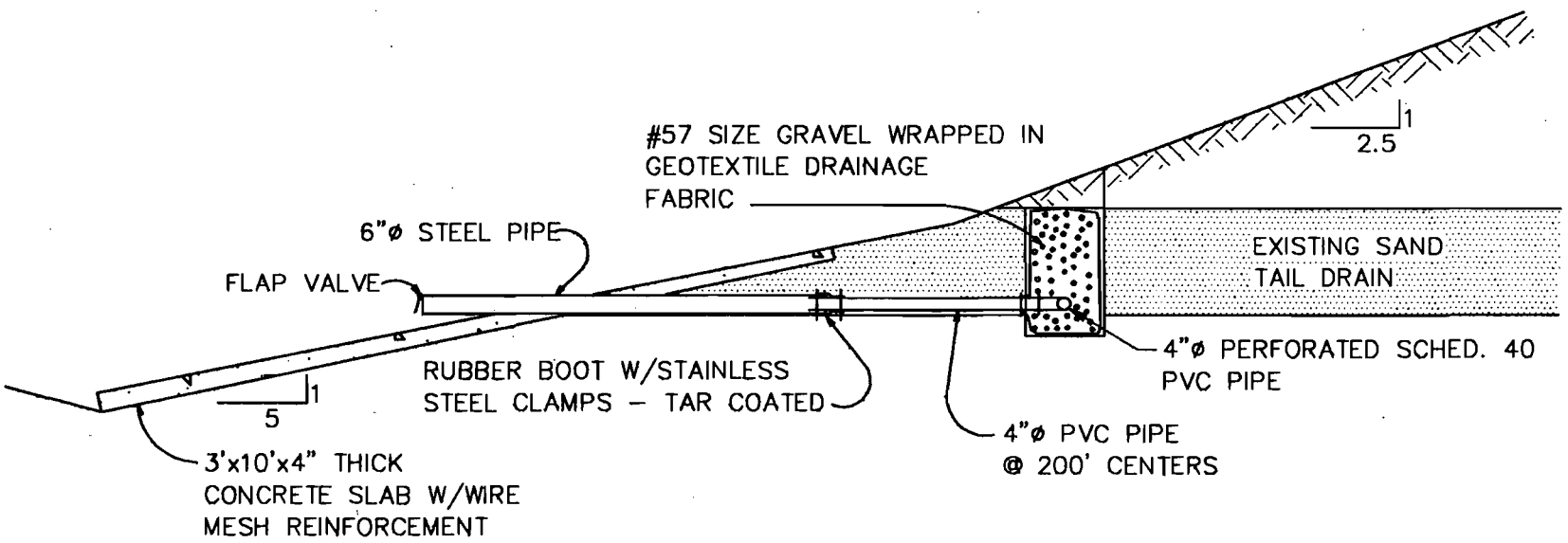


Source: Dames & Moore, 1992 (AFTER PITTSBURG TESTING LABORATORY 1973)

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FIGURE 3.5.1-44
AS-BUILT CROSS-SECTION H-H'
NORTH AND WEST EMBANKMENTS
N-15

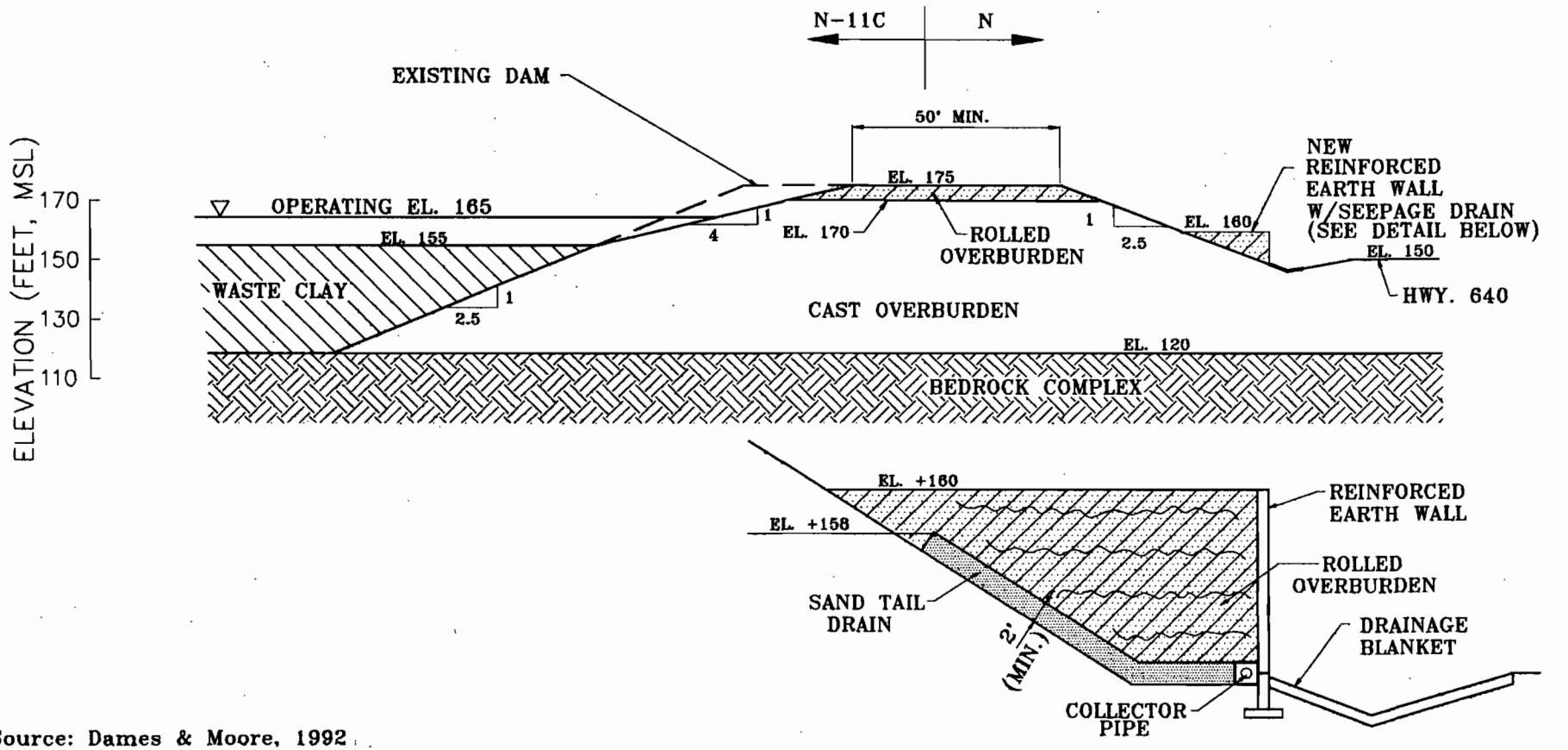


Source: Dames & Moore, 1992

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FIGURE 3.5.1-45
TYPICAL CROSS-SECTION
PROPOSED MODIFICATION TO N-15 AREA SAND DRAIN

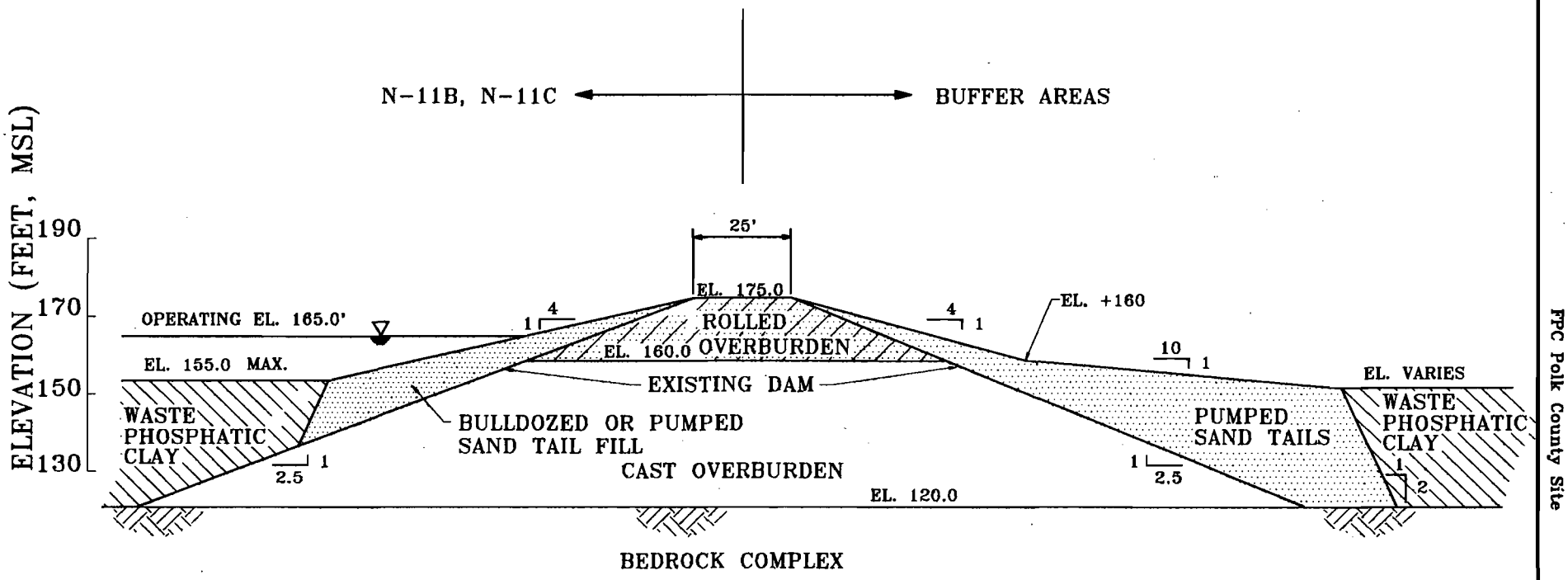


Source: Dames & Moore, 1992

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FIGURE 3.5.1-46
CONCEPTUAL CROSS-SECTION I-I'
NORTH EMBANKMENT
N-11C

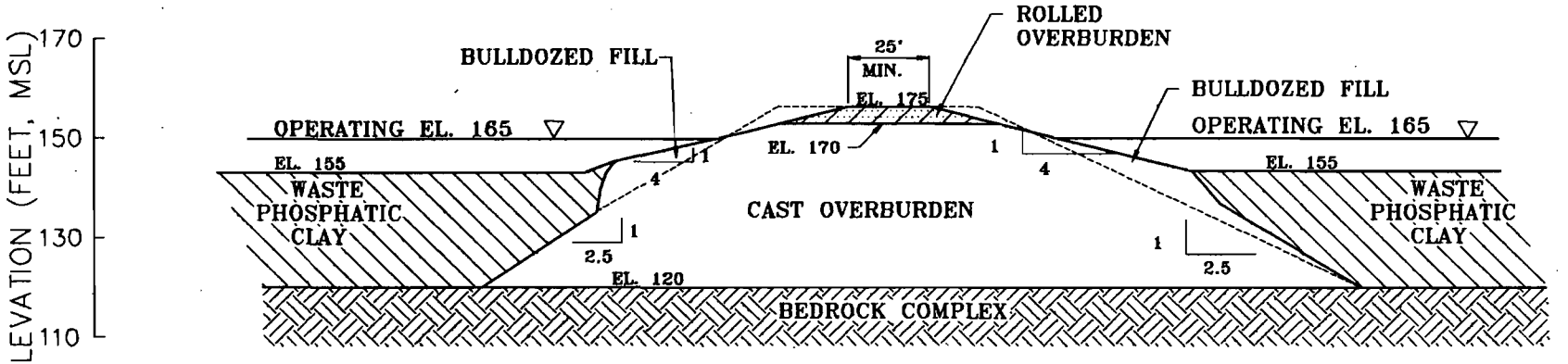


Source: Dames & Moore, 1992

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FIGURE 3.5.1-47
CONCEPTUAL CROSS-SECTION K-K'
EAST EMBANKMENT
N-11C, N-11B

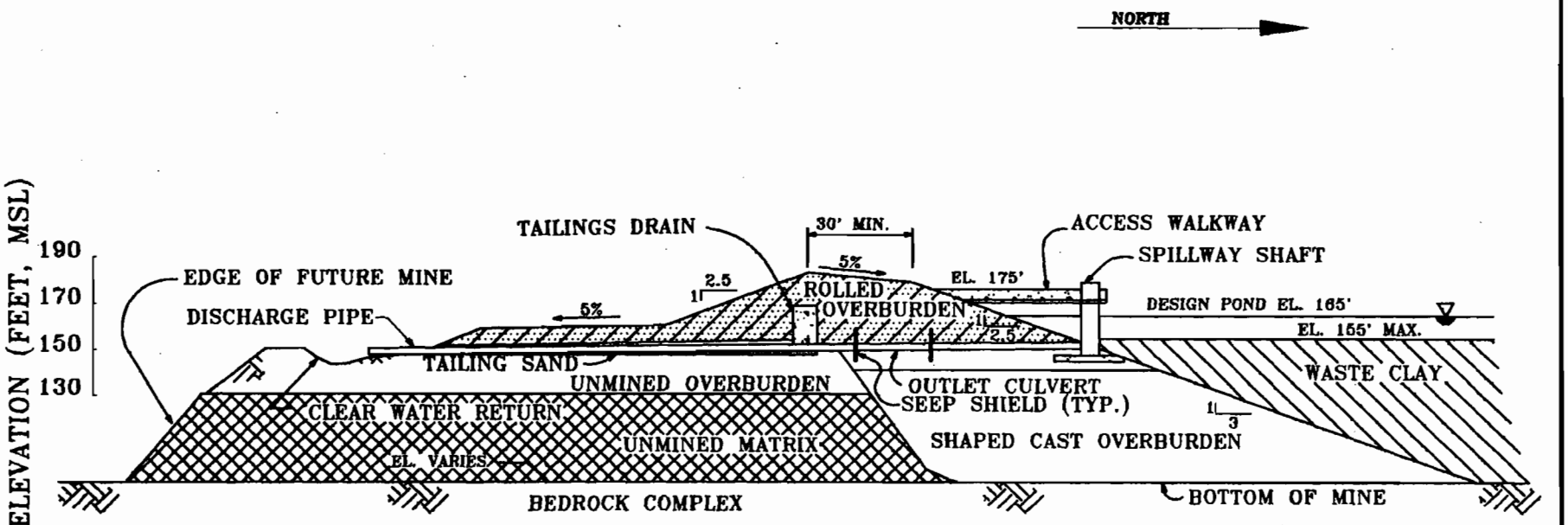


Source: Dames & Moore, 1992

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FIGURE 3.5.1-48
CONCEPTUAL CROSS-SECTION J-J'
INTERIOR ULTIMATE STAGE EMBANKMENT
WASTE CLAY DEPOSITS

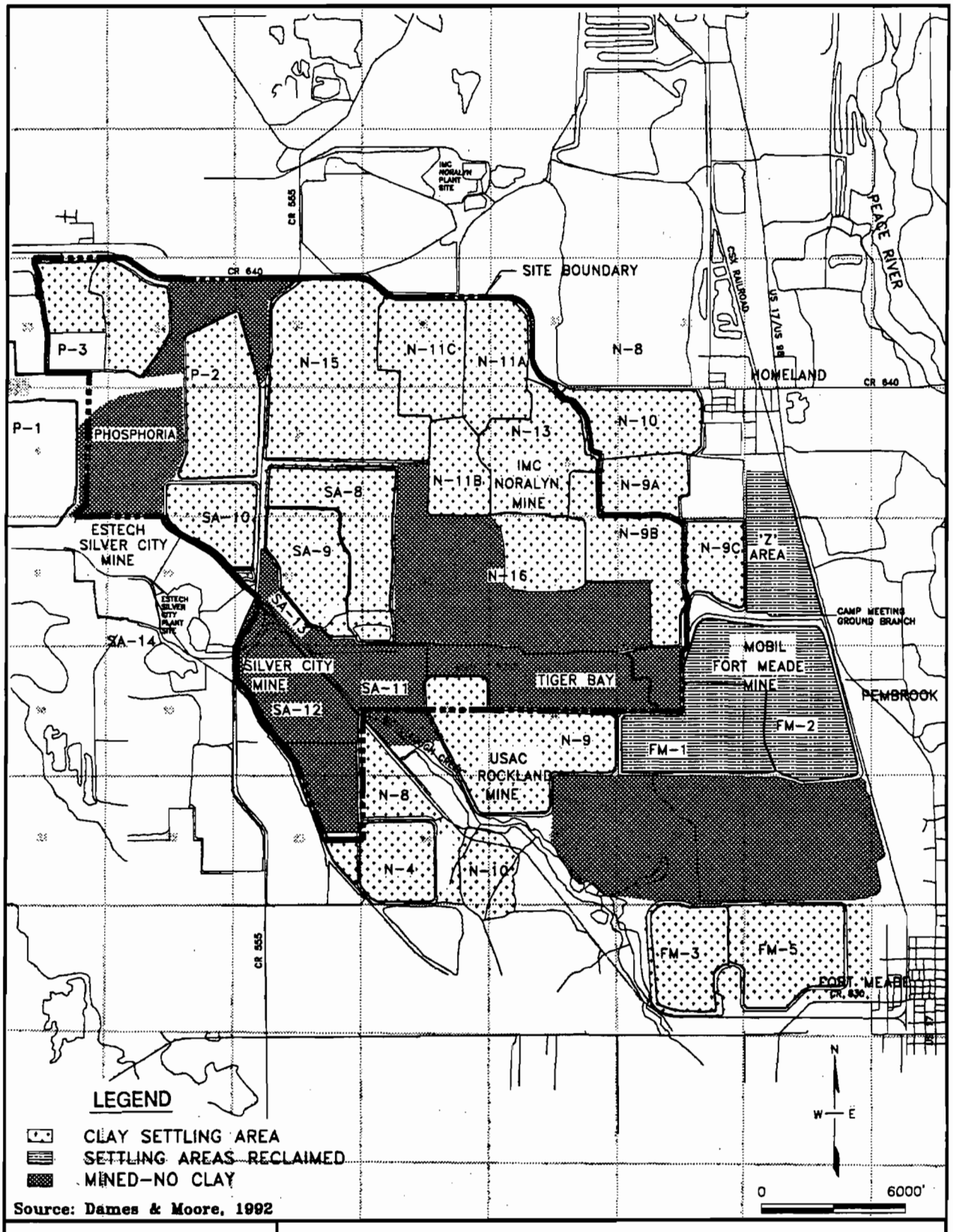


Source: Dames & Moore, 1992 (AFTER PITTSBURG TESTING LABORATORY 1973)

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FIGURE 3.5.1-49
TYPICAL CROSS-SECTION
SPILLWAY EMBANKMENT
N-15

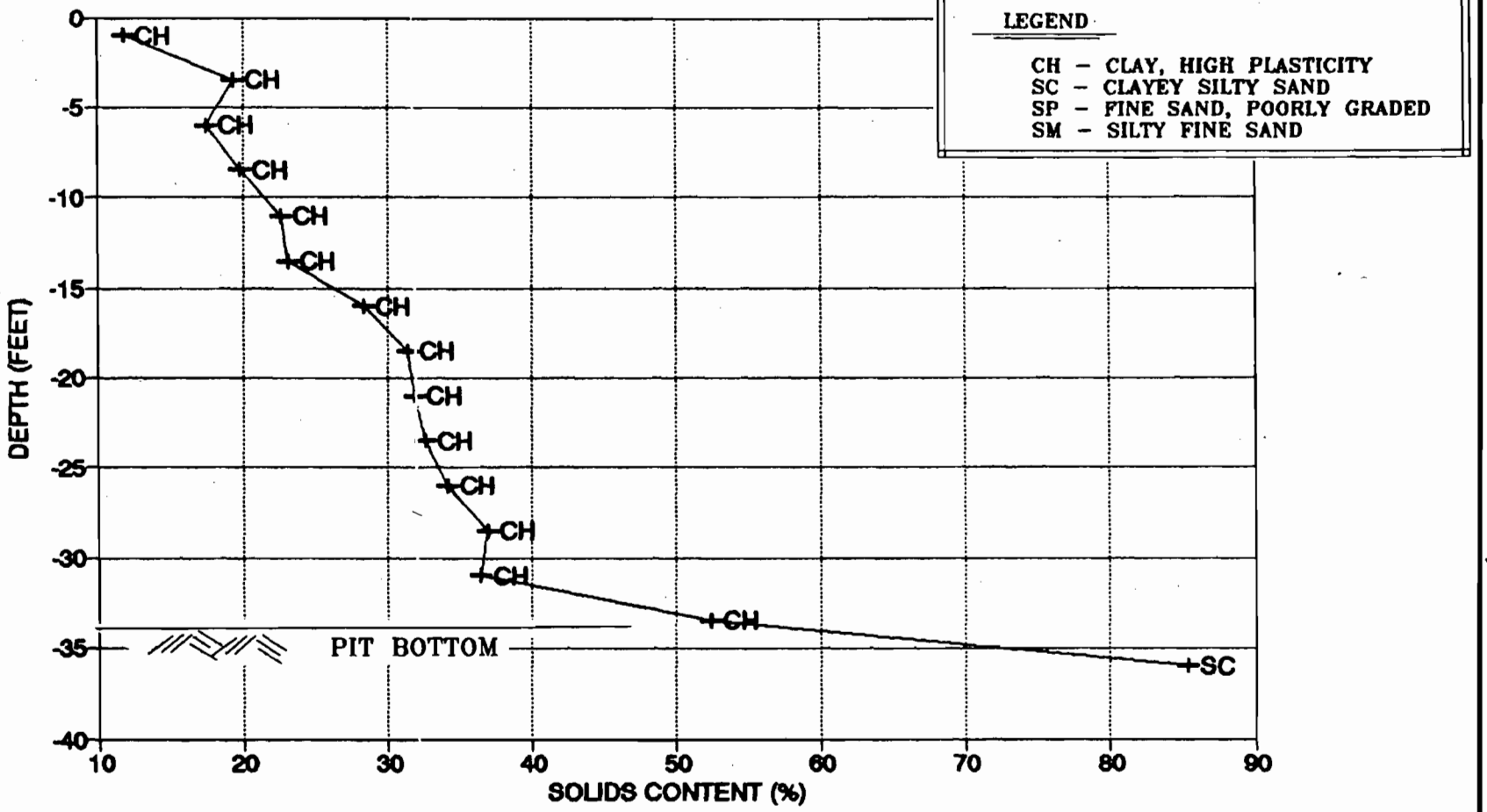


Source: Dames & Moore, 1992

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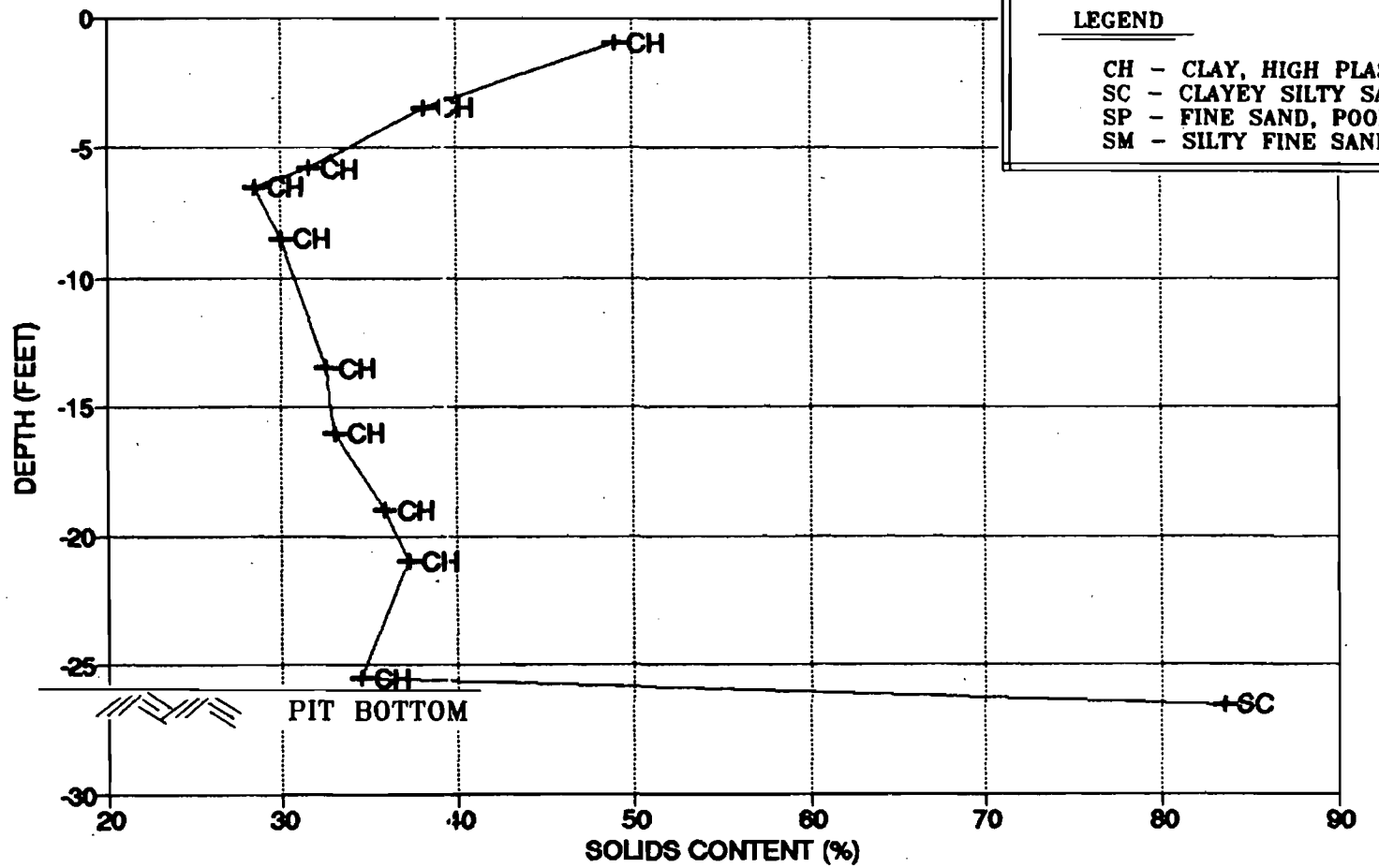
FIGURE 3.5.1-50
MINED/CLAY SETTLING AREAS SITE MAP



Source: Dames & Moore, 1992

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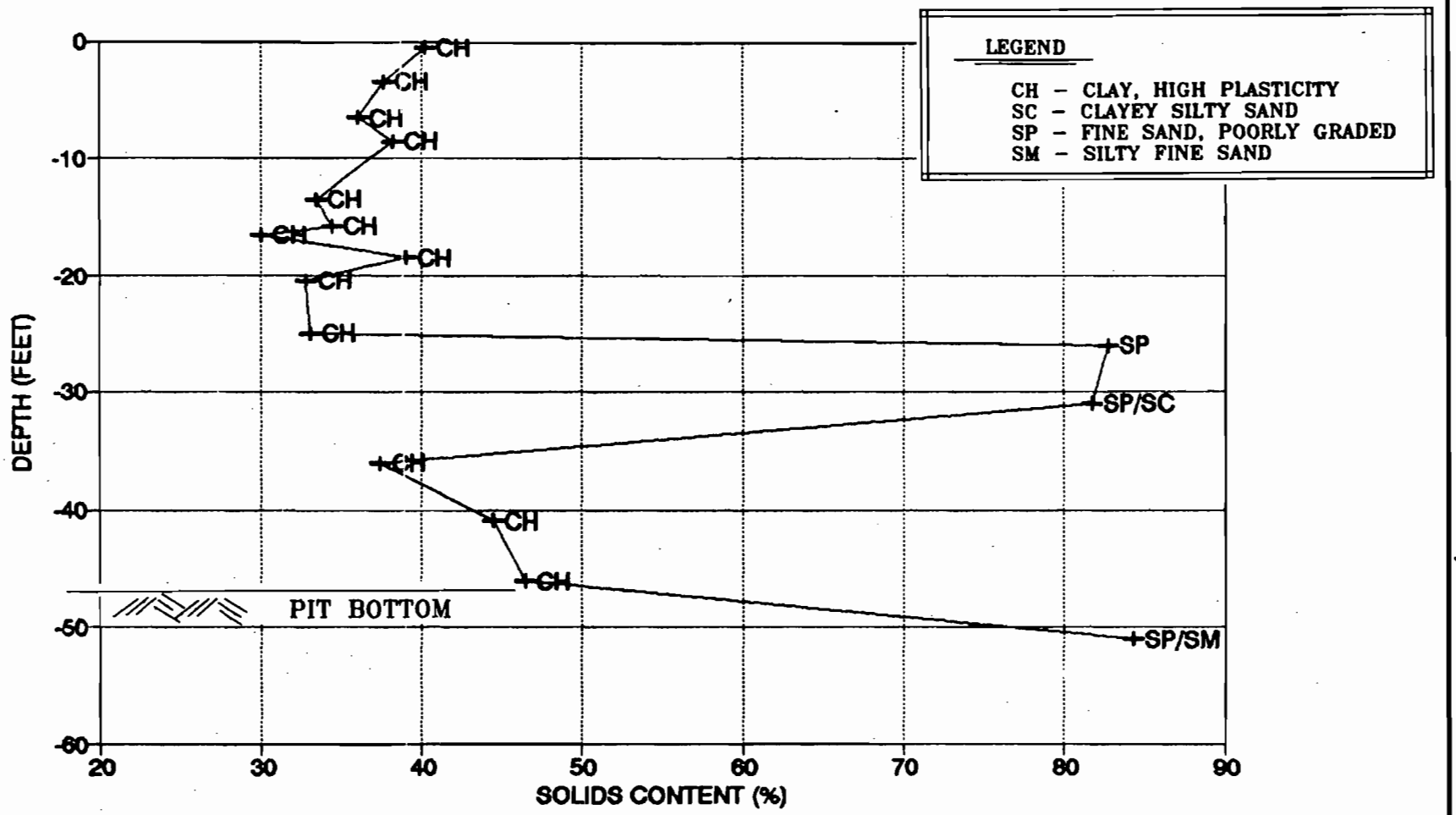
FIGURE 3.5.1-51
SOLIDS CONTENT PROFILE
CLAY POND N-15, BORING C-19



Source: Dames & Moore, 1992

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FIGURE 3.5.1-52
SOLIDS CONTENT PROFILE
CLAY POND N-11B, BORING C-14

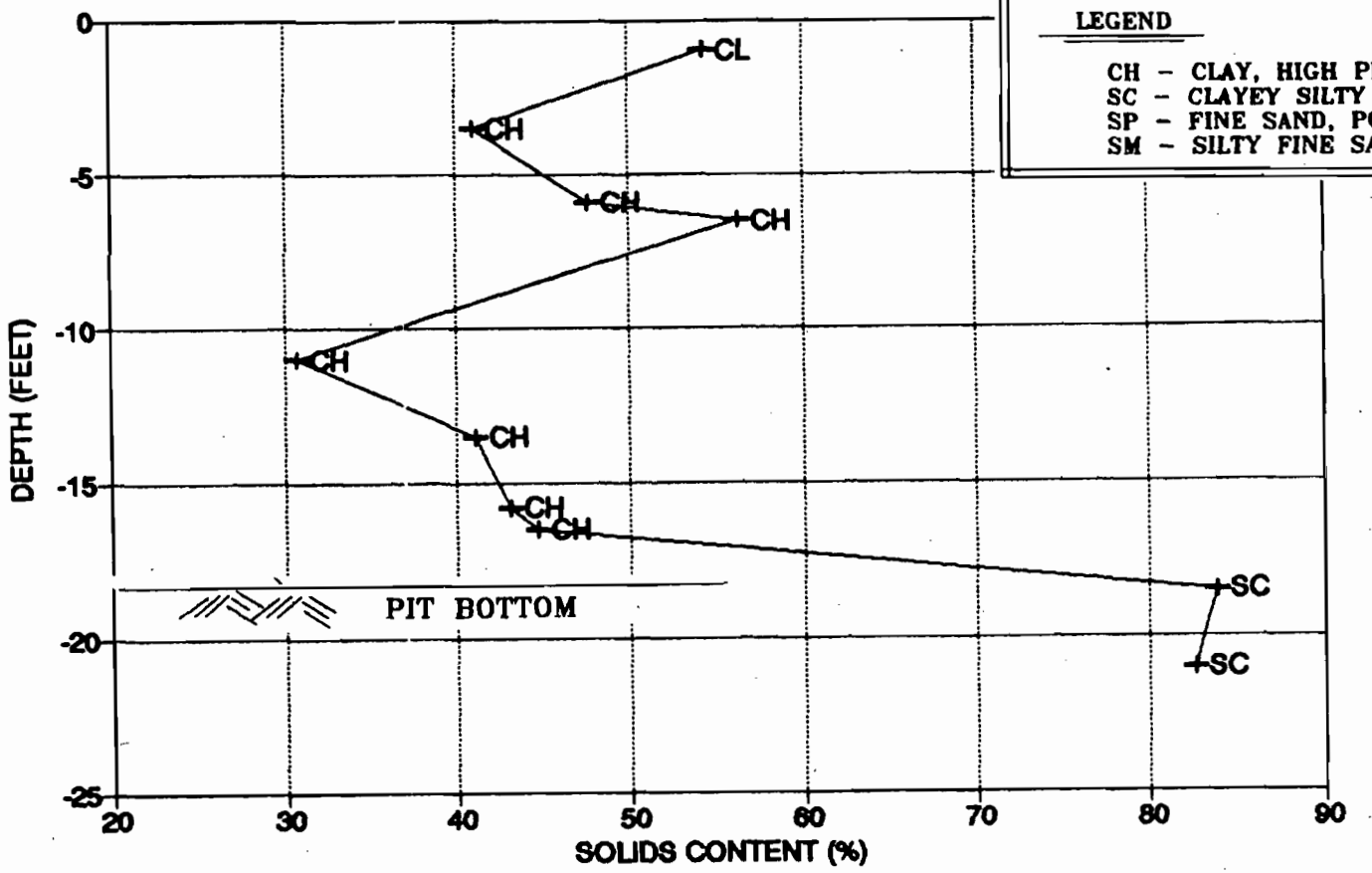


Source: Dames & Moore, 1992

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FIGURE 3.5.1-53
SOLIDS CONTENT PROFILE
CLAY POND N-11C, BORING C-16

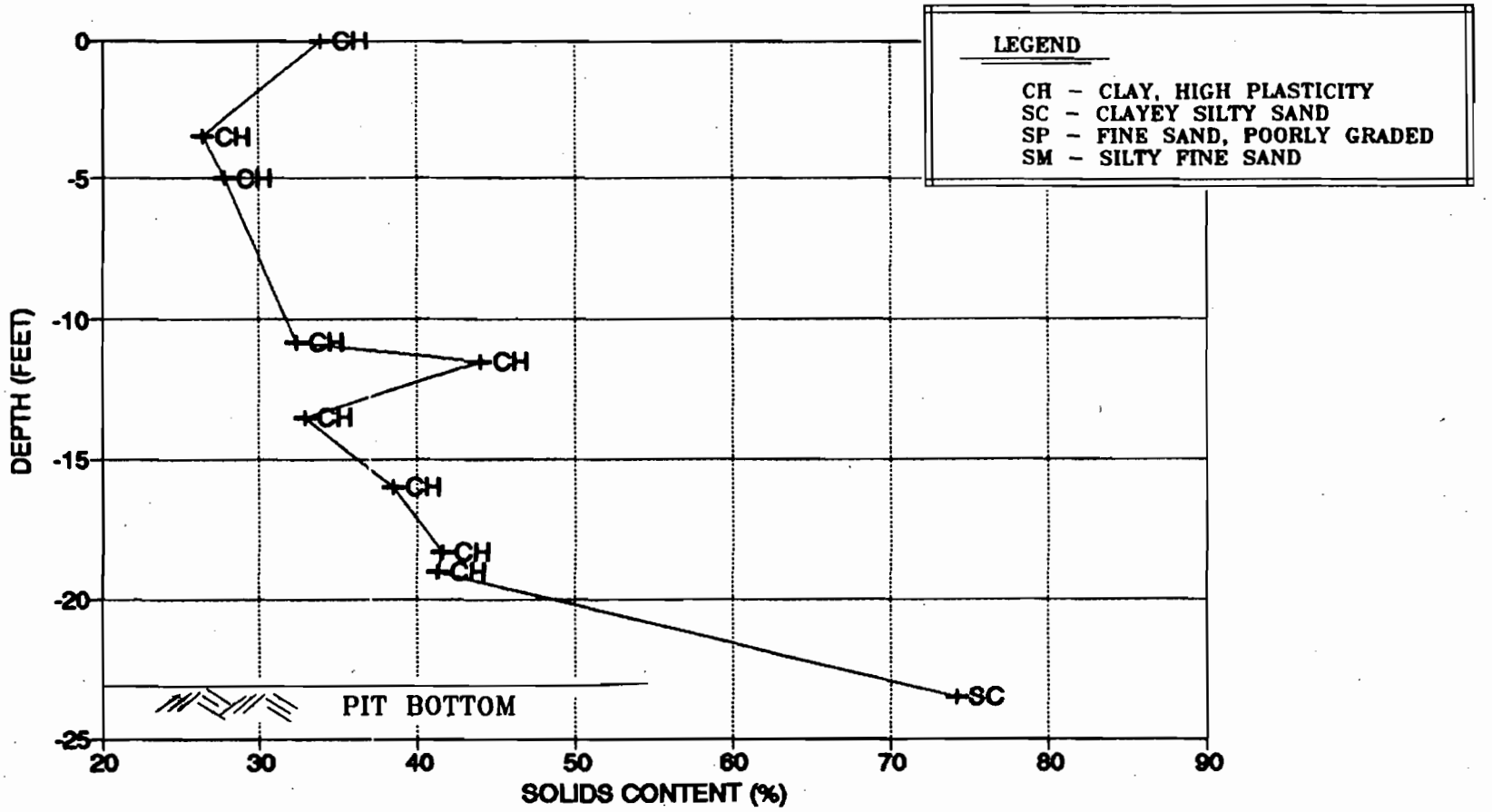


Source: Dames & Moore, 1992

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FIGURE 3.5.1-54
SOLIDS CONTENT PROFILE
CLAY POND N-11A, BORING C-3

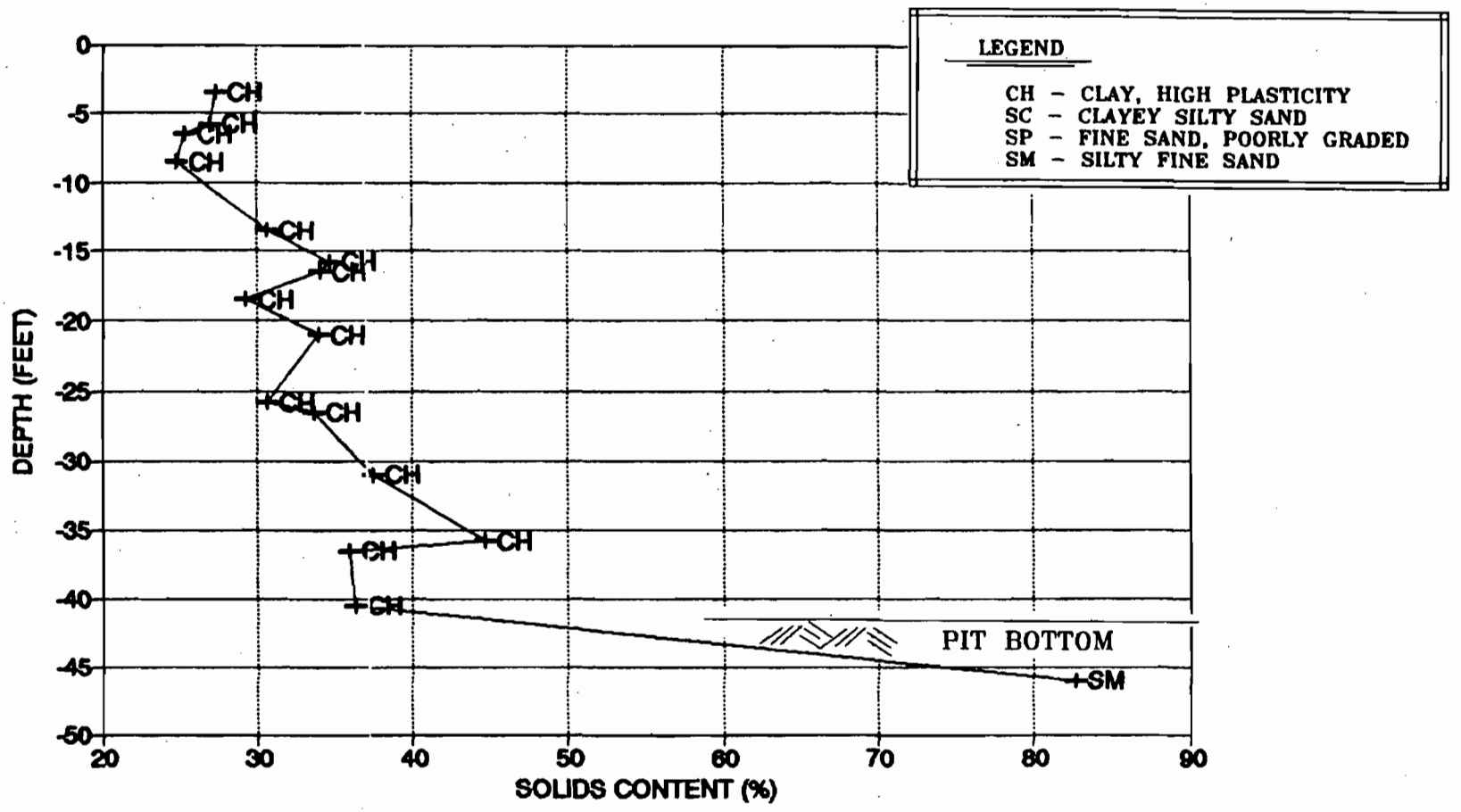


Source: Dames & Moore, 1992

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FIGURE 3.5.1-55
SOLIDS CONTENT PROFILE
CLAY POND N-13, BORING C-4

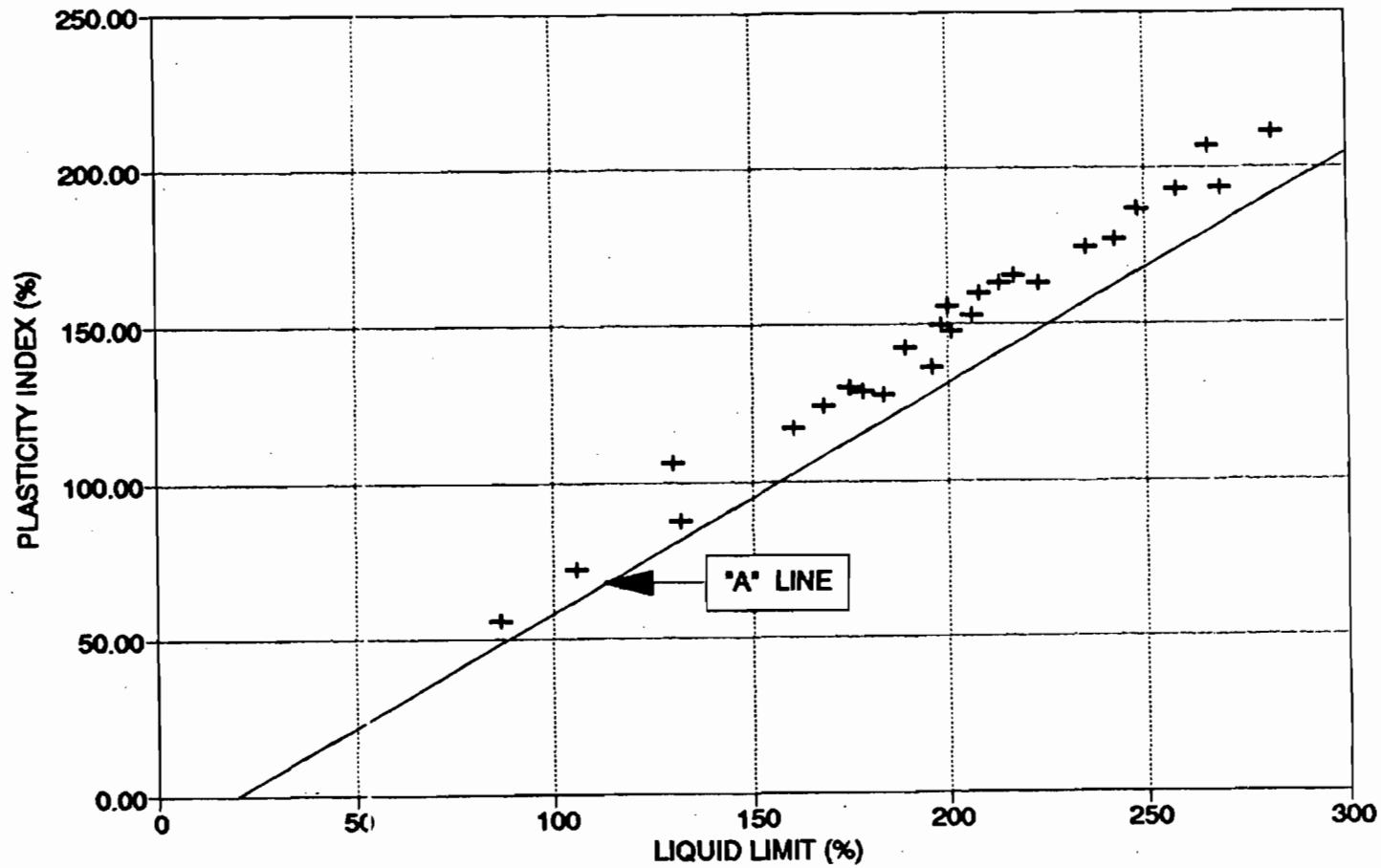


Source: Dames & Moore, 1992

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FIGURE 3.5.1-56
SOLIDS CONTENT PROFILE
CLAY POND N-9B, BORING C-9

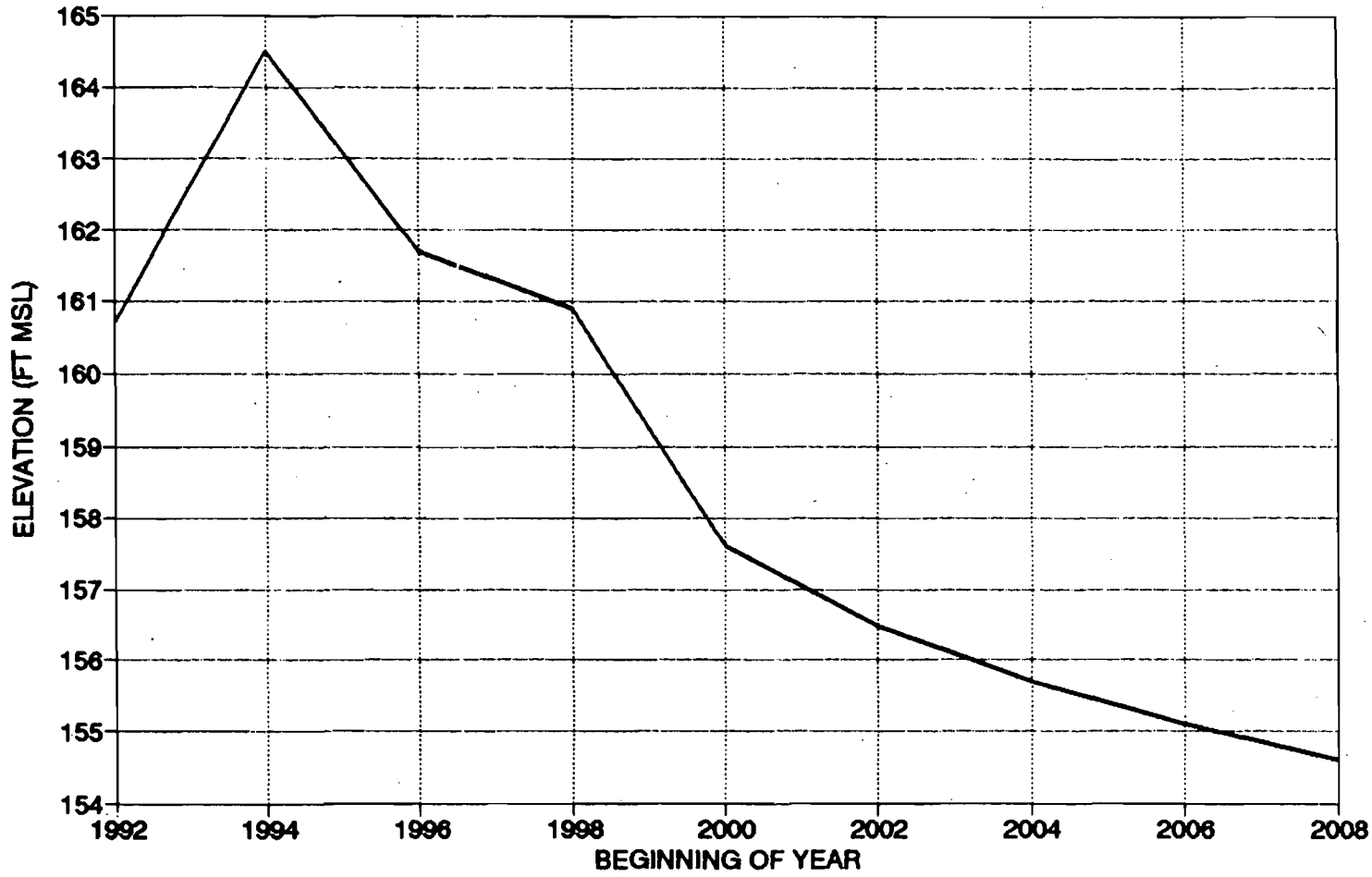


Source: Dames & Moore, 1992

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Polk County Site

FIGURE 3.5.1-57
ATTERBERG TEST RESULTS
PROPOSED COOLING POND AREAS
N-11B, N-11C, AND N-15

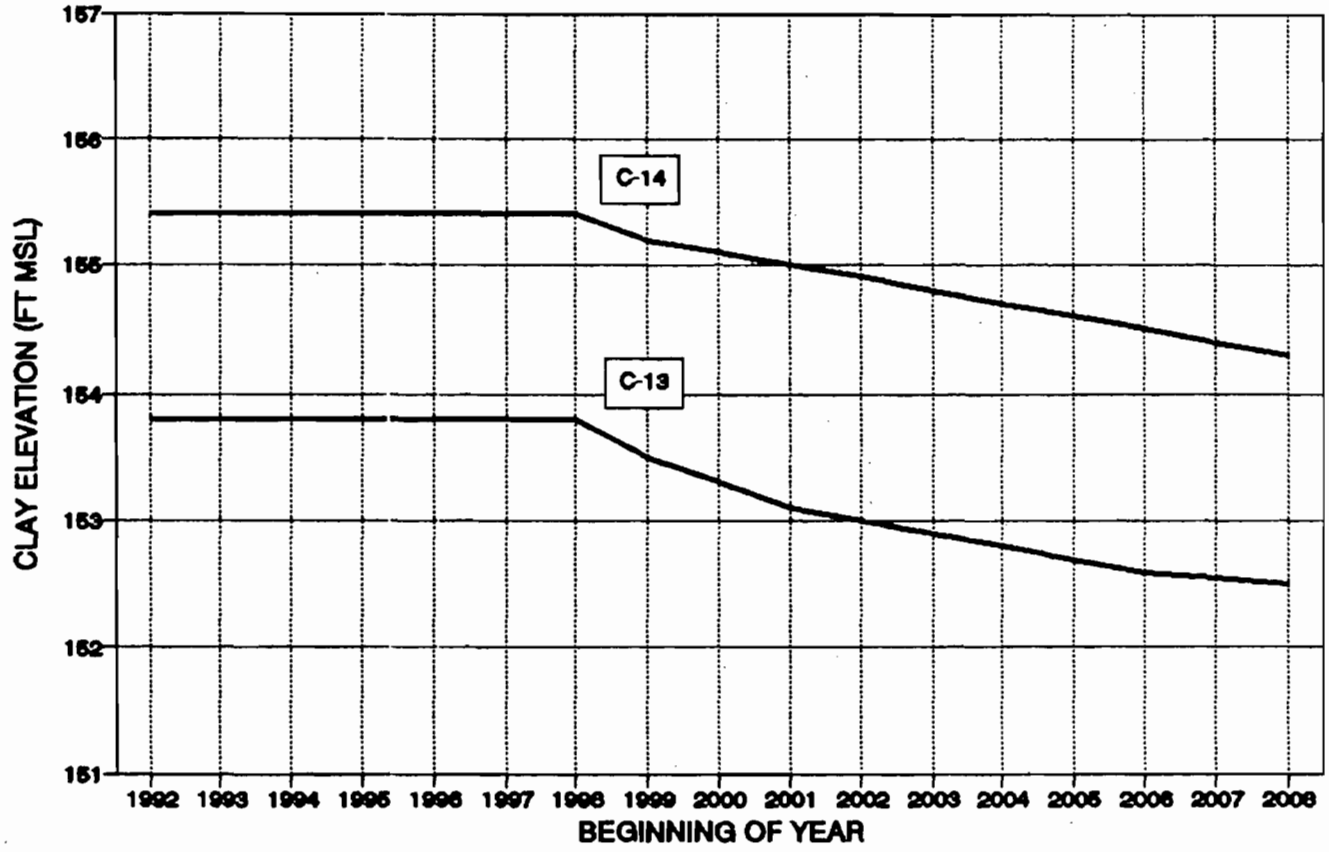


Source: Dames & Moore, 1992

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FIGURE 3.5.1-58
CLAY CONSOLIDATION MODELING PREDICTION
CLAY POND N-15

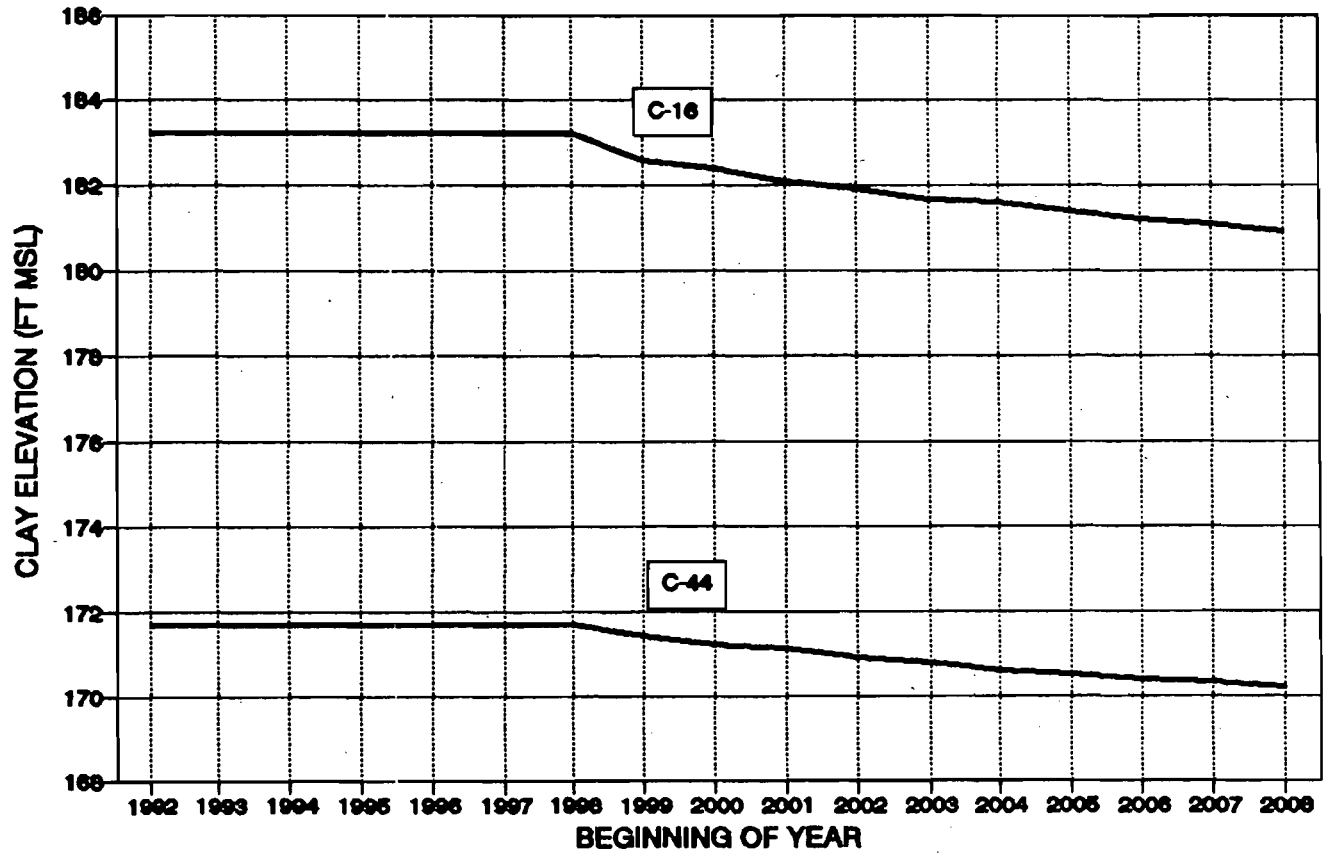


Source: Dames & Moore, 1992

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FIGURE 3.5.1-59
CLAY CONSOLIDATION MODELING PREDICTION CLAY POND N-11B, BORINGS C-13, C-14



Source: Dames & Moore, 1992

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FIGURE 3.5.1-60
CLAY CONSOLIDATION MODELING PREDICTION
CLAY POND N-11C, BORINGS C-16, C-44

3.5.2 Domestic/Sanitary Wastewater

Plant domestic/sanitary wastewater will be generated by showers, lavatories, sinks, toilets, urinals, and drinking fountains. There are two options for treatment and disposal of such wastewater. Under the first option, these wastewaters will be collected and treated in on-site domestic/sanitary waste treatment facilities. The effluent from the sanitary waste treatment system will be routed to the cooling pond. The sanitary wastewater treatment system will provide a minimum of 90 percent reduction of BOD_5 and suspended solids and will meet the requirements of Section 17-600 of the F.A.C. The other option, which will be discussed below, is the use of a municipal treatment system.

The estimated permanent plant population based on ultimate site development will be 544. At a flow of 35 gpd per person, a treatment plant capacity of 19,000 gpd will be required to serve the permanent population. The peak sanitary waste flow will occur during construction of the later units, when the combination of permanent personnel and the construction workforce results in the largest anticipated domestic wastewater production. The estimated peak sanitary waste flows based on an anticipated worst case scenario of 300 permanent personnel and 1,300 construction workers, and flows of 35 gpd per person for permanent personnel and 20 gpd per person for construction workers, will be approximately 36,000 gpd.

The new on-site sanitary waste treatment system would consist of four 10,000 gpd treatment modules for a total plant capacity of 40,000 gpd. Biological loading will be approximately 0.075 pound of BOD_5 per day per person. Initially, two 10,000 gpd treatment modules will be installed. Additional modules will be added during construction of the ultimate development. Upon completion of construction, excess modules will be held in standby in anticipation of outages.

The on-site sanitary waste treatment plant will be a pre-engineered activated sludge unit, consisting of multiple extended aeration and clarification treatment modules to allow for temporary population increases during construction and outages. Each pair of modules will have a common chlorine contact chamber and a common sludge holding chamber. Provisions will be made to allow pumping out of the sludge holding tank for off-site disposal by a contractor. The plant will be provided with a flow equalization lift station and comminutors to reduce the size of solids at the inlet to the plant. Tablet type chlorinators will be used to disinfect the effluent.

As an alternative to on-site treatment, sanitary waste may be routed to the City of Fort Meade for treatment and disposal. The existing plant capacity is 1.0 mgd and usage in 1990 was 0.41 mgd. The projected waste flow from FPC's Polk County Site is within the Fort Meade plant reserve margin. The feasibility of this option is currently under discussion with the City of Fort Meade.

3.5.3 Potable Water Systems

Potable water uses at the plant will include water for drinking, washing, showers, urinals, and toilets. There are two options for potable water supply. Under the first option, potable water for the plant will be provided from the on-site service water system, which will be supplied by well water. The well water will be treated using lime softening pretreatment and filtration in the service water pretreatment system, and chlorination. The estimated potable water analysis following treatment is shown in Table 3.5.3-1. The other option, which will be discussed below, is the use of a municipal water system.

The average potable water demand is estimated to be 19,000 gpd for the ultimate plant operations population of 544. The peak demand is expected to occur with 300 permanent personnel plus 1,300 construction workers on-site. At 35 gpd per person for plant personnel and 20 gpd per construction worker, peak potable water demand is estimated to be approximately 36,000 gpd.

Precipitated solids, mostly calcium carbonate, from the service water pretreatment system will be routed initially to a thickener and the thickened solids sent to the solid waste disposal area. If PC units are added to the site, the pretreatment solids will be routed to the scrubber for use as a scrubber additive. Service water pretreatment gravity filter backwash and thickener overflow will be recovered and returned to the pretreatment system inlet.

As an alternative source of supply, potable water may be obtained from the City of Fort Meade. The current capacity of the City of Fort Meade city water system is 3.3 mgd and usage in 1991 was 1.7 mgd. The proposed potable water requirements for FPC's Polk County Site is within the Fort Meade system reserve margin. Potable water supply from Fort Meade is currently under discussion with the City of Fort Meade.

TABLE 3.5.3-1
ESTIMATED TREATED POTABLE WATER ANALYSIS

Constituent	Treated Typical*
Calcium, mg/l as $CaCO_3$	62
Magnesium, mg/l as $CaCO_3$	63
Sodium, mg/l as $CaCO_3$	22
Potassium, mg/l as $CaCO_3$	1.3
M-Alkalinity, mg/l	35
Sulfate, mg/l as $CaCO_3$	96
Chloride, mg/l as $CaCO_3$	15.4
Silica, mg/l as SiO_2	15.7
Total Dissolved Solids, mg/l	215
Iron, mg/l	0
Sulfide, mg/l	0
Fluoride, mg/l	0.64
Arsenic, mg/l	< 0.01
Barium, mg/l	< 0.1
Beryllium, mg/l	< 0.01
Cadmium, mg/l	< 0.005
Chromium, mg/l	< 0.01
Copper, mg/l	< 0.01
Lead, mg/l	< 0.0035
Manganese, mg/l	< 0.03
Mercury, mg/l	< 0.0002
Nickel, mg/l	< 0.01
Selenium, mg/l	< 0.005
Silver, mg/l	< 0.01
Strontium, mg/l	0.86
Zinc, mg/l	< 0.05
Alpha, Gross (pCi/l)	0.898
Radium 226 (pCi/l)	< 0.7

* Based on aeration and cold lime softening treatment of the raw well water as presented in Table 3.5.4-1

Source: Black & Veatch, 1992

3.5.4 Process Water Systems

Major process water uses will be as follows:

- Service water will be provided throughout the plant for washdown purposes and for pump and equipment seal water and flushing as necessary. Hose stations will be located for washdown use as determined during detailed design.

- A dedicated supply of treated well water will be provided in the service/fire water storage tank. Backup fire water will be supplied from the cooling pond. Fire water pumps will provide water throughout the site by means of an underground piping loop which serves fire hydrants, hose racks and reels, and automatic suppression systems.

- Demineralized water will be required for use as makeup to the steam-condensate-feedwater cycle associated with the HRSGs, coal gasifier steam generators, and the PC steam generators. The makeup is required to replace cycle losses and boiler blowdown. Mixed bed condensate polishers will be used for steam-condensate-feedwater cycle cleanup for the PC units. In addition, demineralized water will be used when firing fuel oil and coal gas to control CT NO_x emissions, as well as for demineralizer regeneration.

  Demineralized water treatment will consist of an ion exchange demineralizer system. Wastewater treatment system permeate or service water will be transferred to the demineralizer inlet. As the water passes through the system cation and anion exchangers, it will be progressively demineralized until the effluent contains essentially no dissolved solids.

  Approximately once per day, the exhausted ion exchange resin will be regenerated using sulfuric acid and sodium hydroxide. The resulting chemical wastewater flows will be treated as described in Section 3.6.

- Process makeup water will be required to replace wastewater and evaporation losses from various streams within the coal gasification process. Coal gasification process wastewater from gas scrubbing, quenching, cooling, sulfur recovery, and tailgas cleaning will be treated for reuse. In addition, evaporative losses from the various coal gasification processes will be replaced with process water. Process water may be required for coal slurry makeup if the chosen gasification process uses coal slurry feed to the gasifiers. Process water will also be used for coal handling dust suppression.

  Recycle basin water will be used to supply process water makeup to the gasifiers. The recycle basin will collect neutralized demineralizer and condensate polisher

regeneration wastewater, coal and limestone storage area runoff, active solid waste disposal area runoff, and cooling pond blowdown.

- The ash handling systems for the PC units will require process water for use in bottom ash handling. Operation of the bottom ash systems will result in heating and evaporation of the process water. Process water makeup will be required to replace evaporative losses and the water entrained in the disposed ash. Process water will also be used for fly ash conditioning and dust suppression. Process water for use in ash handling will be provided from the recycle basin.

- The flue gas scrubber systems for the PC units require process water makeup to replace evaporative losses and the water entrained in the scrubber solids sent to solid waste disposal. Process water will be used for scrubber additive preparation and additive dilution. Process water will be provided to the flue gas scrubber system from the recycle basin. In addition, water treatment system wastewater will be routed to the scrubber systems for use as scrubber additive and to provide a small portion of the process water demand. Service water will be used primarily for seal water and flushing and will be reused in satisfying a portion of the scrubber process water demand.

A summary of the anticipated annual average and peak process water flows for the ultimate 3,000 MW development with all CGCC units, and the option for 3,200 MW including 1,200 MW of PC units is presented in Table 3.5.4-1.

Well water from a depth of approximately 800 feet in the Floridan Aquifer will be treated in a lime softening pretreatment system prior to use as service water (washdown and seal water), fire protection water, potable water, regeneration water, filter backwash, miscellaneous plant water, and a supply for the demineralization system. Untreated well water will be used as cooling pond makeup. Cooling pond blowdown will be used as flue gas scrubber and coal gasification process water. Table 3.5.3-1 shows the estimated treated potable (well) water analysis. The estimated raw well water and water cropping area runoff analyses are shown in Tables 3.5.1-4 and 3.5.1-5, respectively. Note that concentrations of metals will probably be less than that indicated since the wastewater treatment process will tend to remove metals, although that is not its intended function.

A wastewater treatment system will be installed, consisting of lime/soda ash softening pretreatment followed by a reverse osmosis system. A portion of the lime/soda ash pretreatment system effluent will be taken from the treatment stream prior to the reverse osmosis system and routed to the cooling pond to control scaling. As additional generating capacity is installed, a

brine concentrator system will be added for additional wastewater volume reduction as required. The reverse osmosis system permeate and brine concentrator distillate will be high quality, low solids water used to supply the demineralizer, with the remainder directed to the cooling pond. The reverse osmosis reject or brine concentrator concentrate will contain the constituents present in the cooling pond makeup, but at a concentrated level. These constituents are primarily the sulfate and chloride salts of calcium, magnesium, and sodium. These wastewaters will be directed to the brine pond as discussed in Section 3.6.

The estimated cooling pond analyses for the two ultimate development cases are shown in Table 3.5.4-2. This analysis is a worst case for design purposes and does not consider reductions which may take place in the cooling pond as a result of chemical interaction and precipitation as the cycling up of concentrations occur, as described in Section 3.5.1.1. Analyses are included for annual average conditions for each of the two ultimate development cases, as described in Section 3.6. Peak conditions for the purpose of characterizing the water balance are defined as the maximum net yearly evaporation and rainfall of record (1985), no flow from water cropping, and 100 percent generating unit load. The various process water demands and flow paths for each development case are shown on plant water mass balances included as Figures 3.5.4-1 through 3.5.4-4. The actual peak well water makeup requirements will be less than that indicated on Figures 3.5.4-2 and 3.5.4-4 since the cooling pond level will be allowed to vary and the average unit load factor will be less than 100 percent. Actual peak anticipated groundwater requirements for cooling pond makeup are discussed in Section 3.5.1.

TABLE 3.5.4-1
PROCESS WATER DEMAND

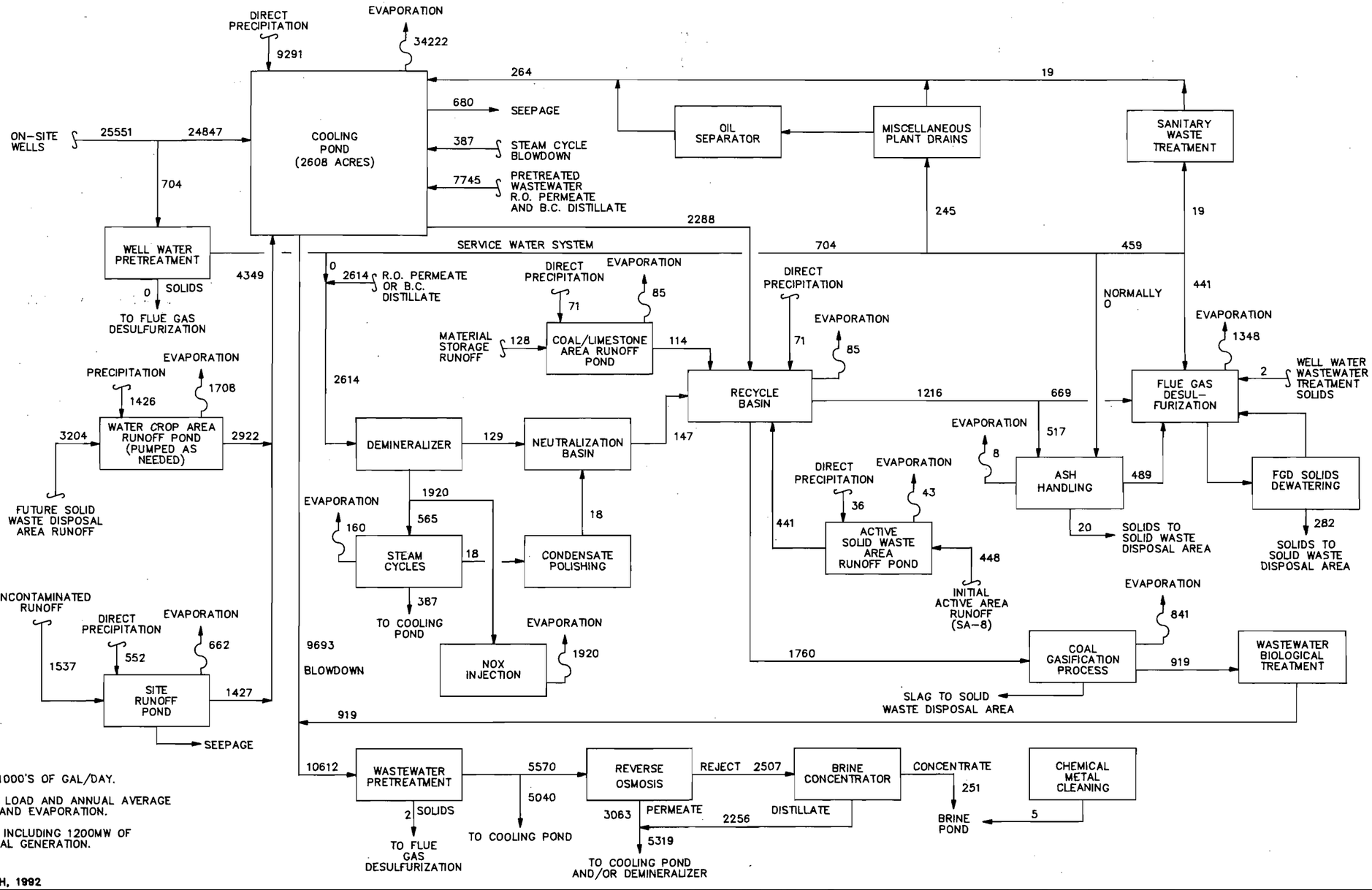
Process Stream	Flow (1,000 gpd)	
	Average	Peak
Ultimate - Case A - 3,000 MW		
Service/Potable Water	264	307
Demineralizer Inlet	3,188	3,751
Coal Gasifiers	2,640	3,105
Ultimate - Case B - 3,200 MW		
Service/Potable Water	704	825
Demineralizer Inlet	2,614	3,070
Condensate Polisher Regeneration	18	18
Ash Handling	517	608
FGD Systems	669	820
Coal Gasifiers	1,760	2,071

Source: Black & Veatch, 1992

TABLE 3.5.4-2
ESTIMATED COOLING POND CHEMICAL ANALYSIS

Constituent	Case B - Ultimate (PC)	Case A - Ultimate (CGCC)
	Annual Average	Annual Average
Calcium, mg/l as $CaCO_3$	299	307
Magnesium, mg/l as $CACO_3$	245	244
Sodium, mg/l as $CaCO_3$	78	77
Potassium, mg/l as $CaCO_3$	9	9
M-Alkalinity, mg/l	294	303
Sulfate, mg/l as $CaCO_3$	367	355
Chloride, mg/l as $CaCO_3$	58	58
Silica, mg/l as SiO_2	55	55
TDS, mg/l	1053	1053
Fluoride, mg/l	2.86	2.85
N, Nitrate	0.3	0.29
Total Nitrogen	1.25	1.30
pH, std units	8.0	8.0
Orthophosphorus, mg/l	1.21	1.26
Total Phosphorus, mg/l	0.98	1.06
Arsenic, µg/l	< 33.6	< 33
Barium, µg/l	< 45	< 46
Beryllium, µg/l	< 30	< 30
Cadmium, µg/l	< 165	< 102
Chromium, µg/l	< 40.5	< 403
Copper, µg/l	< 33	< 32
Iron, µg/l	< 270	< 282
Lead, µg/l	< 13	< 13
Manganese, µg/l	< 122	< 121
Mercury, µg/l	< 0.7	< 0.7
Nickel, µg/l	< 30	< 30
Selenium, µg/l	165	162
Silver, µg/l	< 33	< 324
Strontium, µg/l	2,880	2,830
Zinc, µg/l	< 170	< 0.17
Alpha, Gross(pC/L)	4.12	4.11
Radium 226 (pC/L)	2.43	2.39

Source: Black & Veatch, 1992



NOTES:

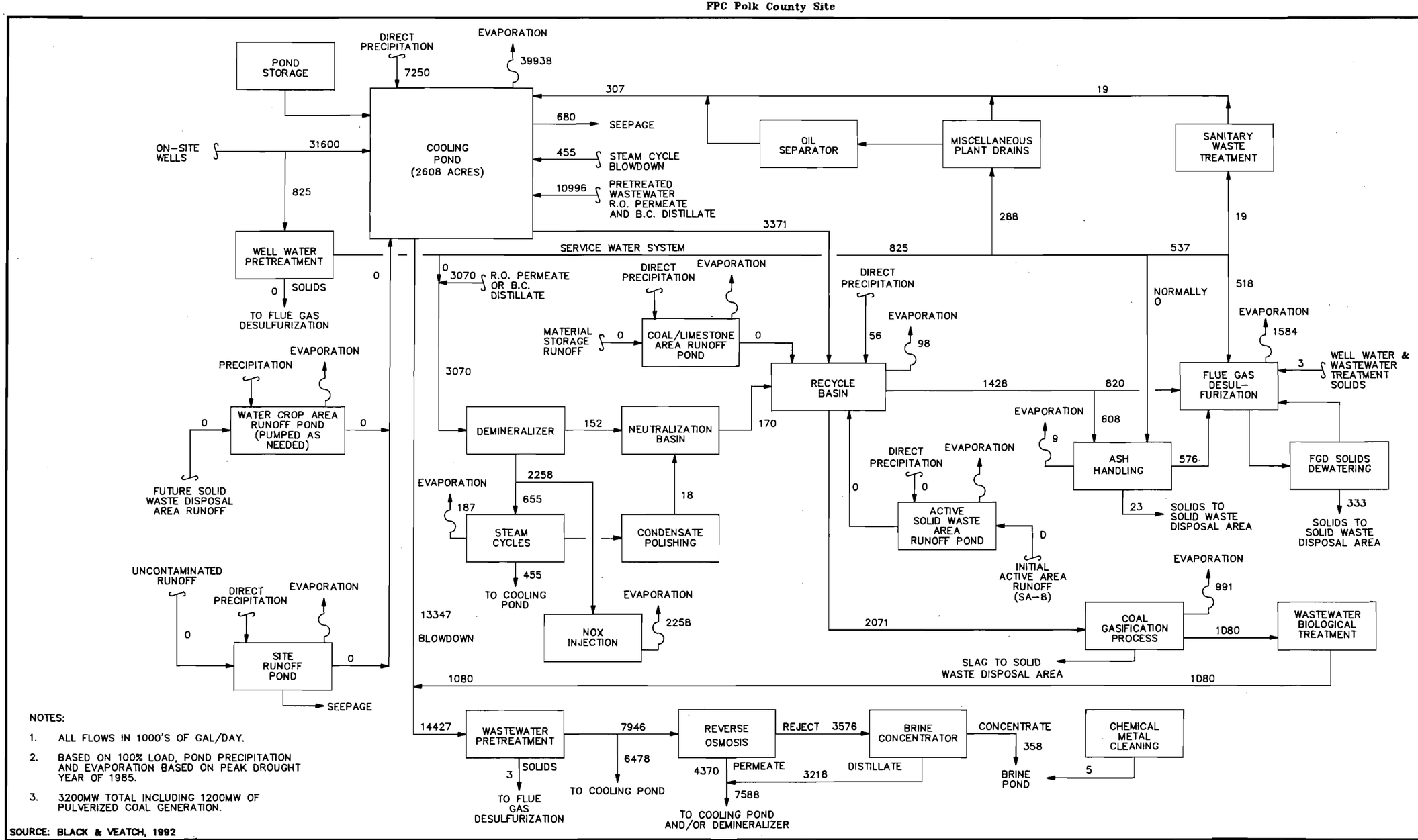
1. ALL FLOWS IN 1000'S OF GAL/DAY.
2. BASED ON 85% LOAD AND ANNUAL AVERAGE PRECIPITATION AND EVAPORATION.
3. 3200MW TOTAL INCLUDING 1200MW OF PULVERIZED COAL GENERATION.

SOURCE: BLACK & VEATCH, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 3.5.4-1
TYPICAL WATER MASS BALANCE ULTIMATE DEVELOPMENT–CASE B (WITH PULVERIZED COAL UNITS) ANNUAL AVERAGE CONDITIONS



NOTES:

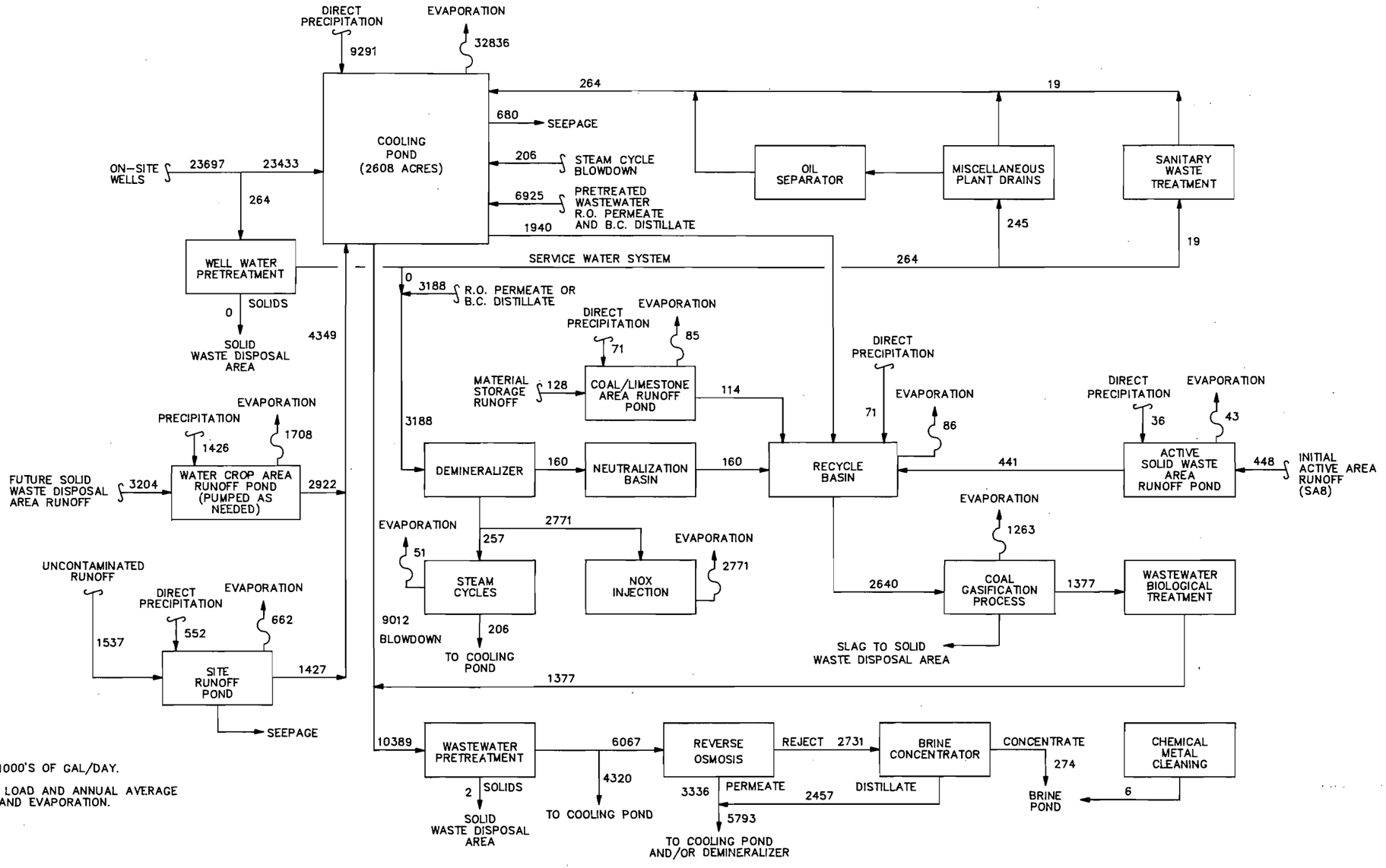
1. ALL FLOWS IN 1000'S OF GAL/DAY.
2. BASED ON 100% LOAD, POND PRECIPITATION AND EVAPORATION BASED ON PEAK DROUGHT YEAR OF 1985.
3. 3200MW TOTAL INCLUDING 1200MW OF PULVERIZED COAL GENERATION.

SOURCE: BLACK & VEATCH, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 3.5.4-2
PROJECTED WATER MASS BALANCE ULTIMATE DEVELOPMENT–CASE B (WITH PULVERIZED COAL UNITS) PEAK CONDITIONS



NOTES:

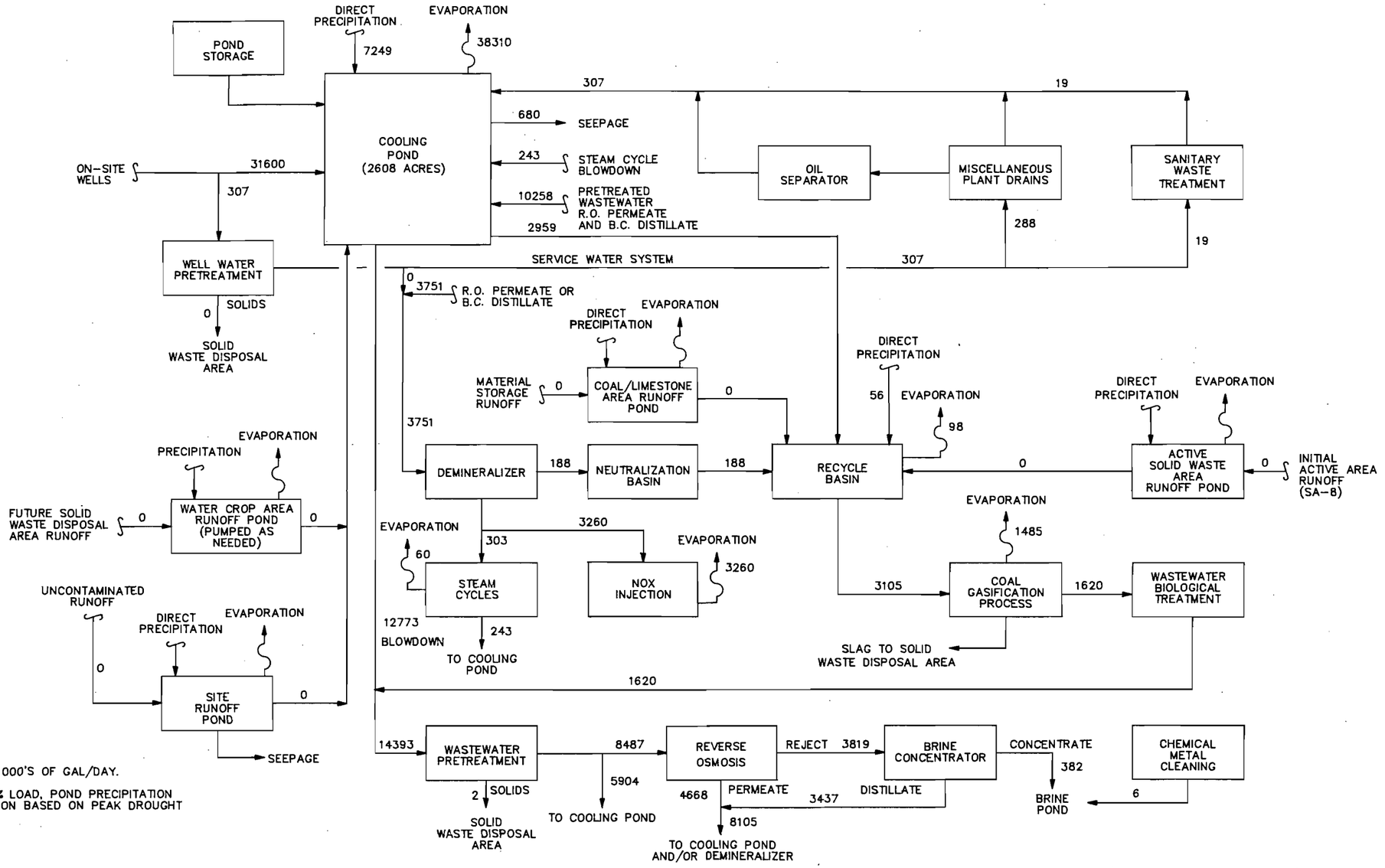
1. ALL FLOWS IN 1000'S OF GAL/DAY.
2. BASED ON 85% LOAD AND ANNUAL AVERAGE PRECIPITATION AND EVAPORATION.
3. 3000MW TOTAL.

SOURCE: BLACK & VEATCH, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 3.5.4-3
TYPICAL WATER MASS BALANCE ULTIMATE DEVELOPMENT–CASE A (ALL COAL GASIFICATION COMBINED CYCLE UNITS) ANNUAL AVERAGE CONDITIONS



NOTES:

1. ALL FLOWS IN 1000'S OF GAL/DAY.
2. BASED ON 100% LOAD, POND PRECIPITATION AND EVAPORATION BASED ON PEAK DROUGHT YEAR OF 1985.
3. 3000MW TOTAL.

SOURCE: BLACK & VEATCH, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 3.5.4-4
TYPICAL WATER MASS BALANCE ULTIMATE DEVELOPMENT–CASE A (ALL COAL GASIFICATION COMBINED CYCLE UNITS) PEAK CONDITIONS

3.6.2.11 Material Storage Area Runoff

Coal and limestone area rainfall runoff will be collected in a coal/limestone area runoff pond. The pond will have a synthetic liner and will provide for equalization and settling of suspended solids. Pond effluent will be directed to the recycle basin for use as process water makeup.

3.6.2.12 Active Solid Waste Area Runoff

Active solid waste area rainfall runoff will be collected in a pond located within the disposal area, which has an existing clay liner. Pond effluent will be directed to the recycle basin for use as process water makeup.

TABLE 3.6.1-1
CLIMATOLOGICAL DATA - LAKE ALFRED, FLORIDA

Year	Class A Pan Evaporation	Estimated Lake Evaporation[2]	Precipitation	Net Annual Evaporation
1961	60.94	47.53	35.83	11.7
1962	58.04	45.27	38.06	7.21
1963	59.48	46.39	46.26	0.13
1964	59.07	46.07	47.53	(1.46)
1965	NR	ND	48.15	ND
1966	NR	ND	45.07	ND
1967	72.41	56.48	37.8	18.68
1968	68.34	53.31	55.37	(2.06)
1969	66.76	52.07	53.0	(0.93)
1970	67.84	52.92	46.56	6.36
1971	68.72	53.60	42.87	10.73
1972	69.3	54.05	38.27	15.78
1973	69.04	53.85	45.41	8.44
1974	70.08	54.66	43.89	10.77
1975	69.07	53.87	41.5	12.37
1976	NR	ND	49.96	ND
1977	NR	ND	45.2	ND
1978	66.84	52.14	49.03	3.11
1979	68.77	53.64	69.72	(16.08)
1980	71.72	55.94	46.8	9.14
1981	86.25	67.28	39.57	27.71
1982	73.66	57.45	62.21	(4.76)
1983	73.68	57.47	63.11	(5.64)
1984	79.48	61.99	39.57	22.42
1985	84.44	65.86	37.36	28.5
1986	81.63	63.67	51.18	12.49
1987	78.61	61.32	56.41	4.91
1988	77.87	60.74	60.54	0.2
1989	80.71	62.95	52.36	10.59
Average	71.31	55.62	47.88	7.61

Notes: Annual data in inches, 1961 through 1989
NR = Not Reported
ND = Not Determined, no pan evaporation data reported

Sources:
[1] NOAA Climatological Data Annual Summaries. 1961 - 1989.
[2] U.S. Dept. of Commerce Weather Bureau Tech. Paper No. 37. Plate 3 shows 0.78 coefficient to convert Class A pan evaporation to lake evaporation.

3.7 SOLID AND HAZARDOUS WASTES AND BY-PRODUCTS

A discussion of solid and hazardous wastes to be generated at the FPC Polk County Site is presented in this section.

3.7.1 Solid Wastes

The quantities and types of solid wastes and by-products and their associated methods of treatment, handling, storage, and disposal are discussed in the following sections.

3.7.1.1 Quantities and Types

The site will generate certain types of solid wastes regardless of which ultimate development case is employed. The quantities of such wastes may vary with the ultimate development case.

GENERAL WASTES. General wastes such as office wastes, grass clippings, other yard wastes, and circulating water system screenings, will be recycled to the extent possible. Remaining wastes will be transported off-site to the county's North Central Landfill for disposal.

FPC has a corporate-wide commitment to waste minimization. This commitment includes extensive recycling of waste products, reduction at the source, and elimination of most hazardous product usage. This corporate commitment will be implemented on a continuing basis at the site.

WATER AND WASTEWATER TREATMENT WASTES. Solids from service water treatment and blowdown pretreatment will be thickened and disposed to the on-site solid waste disposal area (SWDA). Quantities generated annually at ultimate buildout are expected to be about 16,500 tons per year for Case A (3,000 MW of CGCC), or about 18,000 tons per year for Case B (3,200 MW of CGCC/PC).

COMBUSTION TURBINE WASTES. The predominant solid waste which will be generated by the combustion turbines will be used air inlet filters. Assuming Case A (3,000 MW of CC), the estimated volume of waste air filters (similar to automotive air filters and made primarily of paper) will be approximately 120 cubic yards per year. This material will be transported off-site to the county's North Central Landfill.

COAL GASIFICATION FACILITIES

The operation of the coal gasification facilities will generate slag and fly slag, sulfur, and low volume wastes. The quantities and composition of the wastes and by-products are influenced by the chemical constituents of the fuel, the type of sulfur removal and recovery system, as well as other factors. Calculations of solid waste quantities are based on project coal characteristics such as ash percentages, sulfur content, and heating value. These assumptions, basic plant data, and calculated quantities of solid wastes and by-products are shown in Table 3.7.1-1.

SLAG/FLY SLAG. During the gasification of coal, most of the mineral (ash) content of the coal leaves the gasification zone in the form of molten slag. As molten slag contacts the process water bath, slag solidifies into dense, glassy granules. Very fine material called fly slag can escape with the gas being produced. This material is removed from the gas with the use of bag filters or cyclones. The recovered flyslag is then recycled back to the gasifier or leaves the process as a by-product similar to the slag. As shown in Table 3.7.1-1, each 940 MW block of CGCC capacity would produce about 452,000 tons per year of slag and fly slag. This would be a total of 1,355,000 tons per year at ultimate buildout for Case A or about 904,000 tons per year for Case B.

Based on the tests of slag from the Shell Coal Gasification Process - 1 (Deer Park, Texas) and the Cool Water Gasification Program (Texaco Gasification Process), the Polk County Site slag is expected to be characterized by high coal ash levels, some carbon, and relatively small amounts of sulfur, chlorine, hydrogen, and nitrogen. The slag is not expected to exhibit any of the characteristics of a hazardous waste, as defined in 40 CFR 261, Subpart C (corrosivity, ignitability, and reactivity). In addition, the slag is not expected to exhibit toxic characteristics when subjected to the EPA's Toxicity Characteristic Leaching Procedure (TCLP) tests. Other gasification processes produce slag with similar characteristics.

SULFUR. Elemental sulfur in the molten state will be a product of the sulfur removal-recovery system. The sulfur recovered will be a marketable-grade material. Based on previous tests, sulfur leachate has been found to be nonhazardous. As shown in Table 3.7.1-1, each 940 MW block of CGCC capacity would produce about 94,700 tons per year of sulfur.

LOW VOLUME WASTES. Low volume wastes generated by the gasification process include spent catalysts, solvents, and resin beds.

PULVERIZED COAL

The major solid wastes that will be generated by the PC units are bottom ash, fly ash, boiler hopper ash, coal pulverizer rejects, and scrubber solids. The calculated quantities of solid waste and by-products that will be generated by each 600 MW PC unit are shown in Table 3.7.1-2.

ASH/SCRUBBER WASTES. The combustion of coal results in the production of ash due to the incombustibles in the coal. This ash is collected at various points in the process. Bottom ash and boiler hopper ash falls to the bottom of the boiler into a water quench tank. This ash is removed from the bottom of the boiler by a submerged tray conveyor. Fly ash is the finer noncombustible portion of the coal which is carried by the flue gas out of the boiler and will be collected in a baghouse or electrostatic precipitator. The scrubber wastes are generated by capturing the sulfur dioxide in the flue gas with the limestone slurry to create sulfates/sulfites.

Two 600 MW PC units are expected to produce about 95,200 tons per year of bottom ash and about 1,490,000 tons per year of the mixed fly ash/scrubber wastes. It is expected that much of this material will be marketable. FPC currently sells 99 percent of its fly ash as a pozzolan replacement, either in direct form or as a component of Aardelite®, a gravel-like compound. Only 1 percent of FPC's fly ash from other facilities is currently disposed on-site where generated.

ULTIMATE SITE DEVELOPMENT

Under the ultimate development scenario involving 3,000 MW (Case A) of CGCC capacity, the following quantities of solid wastes would be produced:

- Slag/fly slag 1,355,000 tons/year
- Sulfur 284,000 tons/year
- Water/wastewater solids 10,500 tons/year

Under the ultimate site development scenario involving 3,200 MW (Case B), consisting of two 600 MW pulverized coal units and two 940 MW blocks of CGCC facilities, the following quantities of solid wastes would be produced.

- Bottom ash 95,200 tons/year
- Fly ash/scrubber wastes 1,490,000 tons/year
- Slag/fly slag 903,400 tons/year
- Sulfur 189,400 tons/year
- Water/wastewater solids 18,000 tons/year

Under either ultimate site development scenario, there will be comparatively minor amounts of low volume and general wastes produced at the site.

3.7.1.2 Methods of Treatment, Handling, Interim Storage, and Off-Site Disposal

The methods of treatment, handling, interim storage, and off-site disposal or reuse of solid wastes from the CG facilities and PC units are discussed in the following subsections.

COAL GASIFICATION FACILITIES

SLAG/FLY SLAG. Most of the slag produced will be at the bottom of the gasifier, and it will be quenched with water to form dense, glassy granules. Fly slag is removed from the coal-derived gas by water quenching followed by treatment with a direct water quench venturi scrubbing system.

Slag and fly slag are potentially marketable products. Slag has been used successfully as synthetic lightweight aggregate for manufacturing concrete blocks, roofing tiles, and structural concrete.

The need for on-site disposal will be reduced greatly if the slag can be sold for commercial purposes. The slag which is marketed would be shipped off-site in trucks or rail cars. If necessary, the Polk County Site has storage adequate to accommodate the long-term storage of slag and fly slag (40 years per unit). If on-site disposal is necessary, the slag and fly slag will be handled dry, using either trucks or conveyors.

SULFUR. The sulfur produced from the gasification process is expected to be marketable-grade sulfur. Sulfur will be stored initially in a molten state in steam-heated tanks. The molten sulfur will be pumped to trucks or rail cars for delivery to buyers or poured into solid slabs. A large, heated, 30-day storage tank also will be available to hold this liquid sulfur, if needed. Sulfur will be handled according to the provisions of F.A.C. 17-2.600(11), Sulfur Storage and Handling Facilities.

OTHER WASTES. Spent sulfur solvent and replaced resin beds will be removed by suppliers. Spent catalyst will be removed to an approved off-site disposal area. Water and wastewater treatment wastes will be co-disposed with the slag. General waste will be disposed off-site to the county landfill, as will combustion turbine inlet air filters.

PULVERIZED COAL

BOTTOM ASH, FLY ASH, AND SCRUBBER SOLIDS. These solid wastes will be transported to the clay-lined, on-site disposal area. Bottom ash will be sluiced from the plant area prior to transport to the on-site disposal area. Fly ash will be pneumatically transported from collection hoppers of the baghouse or electrostatic precipitators. The fly ash will be mixed with the scrubber solids prior to transport to the on-site disposal area. To the extent practicable, FPC intends to market bottom ash, fly ash, and scrubber solids for reuse by other entities. Bottom ash could be used in asphalt, while fly ash and scrubber solids could be used as an aggregate in building materials. Such reuse of these wastes would reduce the volume to be disposed of on-site.

WATER AND WASTEWATER PRETREATMENT WASTES.

Water and wastewater pretreatment solids will be thickened and transferred to the on-site disposal area. If flue gas desulfurization systems using limestone reagents are added, the solids will be transferred to the scrubber additive tank for reuse as a scrubber additive.

3.7.1.3 On-Site Disposal

The use of reclaimed clay settling areas for solid waste disposal represents a major advantage for this particular power plant site. After ordinary mining reclamation, clays within the settling

areas will form an effectively impermeable liner. The clays, because of their high adsorptive capacity, also trap dissolved ions (e.g. metals) and remove them from leachate.

The design of waste disposal areas proposes to utilize existing waste phosphatic clay settling ponds SA-8, SA-9 (brine storage), SA-10, P-2 and portions of P-3 as primary disposal locations. A portion of the P-3 settling pond in the west central area has not yet been mined and has only a few feet of clay thickness. Figure 3.2.2-3 identifies the location of the proposed solid waste disposal and brine storage areas proposed for the site.

Average solid waste depths of 30 feet are easily achievable in these areas (not including the brine pond). Based on that estimate, the capacities are as follows:

Parcel	Acreage	Ac-Ft	Cumulative Acre-Feet
SA-8	429	12,870	12,870
SA-10	220	6,600	19,470
P-2	414	12,420	31,890
P-3	477	14,310	46,200
Phosphoria	523	15,690	61,890

Inflow to the brine pond will be limited to its evaporative loss; thus, the capacity of the brine pond will not decrease over time except by the negligible volume of the dissolved solids left behind.

The initial solid waste disposal area to be used will be parcel SA-8. The initial phase of the project will generate wastewater treatment sludges as the only solid waste requiring on-site disposal. A plan view of this parcel is shown on Figure 3.7.1-1. A corresponding cross-section is shown on Figure 3.7.1-2.

The placement of solid waste in SA-8 is expected to require a coarse geotextile material to reinforce the interface between the clay liner and the solid waste. The geotextile material used will be tensar, or an equivalent. The use of this material will allow the placement of solid waste a few feet thick in the disposal area, and this waste will then be able to support traffic

sufficiently so that trucks and other heavy machinery can be used for final solid waste placement.

Should the PC option of the ultimate site configuration be exercised, the solid waste disposal plan becomes more complex. The P-3 and Phosphoria areas are not necessary for the CGCC option, because gasifier slag is more dense than fly ash generated by PC units. Also, because bottom ash from PC units is more readily handled with a wet sluicing system, SA-10 is the potential bottom ash pond for the PC scenario. SA-10, like SA-8, is a former clay settling area.

P-2 and P-3 are also both former clay settling areas presently well along in the clay consolidation/reclamation process. Placement of solid waste in these areas will be conducted in a manner similar to that described for SA-8.

The Phosphoria area is still an active mining area in which mining is expected to take place prior to commercial operation of the power generating units. Should Phosphoria be required for solid waste disposal, it can be filled with waste clays which will then be consolidated to form an impervious liner. Alternately, it might be filled to above the water table and given a synthetic liner.

SOLID WASTE DISPOSAL CAPACITY

FPC has estimated solid waste generation requirements for the worst case (Case B - 2,000 MW CGCC and 1,200 MW PC) based on the following assumptions:

- Heat rate of 9,500 Btu/kw-hr for CGCC units and 10,000 Btu/kw-hr for PC units
- 85 percent capacity factor
- 13 percent ash content in coal (and 3.5 percent sulfur content)
- Slag at 75 percent bottom and 25 percent fly
- PC ash at 80 percent fly and 20 percent bottom
- Fly ash density at 60 lb/ft^3
- Bottom ash density at 80 lb/ft^3

- Scrubber sludge density at 64 lb/ft^3
- Bottom slag density at 100 lb/ft^3
- Fly slag density at 60 lb/ft^3
- Wastewater treatment sludge density at 65 lb/ft^3
- 40 years of operation
- 0 percent of combustion by-products marketed

Based on these assumptions, the cumulative solid waste quantities generated are estimated to be as shown in Table 3.7.1-3.

At this time, it is proposed that the solid waste areas be utilized in the order shown below. Based on that proposal, the areas would fill on the following estimated schedule:

Area	Year
SA-8	2014
SA-10	2018
P-2	2027
P-3	2036
Phosphoria	2058

With the total capacity of 84,660 acre-feet and the estimated generation quantity of 61,624 acre-feet, there is sufficient capacity on-site for the worst-case solid waste scenario.

WASTE DISPOSAL AREAS - GENERAL DESIGN CONCEPT

The general design concept proposes to utilize the consolidated clay within the settling pond areas to form an impermeable clay soil liner between the deposited wastes and the underlying soils. Development of the clay ponds as waste disposal areas requires that they be reclaimed and initially consolidated by standard reclamation techniques. Reclamation activities will dewater the upper clays and develop a desiccated surface crust capable of supporting very light-weight construction equipment. Waste materials will be spread initially over the disposal areas

in controlled lifts and filling locations. Placement of the solid waste will utilize geotextile or geogrid materials to strengthen the upper clay surface to prevent equipment and solid waste failures into the very soft clays. Solid wastes may be placed within the storage areas to approximately 30 to 40 feet above the pre-mining ground surface which corresponds to a maximum elevation of approximately 200 to 205 ft MSL. Over time, the weight of the solid wastes will cause the lower clays to consolidate, increasing their solids content and causing them to gain strength. During this consolidation the clays will further decrease in permeability, providing an effectively impermeable soil barrier in the bottom of the disposal area. The design concepts to be implemented in the development and use of the pond areas for waste disposal are presented below.

CONSTRUCTION OF CLAY SETTLING AREAS. In assessing the suitability of the pond areas for the disposal of solid wastes it is important to describe the nature of mining activities leading to the present waste clay filled status of areas SA-8, SA-9, SA-10, P-2, and P-3. During mining operations, the non-phosphatic sands, silts and clays overlying the ore matrix are stripped off by large draglines and stockpiled in areas adjacent to the excavation. After removal of the ore matrix, the mined section is partially refilled with overburden stripped from the adjacent mining row. Mining activities proceed within a designated area using this alternating cut and refill sequence until all of the minable phosphatic ore is removed.

After completion of mining operations, the SA-8, SA-9, SA-10, P-2, and P-3 areas were designated for waste phosphatic clay disposal and prepared to receive waste clay slurry effluent from the beneficiation plant operation. Perimeter impoundment dams for SA-8, SA-9, SA-10, P-2, and P-3 were designed as professionally engineered dams for water impoundment purposes (Ardaman, 1978, 1979, and 1981; Armac 1977 and 1979 respectively), and constructed under the guidelines of F.A.C. 17-9 (renumbered to F.A.C. 17-672). The impounding dams were typically constructed 10 to 20± feet above the original ground surface. The dam sections below original grade were typically composed of shaped cast overburden piles or undisturbed ground. Above grade, the embankment sections were constructed with sections of compacted-rolled fill to specified elevations and dimensions. Borrow fill for embankment construction was typically obtained from the upper portions of the interior overburden piles. Additionally, the tops of interior overburden piles were typically knocked down to facilitate clay settling and sheet water flows across the pond. Clay slurries were pumped into the ponds at designated locations and the suspended clays allowed to settle out in the still pond water. The clay slurry entered the ponds at around 3 to 5 percent clay solids content by weight. The clay settled out to between

15 and 20 percent solids content within several months after deposition. The pond areas were filled with clays in this manner until the desired clay elevations were achieved within the pond area. Water from the filling process was removed from the ponds by a series of overflow structures which returned clear water back to the processing plant through a series of surface ditches or piping systems exterior to the pond areas.

INVESTIGATION OF CLAY SETTLING AREAS. The clays within the proposed SA-8, SA-9, SA-10, P-2, and P-3 disposal areas have been investigated by performing subsurface borings. Details of the subsurface investigation program and the results of laboratory testing performed on selected soil samples are provided in Section 2.3.1.2, Detailed Site Lithologic Description. In addition to the subsurface borings, a number of clay depth probing sections were performed. Figures 3.7.1-3 through 3.7.1-6 present the clay pond areas planned for waste disposal and show the approximate location of subsurface borings and clay probing sections performed in each pond. The probings were performed by pushing a one-half inch diameter steel rod into the clays from the surface. The steel rod penetrated the clays and was pushed to the bottom of the clay deposit and the depth of penetration was recorded. Probings of clay depth were typically performed on 50-foot spacings. The results of the clay probing sections are shown on Figures 3.7.1-7 through 3.7.1-20. January 1992 clay thicknesses in these ponds ranged typically from 20 feet to more than 40 feet with an average thickness of 30 to 35 feet.

RECLAMATION CONSOLIDATION OF WASTE POND AREAS. Initial preparation of the proposed waste disposal areas, SA-8, SA-9, SA-10, P-2, and P-3, will require reclamation consolidation of the phosphatic waste clays contained in these areas.

Analysis of the amount and rate of clay consolidation due to self-weight consolidation has been predicted using the computer model SLURRY (Ardaman, 1989) in combination with hand calculations utilizing standard Terzaghi one-dimensional infinitesimal-strain theory of consolidation (Terzaghi, 1943). Program SLURRY is a finite difference computer program developed for the mining industry to predict self-weight consolidation of clays during deposition in settling areas at arbitrary rates and subsequent consolidation. The program uses a Crank-Nicholson finite difference scheme to obtain a solution to Terzaghi's differential equation of consolidation. The program implicitly accounts for the effects of non-uniform large strain by using an incremental approach combining infinitesimal strain theory and numerical simulation of large strains. Consolidation in the model is assumed to occur in the vertical direction, (i.e., the program models one-dimensional conditions). Predictions of the program have been

compared with other large strain consolidation programs (Ardaman, 1989) and the results found comparable. A limitation of the model is that it was not developed to specifically handle a variable initial clay solids content distribution with typically high values. Because of this limitation, the model was used with discretion and verified, where necessary, by hand calculations using traditional Terzaghi consolidation theory. In the P-2 area, the clays have been sufficiently reclaimed and consolidated that settlement projections were made by traditional consolidation theory calculations.

Program SLURRY modeling of clay consolidation in the waste disposal areas was performed assuming an initial uniform solids content profile (January 1992) equal to the average clay solids content measured during the investigation at a given boring location. For all areas, some level of dewatering and/or reclamation consolidation has occurred. It was assumed that dewatering will be intensified in the near future to achieve a 5-foot water table drop in the ponds early in 1994, as part of on-going reclamation efforts. The dewatering effort will be coordinated with water cropping and maintenance in the pond through the beginning of waste placement. Single layer drainage conditions are assumed in all the initial consolidation analyses.

The predicted SA-8 clay elevation at four boring locations, is plotted over time on Figure 3.7.1-21. Predictions are provided to the year 1998 when the pond is anticipated to start receiving wastes. Two prediction curves are shown for C-22 which compare predictions using the modeling parameters reported herein, and those found in other published literature (FDNR, 1985). The results of the comparison show that the settlement modeling predictions are similar, with the prediction based on FDNR data being slightly less. Figure 3.7.1-21 shows a large difference in present clay elevation between boring C-20 to the south end of SA-8 and the remaining borings. This difference is attributed to boring C-20 being at the low end of clay disposal operation near the overflow structures. Partial reclamation dewatering is occurring in this area. As shown on Figure 3.7.1-21, the compression expected to take place by the year 1998, at the anticipated date of service, is on the order of 1 to 2 feet. The corresponding clay elevation in the SA-8 pond is expected to vary between 155 ft MSL to the south and 176 ft MSL toward the north end of the pond at the time the pond will start to receive solid wastes.

Results of the consolidation modeling for the proposed brine pond, SA-9, are summarized on Figure 3.7.1-22. The amount of consolidation anticipated to have taken place by the year 1998, when the pond will start receiving brine water, is on the order of 1 to 2 feet. Clay elevations

at the date of service are estimated to vary from between 167 ft MSL to the south to about 174 ft MSL at the north end of the pond.

The results of the consolidation modeling for pond SA-10 are presented on Figure 3.7.1-23. The modeling is based on an estimated initial clay solids content of 25 percent which is less than the profiles obtained during the field investigation. Considering the age of the pond area and pond access difficulties, the solids content measured in the three pond borings was higher than expected. At the time of the field investigation program, the pond was mostly flooded and generally not accessible to field drilling equipment, except at a few locations along slightly elevated ground areas, or closer to the embankment. These areas typically have higher solids contents which may not be representative of the overall pond area. Based on an assumed and reduced 25 percent average solid content, about 11 feet of settlement is predicted to take place by the year 2014 when the pond is planned to be needed for solid waste disposal. Clay elevations at that date of service are predicted to be about 161 ft MSL.

SLURRY modeling of the P-2 area was not attempted due to the high average solids-content values (as high as 47 percent measured in the pond). The P-2 pond area has been under reclamation consolidation for several years. Alternatively, hand calculations were performed using standard one-dimensional consolidation theory (Terzaghi, 1943) based on laboratory consolidation tests. Consolidation levels at the scheduled date of service in the year 2018 are estimated to be on the order of 1 to 2 feet, with corresponding average clay surface elevations around 155 ft MSL.

Results of the consolidation modeling for pond P-3 are summarized on Figure 3.7.1-24. The anticipated settlement at the scheduled date of service in the year 2027 ranges between 5 and 9 feet, depending on clay thickness and solids content profile. The corresponding anticipated clay elevation in the pond ranges between 157 and 162 ft MSL. Table 3.7.1-4 summarizes the results of the consolidation analyses at all boring locations, including the projected average solids content at the time the pond is planned to enter into service (i.e. 1998 for SA-8 and SA-9, 2014 for SA-10, 2018 for P-2, and 2027 for P-3). The average solids content predicted with the SLURRY model does not include the desiccated crust, the solids content of which is estimated to be about 50 to 60 percent. The desiccated crust is anticipated to form to a depth of 4 to 5 feet during the reclamation dewatering process. No consolidation predictions were attempted for Phosphoria, as this area has not received waste clays. The Phosphoria area is presently in active mining operation scheduled to be complete around the year 1998. It is proposed that the

Phosphoria and P-3 settling pond areas would not be used for solid waste storage, unless the generating facility exercises an option to utilize PC, starting sometime after the year 2008.

Table 3.7.1-5 summarizes the volume availability in the respective storage areas. Based on a computed total volume storage of 141.7 mcy and a maximum waste generation rate of 1,700 ac-ft/yr, the proposed SA-8, SA-10, P-2, P-3, and Phosphoria solid waste disposal areas will have an anticipated life in excess of 50 years. These estimates are considered conservative, as they ignore the added volume due to settlement of the clays in the pond areas under the weight of the solid wastes. The added volume is difficult to estimate accurately, as the clay consolidation is a time-related function dependent upon the actual rate of filling.

CLAY LINER SUITABILITY

The impermeability, thickness, and drainage/consolidation characteristics of the waste phosphatic clays deposited in the ponds are important considerations in their suitability to function as an impermeable soil liner. Figure 3.7.1-25 presents a plot of clay permeability versus soil void ratio/solids content for permeabilities determined from laboratory consolidation and triaxial permeability tests on clay samples from the waste disposal and cooling pond areas. The results of the permeability testing show that the clays typically exhibited permeabilities less than 2.0×10^{-7} cm/sec for solids contents as low as approximately 35 percent. Typical profiles of clay solids content with depth at clay pond boring locations in ponds SA-8, SA-9, SA-10, and P-3, are presented on Figures 10.5.3-222 through 10.5.3-267 in Appendix 10.5.3.

Clay permeability for the proposed waste disposal areas SA-8, SA-9, SA-10, and P-3 can also be estimated based on empirical correlations with plasticity indices which were derived for the large strain consolidation modeling of clay settling areas (Ardaman, 1989). The plasticity index is a measure of the range of moisture content over which the clays behave in a plastic or pliable manner. Typically, the higher the plasticity index of a clay, the less permeable the clay. The plasticity index is computed by calculating a set of soil properties known as the liquid and plastic limits, which are determined in accordance with a standardized testing procedure (ASTM, 1992). The plasticity index is the difference of the two limit determinations. The results of plasticity tests on samples from the SA-8, SA-9, and SA-10 ponds and P-2 and P-3 (Phosphoria) areas are presented on Figure 3.7.1-26. The plasticity testings indicate that higher plasticity clays are found in the P-2, P-3 areas. Based on average plasticity index values of 134 percent for the

clays for the SA-8, SA-9, and SA-10 pond clays and 164 percent for the P-2 and P-3 pond clays, the following permeability-void ratio relationships were obtained:

SA-8, SA-9, SA-10 areas: $e = 21.0\ (\sigma)^{-0.263}$

$k = 5.68 \times 10^{-10}\ (e)^{4.0}$ (cm/sec)

P-2, P-3 areas: $e = 25.7\ (\sigma)^{-0.268}$

$k = 3.11 \times 10^{-10}\ (e)^{4.0}$ (cm/sec)

where: e - Soil Void Ratio

σ - Effective stress in pounds per square foot (psf)

k - Coefficient of permeability (feet per day)

These relationships are also plotted with the permeability test data shown on Figure 3.7.1-25. As can be seen by the presented data, the permeability of the waste phosphatic clays decreases with increased solids contents in the clays and increased plasticity of the clays. After reclamation, the SA-8 and SA-10 areas are expected to begin to function as solid waste disposal areas at initial average solids content of 36 percent or higher. This average solids content corresponds to an initial average clay permeability on the order of 3.0×10^{-7} cm/sec or less for these settling areas. Areas P-2 and P-3 are expected to function initially as disposal areas at average solids content of 38 percent or greater in the P-2 settling areas and approximately 33 percent or greater in the P-3 settling area. Initial average clay permeabilities at the time the ponds are utilized for solid waste disposal should be about or less than 1.5×10^{-7} cm/sec in the P-2 settling area and 3×10^{-7} cm/sec in the P-3 settling area.

Another important consideration in evaluating the suitability of the phosphatic clays to function as liner material is their thickness. The clay thickness in the proposed solid waste disposal areas is much greater than in typical compacted clay liners. This will result in a significant hydraulic gradient reduction across the clay layer and thus reduced seepage. Table 3.7.1-6 presents the range of clay thickness encountered in the proposed solid waste disposal areas during the field investigation. Variations in clay thickness within a given area are the result of the irregular profile of the overburden material underlying the clay and variations in clay surface elevation resulting from the slurry depositional mechanism. The table includes the projected range in clay thickness resulting from the reclamation activities at the corresponding time of service.

Under the weight of the deposited solid wastes, the clays will further consolidate and increase in solids content. Values obtained from laboratory consolidation tests reported in Section 2.3.1.2 indicate the Compressibility Index (C_c) of the waste clay ranges from 1.7 to 2.2, with a representative average value on the order of 2.0. Utilizing an average unit weight for the solid waste of 90 lbs/ft^3 and assuming an average initial clay thickness of 30 feet after reclamation consolidation, placement of 40 feet of solid waste material over the clays will result in approximately 9 to 11 feet of ultimate settlement. The settlement of 9 to 11 feet of the clay surface is due to the compression of the clay layer. This magnitude-of-settlement will result in an eventual compressed average clay layer thickness about 60 to 70 percent of its initial thickness at the time of the start of solid waste placement. Table 3.7.1-6 also presents the estimated clay thickness range at the end of solid waste placement operations in 2058.

The consolidation of the clays under the weight of the solid wastes will result in an increase in the clay solids content to values in the range of 55 to 62 percent. As shown on Figure 3.7.1-25, this range of solids content corresponds to soil permeabilities on the order of or less than 1.0×10^{-8} cm/sec. Correspondingly with time, the clays under the weight of the deposited wastes will decrease in permeability by as much as an order of magnitude or more, resulting in a very impervious clay soil liner in the disposal area. Final clay liner thicknesses in central pond areas should typically range from 9 to 30 feet in thickness and exhibit permeabilities less than 1×10^{-8} cm/sec under final consolidated conditions.

A secondary significant benefit of the consolidation of the clays under the applied loads of the deposited wastes is the flow of water from the clays due to consolidation which will be mostly vertically upward from the clay layer during the consolidation process. The upward flow of water from the clays is the result of the dissipation of the excess pore-water pressure buildup in the clays resulting from the weight of the underlying waste. Consolidation-related drainage of the clays vertically upward will continue, so long as excess pore-water pressure in the clays exceeds hydrostatic water pressure due to saturation of the solid wastes. This condition means that for many years the flow of water will be upward and out of the consolidating clays and into the waste material. This upward flow of water will prevent the migration of any leachate down through the consolidating clay liner. Under the applied loads of the deposited waste, consolidation of the clays will continue for several decades. Based on an average coefficient of consolidation equal to 0.00124 inches squared per minute, an initial average 30-foot-thick clay layer will not reach 90 percent average primary consolidation for a period approaching 100

years. Hydrostatic water pressure in the solid wastes is not anticipated to exceed excess pore water pressures in the clays for a period in excess of 50 years.

Present DER guidelines (Rule 17-701, F.A.C.) for the management of solid waste disposal areas allows for minimum composite liner systems with 60 mil (1.52 mm) synthetic liners of $1x10^{-11}$ cm/sec or less permeability combined with at least three feet of impermeable clay at $1x10^{-7}$ cm/sec or less permeability. Converted to an equivalent single-clay liner system, the composite liner system described above is equivalent to approximately 5.3 feet of consolidated clay at $1x10^{-8}$ cm/sec permeability. Based on the clay probing data, subsurface borings data, and the results of consolidation testing and analysis, clay liner thickness in solid waste disposal areas under final consolidated conditions should typically exceed the minimum equivalent clay thickness of the composite system by a factor of two or more at the locations where the clay is at its thinnest.

A leachate collection system will be installed along the perimeter edge of the waste clays at the interface with the dam slope. The system of toe ditch, pumps and transfer piping will collect leachate at that location and will minimize leachate movement laterally from the solid waste disposal area. Leachate collected by the piping system will be treated prior to recycling to the cooling pond if the leachate water quality proves to be unacceptable. Figure 3.7.1-27 presents the typical detail of the proposed perimeter leachate collection system piping. Figures 3.7.1-28 through 3.7.1-41 present conceptual cross-sections through the various impoundment embankments proposed for the SA-8, SA-9, SA-10, P-2, and P-3 waste storage areas. The locations of the cross-section are shown on Figures 3.7.1-3 through 3.7.1-6.

The concentrated brine in the brine pond will not comply with water quality standards and a synthetic liner along the impoundment dam slopes will be installed to prevent lateral seepage from the pond. Figure 3.7.1-42 presents the conceptual design of the perimeter synthetic liner proposed for the brine pond. The 60 mil HDPE liner will be placed out on the clay surface a distance necessary to achieve a minimum 10-foot vertical clay depth and for a minimum distance of 25 feet from the edge of the clay. The clay depth will be determined at the time of liner installation by probing of the clays with a 1/2-inch diameter steel rod probe. Probe sections will be performed at 100-foot spacings around the perimeter. Documentation of probe depths and locations will be provided as part of quality assurance documentation for the liner installation.

In conclusion, the clays that line the bottom of the waste disposal pond areas will provide a thick, highly impermeable, continuous soil barrier to the movement of leachate. The clays will continue to consolidate for many years under the load of the solid waste and will gradually decrease in permeability. Prior to waste deposition in the areas, the surface of the clays will be prepared by discing/grading to close any surface cracks. Once covered with solid waste, the clays will no longer be subject to surface drying. Further cracking of the clay surface will not occur and the clays will deform as needed to accommodate their consolidation under the solid waste. Due to their cohesive and plastic or deformable nature, the clays will not be subject to cracking or tearing and by their use as a very thick liner, the integrity of the clay and its continued impermeability for an indefinite time period can be assured. The inherently impermeable characteristic of thick clay deposits is a well known and documented geological fact worldwide, and their presence in the large impoundments at this site is a prime reason for its suitability as a power plant site.

CLAY LINER - BRINE INTERACTION

Storage and evaporation of the brine stream from the cooling water treatment facility is proposed for the SA-9 area. Deposition of the brine in the clay settling area will subject the clay liner to high concentrations of ionized particulates which will crystallize and precipitate during the evaporation process.

To evaluate the potential impacts of the brine on the clay liner, several samples from clay pond borings were provided to FIPR for testing. Samples were subject to a series of tests including; particle-size distribution, percent solids determination; basic chemistry including pH, cation exchange capacity and acid insolubility; and mineralogy. Table 3.7.1-7 presents the results of the particle-size distribution and percent solids content testing. Table 3.7.1-8 presents the results of the basic chemistry tests. Table 3.7.1-9 presents the results of the soil mineralogy.

The test results indicate that over 85 percent of the solids in the tested samples are finer than the No. 325 U.S. Standard sieve size. Clay content in the solid constituent varied from 18 to 34 percent with an average of approximately 25 percent. Of the 25 percent clay fraction, approximately 60 percent of the clay is montmorillonite with illite and kaolinite comprising equal portions of approximately 20 percent each. The non-clay minerals comprise approximately 75 percent of the solid content with quartz and apatite being the dominant minerals. The soil chemistry tests indicate the clay soils are neutral to slightly alkaline. Cation exchange capacities

(CEC) for the clays ranged from 28 to 83 milliequivalents (meq) per 100 grams with an average of approximately 69 meg.

The mineralogical data reported show that the phosphatic clays are a mix of clay and non-clay minerals in relative proportions which vary throughout the area. The amount of active clay minerals, such as montmorillonite and illite, is large enough to make the material behave as a clay.

An important parameter in the evaluation of the potential clay-brine interaction is the CEC, which is a measure of the clay particle electrical imbalance and the potential for substitution or exchange of cations within the clay structure when the clay particle is put in a different environment. The CEC varies from 70 to 100 meq for montmorillonite, from 10 to 40 meq for illite, and from 3 to 15 meq for kaolinite (Peck et al., 1974). Correspondingly, the test results indicate the clays on the average are slightly less active than montmorillonite, but more active than kaolinite or illite. Plasticity characteristics of the phosphatic clays encountered at the site are clearly the result of the complex interaction of the various minerals present in the soil.

The increased use in the last decade of clay liners for containment of chemically-active waste products has resulted in a number of studies to evaluate the effects of chemicals on the properties of the liner (e.g. Brandl, 1992; Mitchell and Madsen, 1987; Ho and Pufahl, 1987; Ridley et al., 1984; Ridley and Bewtra, 1983; Folkes, 1982). Several of these studies dealt with brine-soil interaction, primarily with sodium (Na) dominated brine. Based on water quality data from pump tests performed at the Estech Plant site, the concentrated brine deposited in SA-9 pond will be highly dominated by calcium (Ca) and to a much lesser degree by Na. Although the conditions of the soils and brines evaluated in these studies are not representative of the phosphatic clays at the site (i.e., most studies dealt with compacted clays), the concepts discussed and general conclusions will help understand the potential effects of brine water on the phosphatic clays.

The engineering behavior of clay soils is the result of the electro-chemical interaction of the soil particle and the fluid surrounding it. True clay soils have a very flat microscopic particle shape which, because of its molecular structure, has a negative charge balance on the flat particle surface. This negatively charged surface has an affinity for positively charged particles such as Ca++ and Na+, and other cations. The CEC is thus a measure of the clay's particle shape, surface area and chemical composition, and thus its ability to absorb and exchange the positively

charged particles within the clay structure. Flat clay particles with relatively large specific surface areas (such as montmorillonite) have a greater CEC and thus affinity for exchanging and absorbing cations than do smaller particles, such as kaolinite and illite. Altering or exposing the clays to fluids with differing fluid chemistry, such as variations in electrolyte concentration, ion valence, temperature, dielectric constant, size of hydrated ion, pH, and anion absorption can cause an alteration in the soil structure (Lambe and Whitman, 1969).

Several studies have concluded that, in general, increasing the cation concentration of the pore water in fine-grained soils causes an increase in hydraulic conductivity (Ridley et al., 1984; Mitchell and Madsen, 1987; Brandl, 1992, and Folkes, 1992). This is attributed to consolidation of the clay structure and an increase in the free pore-water volume (effective porosity). These studies also show that changes in the soil structure are reflected by changes in the Atterberg limits. While the plastic limit appears to be unaffected by an increase in electrolyte concentration, the liquid limit generally decreases, thus resulting in a reduced plasticity index. The magnitude of these changes has been found to vary depending on the amount and type of clay mineral present in the soil. The alteration of soil structure and properties commonly occurs in the following order of intensity: sodium-montmorillonite > calcium-montmorillonite > illite > kaolinite (Brandl, 1992). Non-clay minerals are relatively unaffected by increases in the cation concentration of the pore fluid.

Ho and Pufahl (1987), in their study of brine contamination of fine-grained soils, demonstrated that consolidation takes place in some soils upon brine contamination. The consolidation under constant pressure is caused by the inward diffusion of ions and the simultaneous outward diffusion of water molecules within the clay structure. This phenomenon is significant in that the reduction in soil void ratio due to consolidation which leads to a reduction in permeability may counterbalance the increase in free water volume due to particle shrinkage which leads to an increase in permeability. Their tests found that, except for a high plasticity clay at a low initial void ratio, the net effect of increasing the ion concentration was a reduction in hydraulic conductivity or permeability.

Other investigators (Ridley and Bewtra 1983, 1984) have studied the impacts of subjecting a compacted clay liner to long-term brine concentrate under hydrostatic head. Their study measured the rate of brine concentration movement through several different soil types. The results of their study concluded that only soils containing significantly high percentages of montmorillonitic clays (in excess of 90 percent) exhibited accelerated rates of brine movement

through the sample well in excess of that anticipated under the hydraulic gradients to which the samples were subject. Soils containing high percentages of non-clay minerals and low percentages of montmorillonitic clays were unaffected by the brine concentrate and exhibited rates of movement (permeability) anticipated for the applied hydraulic gradients.

The results of the testing of clay samples from the brine storage pond and the literature research lead to the following conclusions:

- Due to the high percentage of non-clay particulate matter plus low activity kaolinite and illite clays, the permeability of the waste clays are not anticipated to be adversely affected by the brine concentrate.

- Limited exchange of cations in the clays is expected to take place, only if cation concentration ratios in the brine are significantly different than that of the deposited clays. The clays deposited in the brine storage area have been processed and transported to their present location with processing water extracted from the Upper Floridan Aquifer. Correspondingly, the clays have been subjected to relative ratios of ion distribution anticipated for the brine concentrate. The clays while having been deposited (before mining) in a Na dominated marine environment have been subject to a Ca dominated post-mining environment. Exchange of Ca for Na cation in the clay structure occurred prior to deposition in the settling area.

- The presence of more than 80 percent of the solids as fines and clay-size fraction confirms that these deposits would be of low permeability.

- Neutral or alkaline solutions may not change the mineralogy. Only acidic solutions may lead to dissolution of phosphate and/or dolomite constituents. Thus, it is not expected that the neutral brine will cause any change in the mineralogy and/or permeability of these deposits.

SOLID WASTE DISPOSAL AREA CONSTRUCTION

During maximum operating capacity of the generating facility using PC, solid wastes are anticipated to be produced at a maximum rate on the order of 1,700 ac-ft/yr. For a 6-foot total fill placement thickness per year, approximately 300 acres of depositional area are required yearly. In the early periods of the project, the acreage requirements will be less. Based on the stated solid waste generation rates and available acreage in the pond areas (Table 3.7.1-3), more

than adequate disposal area is available to accommodate the initial placement of solid wastes over the clays in a slow controlled sequence.

Prior to the placement of solid waste material, it will be necessary to reclaim the clay pond areas by dewatering near surface clays and developing a desiccated crust in the upper 4 to 5 feet. The desiccated surface layer are expected to have solids contents on the order of 50 percent or higher, with underlying clays exhibiting average solids contents on the order of 35 percent or higher. Based on the results of the SLURRY modeling studies as well as the measurement of solids content profiles in various site pond areas, the desired solids content are achievable by normal reclamation techniques previously discussed. Formation of the desiccated crust is important as it will provide a working surface for light ground pressure equipment to be used to spread the initial solid waste fill lifts.

To place solid wastes upon the clay surface, it will be necessary that a high-strength woven geofabric or geogrid be placed over a prepared clay surface. A prepared surface consists of one which has been leveled and graded/disced such that any open surface desiccation cracks more than 1 foot in depth are filled and closed just prior to solid waste placement. Surface vegetation will be flattened prior to placement of reinforcing material. The high-strength geotextile material will add reinforcement and tensile capacity to the upper clay layer to prevent failure of the placement equipment and solid wastes into the clays. This method of subgrade stabilization has become common practice in construction of fills over very soft subgrade deposits. Because of its light weight, ease of handling and high strength, a reinforcing product such as Tensar geogrid or equivalent is proposed for use.

To prevent excessive mudwaving movement of the underlying clays in advance of the fill placement, the waste placement operations will be controlled and limited to placement areas constructed in a waffle-type pattern. Figure 3.7.1-43 provides a schematic of a controlled placement sequence. The fill material will be initially advanced in a 2- to 3-foot lift over geofabric/geogrid material placed on the clay surface in a series of access roadway fill placements. Roadways are anticipated to be about 30 feet wide, thus forming a grid-type pattern on a 150-foot grid spacing. The weight of the access roadway fill will result in some limited heaving of the interior portions of the open-grid area. Each open-grid area will be subsequently covered with the high-strength geogrid with seamed overlaps, and then filled in a checkerboard pattern. The open-grid pattern is proposed to be advanced, not less than one-grid spacing in front of the advancing filled areas in any direction. Filled areas will be constructed in an

alternating checkerboard pattern. The advancing roadway fills will have the effect of applying a partial surcharge in the area in advance of the primary filling sections.

FILL PLACEMENT STABILITY. An evaluation of the stability of the initial fill lifts has been performed. During the subsurface investigation for the waste storage ponds, in-situ shear strength measurements of the waste clays were performed by vane shear tests. In addition, triaxial, unconsolidated undrained tests were performed on undisturbed samples. Details of the testing program are provided in Section 2.3.1.2. The shear strength test results were correlated with clay solid content determinations at the respective test location. The correlations are plotted on Figure 3.7.1-44, along with the results of other published clay shear strength data (Bromwell, 1982). The data demonstrate that as the clays consolidate and increase in solids content, they gain shear strength. For initial stability evaluation purposes, a lower bound of the plotted shear strength data was established. These lower bound values were used to determine shear strengths to be applied to a corresponding solids content for stability evaluation purposes.

Slope stability assessments were made using computer program PCSTABL5M (Achilleos, 1988). The program was developed in 1987 at Purdue University and is one of several microcomputer versions of the mainframe slope stability program STABL. The program has been adopted by various agencies, including the Federal Highway Administration (FHWA). PCSTABL5M is written in FORTRAN and calculates the factor-of-safety against slope failure using a two-dimensional, limiting equilibrium method. The program is capable of handling heterogeneous soil profiles, anisotropic soil strength parameters, excess pore-water pressure due to shear, and static groundwater and surface water. The analytical methods available for use in the program include the simplified Bishop method (Bishop, 1955) applicable for circular-shaped failure surfaces; the simplified Janbu method (Janbu, 1954) applicable for failure surfaces of a general shape; and the Spencer method (Spencer, 1967) which is applicable for any surface.

Figure 3.7.1-45 presents the results of stability analyses performed at the leading fill face using three feet of fill placement and circular-slip circle analysis. The analysis assumes an average 30-foot thick clay layer at the time of initial fill placement. The upper five 5 of clay profile is comprised of a desiccated clay crust at a solids content of 50 percent. The underlying 25 feet of clay is subdivided into five, 5-foot layers with initial solids contents increasing linearly with depth from 35 to 45 percent. The results of the stability analysis indicate that if the integrity of the surface clay crust is maintained (Case I), the advancing fill face will have a factor-of-safety of 1.90 against failure into the underlying clays. If the shear strength of the clay crust

in advance of the fill is lost, due to cracking or heaving (Case II), the factor-of-safety is reduced to 1.43. If the integrity of the clay crust, both beneath and in advance of the fill is lost due to cracking (Case III), the section is unstable. The results of these analyses are considered conservative, as they utilize the low bound of the clay shear strength data. Nevertheless, the results of the latter analyses demonstrate the need to reinforce the clay surface with high-strength geogrid. The geogrid reinforcement will also be required to help distribute the loads of construction equipment used to place and spread the solid wastes. The geogrid will also prevent punching failure of the equipment through the initial solid waste lift into the underlying clays. Loads due to construction equipment were not included in the presented analysis, because at any stage of filling, the stresses induced by the equipment will be small compared to those imposed by the solid waste.

Figure 3.7.1-46, presents the results of the stability analysis for placement of the second lift. For the placement of the second lift, the unreinforced section factor-of-safety increased to 2.13 assuming the integrity of the clay crust and fill in advance of the fill face is maintained. For a cracked clay crust in front of the advancing fill face without reinforcement, the factor-of-safety decreases to 1.58. For a totally cracked section, the section approaches instability. The analysis also indicates that as the fill thickness increases in height, the factor-of-safety against failure increases because the contribution of shear strength in the granular solid waste material improves the global stability of the placed section.

During the initial fill placement, the average slope of the advancing lifts should not exceed 4 to 5 percent, as the fill progresses across the area of the ponds. This will necessitate that the second 3-foot lift of fill should not be advanced to within 75 to 100 feet of the leading face of the first lift. Considering the potential for variability in the depth of the underlying clay, the leading face of the second lift fill will not be allowed to advance to within one cells distance (150 feet) from the underlying fill edge. Once the fill has been placed in excess of two lifts, heavy equipment such as light bulldozers and dump trucks, will be capable of operating on the fill surface without difficulty. Placement of solid waste fill in the predescribed sequence will no longer be required; however, lift thicknesses would be limited to 3 feet in height.

Two stability analyses were also performed to evaluate the perimeter stability of placing the solid waste in the area of the impoundment dams. In the SA-8 area, the solid wastes will be placed against the east and north dams of SA-9 and the east and south dams of SA-8. These dam sections are to be left at their present elevation of 185 ft MSL. Stability analyses were

performed for waste fill placed against a 2.5H:1V dam slope, assuming the fill reached a maximum height of an elevation of 205 ft MSL. An initial clay elevation of 175 ft MSL consolidated to elevation 173 ft MSL during reclamation was analyzed for stability purposes. To provide adequate stability at the sides of the solid waste disposal areas, it is necessary that side slopes of 4H:1V be provided and a 150-foot wide bench be constructed at elevation 190 ft MSL. Figure 3.7.1-47 presents the results of a circular slope stability (Bishop, 1955) analysis of the section assuming fill is placed on the slopes to an elevation of 180 ft MSL. Using 5-year average clay cohesive strengths, the proposed 4H:1V slopes have factor-of-safety in excess of 1.45 for the circular failure surfaces. This analysis used the low bound shear strength as shown on Figure 3.7.1-44 and is considered conservative. Under long-term consolidation, the clays will continue to gain strength and the factor-of-safety will increase until the clays approach effective stress conditions. Effective stress conditions exist when the excess pore water pressures in the clays are dissipated and the clays behave as a non-cohesive soil with internal friction and zero cohesion. Assuming a soil friction angle (ø) for the consolidated clays of 25° (Ardaman, 1983), the computed factor-of-safety for the clays increases to in excess of 2.0 for the circular failure surfaces.

The second condition evaluated considered the edge effects of placing the fill against a bulldozed section on the interior dam slopes. During reclamation, the existing dam for the SA-10, P-2, P-3, and the north and northwest SA-8 dams will be partially leveled. Dam fill above a specified elevation is proposed to be pushed down into the clay pond areas resulting in a section of bulldozed fill being placed on top of the original embankment on interior areas of the dam. Figure 3.7.1-48 presents the results of a stability analysis performed on a conceptual section of a reclaimed dam area. Five-year cohesion clay strengths were similarly assumed using low-bound strength data from Figure 3.7.1-44. Slope stability factor-of-safety are computed at 1.20 for the section using the circular method. Under long-term effective stress conditions, the factor-of-safety increases to slightly in excess of 2.5. As demonstrated by the stability analyses, the failure of the slopes is highly controlled by the underlying soft clay. Global slope stability failures of the fill into the existing impoundment embankments will not occur, and the integrity of the existing perimeter dam is not a significant concern.

All perimeter dams of the proposed solid waste storage areas were originally designed as professionally engineered dams for water impoundment purposes. The perimeter dams under the proposed solid waste disposal use will be subject to lower interior water levels and reduced seepage forces than the original designs. Some temporary but lower water-level heads may

develop behind the dams due to temporary storage of water cropping runoff. The levels would be lower than water levels anticipated by the original design. In any case, the stability and integrity of the impoundment dams will be improved as compared to original design functions as the result of lower water levels and reduced seepage forces. Placement of the solid waste fill will subject the dams to some increased lateral forces acting to push the dams horizontally along the base of the embankment, or at elevations of the exterior ground surface. Horizontal base shear factors-of-safety will be in excess of 2.0 for all dam sections.

Clay stability considerations in the brine waste disposal area are not considered a concern. The method of disposal of the brine provides for the slurrying of the brine concentrate to the disposal area. As the result of evaporation, the mineral components of the brine will precipitate out or crystallize on the bottom, resulting in a very slow uniform buildup of waste in the SA-9 disposal area. Equipment is not proposed to operate in the disposal area, except to prepare initially the pond area and construct the edge liner prior to receiving the concentrated brine slurry. Stability of the clays is not a concern except for initial construction activities which will be accomplished with very light ground-pressure equipment, such as Gemcos. Preparation of the disposal area surface will consist of the leveling of vegetation and the construction of perimeter lining system around the interior embankment slope area. The bottom of the brine pond will be scarified or disced just prior to its use, if necessary, to fill in any desiccation-type surface cracks in the clay surface and to level surface vegetation.

The SA-9 brine storage areas perimeter embankments were originally designed, permitted and constructed in accordance with F.A.C. 17-672 (Ardaman, 1978 and 1979). The embankments were designed to resist seepage forces from a full hydrostatic head of water in the pond area to an elevation of 180 ft MSL. The slope stability of the perimeter embankment section will be higher than initial designs (minimum 1.5). The increased stability is the result of the waste clay disposal in the pond and the construction of the perimeter liner system. These materials will eliminate seepage forces from the embankment section thereby improving the internal embankment stability.

CONSTRUCTION INSPECTION, TESTING AND MONITORING

During construction of the brine pond perimeter liner system, inspection and testing by qualified personnel will be provided to assure that the liner is installed in accordance with project plans and specifications and in accordance with manufacturer's recommendations. All seam welds for

liner construction will be vacuum or pressure tested to assure the integrity of the liner system is not compromised due to faulty-seam welding.

During construction of the solid waste disposal areas in SA-8, SA-10, P-2, and P-3, each area will be monitored at several locations with vertical slope indicators. Slope indicators consist of an interior grooved PVC tubing inserted vertically into the clays. The vertical alignment of the groves is initially measured with a tiltmeter to calibrate the installation. Subsequent measurements of the vertical alignment of the pipes are made and compared to the initial calibration. Changes in the vertical alignment of the inclinometer pipe are used to identify the magnitude of any lateral movement of the underlying clays. Such movements, if they occur, may be an indicator of a developing failure condition. It is likely that the inclinometer casings be installed in the bench section near the toe of the upper 4H:1V slope section and that at least four casings will be installed in each clay pond area. The actual number of inclinometer installations will reflect the field conditions and the observed need for monitoring stations to detect and prevent slope movements. Installation details and monitoring frequency will be defined in a detailed specification and operations/maintenance manual to be developed for the project.

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3.7.2 Hazardous Wastes

Hazardous wastes are characterized in 40 CFR 261, Subpart C, and a list of hazardous wastes is given in Subpart D. There are five categories of hazardous wastes listed. They are non-specific sources, specific sources and discarded commercial products, off-specification species, container residues, and spill residues. Every hazardous waste listed has an identification number. Following is a discussion of the types of potentially hazardous wastes expected to be generated at the Polk County Site.

3.7.2.1 Coal Gasification Units

The operation of the CG units will produce some potentially hazardous waste streams. These streams include wastewater treatment wastes, acid gas removal wastes (filter cake), sulfur recovery wastes (spent refractory), and tail gas treatment wastes (filter cake, spent catalyst). These wastes may or may not qualify as hazardous. The materials will be tested before disposal to determine if they represent listed or characteristic hazardous wastes. The materials will be handled and stored as hazardous wastes until test results are known. If they are determined to be hazardous, disposal will be accomplished off-site by a licensed contractor.

In addition to these waste streams, the CGCC units may generate non-thermal wastes, chemical product storage and transfer wastes, or miscellaneous wastes that meet the criteria to be designated as hazardous. These wastes are discussed in Section 3.7.2.3.

3.7.2.2 Pulverized Coal Units

The PC units may generate non-thermal wastes, chemical product storage and transfer wastes, or miscellaneous wastes that meet the criteria to be designated as hazardous. These wastes are discussed in the following section.

3.7.2.3 Other Hazardous Wastes

NON-THERMAL WASTES

Non-thermal wastes include wastewater treatment system generated filter cake, spent demineralizer regeneration solutions, boiler (HRSG) blowdown, demineralized resin beds, and

metal cleaning wastes. Because there are no hazardous substances in the raw process water, the filter cake from the CC units is not expected to be hazardous. Spent acidic and basic solutions used to treat the demineralized resin bed ion exchangers will be treated to eliminate corrosivity. Since these solutions will be treated in "an enclosed neutralization unit" or "elementary neutralization unit," they will not be classified as hazardous wastes according to Florida Hazardous Waste Rules (F.A.C. 17-730). Boiler (HRSG) blowdown may contain trace quantities of hydrazine, but the high quality water can be discharged to the cooling pond without any additional treatment. Metal cleaning wastes will be disposed of off-site by a metal cleaning contractor, if such wastes are determined to be hazardous wastes.

CHEMICAL SPILLS

The storage and transfer of chemical products could result in an accidental spill. Such spills will be confined by berms, and contaminated areas will be thoroughly washed and rinsed. The primary materials involved would be dissolved and suspended solids, acids, alkalies, and oil. Except for oily wastes, these wastes will be treated at the wastewater treatment facility as described in Section 3.6. The oily wastes will be collected and recycled or disposed of by an approved contractor.

MISCELLANEOUS WASTES

If potentially hazardous materials such as paint, thinners, solvents, laboratory reagents that might be hazardous, and similar products are used, the spent substances will be stored in appropriate containers and stored in segregated storage areas for less than 90 days. These wastes will be disposed of off-site by a licensed hazardous waste contractor.

3.7.2.4 On-site Disposal and Storage

Hazardous wastes will not be treated or disposed of on-site. Such wastes will not be stored on-site for over 90 days.

TABLE 3.7.1-1
SOLID WASTES AND BY-PRODUCTS FROM
COAL GASIFICATION FACILITIES

ASSUMPTIONS AND BASIC PLANT DATA	
Coal	
High Heating Value, Btu/lb	12,100
Sulfur Content, Percent	3.50
Ash Content, Percent	13.00
Plant Data	
Plant Capacity, MW	940
Plant Capacity Factor, Present	85
Coal Firing Rate, tons/day (based on 9,500 Btu/kWh)	8,860
Sulfur Removal/Recovery, Percent	98.5
Limestone Fluxing Addition, Percent of Ash	20
Carbon Conversion, Percent	99

ESTIMATES OF SOLID WASTE/BY-PRODUCT QUANTITIES	
Material	Quantity (tons/year)
Slag and Fly Slag	451,700
Sulfur	94,725
Spent Solvent	30
Spent Catalyst	19
Water/Wastewater Treatment Solids	5,500
General Wastes	1,300

Source: Black & Veatch, 1992

TABLE 3.7.1-2
SOLID WASTES AND BY-PRODUCTS FROM PULVERIZED COAL UNITS

ASSUMPTIONS AND BASIC PLANT DATA	
Coal	
High Heating Value, Btu/lb.	12,100
Sulfur Content, Percent	3.50
Ash Content, Percent	13.00
Limestone	
Purity, Percent	90
Plant Data	
Plant Capacity, MW	600
Capacity Factor, Percent	85
Coal Firing Rate, tons/day (100% load)	5,900
Limestone Requirements, tons/year	234,000
Oxidation to Sulfate, Percent	99
SO_2 Removal, Percent	95
Fly Ash Removal, Percent	99.6
Quantities of Solid Waste Per 600 MW Unit	Quantity (tons/year)
Bottom Ash	47,600
Fly Ash	189,000
Scrubber Solids	
Excess Limestone	20,100
Inert Material	23,400
Calcium Sulfite	2,500
Calcium Sulfate	324,000
Total Dry Solid	370,000
Water In Sludge	186,000
Total Wet Sludge	556,000
Subtotal Fly Ash/Sludge Dry Solids	559,000
Subtotal Water In Fly Ash/Sludge Mixture	186,000
Grand Total Fly Ash/Sludge Mixture	745,000
Water/Wastewater Treatment Solids	3,500
General Wastes	900

Source: Black & Veatch, 1992

TABLE 3.7.1-3
WORST CASE (CASE B) SOLID WASTE GENERATED

Year	Cumulative (ac-ft)	# of Years	Year	Cumulative (ac-ft)	# of Years
1998	0.24	1	2029	34,929	32
1999	0.96	2	2030	36,532	33
2000	1.92	3	2031	38,136	34
2001	2.88	4	2032	39,740	35
2002	3.84	5	2033	41,343	36
2003	4.80	6	2034	42,947	37
2004	577	7	2035	44,551	38
2005	1,149	8	2036	46,155	39
2006	1,721	9	2037	47,758	40
2007	2,292	10	2038	49,305	41
2008	2,864	11	2039	50,736	42
2009	4,007	12	2040	52,109	43
2010	5,380	13	2041	53,481	44
2011	6,753	14	2042	54,854	45
2012	8,184	15	2043	56,227	46
2013	9,614	16	2044	57,029	47
2014	11,102	17	2045	57,831	48
2015	12,590	18	2046	58,632	49
2016	14,136	19	2047	59,434	50
2017	15,682	20	2048	60,236	51
2018	17,287	21	2049	60,467	52
2019	18,891	22	2050	60,698	53
2020	20,495	23	2051	60,929	54
2021	22,099	24	2052	61,103	55
2022	23,702	25	2053	61,276	56
2023	25,306	26	2054	61,392	57
2024	26,910	27	2055	61,507	58
2025	28,514	28	2056	61,566	59
2026	30,117	29	2057	61,624	60
2027	31,721	30	2058	61,624	61
2028	33,325	31			

Source: Ebasco Environmental, 1992

TABLE 3.7.1-4
SUMMARY OF CONSOLIDATION PREDICTIONS

					At Date of Service	
Mine Area	Area (ac.)	Boring Number	Present Elevation (ft., MSL)	Initial Solid Content Average (%)	Projected Elevation (ft., MSL)	Average Solid Content (4) (%)
SA-8	429	C-20	159.8	31.7	157.7	33.5
		C-21	175.9	40.5	N/A	N/A
		C-22	175.6	32.4	173.6	33.6
		C-26	177.0(1)	34.9	175.3	36.8
		C-28	174.4	34.4	173.0	35.4
SA-9	311	C-23	168.8	34.7	167.5	36.6
		C-24	173.2	32.6	171.3	34.1
		C-25	174.8	34.6	173.5	36.1
		C-27	175.4	35.2	174.2	36.0
SA-10	220	C-29	172.0(1)	25.0(3)	161.2	36.9
		C-30	172.0(1)	41.9	N/A	N/A
		C-36	172.0(1)	29.6	N/A	N/A
P-2	414	C-31	157.0(2)	36.2	155.4	39.9
		C-32	157.0(2)	39.9	155.4	42.7
		C-33	157.0(2)	46.8	155.8	98.0
		C-34	157.0(2)	33.1	155.8	34.5
		C-35	157.0(2)	35.1	155.4	38.4
P-3	490	C-37	167.0(2)	26.3	159.6	33.6
		C-38	167.0(2)	31.1	162.3	34.7
		C-39	167.0(2)	29.6	162.5	34.8
		C-40	(Only about 2 feet of clay)		161.5	

Notes:

(1) Estimated
(2) Average in general area
(3) Estimated representative conditions
(4) Predicted by SLURRY model or hand calculation, not including the desiccated crust

Source: Dames & Moore, 1992

TABLE 3.7.1-5
WASTE STORAGE VOLUME AVAILABILITY

Name	Area - A_p (Acres)	Estimated Average Clay Elevation (ft-MSL)	Average Fill Height H_a (Feet)	Fill Volume (Mcy)	Notes
SA-8	429	170	32.5	21.5	1, 2, 4
SA-9	311	170	10.0	5.0	3, 4
SA-10	220	161	40.0	13.5	2, 4
P-2	414	155.5	40.0	25.4	2, 4
P-3	490	162	40.0	30.0	2, 4
Phosphoria	795	Unknown	40.0	51.3	

Notes:

(1) Maximum average fill elevation of 202.5 ft MSL
(2) Volume calculated assuming 95% of A_p x H_a
(3) Volume calculated to elevation of + 180 ft MSL
(4) Average fill height does not account for settlement of clay beneath fill

Source: Ebasco-Environmental, 1992

TABLE 3.7.1-6
SWDA CLAY THICKNESS DATA

Area	Estimated Range of Clay Thickness (ft)[1]		
	Present-Early 1992	At Time of Service	At End of Operations
SA-8	25-45	24-43	18-38
SA-10[2]	28	17	13
P-2	14-34	12-33	9-29
P-3[3]	36-44	27-38	23-34
Phosphoria	0-15[4]	-	-

Notes: (1) For area beyond estimated dam toe
(2) Assumed typical conditions
(3) Within mined out area
(4) Limited to some areas; clay underlying other materials

Source: Dames & Moore, 1992

TABLE 3.7.1-7
PARTICLE SIZE DISTRIBUTION AND PERCENT SOLIDS CONTENT, SA-9

Boring No./ Sample I.D.	Particle-Size Distribution			Percent Solids Content	
	Weight (Percent)				
	U.S. Standard Sieve Size			(Percent by Weight)	
	< +150 Mesh	150 to 325	> -325	Oven Dried	Air Dried
C 23/#5	9.65	5.52	84.83	29.91	34.05
C 23/#7B	1.32	2.31	96.37	37.50	40.06
C 24/#1	0.01	2.42	97.08	26.20	27.36
C 24/#4	6.33	6.78	86.88	23.58	30.94
C 25/#2B	3.15	7.23	89.62	30.96	37.66
C 25/#12	0.64	2.08	97.29	29.54	33.71
C 27/#1	0.63	2.46	96.91	25.26	28.00
C 27/#4A	3.73	3.38	92.89	31.70	38.80
C 27/#11	0.20	1.65	98.15	29.23	33.84

Note: High organic content in < +150 mesh fractions from C 23 #5, C 23 #7B, C 24 #4, C 25 #12-12 1/2, and in the 150 to 325 mesh fraction of C 23 #5.

Source: Dames & Moore, 1992

TABLE 3.7.1-8
BASIC SOIL CHEMISTRY, SA-9

Boring No./Sample	pH	CEC	Acid insol
C 23/#2B	7.4	76	---
C 23/#5	7.2	64	57.34
C 23/#7B	7.3	75	56.22
C 24/#7B	7.2	81	---
C 24/#1	7.1	62	54.54
C 24/#4	7.0	64	56.16
C 25/#7B	7.1	74	---
C 25/#2B	6.9	76	54.46
C 25/#12	7.1	80	52.74
C 27/#1	7.3	83	46.72
C 27/#4A	7.1	28	50.36
C 27/#11	7.1	67	53.88

Note: Cation Exchange Capacity (CEC)was determined by the sodium displacement method used by the Clay Mineral Society and described in "Methods of Soil Analysis", Part 2, Section 2, 1982, Soil Science Society of America.

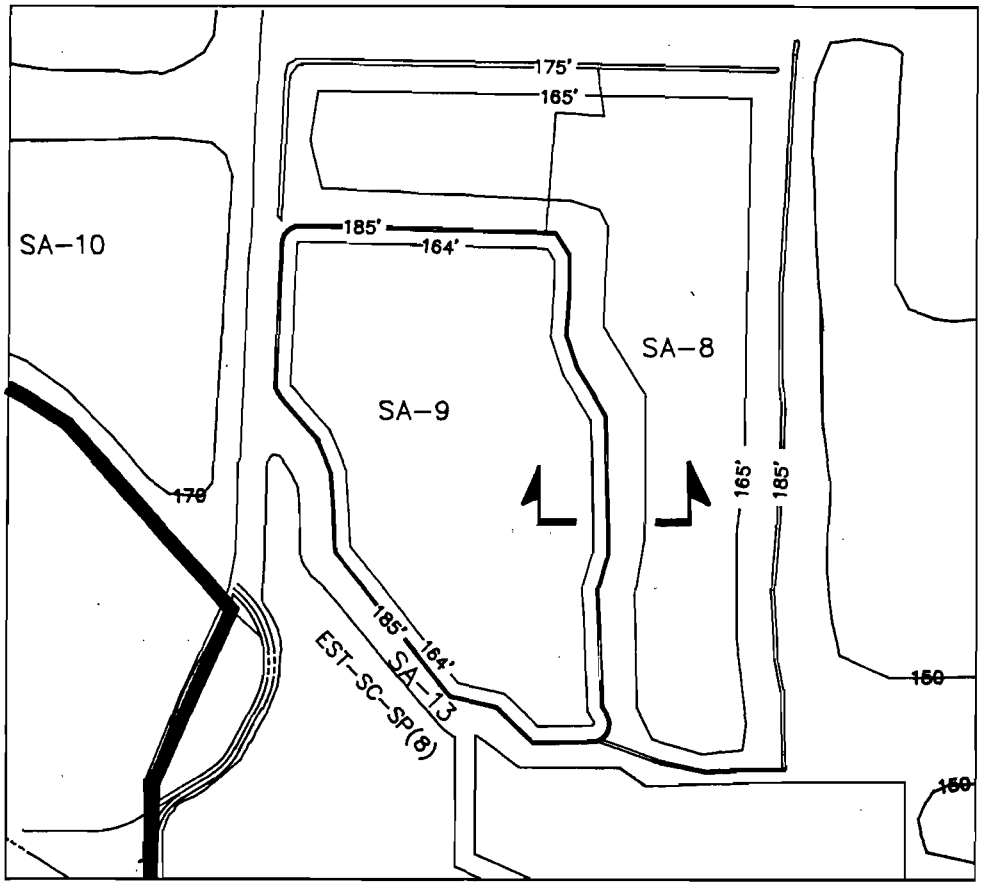
Source: Dames & Moore, 1992

TABLE 3.7.1-9
CLAY MINERALOGY, SA-9

	Percent by Weight			
	Quartz	Apatite	Dolomite	Clay
C 23 #5	23	40	3	34
C 23 #7B	29	40	4	26
C 24 #1	30	34	11	25
C 25 #4	24	32	12	32
C 25 #2B	37	31	15	18
C 25 #12-12 1/2	31	40	7	23
C 27 #1	17	30	23	29
C 27 #4A	32	46	3	19
C 27 #11	35	41	5	19
	Montmorillinite	Illite	Kaolinite	Palygorskite
C 23 #5	14	15	5	n.d.
C 23 #7b	16	4	6	n.d.
C 24 #1	17	5	3	n.d.
C 24 #4	24	3	5	n.d.
C 25 #2B	10	0	7	1
C 25 #12-12 1/2	14	6	3	n.d.
C 27 #1	16	8	5	n.d.
C 27 #4A	9	5	5	n.d.
C 27 #11	8	5	6	n.d.

Note: n.d. - None Detected

Source: Dames & Moore, 1992



LEGEND

SITE BOUNDARY

EXIST. FDNR APPROVED TOPO

PROPOSED CONTOUR

N
W E

0 2000'

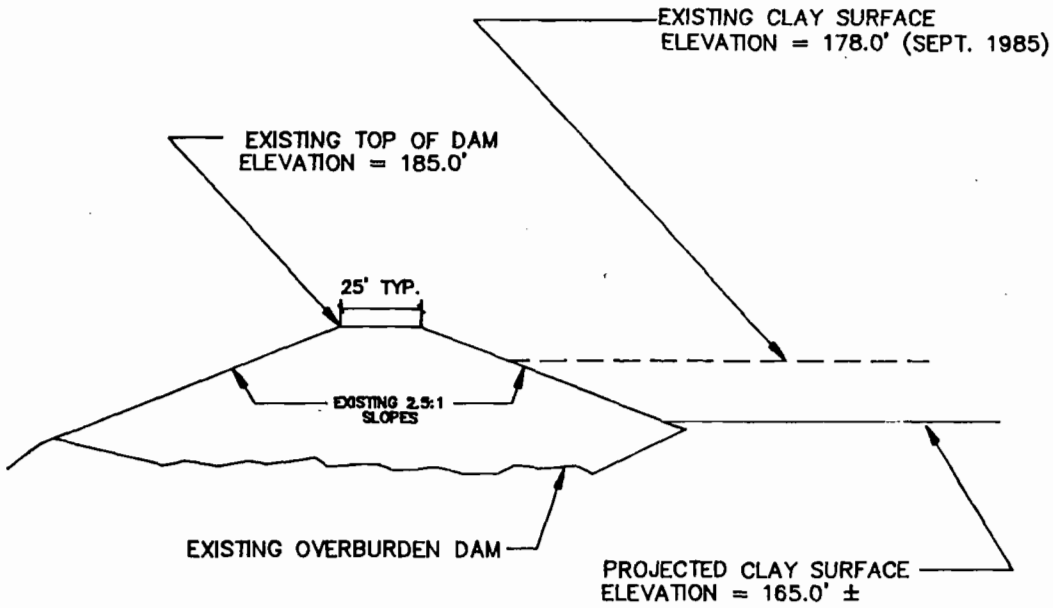
SOURCE: DAMES & MOORE, 1992

FOR CROSS-SECTION, SEE FIGURE 3.7.1-2

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-1
INITIAL SOLID WASTE AREA
PLAN VIEW



SOURCE: DAMES & MOORE, 1992

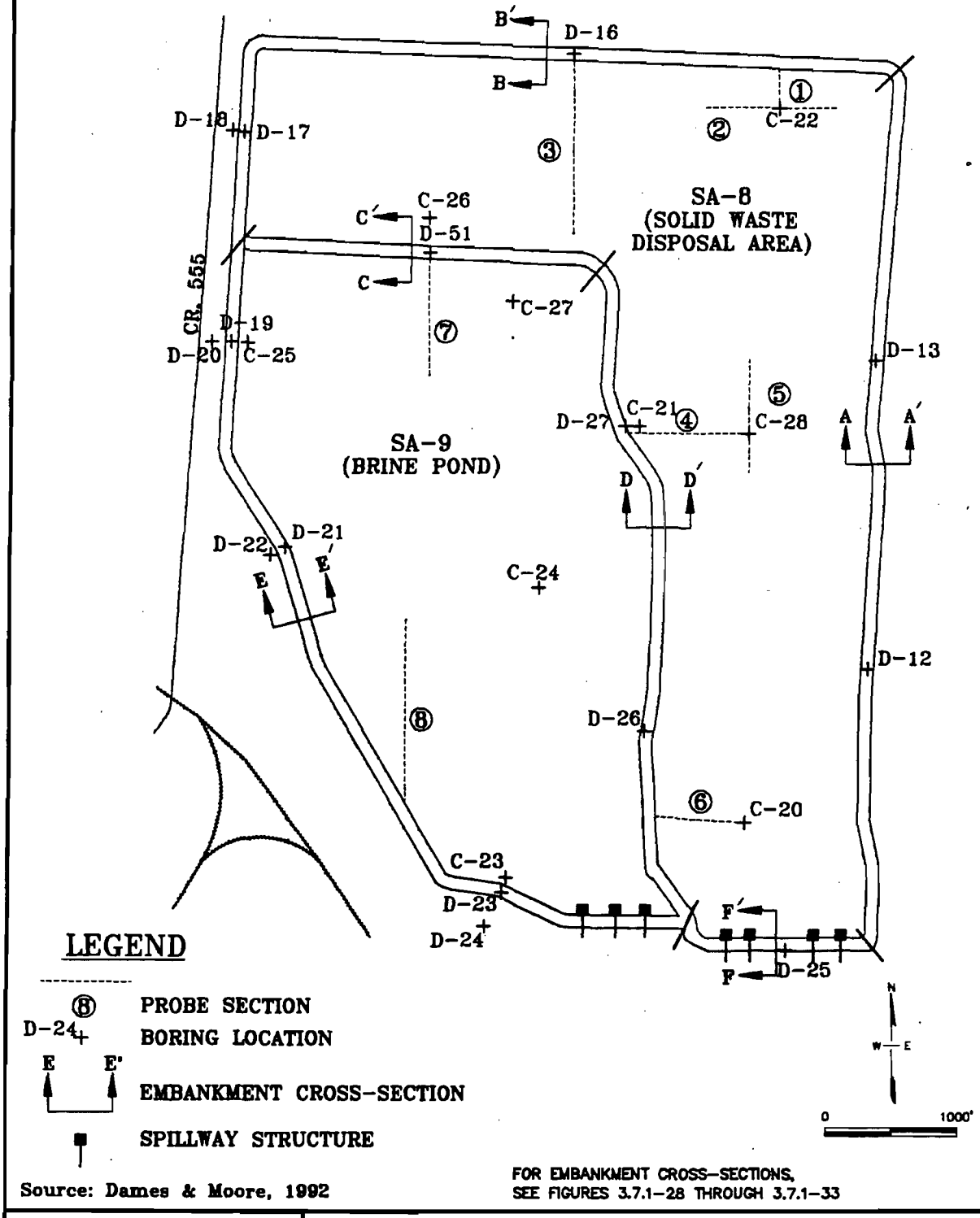
FOR CROSS-SECTION LOCATION SEE FIGURE 3.7.1-1

NOT TO SCALE

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-2
INITIAL SOLID WASTE AREA CROSS-SECTION



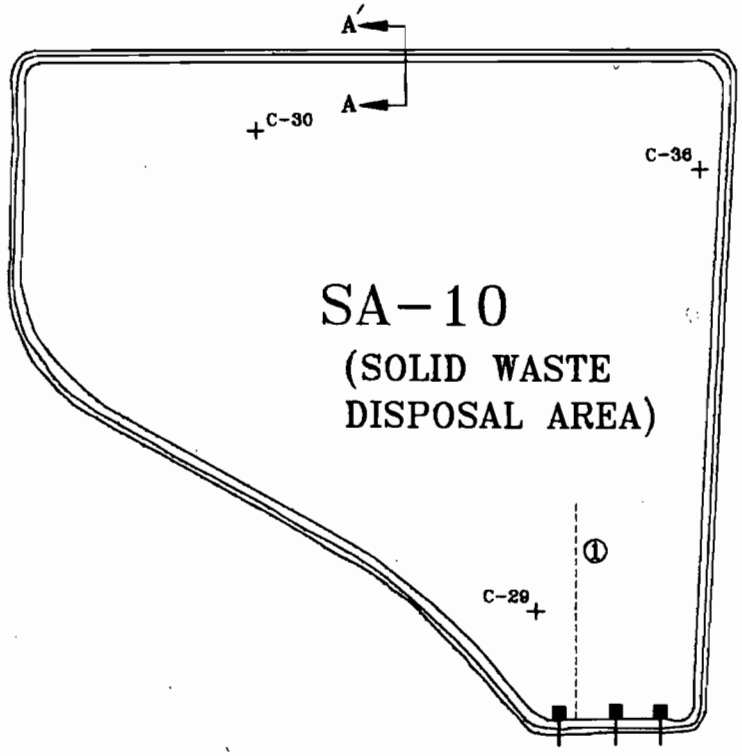
Source: Dames & Moore, 1992

FOR EMBANKMENT CROSS-SECTIONS,
SEE FIGURES 3.7.1-28 THROUGH 3.7.1-33

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-3
EMBANKMENT PLAN
SA-8 AND SA-9



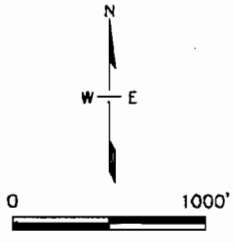
LEGEND

① PROBE SECTION

C-30 BORING LOCATION

A A' EMBANKMENT CROSS-SECTION

SPILLWAY STRUCTURE



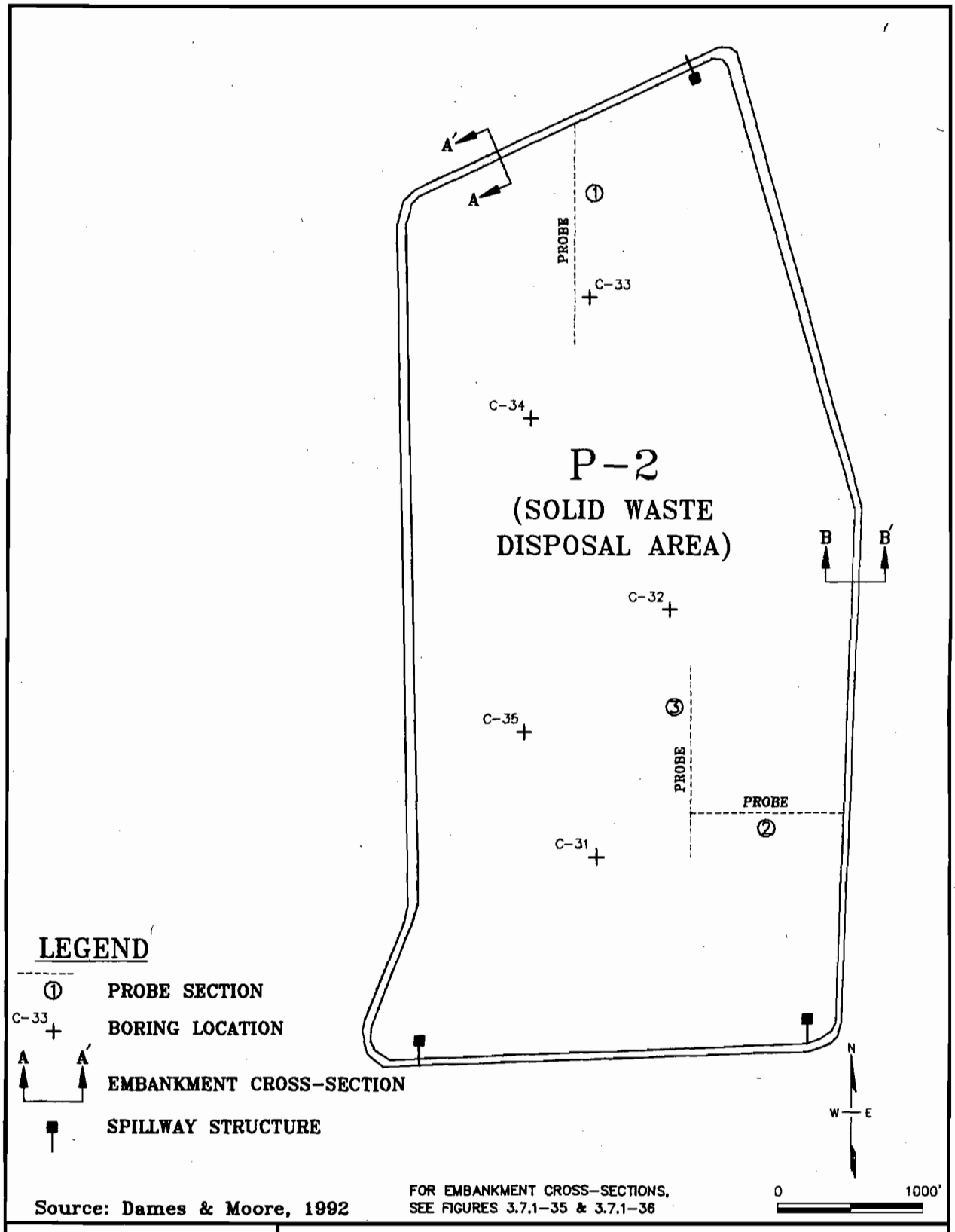
Source: Dames & Moore, 1992

FOR EMBANKMENT CROSS-SECTION, SEE FIGURE 3.7.1-34

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-4
EMBANKMENT PLAN
SA-10

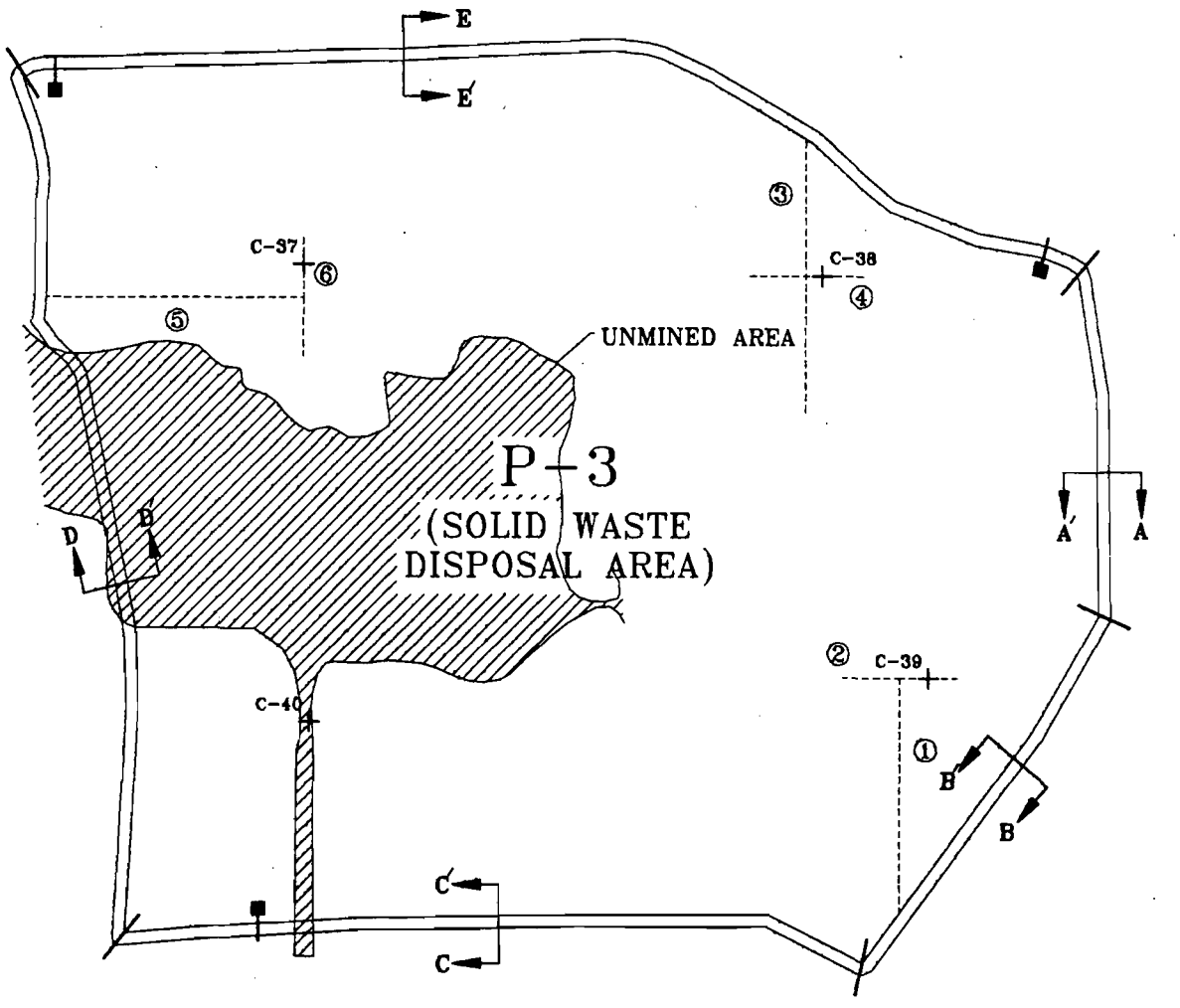


Source: Dames & Moore, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-5
EMBANKMENT PLAN
P-2



LEGEND

① PROBE SECTION

C-38 + BORING LOCATION

A A' EMBANKMENT CROSS-SECTION

SPILLWAY STRUCTURE

UNMINED

Source: Dames & Moore, 1992

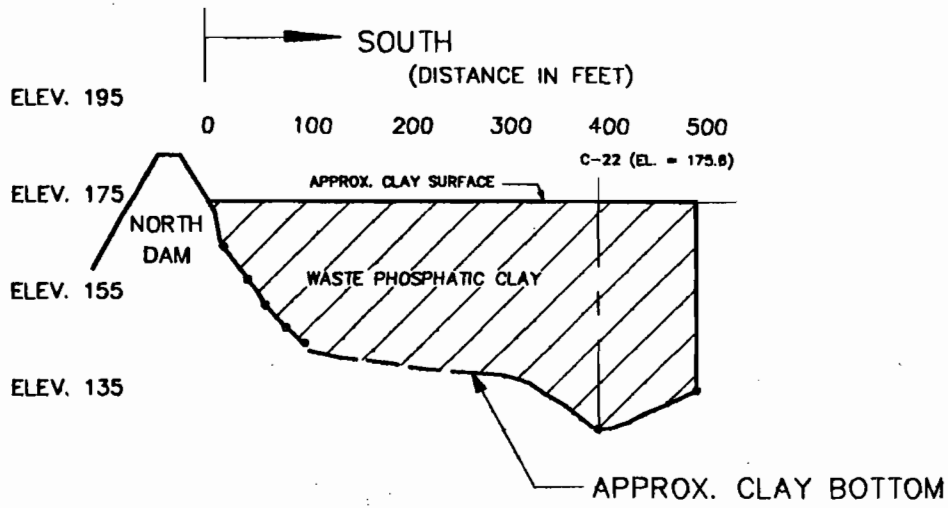
FOR EMBANKMENT CROSS-SECTIONS, SEE FIGURES 3.7.1-37 THROUGH 3.7.1-41

N
W E
0 1000'

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-6
EMBANKMENT PLAN
P-3



Source: Dames & Moore, 1992

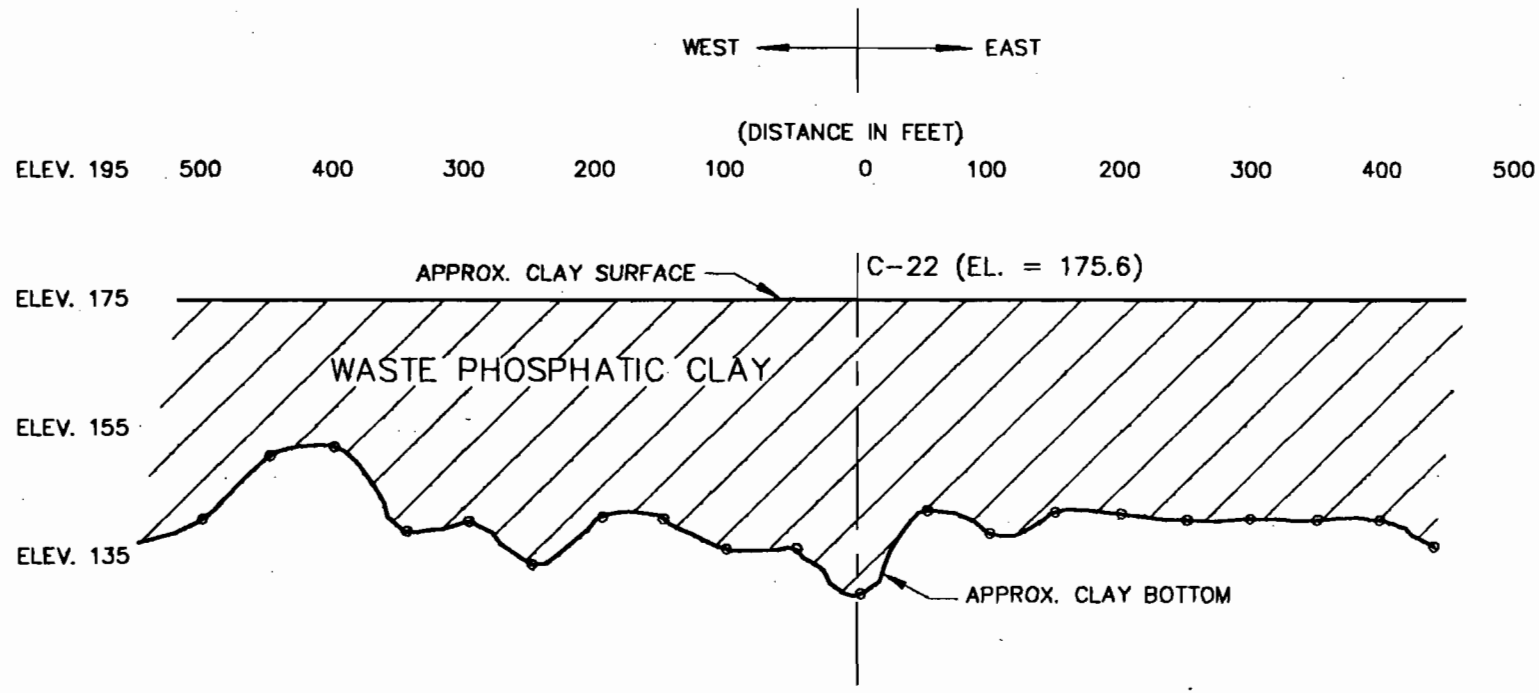
(PROBING SOUTH FROM NORTH DAM SOUTH NEAR THE NE CORNER)

SCALE: AS SHOWN

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-7
SA-8 PROBE-SECTION ①
NORTH-SOUTH DIRECTION



Source: Dames & Moore, 1992

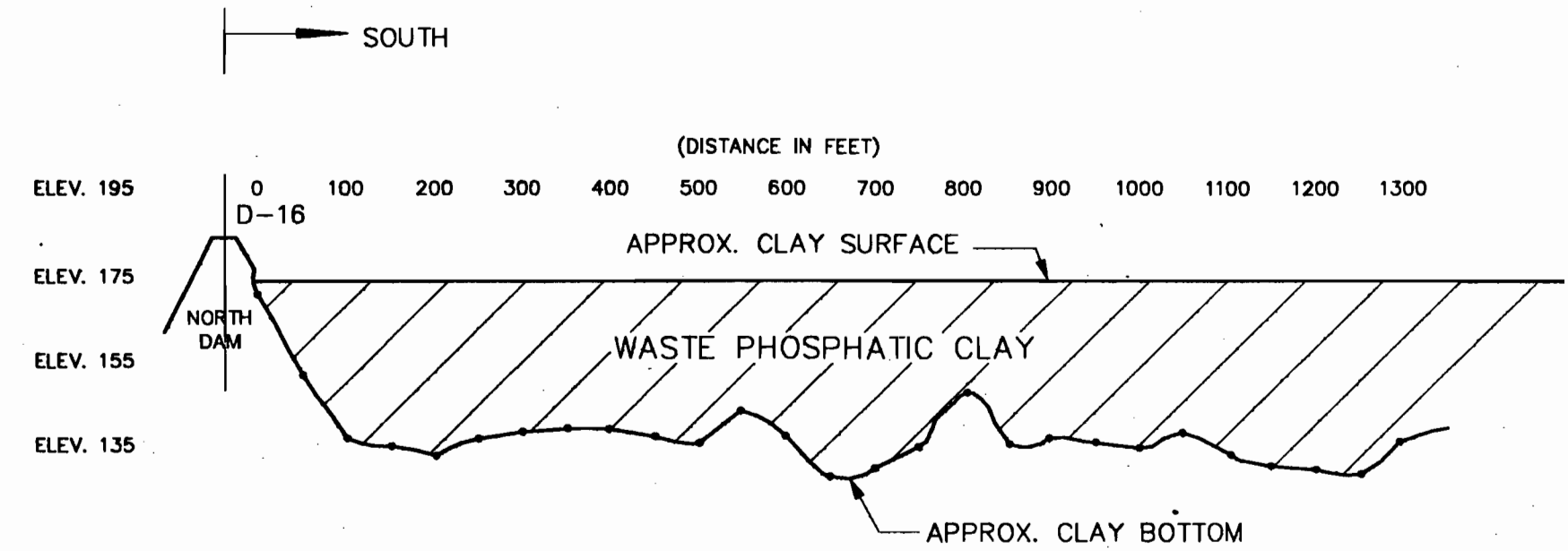
(PROBING EAST & WEST FROM BORING C-22 LOCATION)

SCALE: AS SHOWN

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-8
SA-8 PROBE-SECTION ②
EAST-WEST DIRECTION



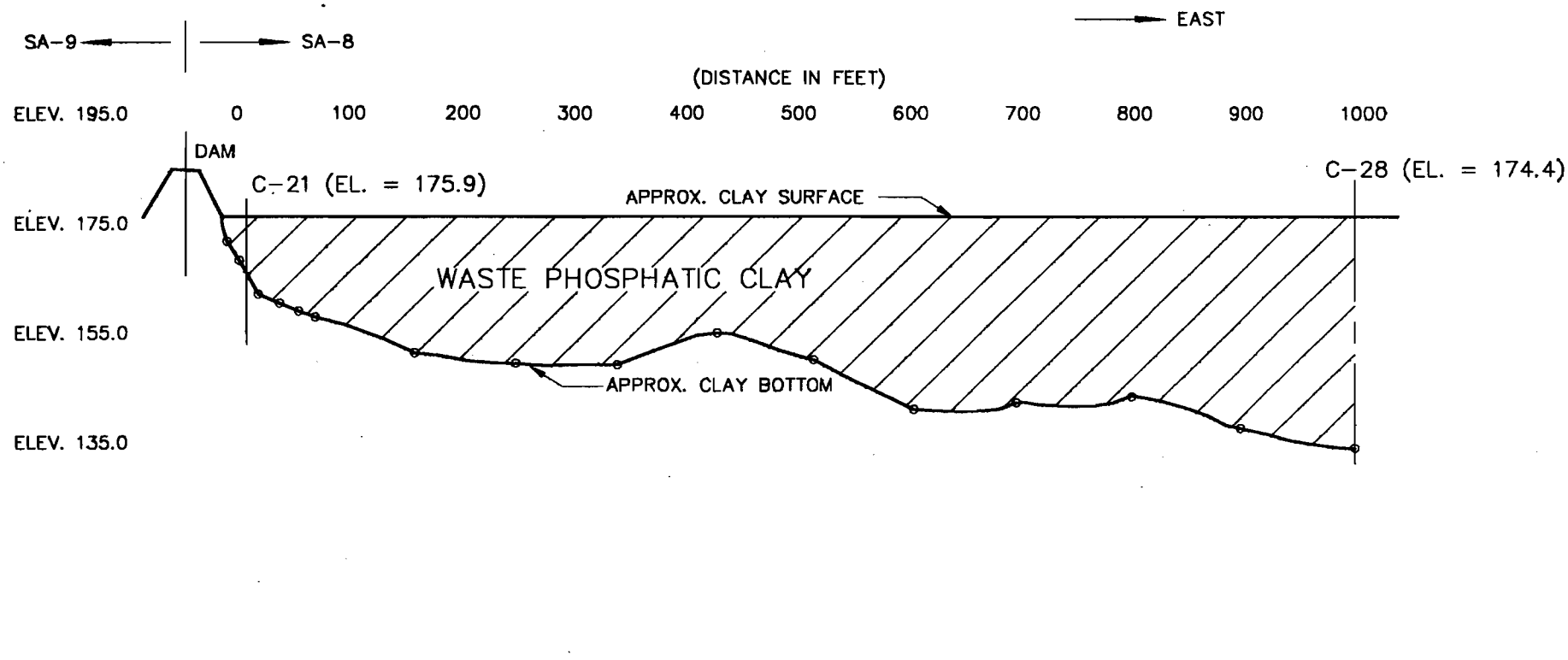
NO BORING DATA FOR THIS SECTION

Source: Dames & Moore, 1992 (PROBING SOUTH FROM NORTH DAM APPROX. 2500' EAST OF NW CORNER) SCALE: AS SHOWN

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-9
SA-8 PROBE-SECTION ③
NORTH-SOUTH DIRECTION



Source: Dames & Moore, 1992

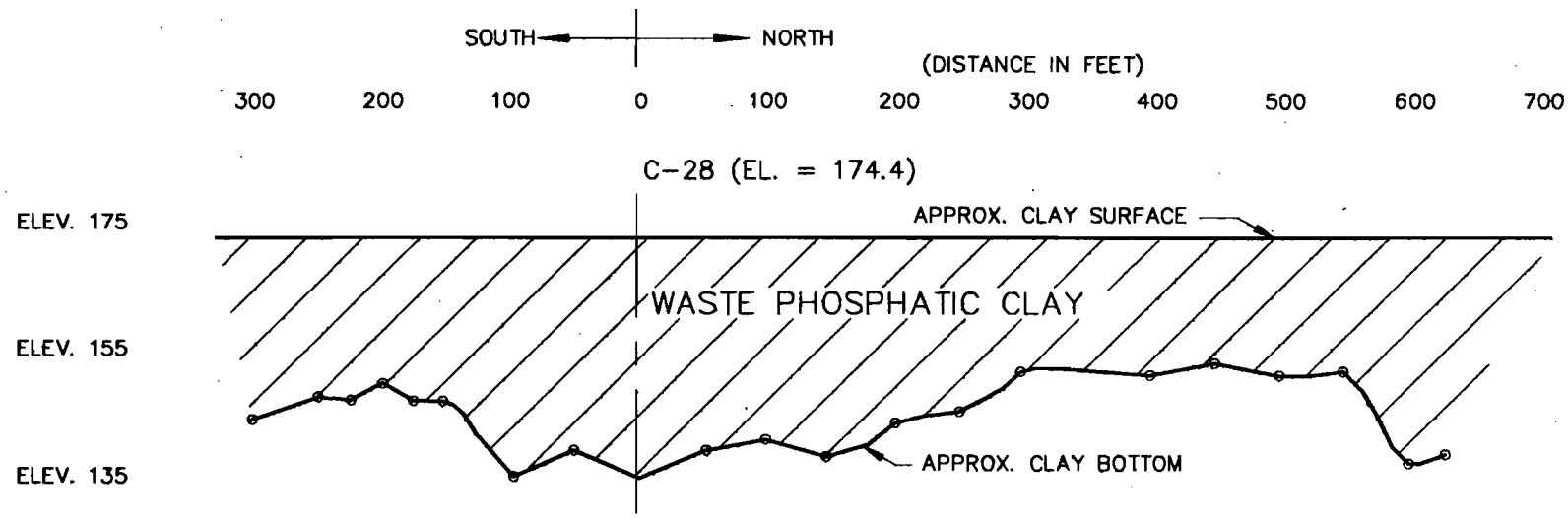
(PROBING EAST OF WEST DAM AT BORING C-21 LOCATION)

SCALE: AS SHOWN

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-10
SA-8 PROBE-SECTION ④
EAST-WEST DIRECTION



Source: Dames & Moore, 1992

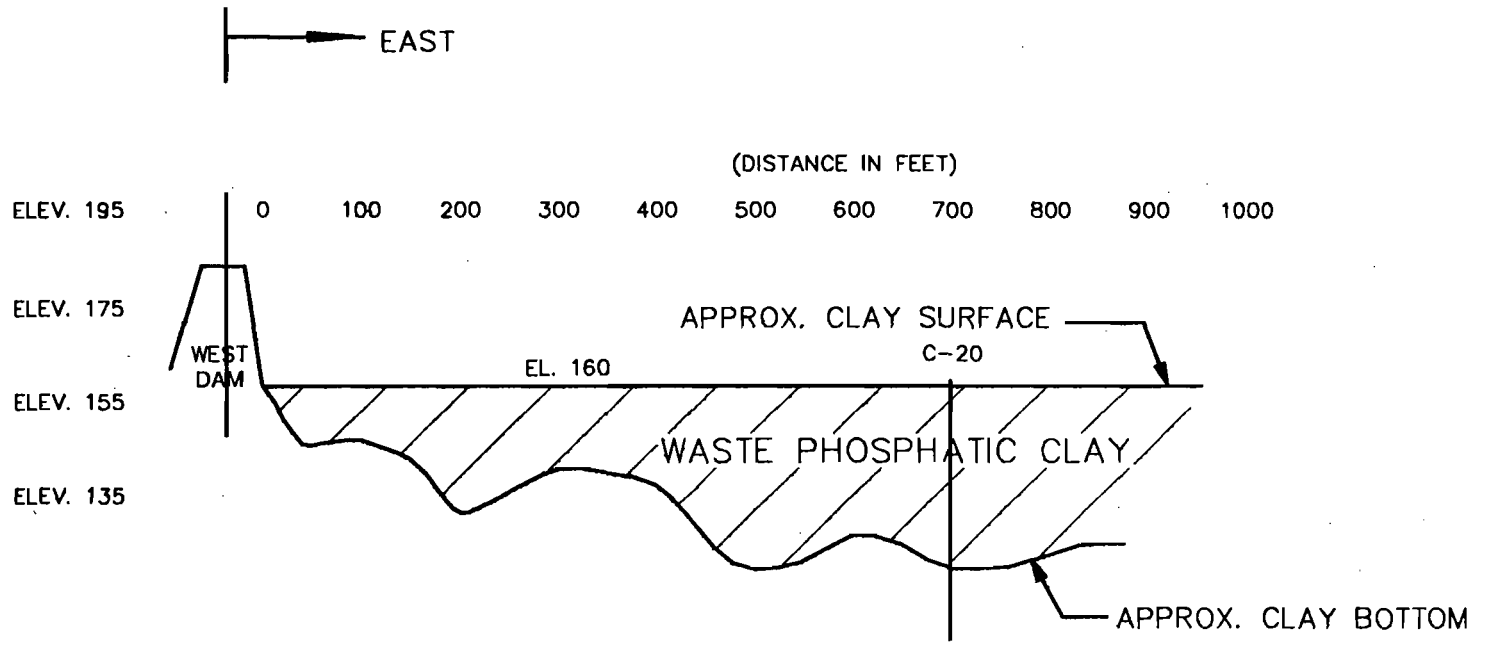
(PROBING NORTH & SOUTH FROM BORING C-28 LOCATION)

SCALE: AS SHOWN

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-11
SA-8 PROBE-SECTION ⑤
NORTH-SOUTH DIRECTION

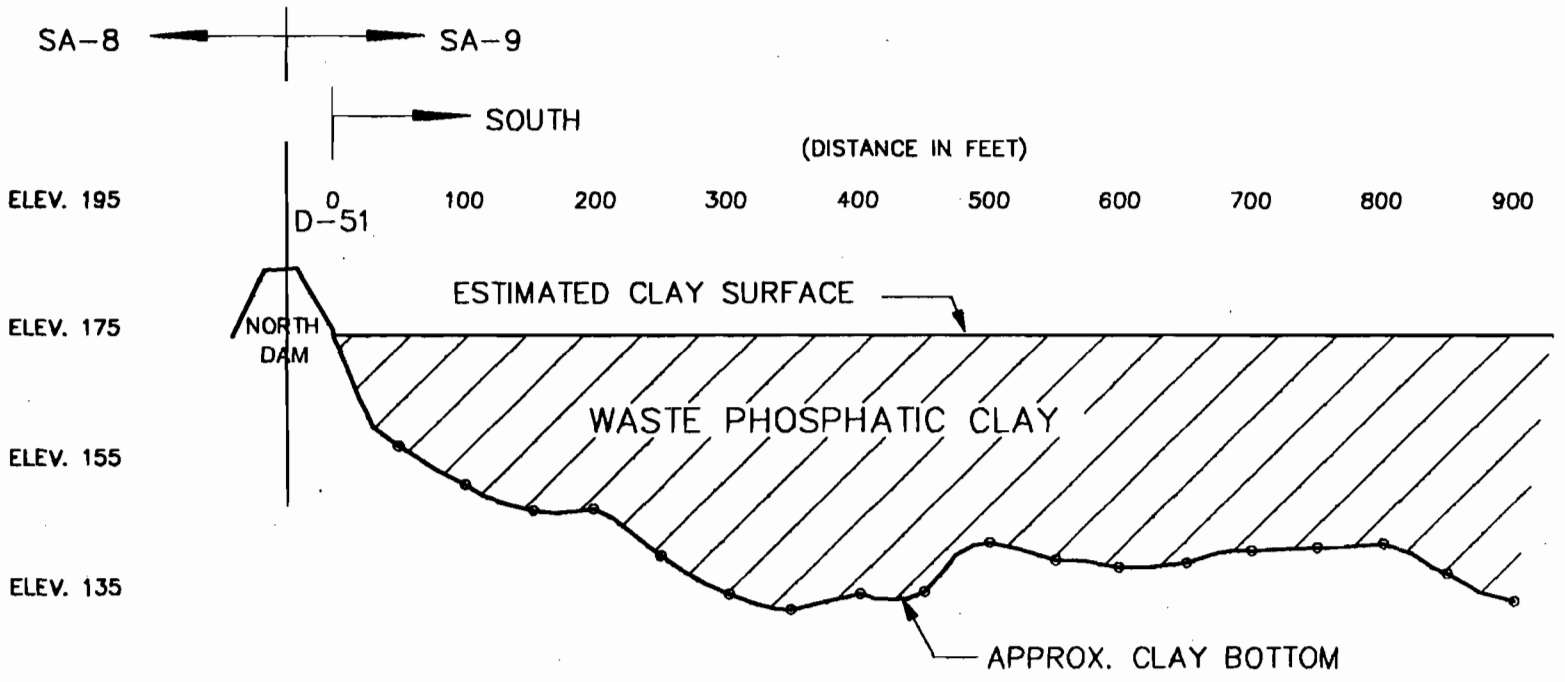


Source: Dames & Moore, 1992 (PROBING EAST FROM WEST DAM APPROX. 1200' NORTH OF SW CORNER) SCALE: AS SHOWN

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-12
SA-8 PROBE-SECTION (6)
EAST-WEST DIRECTION



NO CLAY BORING DATA FOR THIS SECTION

Source: Dames & Moore, 1992

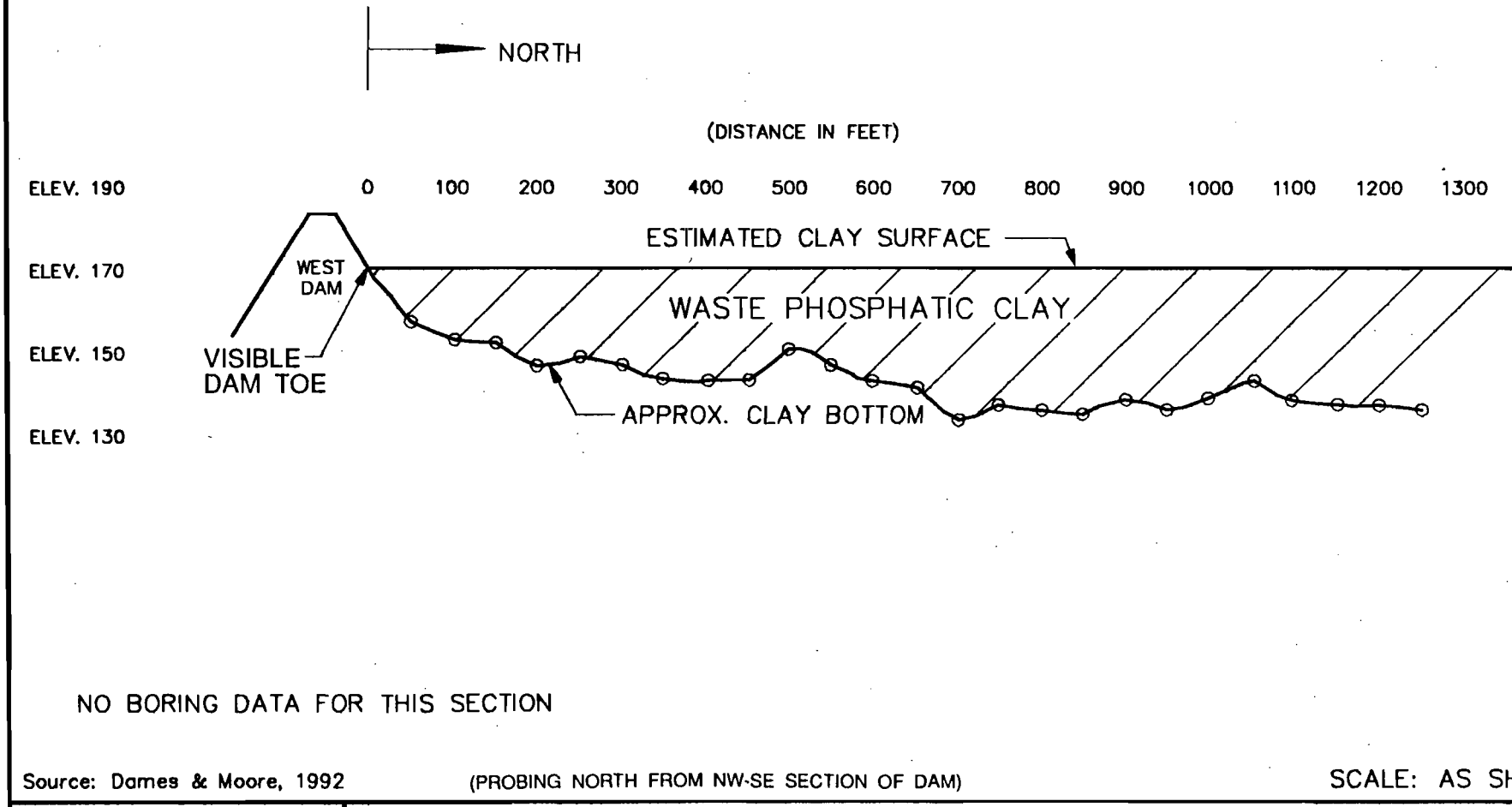
(PROBING SOUTH FROM NORTH DAM @ BORING D-51 LOCATION)

SCALE: AS SHOWN

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-13
SA-8 PROBE-SECTION ⑦
NORTH-SOUTH DIRECTION



Source: Dames & Moore, 1992

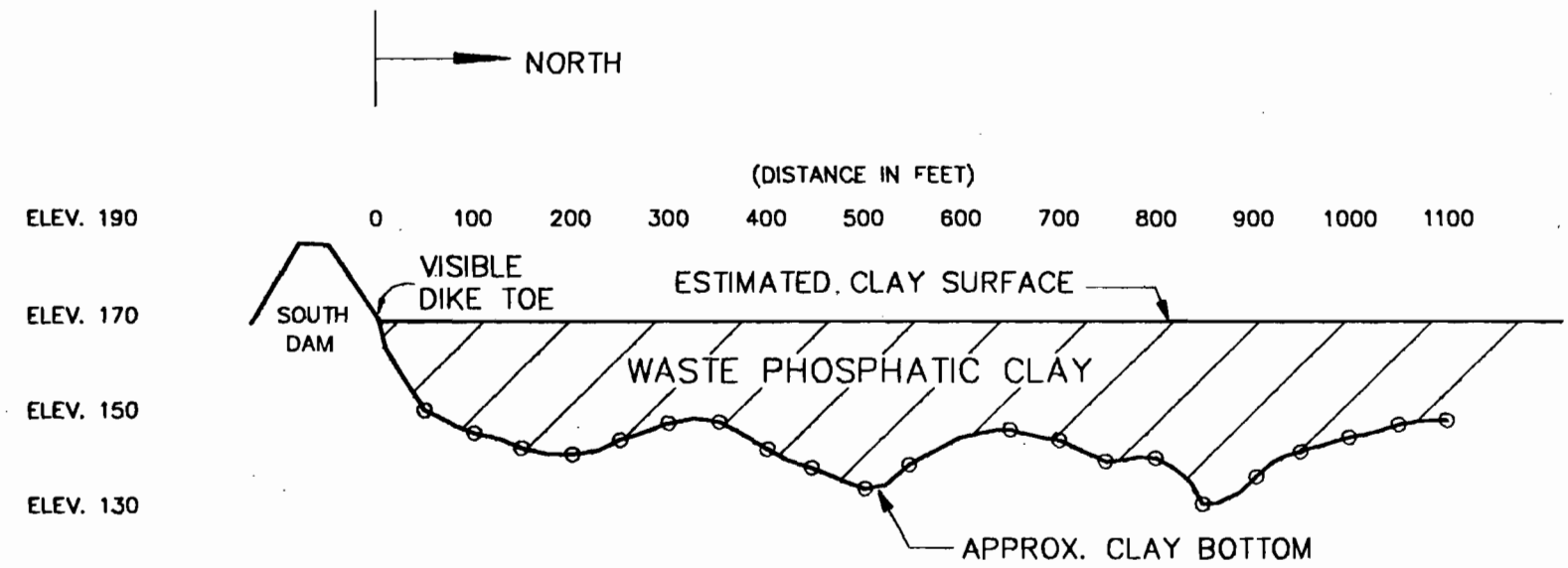
(PROBING NORTH FROM NW-SE SECTION OF DAM)

SCALE: AS SHOWN

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-14
SA-9 PROBE-SECTION ⑧
NORTH-SOUTH DIRECTION



NO BORING DATA FOR THIS SECTION

Source: Dames & Moore, 1992

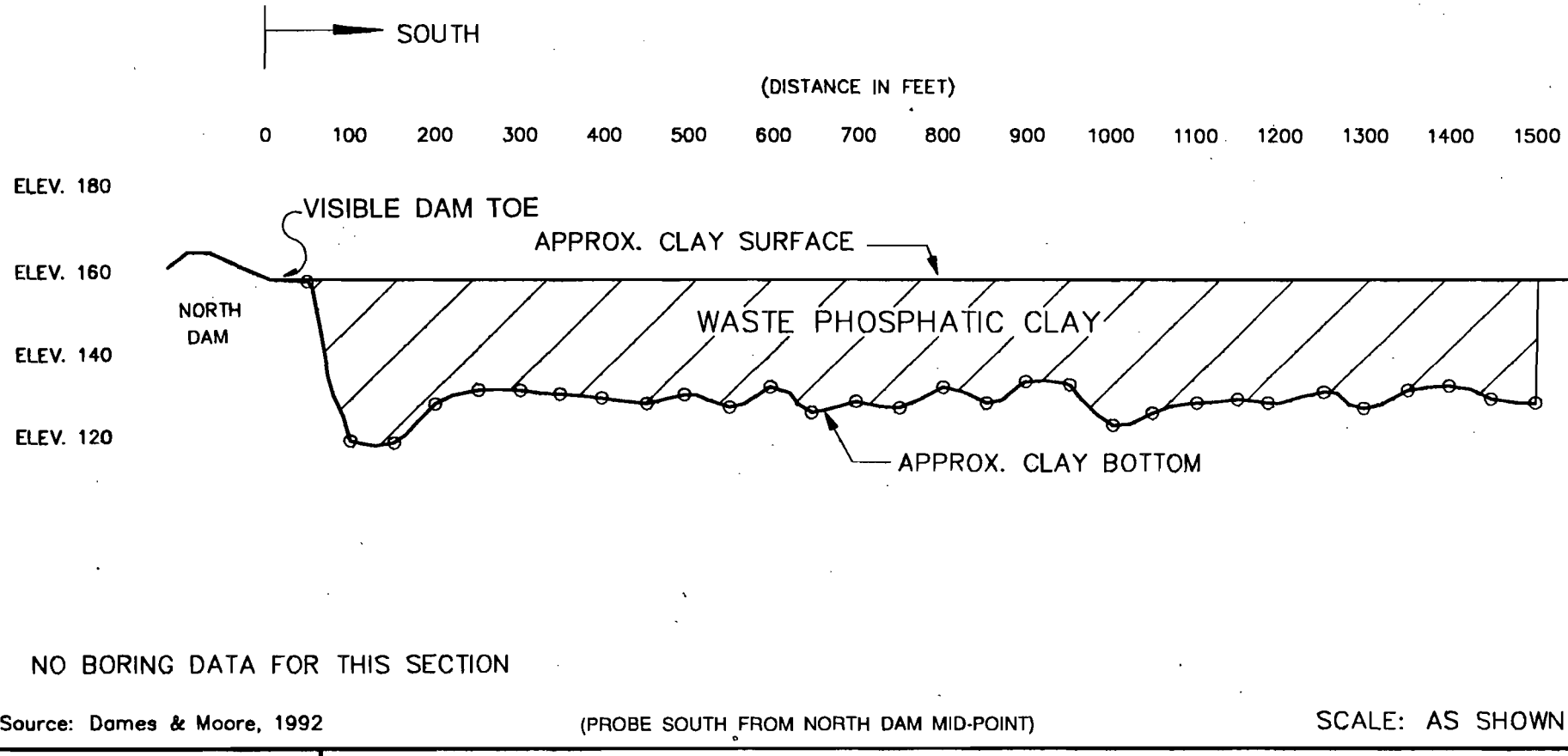
(PROBE NORTH FROM SOUTH DAM - 750' WEST OF SE CORNER)

SCALE: AS SHOWN

Florida Power CORPORATION

Polk County Site

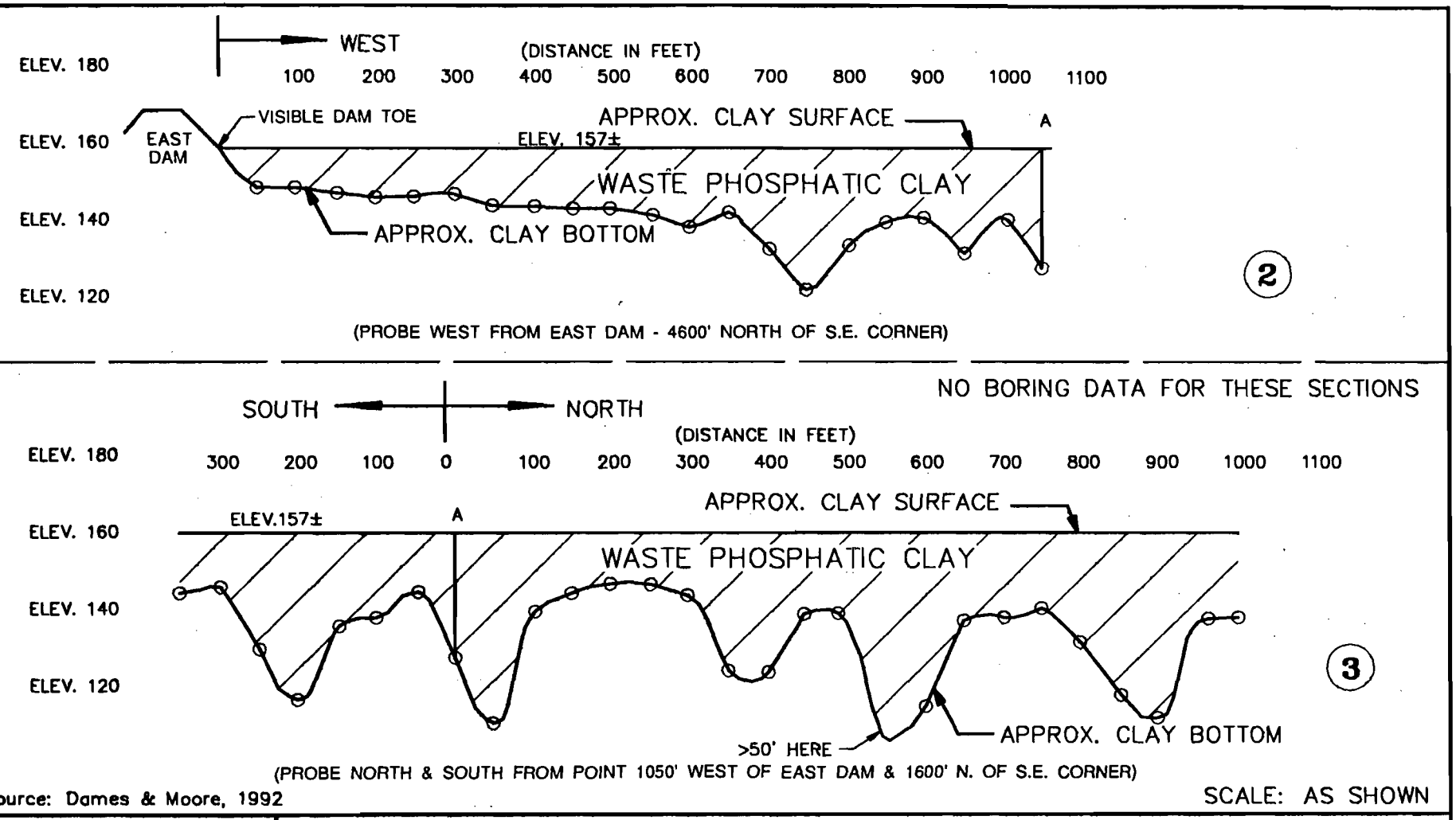
FIGURE 3.7.1-15
SA-10 PROBE-SECTION ①
NORTH-SOUTH DIRECTION



Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-16
P-2 PROBE-SECTION ①
NORTH-SOUTH DIRECTION



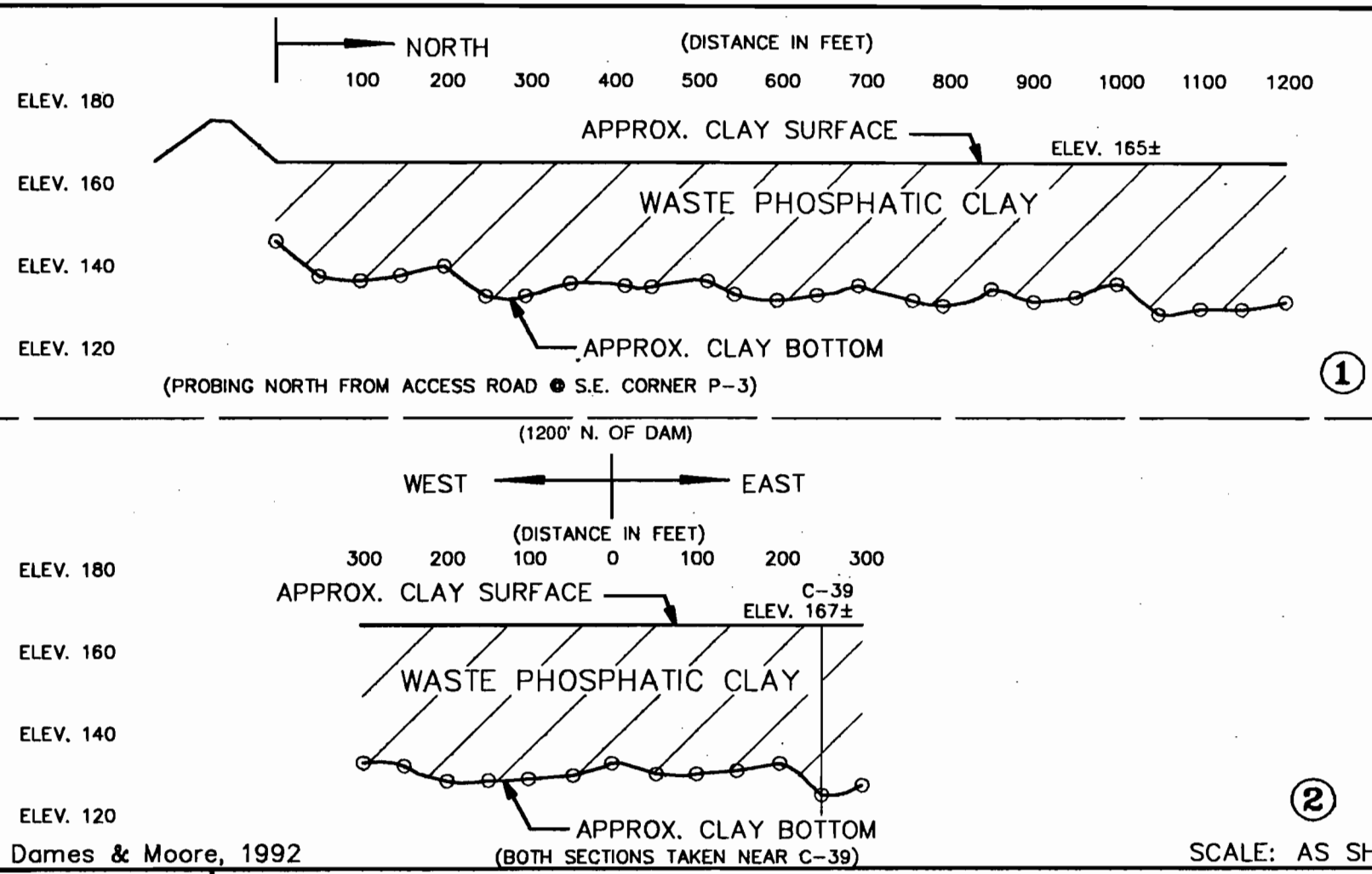
Source: Dames & Moore, 1992

SCALE: AS SHOWN

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-17
P-2 PROBE-SECTIONS ②/③
EAST-WEST AND NORTH-SOUTH DIRECTIONS



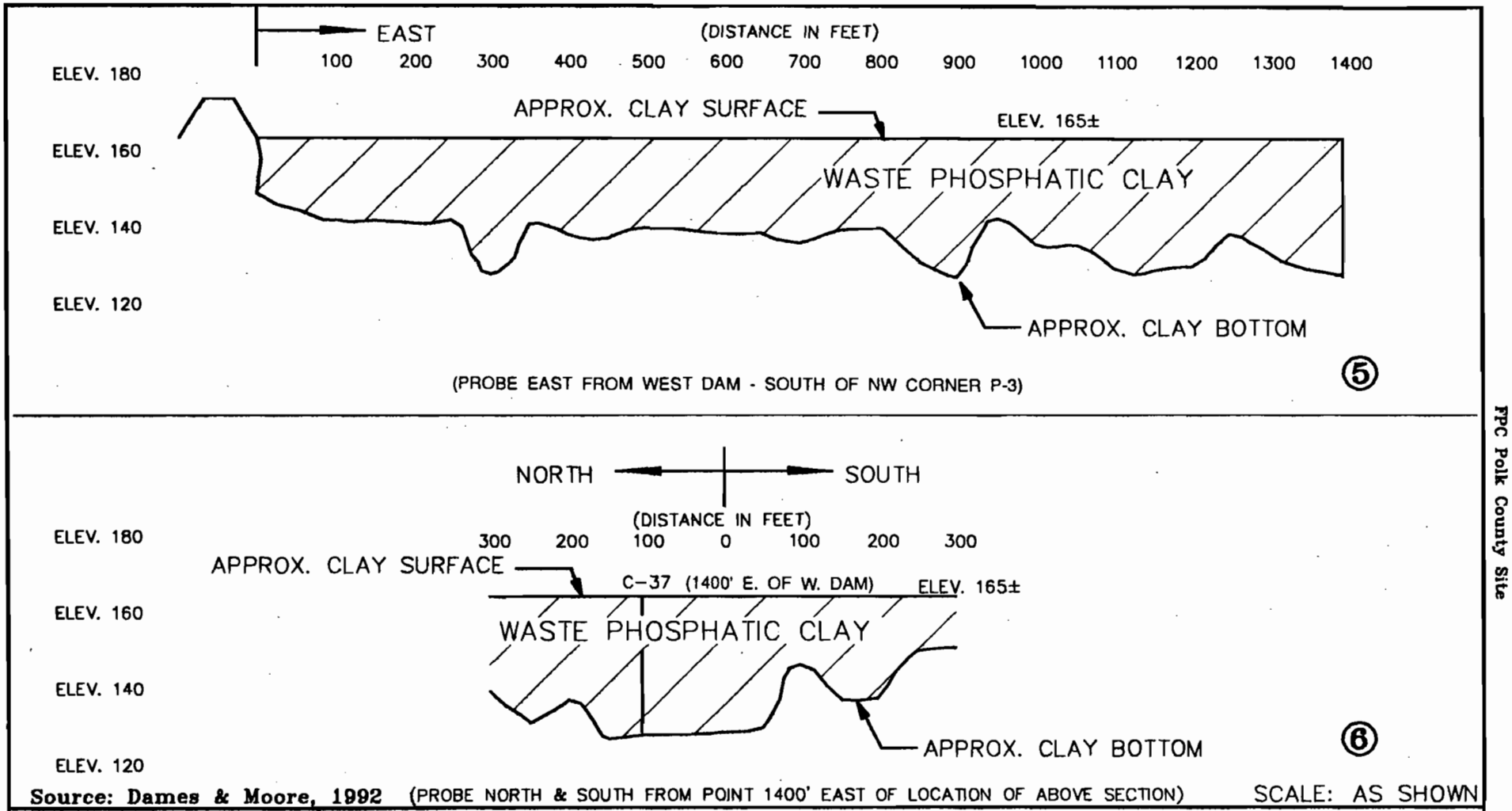
Source: Dames & Moore, 1992

SCALE: AS SHOWN

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-18
P-3 PROBE-SECTIONS ①/② NORTH-SOUTH AND EAST-WEST DIRECTIONS

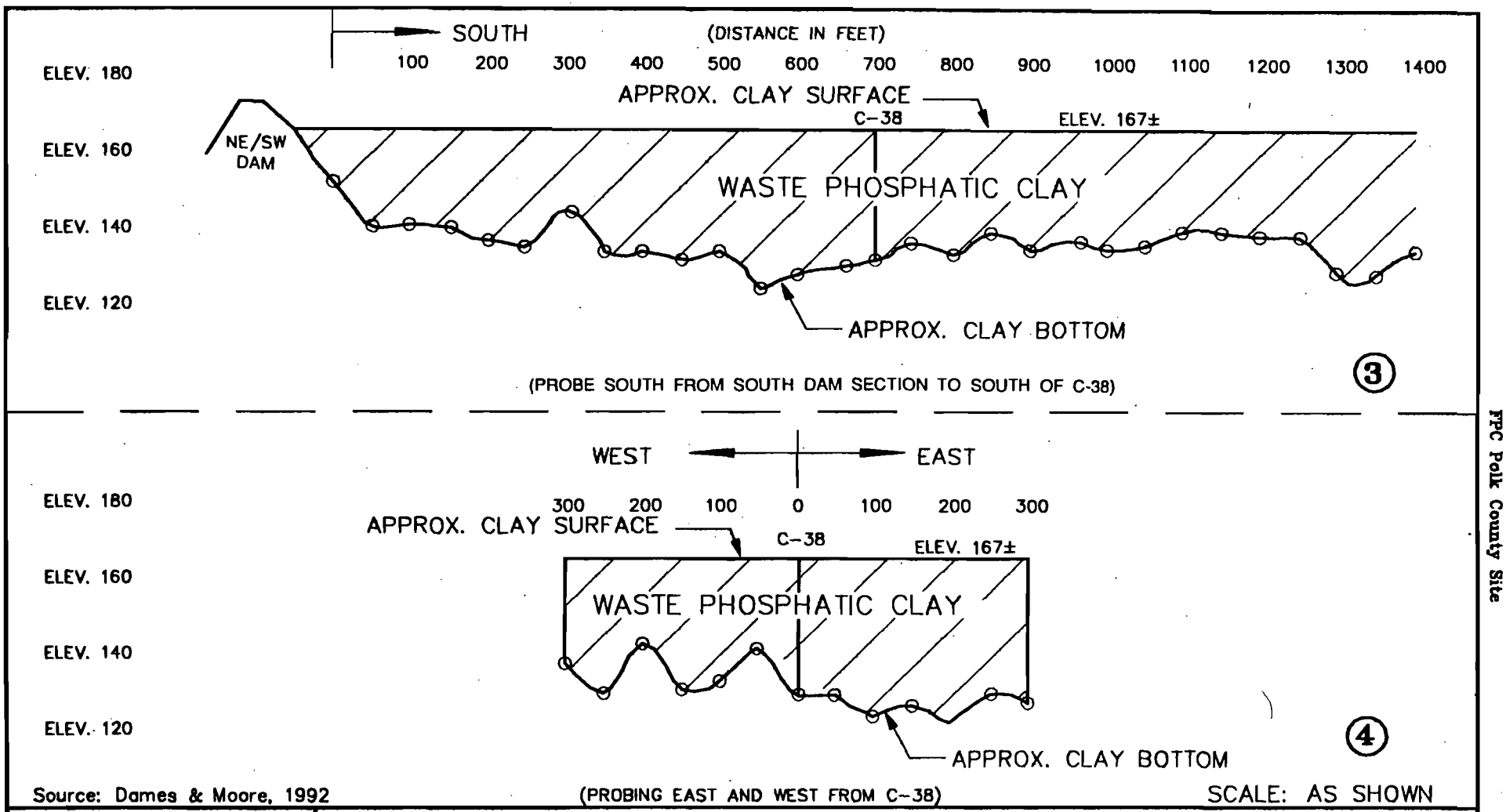


Source: Dames & Moore, 1992 (PROBE NORTH & SOUTH FROM POINT 1400' EAST OF LOCATION OF ABOVE SECTION) SCALE: AS SHOWN

Florida Power CORPORATION

Polk County Site

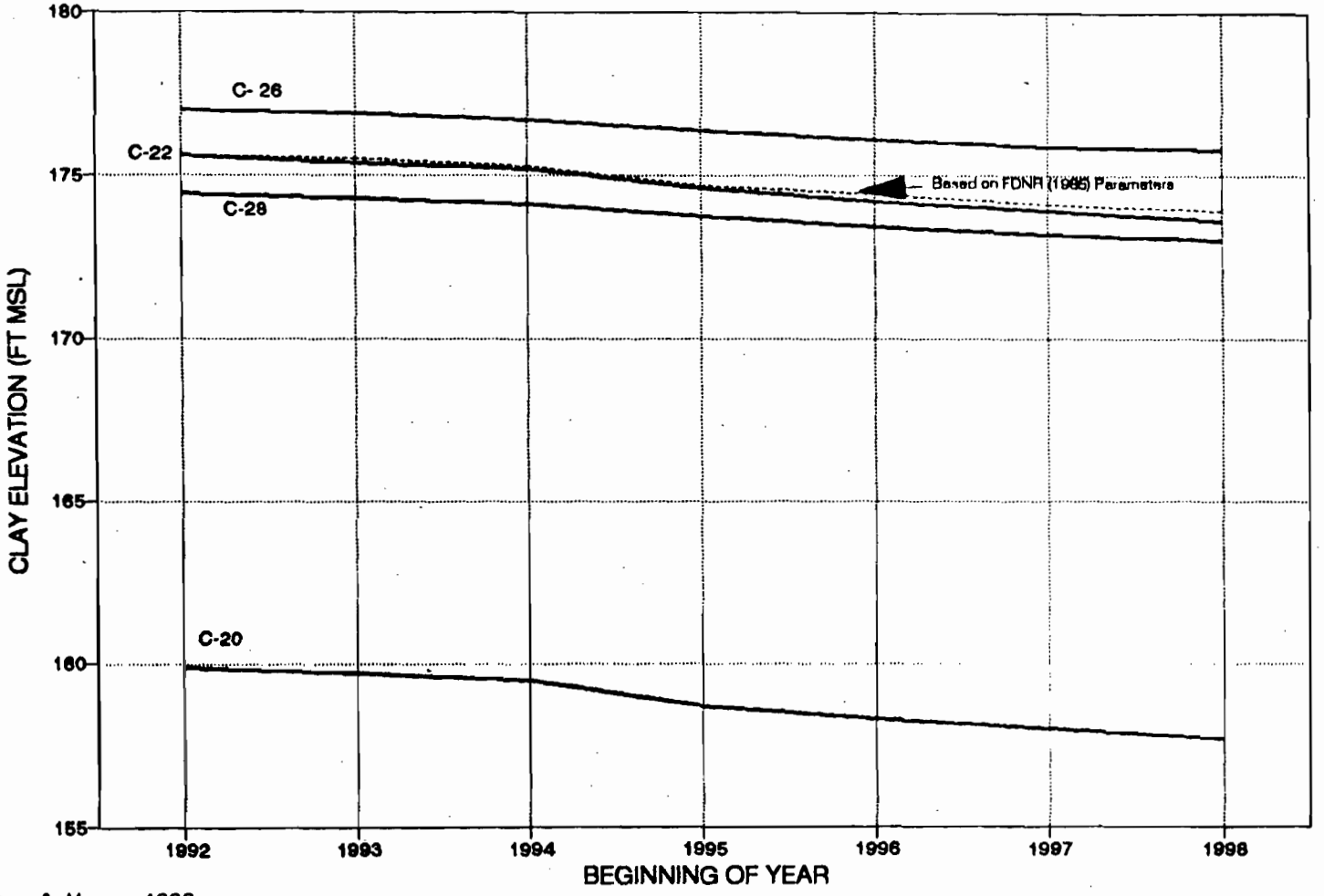
FIGURE 3.7.1-19
P-3 PROBE-SECTIONS ⑤ / ⑥
EAST-WEST AND NORTH-SOUTH DIRECTIONS



Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-20
P-3 PROBE-SECTIONS ③/④
NORTH-SOUTH AND EAST-WEST DIRECTIONS

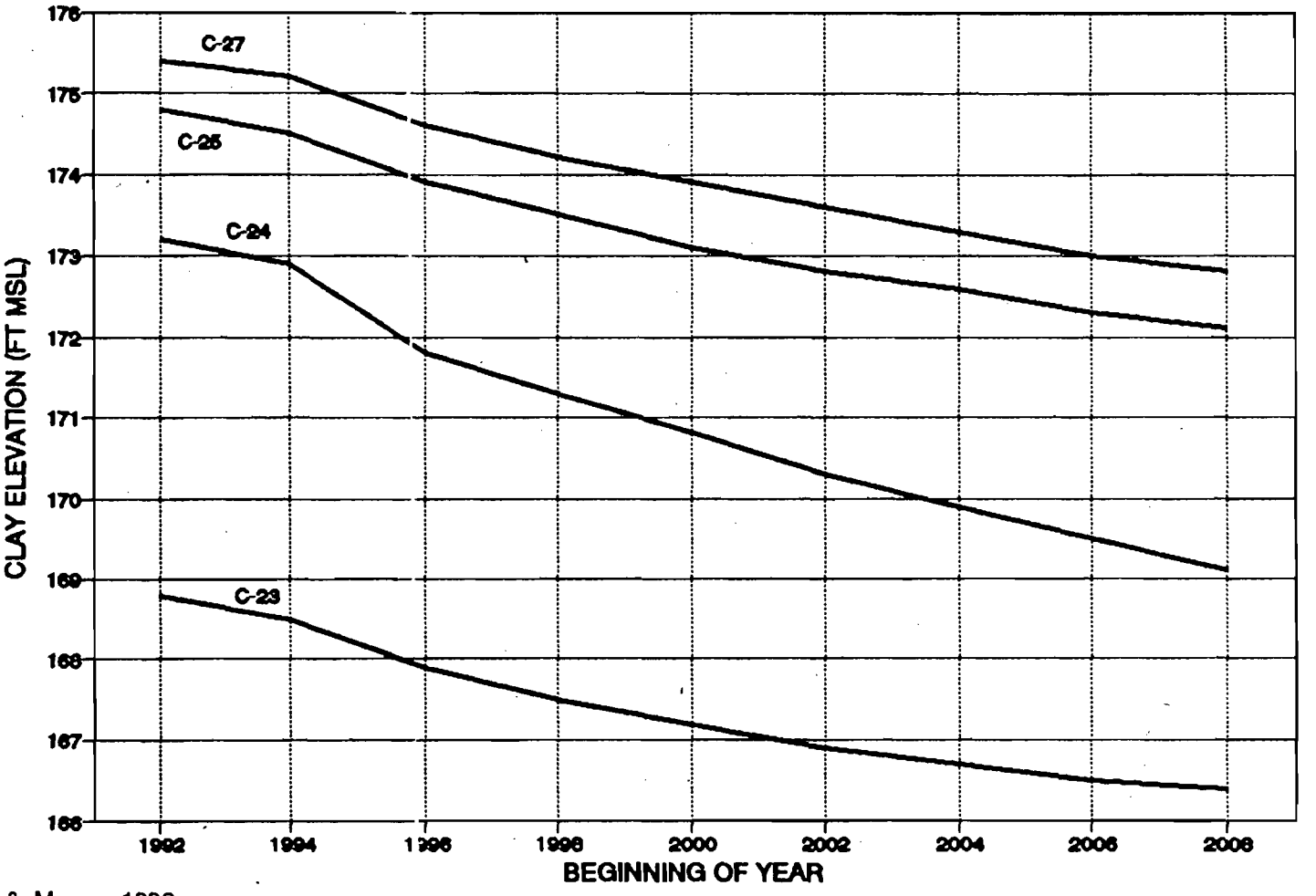


Source: Dames & Moore, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-21
CLAY CONSOLIDATION MODELING PREDICTION
CLAY POND SA-8, BORINGS C-20, C-22, C-26, C-28

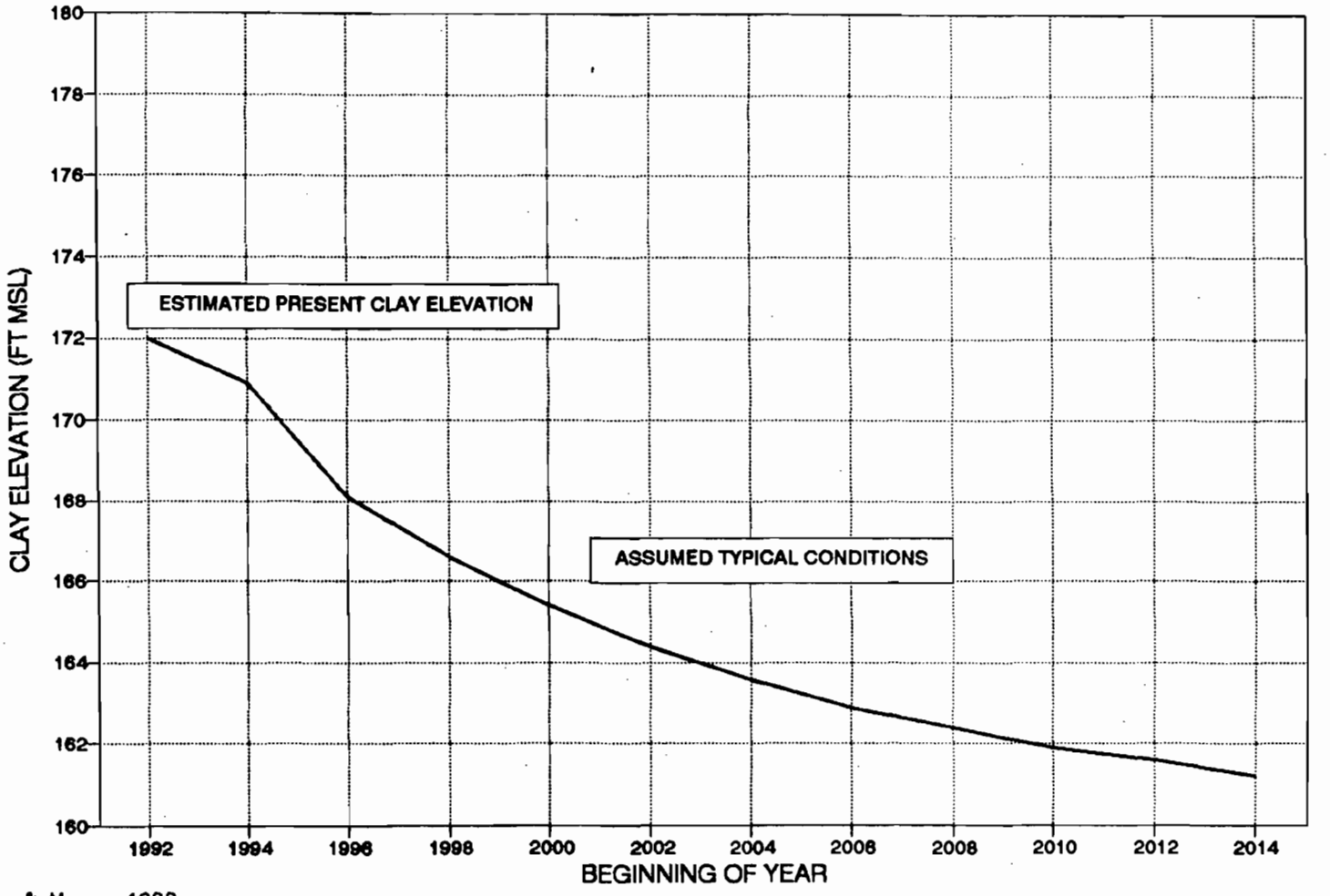


Source: Dames & Moore, 1992

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Polk County Site

FIGURE 3.7.1-22
CLAY CONSOLIDATION MODELING PREDICTION
CLAY POND SA-9, BORINGS C-23, C-24, C-25, C-27

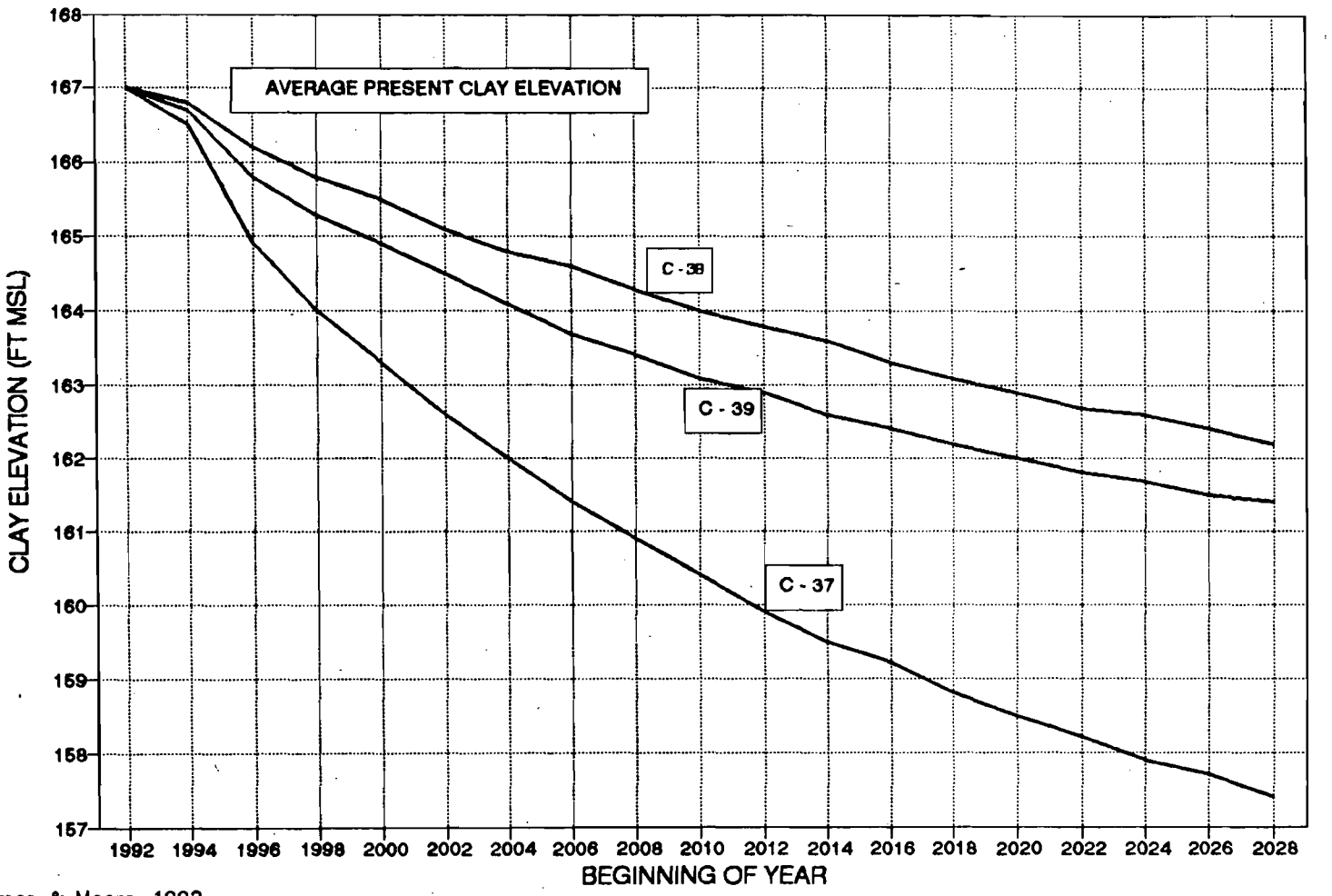


Source: Dames & Moore, 1992

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Polk County Site

FIGURE 3.7.1-23
CLAY CONSOLIDATION MODELING PREDICTION
CLAY POND SA-10

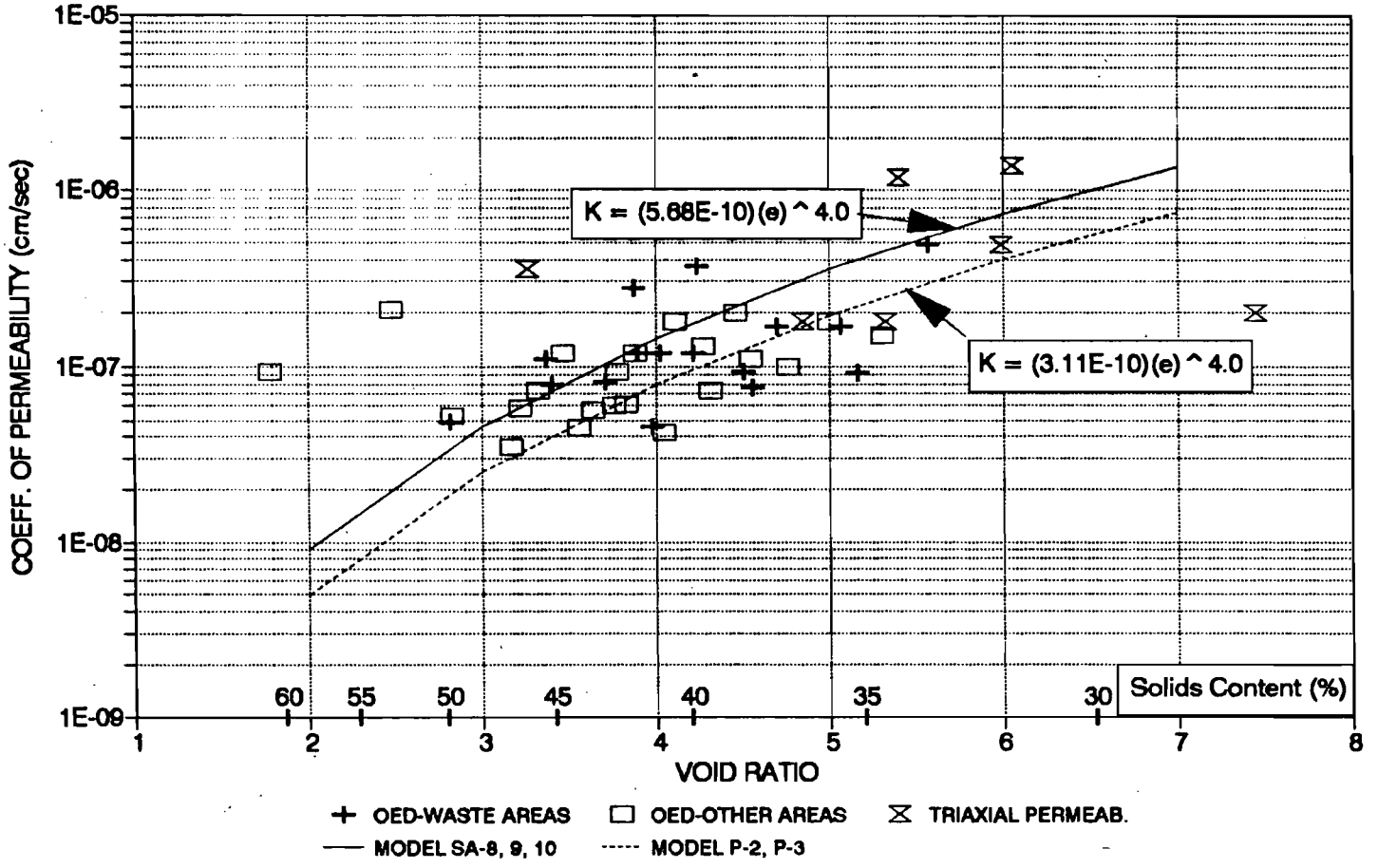


Source: Dames & Moore, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-24
CLAY CONSOLIDATION MODELING PREDICTION
CLAY POND P-3, BORINGS C-37, C-38, C-39

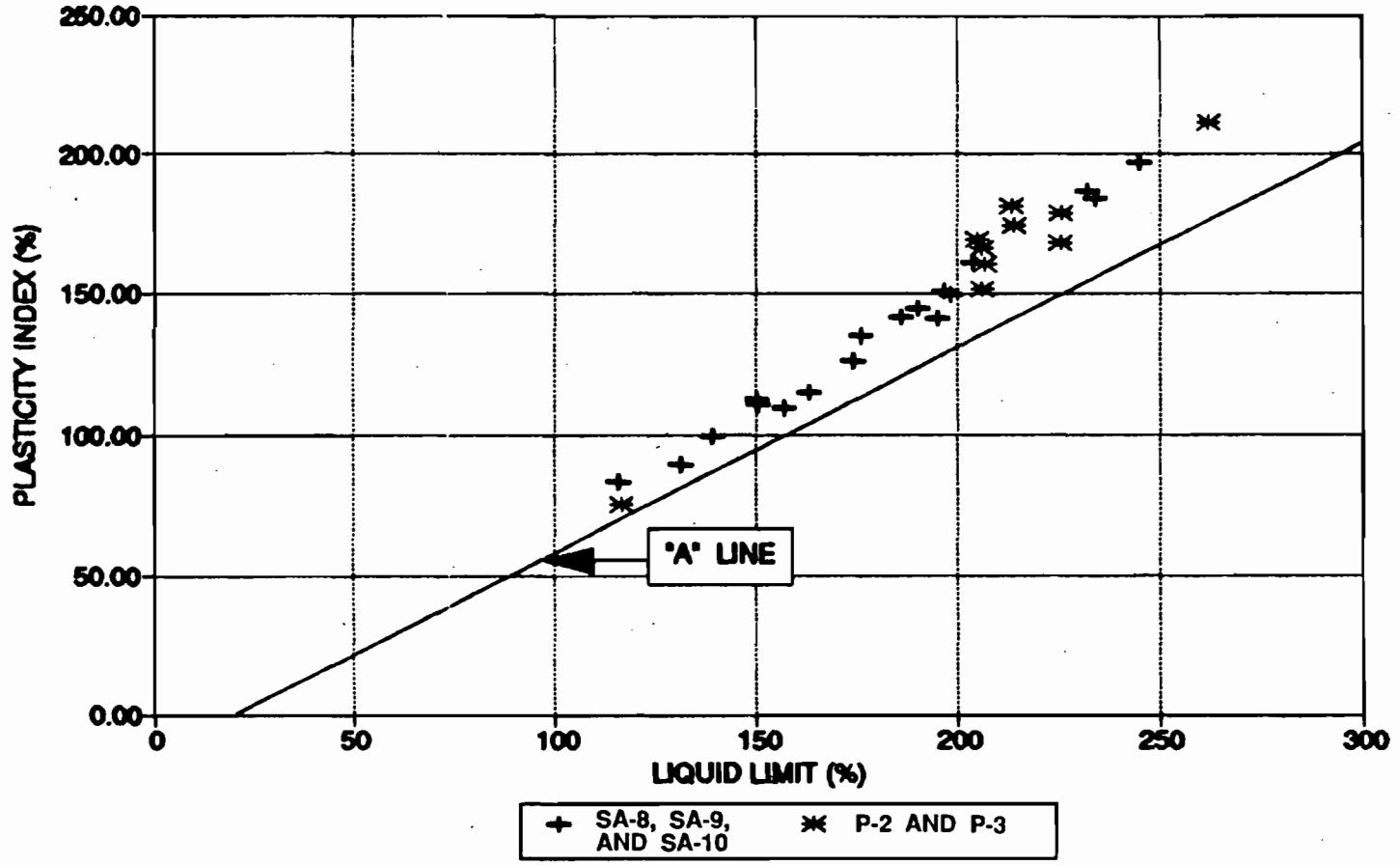


Source: Dames & Moore, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-25
PERMEABILITY RELATIONSHIPS SOLID WASTE DISPOSAL AREAS

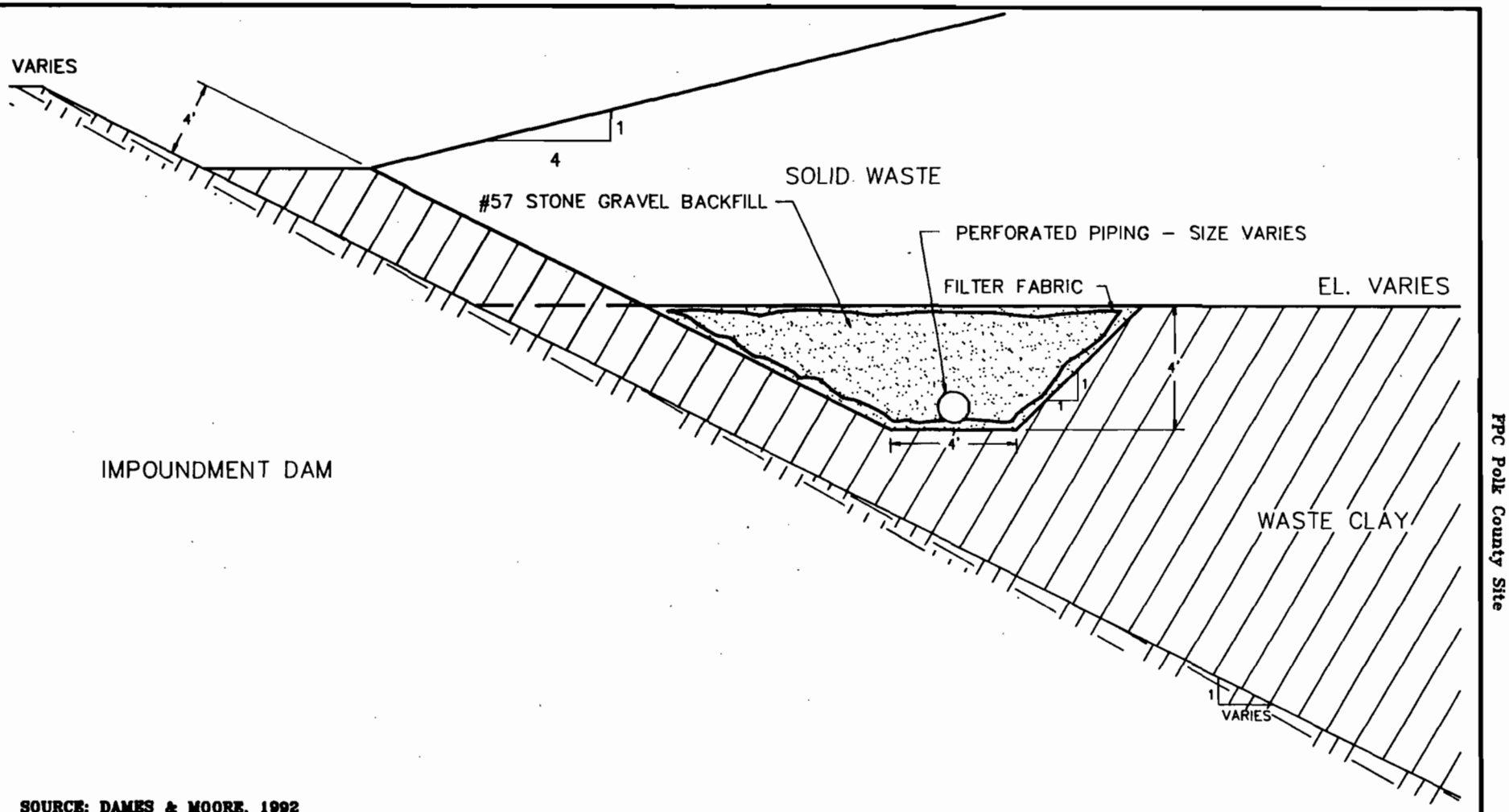


Source: Dames & Moore, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-26
ATTERBERG TEST RESULTS

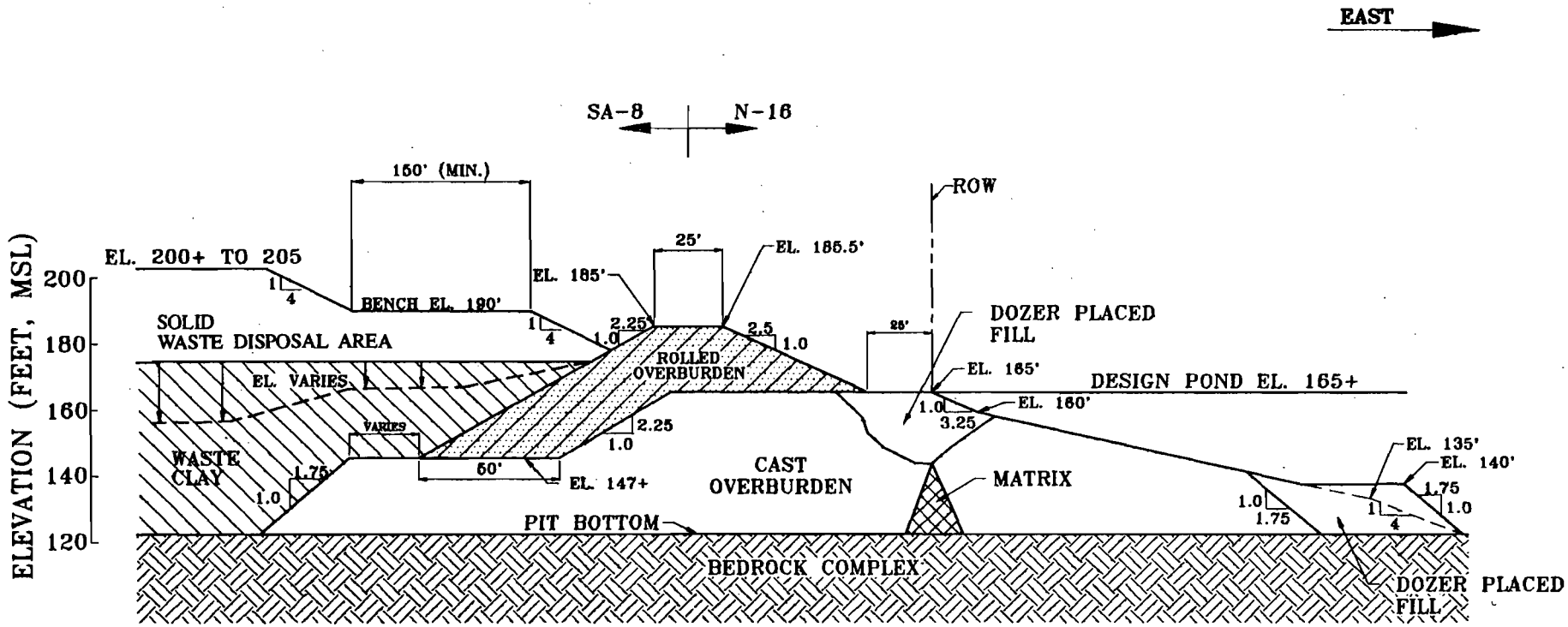


SOURCE: DAMES & MOORE, 1992

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Polk County Site

FIGURE 3.7.1-27
TYPICAL EDGE LINER AND LEACHATE COLLECTION DETAIL SOLID WASTE DISPOSAL AREA



Source: Dames & Moore, 1992

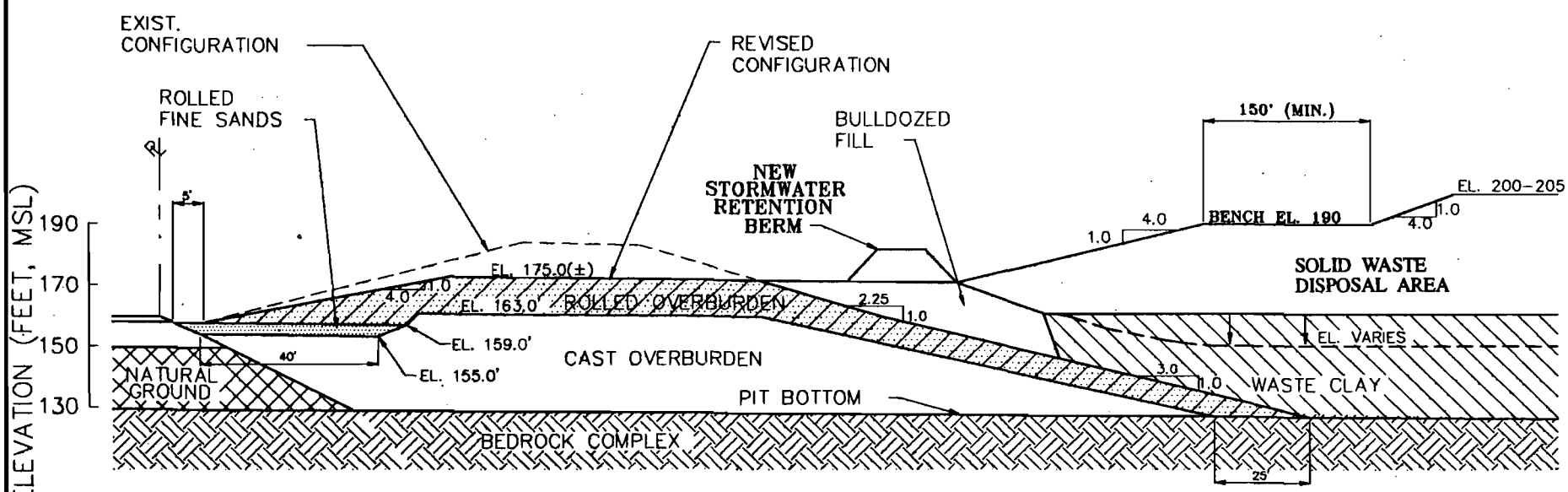
FOR CROSS-SECTION LOCATION,
SEE FIGURE 3.7.1-3

(MODIFIED AFTER ARDAMAN 1978)

Florida Power
CORPORATION

Polk County Site

FIGURE 3.7.1-28
CONCEPTUAL CROSS-SECTION A-A'
SA-8 EAST EMBANKMENT



Source: Dames & Moore, 1992

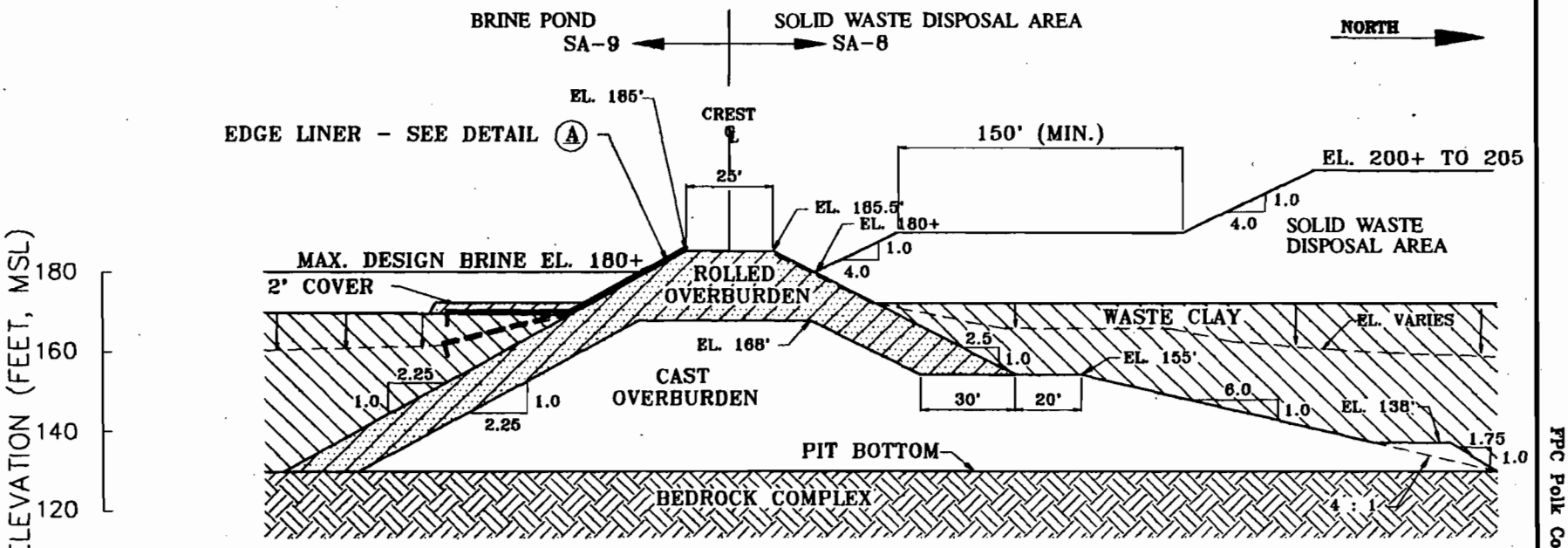
FOR CROSS-SECTION LOCATION, SEE FIGURE 3.7.1-3

(MODIFIED AFTER ARDAMAN 1978)

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-29
CONCEPTUAL CROSS-SECTION B-B'
SA-8 NORTH AND NORTHWEST EMBANKMENTS



Source: Dames & Moore, 1992

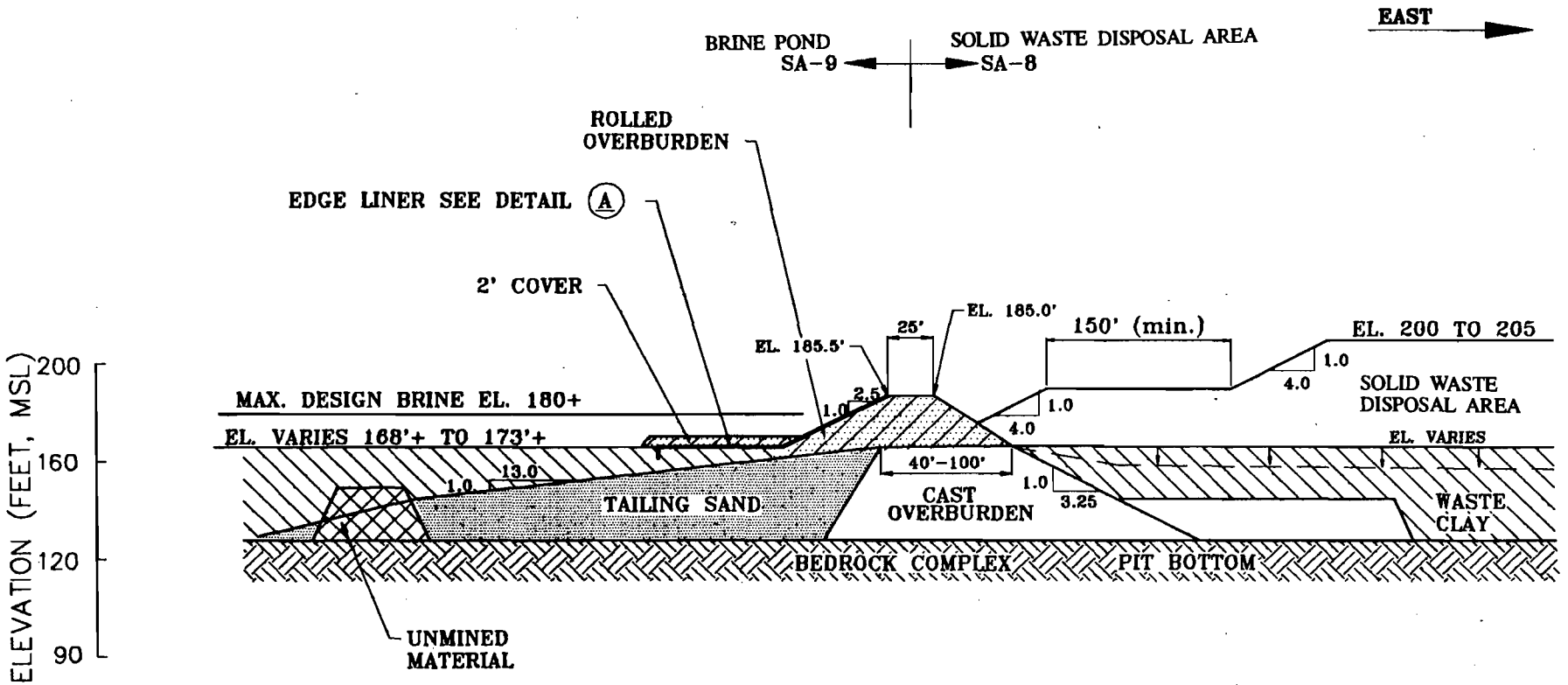
FOR CROSS-SECTION LOCATION, SEE FIGURE 3.7.1-3

(MODIFIED AFTER ARDAMAN 1978)

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-30
CONCEPTUAL CROSS-SECTION C-C'
SA-9 NORTH EMBANKMENT



Source: Dames & Moore, 1992

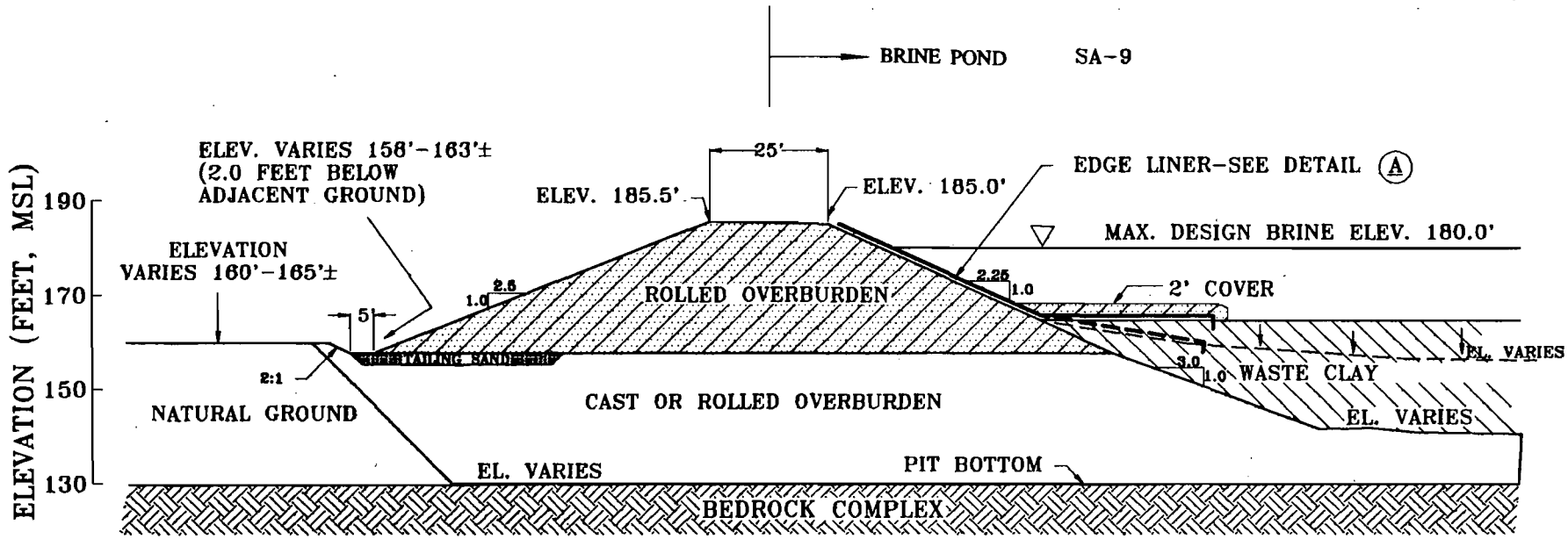
FOR CROSS-SECTION LOCATION, SEE FIGURE 3.7.1-3

(MODIFIED AFTER ARDAMAN 1979)

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-31
CONCEPTUAL CROSS-SECTION D-D'
SA-9 EAST EMBANKMENT



Source: Dames & Moore, 1992

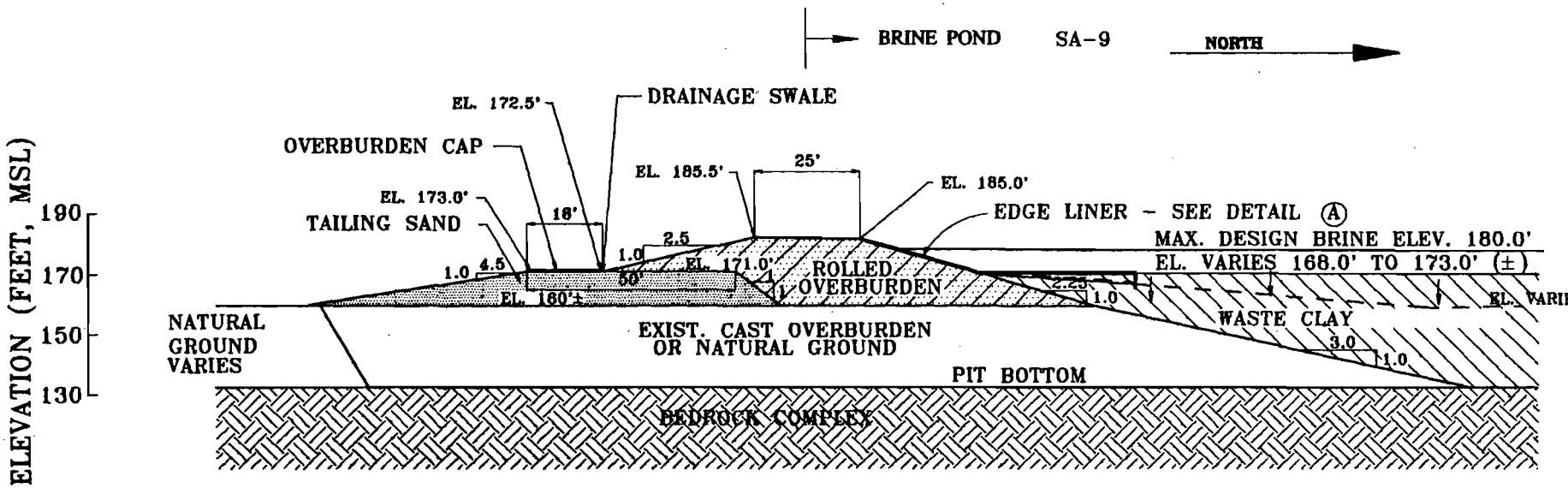
FOR CROSS-SECTION LOCATION, SEE FIGURE 3.7.1-3

(MODIFIED AFTER ARDAMAN 1979)

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-32
CONCEPTUAL CROSS-SECTION E-E'
SA-9 WEST AND SOUTHWEST WALLS



Source: Dames & Moore, 1992

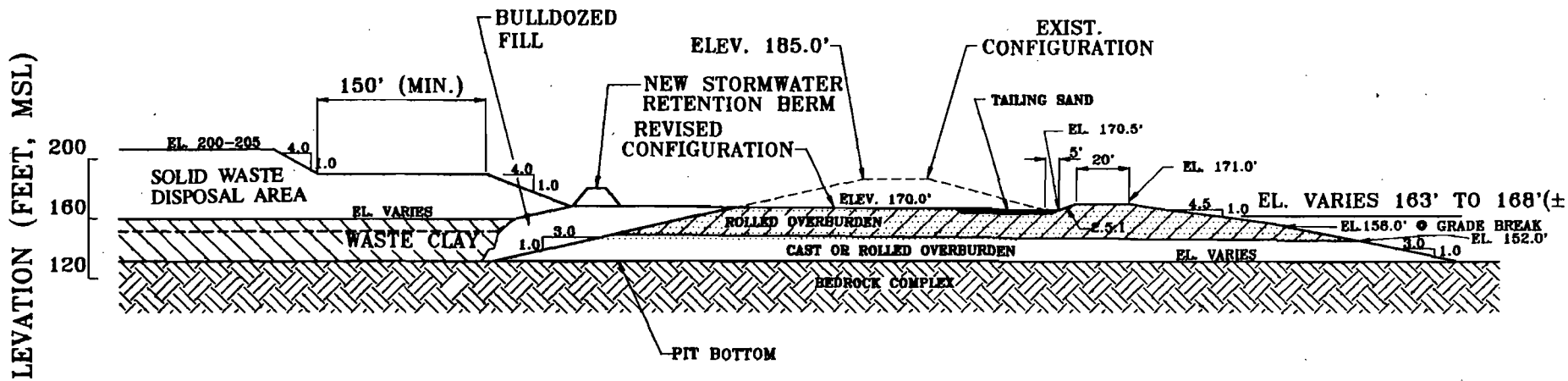
FOR CROSS-SECTION LOCATION, SEE FIGURE 3.7.1-3

(MODIFIED AFTER ARDAMAN 1979)

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-33
CONCEPTUAL CROSS-SECTION F-F'
SA-9 SOUTH EMBANKMENT



Source: Dames & Moore, 1992

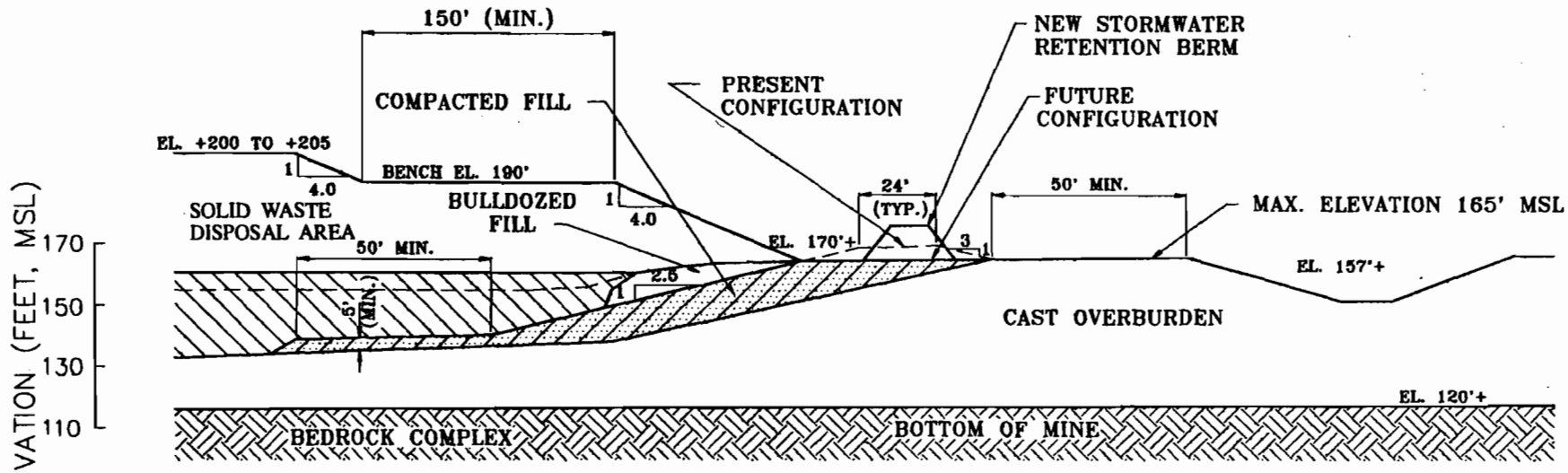
FOR CROSS-SECTION LOCATION, SEE FIGURE 3.7.1-4

(MODIFIED AFTER ARDAMAN 1981)

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-34
CONCEPTUAL CROSS-SECTION A-A'
SA-10 EMBANKMENT



Source: Dames & Moore, 1992

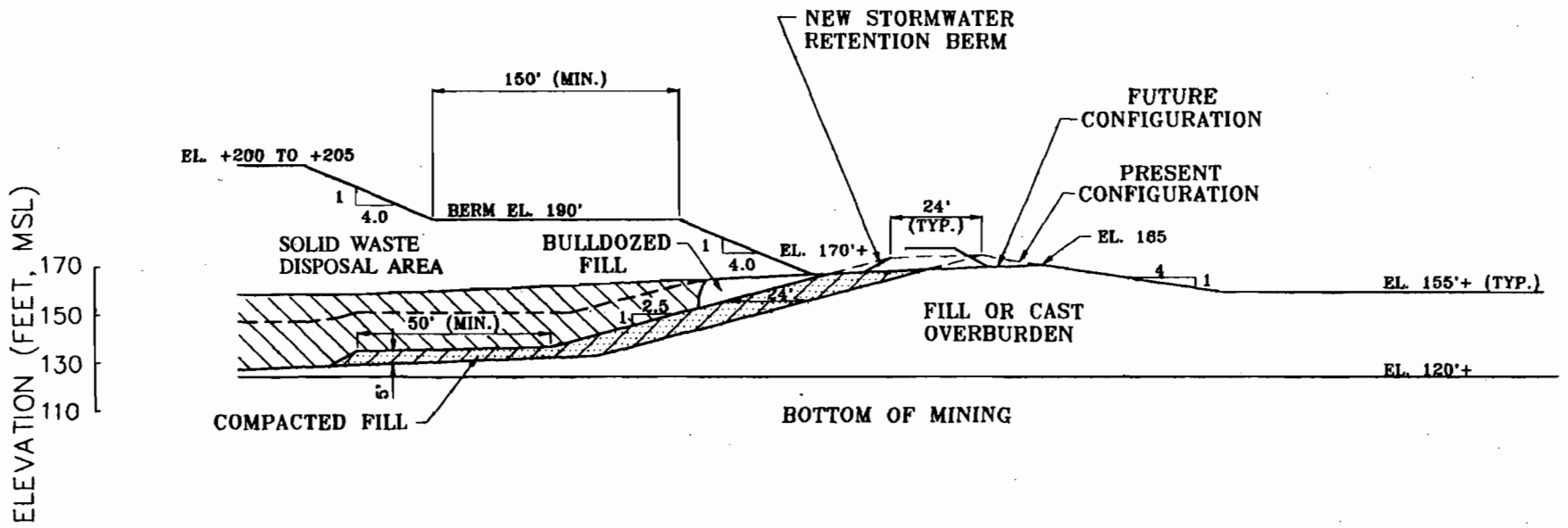
FOR CROSS-SECTION LOCATION, SEE FIGURE 3.7.1-5

(MODIFIED AFTER ARMAC 1977)

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-35
CONCEPTUAL CROSS-SECTION A-A'
P-2 EMBANKMENT



Source: Dames & Moore, 1992

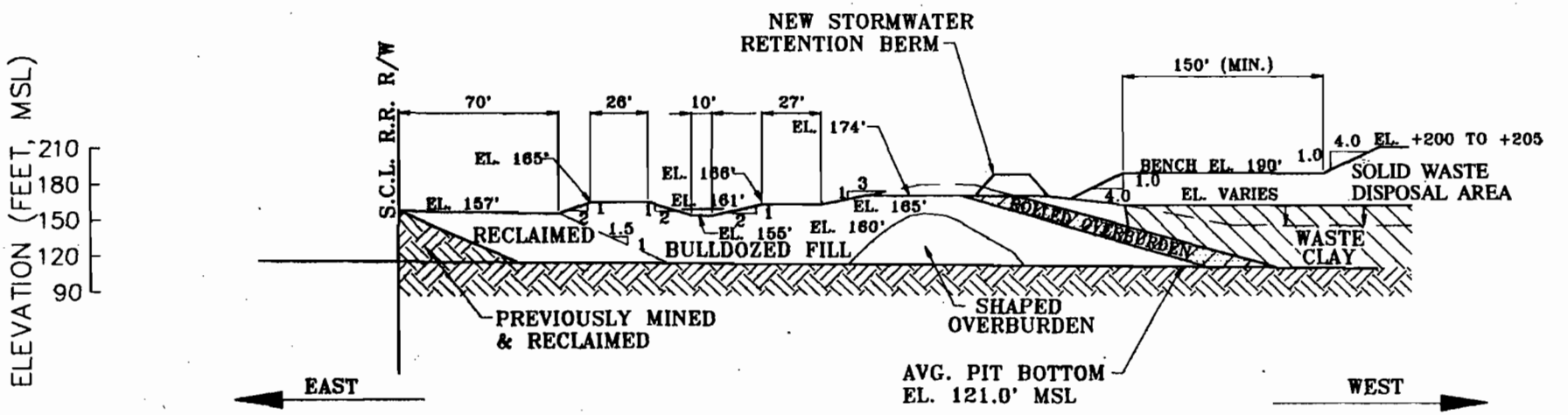
FOR CROSS-SECTION LOCATION, SEE FIGURE 3.7.1-5

(MODIFIED AFTER ARMAC 1977)

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-36
CONCEPTUAL CROSS-SECTION B-B'
P-2 EMBANKMENT



Source: Dames & Moore, 1992

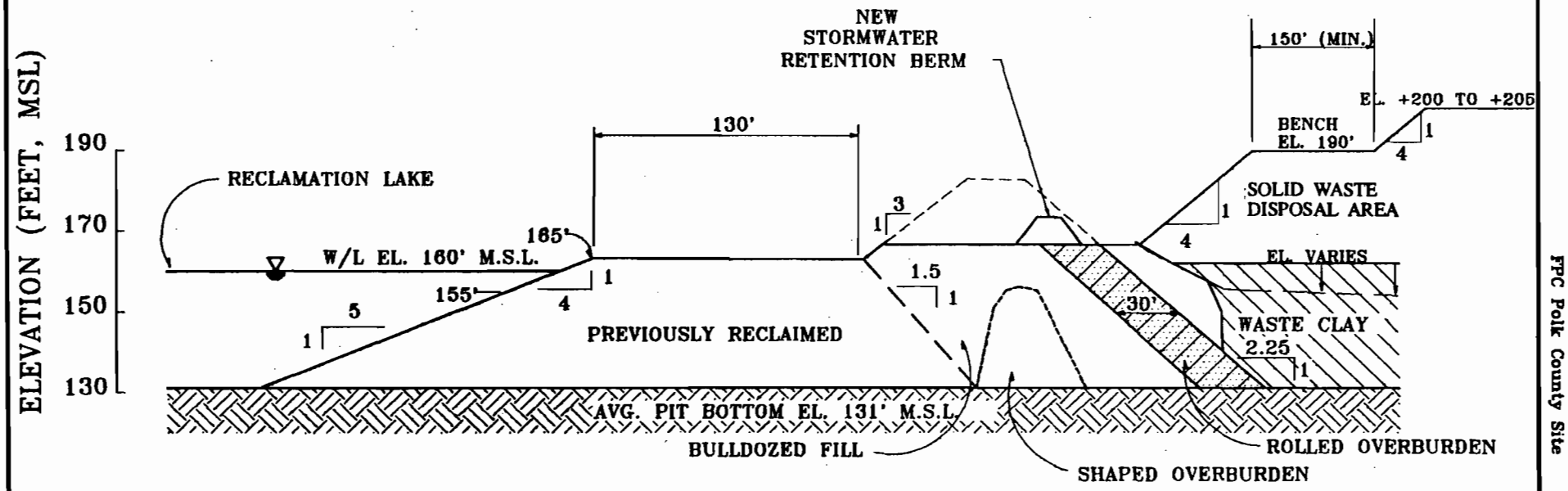
FOR CROSS-SECTION LOCATION, SEE FIGURE 3.7.1-6

(MODIFIED AFTER ARMAC 1979)

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Polk County Site

FIGURE 3.7.1-37
CONCEPTUAL CROSS-SECTION A-A'
P-3 EAST EMBANKMENT



Source: Dames & Moore, 1992

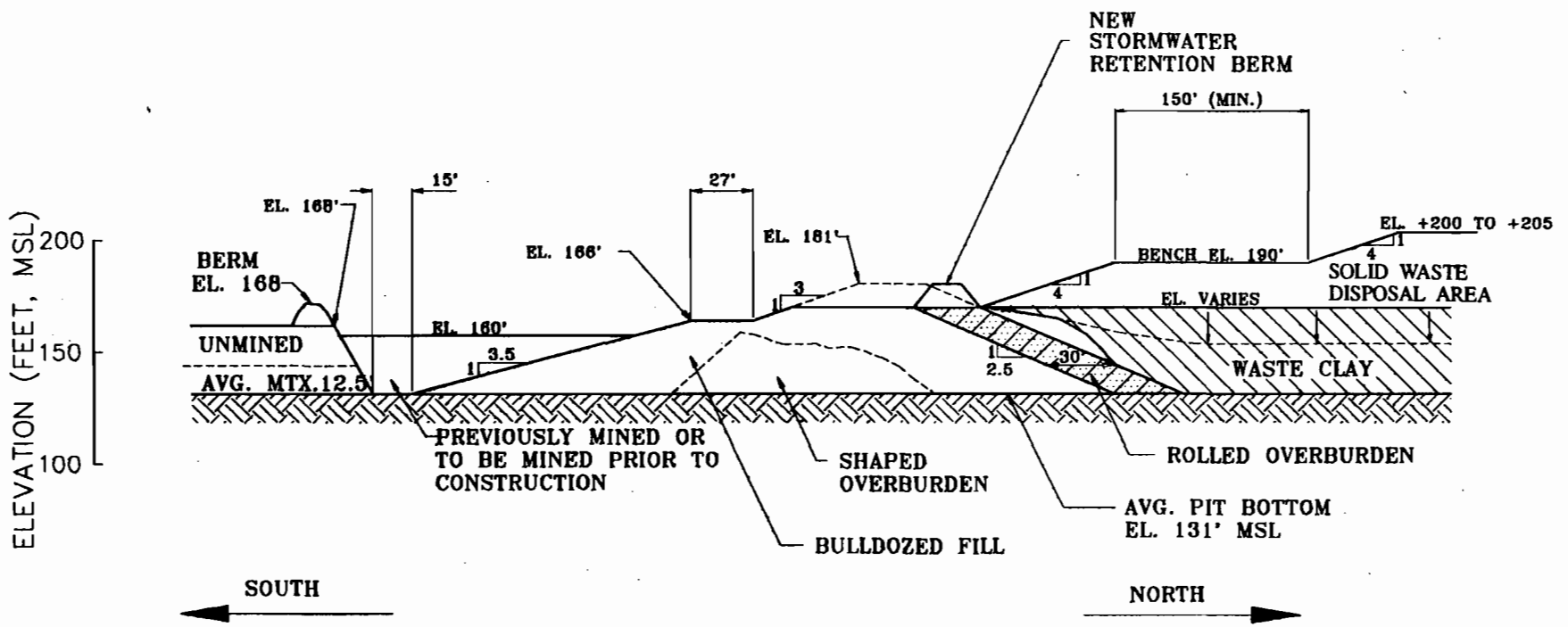
FOR CROSS-SECTION LOCATION,
SEE FIGURE 3.7.1-6

(MODIFIED AFTER ARMAC 1979)

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FIGURE 3.7.1-38
CONCEPTUAL CROSS-SECTION B-B'
P-3 SOUTHEAST EMBANKMENT



Source: Dames & Moore, 1992

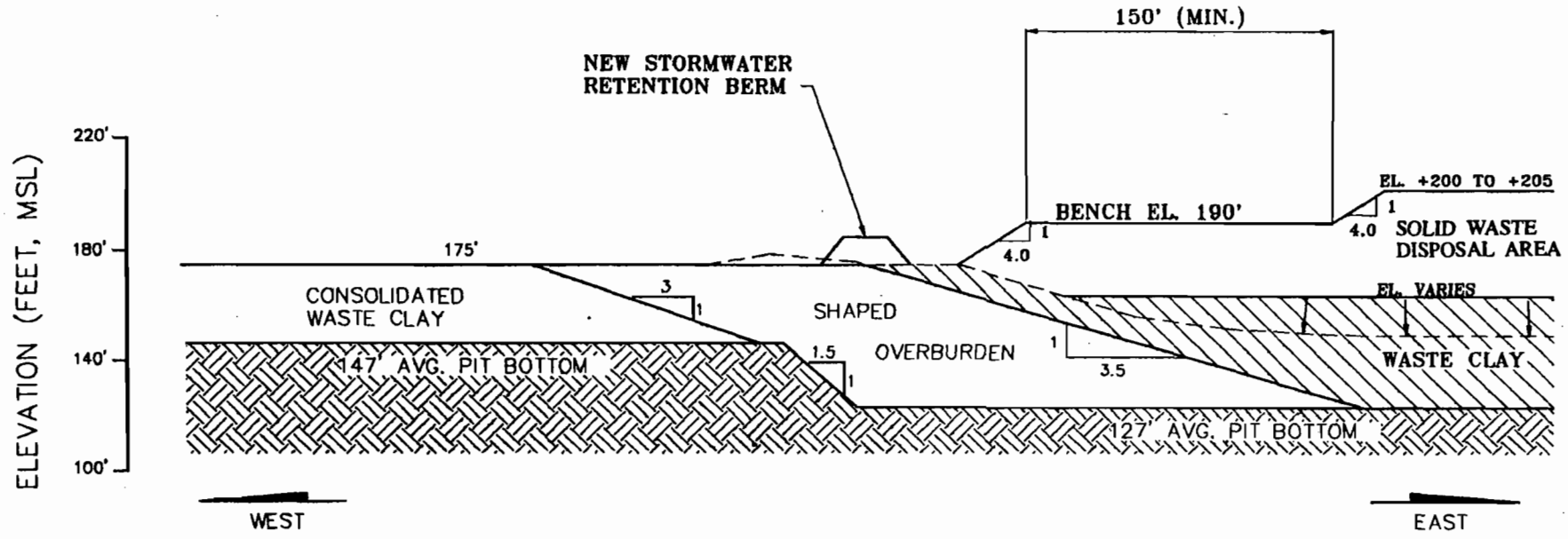
FOR CROSS-SECTION LOCATION,
SEE FIGURE 3.7.1-6

(MODIFIED AFTER ARMAC 1979)

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FIGURE 3.7.1-39
CONCEPTUAL CROSS-SECTION C-C'
P-3 SOUTH EMBANKMENT



Source: Dames & Moore, 1992

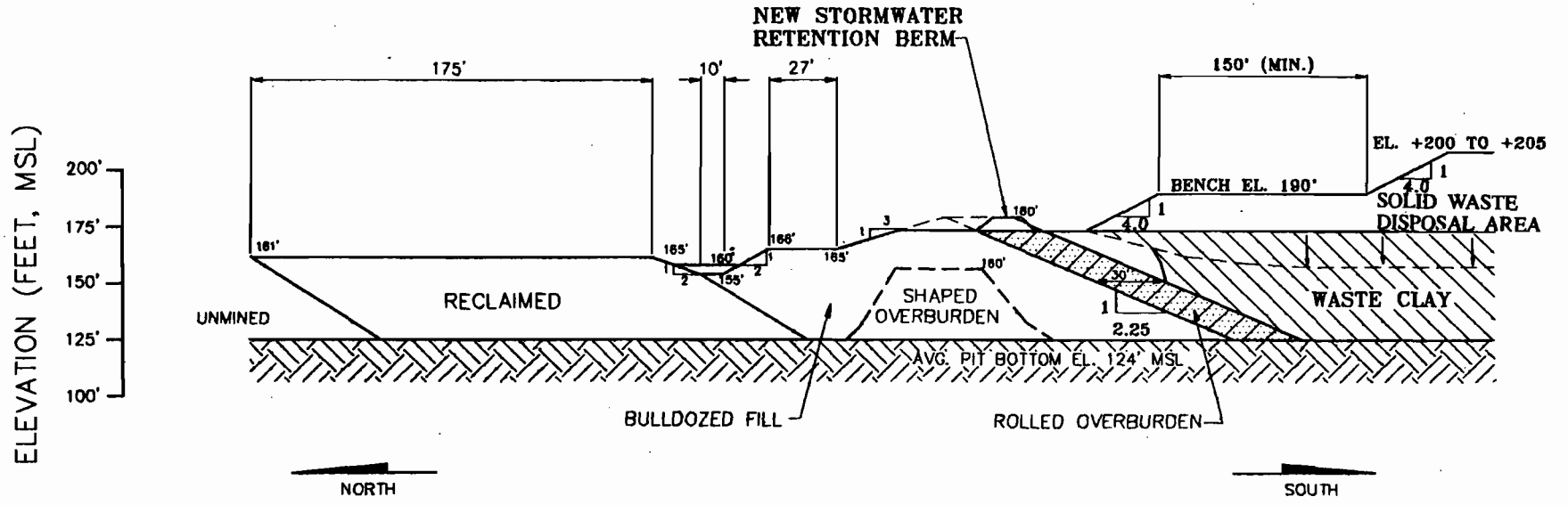
FOR CROSS-SECTION LOCATION, SEE FIGURE 3.7.1-6

(MODIFIED AFTER ARMAC 1979)

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FIGURE 3.7.1-40
CONCEPTUAL CROSS-SECTION D-D'
P-3 WEST EMBANKMENT



Source: Dames & Moore, 1992

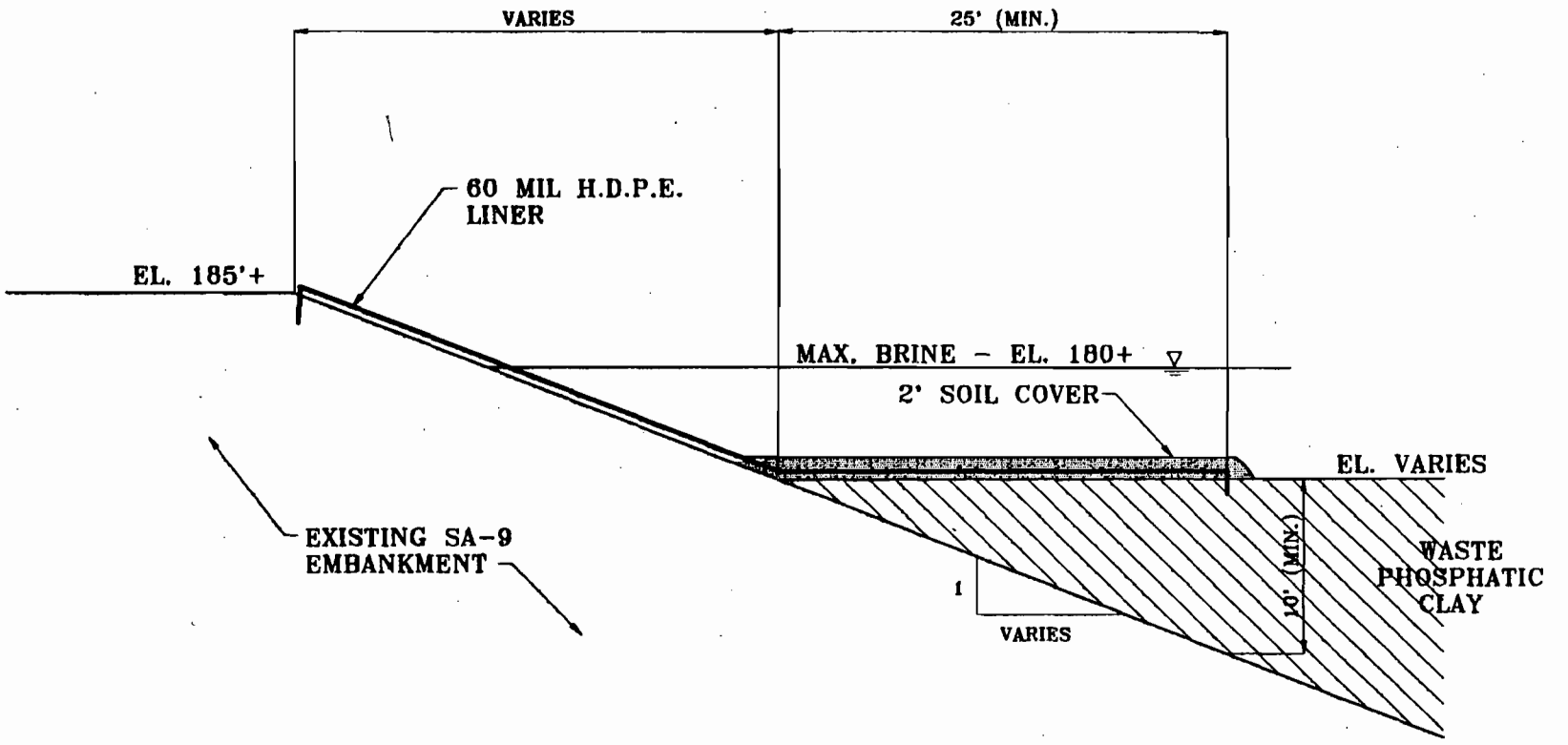
FOR CROSS-SECTION LOCATION, SEE FIGURE 3.7.1-6

(MODIFIED AFTER ARMAC 1979)

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FIGURE 3.7.1-41
CONCEPTUAL CROSS-SECTION E-E'
P-3 NORTH EMBANKMENT

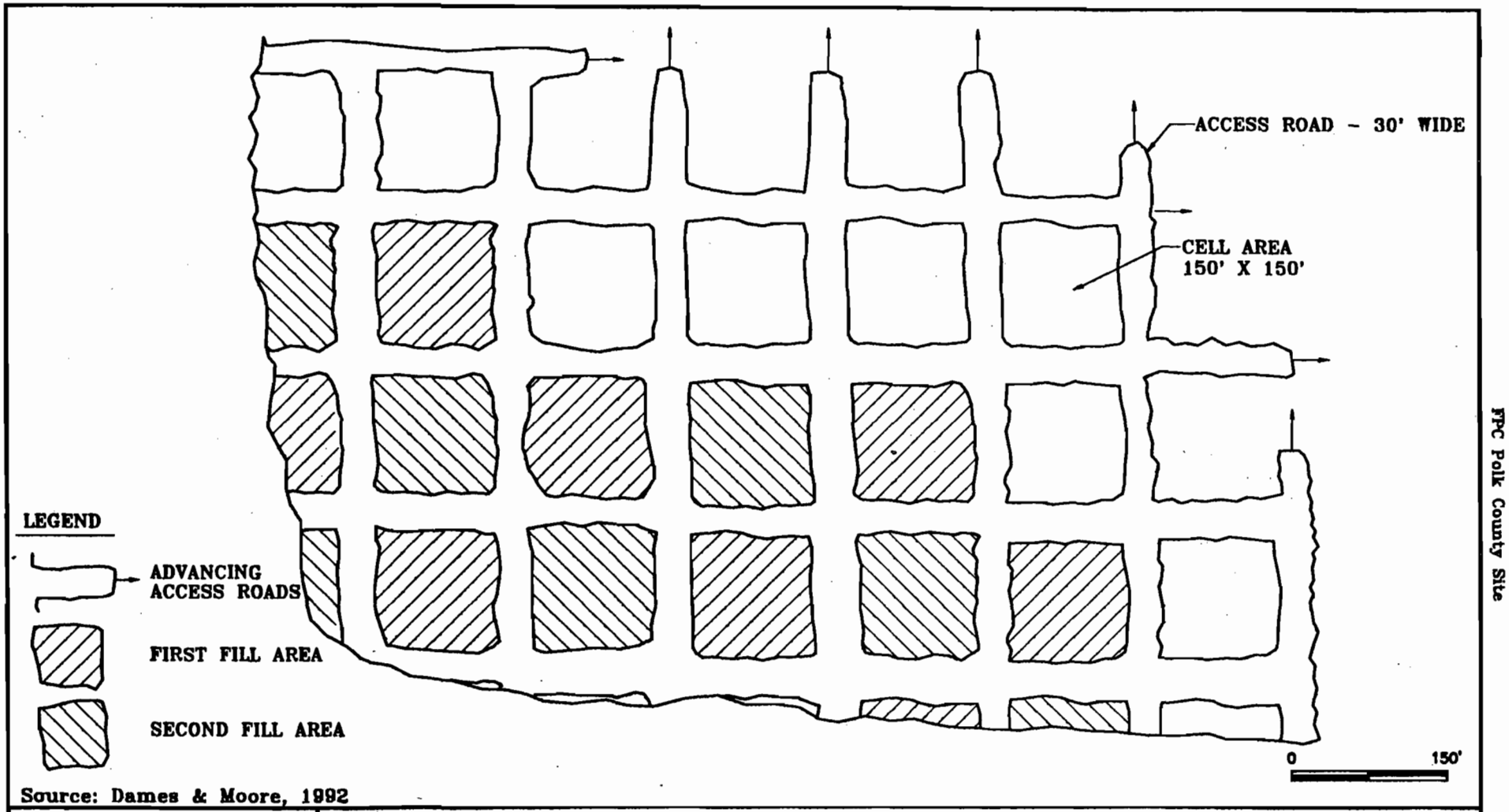


Source: Dames & Moore, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 3.7.1-42
TYPICAL EDGE LINER DETAIL (A)
SA-9 BRINE POND

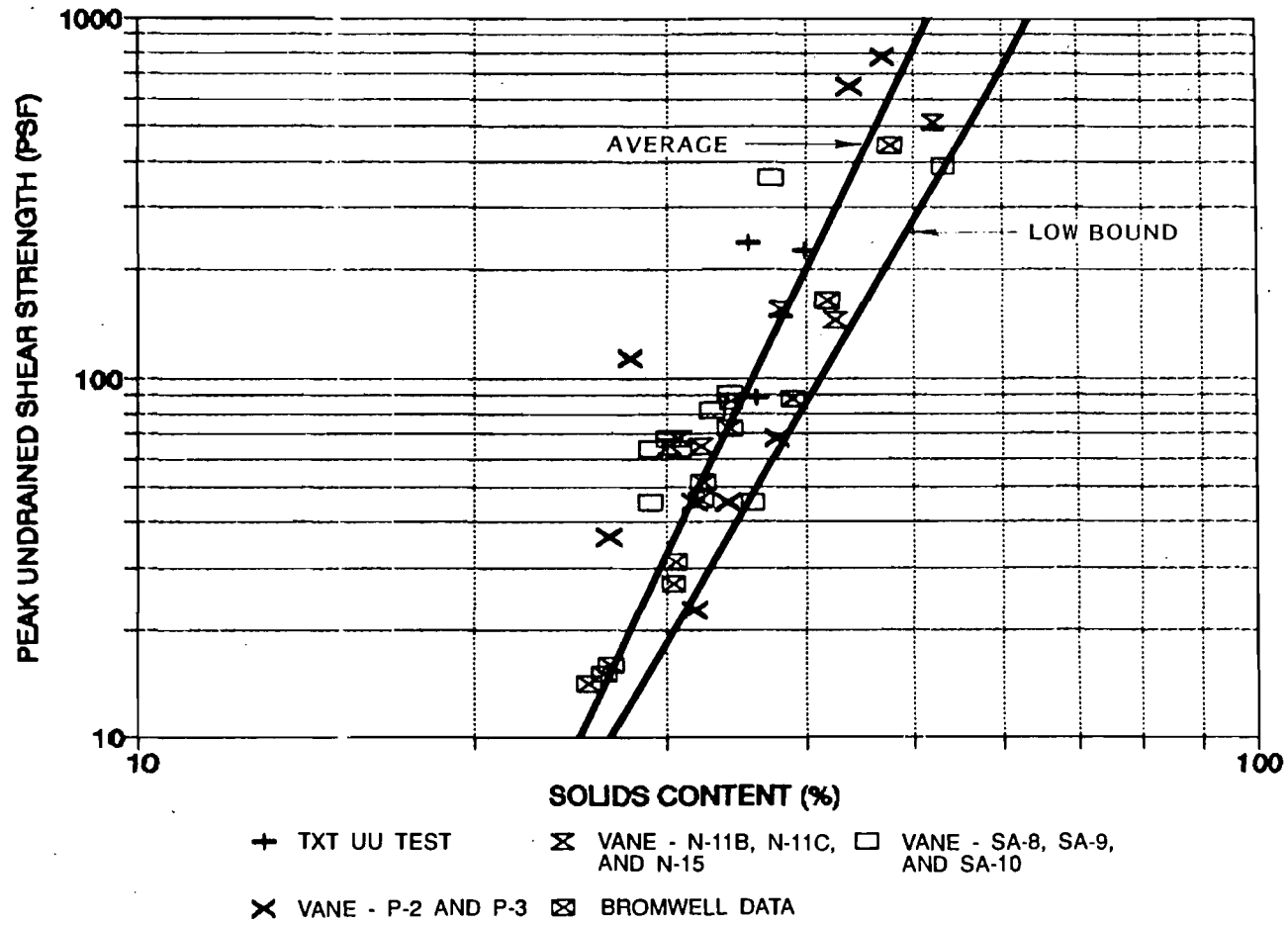


Source: Dames & Moore, 1992

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FIGURE 3.7.1-43
SCHEMATIC OF FIRST LIFT WASTE FILL ADVANCEMENT SEQUENCING

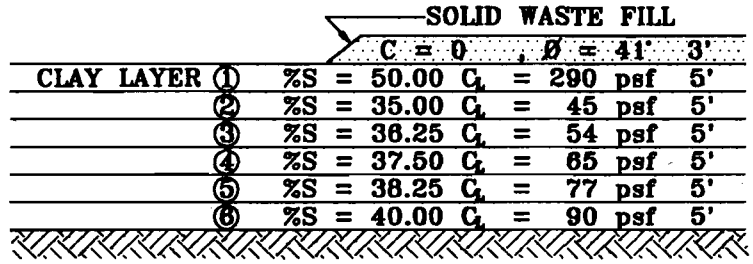


Source: Dames & Moore, 1992

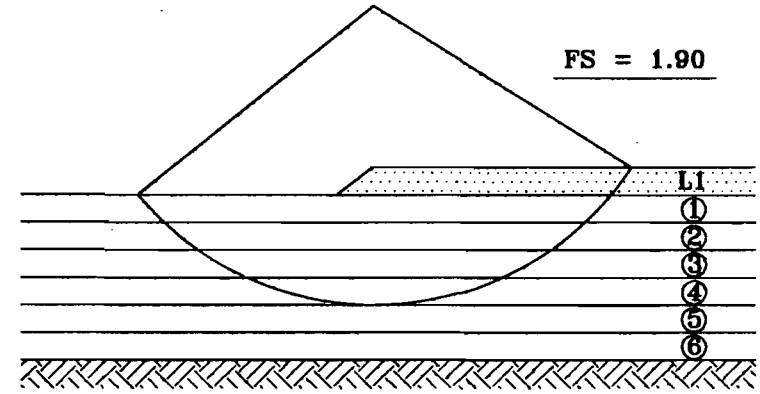
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FIGURE 3.7.1-44
UNDRAINED SHEAR STRENGTH DATA
CLAY SETTLING AREAS



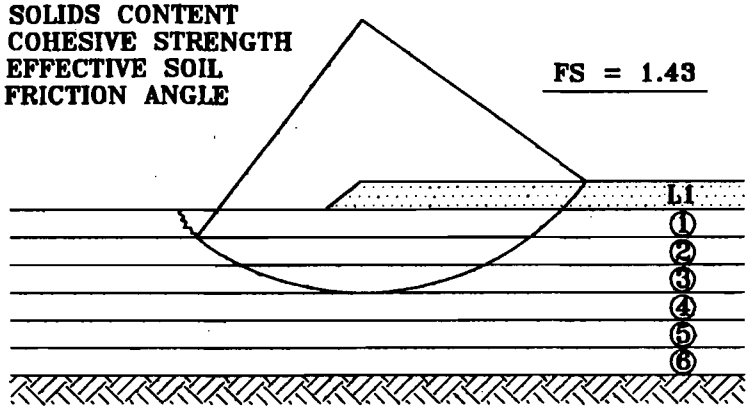
ANALYZED PROFILE



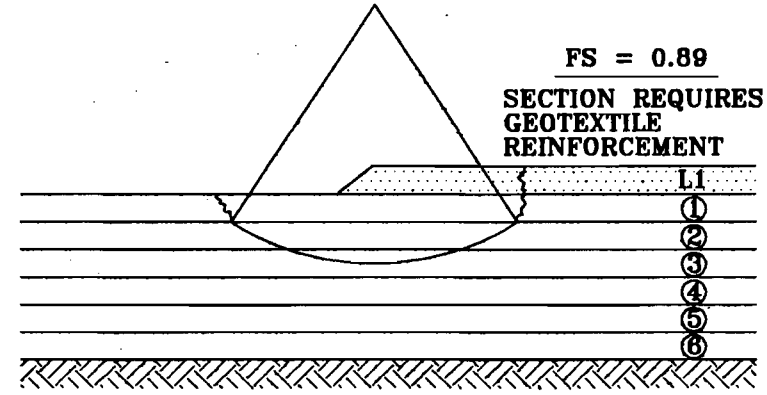
SCENARIO I – **UNCRACKED CRUST**

LEGEND

%S = SOLIDS CONTENT
C = COHESIVE STRENGTH
ø = EFFECTIVE SOIL FRICTION ANGLE



SCENARIO II – **CRACKED EXTERIOR CRUST**



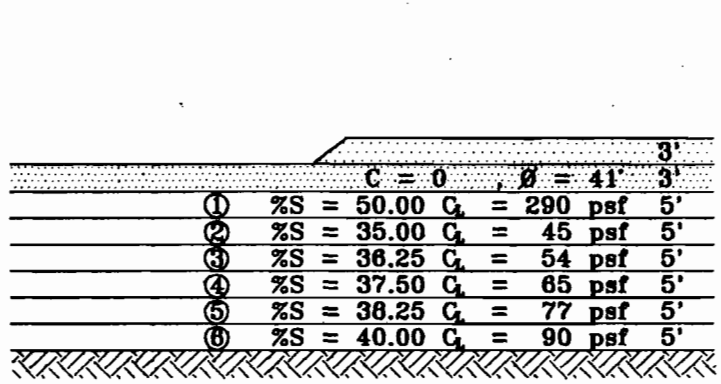
SCENARIO III – **CRACKED EXT./INT. CRUST**

Source: Dames & Moore, 1992

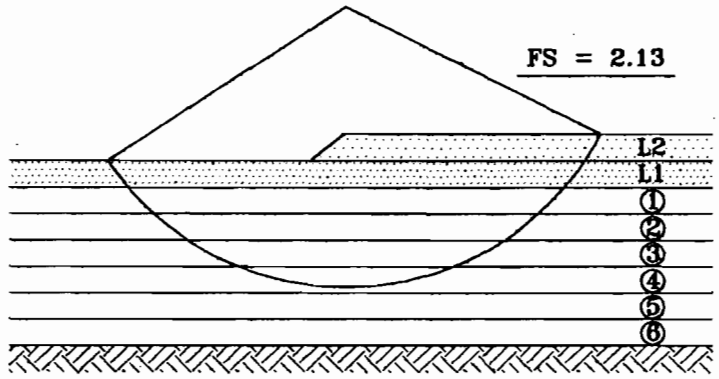
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FIGURE 3.7.1-45
STABILITY ANALYSIS
PLACEMENT OF FIRST SOLID WASTE LIFT



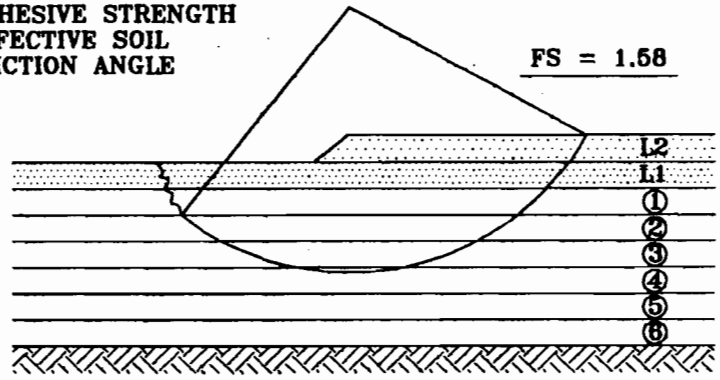
TYPICAL CROSS-SECTION



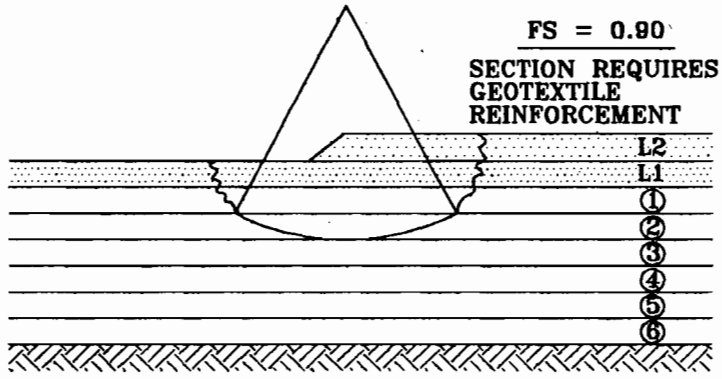
SCENARIO I – **UNCRACKED SECTION**

LEGEND

%S = SOLIDS CONTENT
C = COHESIVE STRENGTH
Ø = EFFECTIVE SOIL FRICTION ANGLE



SCENARIO II – **CRACKED EXTERIOR CRUST**



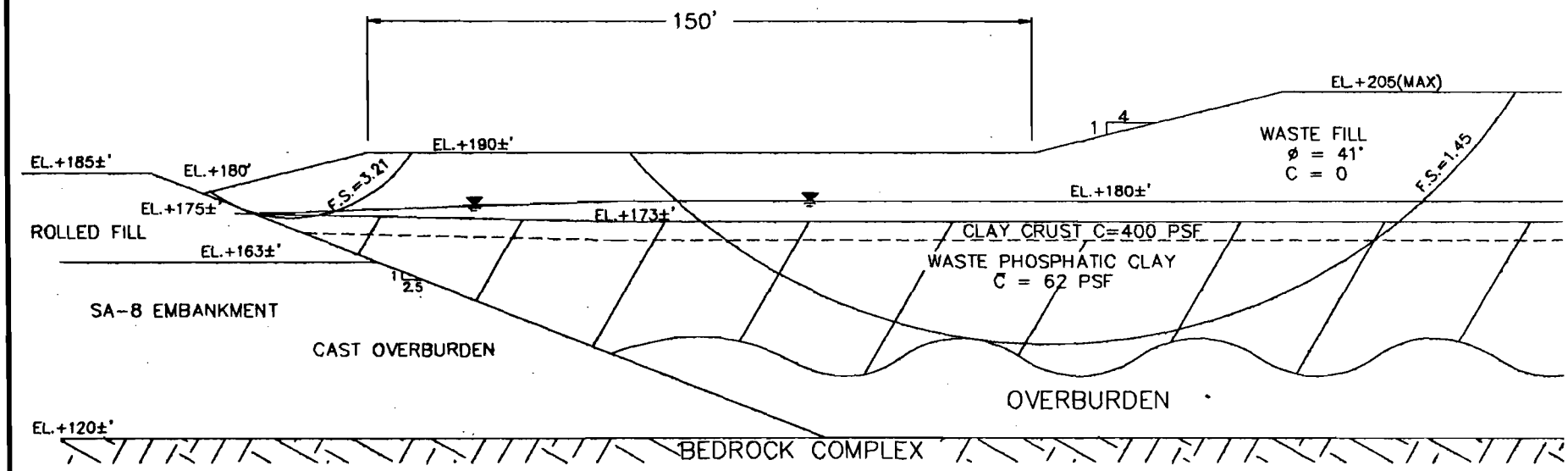
SCENARIO III – **CRACKED EXT./INT. CRUST**

Source: Dames & Moore, 1992

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Polk County Site

FIGURE 3.7.1-46
STABILITY ANALYSIS
PLACEMENT OF SECOND SOLID WASTE LIFT

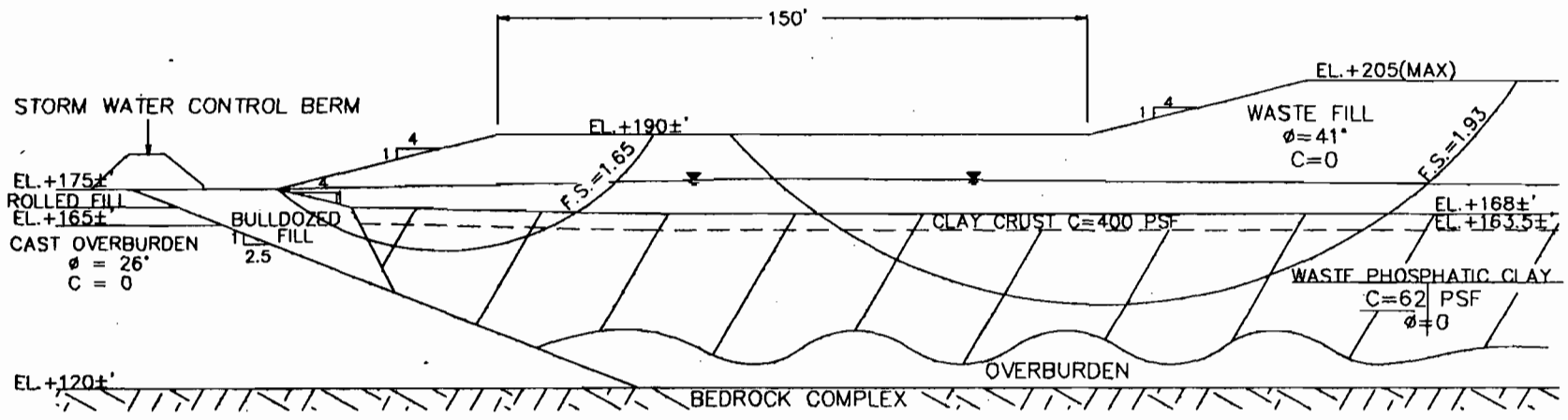


Source: Domes & Moore, 1992

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Polk County Site

FIGURE 3.7.1-47
PERIMETER STABILITY OF SOLID WASTE DISPOSAL AREA TEST 1



Source: Dames & Moore, 1992

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Polk County Site

FIGURE 3.7.1-48
PERIMETER STABILITY OF SOLID WASTE DISPOSAL AREA TEST 2

3.8 ON-SITE DRAINAGE SYSTEM

Two unique features of this project render the design of the on-site drainage system extremely simple in concept. The first feature is that most of the site presently is part of active phosphate operations (mining beneficiation, water recirculation, or reclamation) and will remain so until or beyond the time when the initial power plant unit comes on line. The second feature is the zero surface water discharge design of the site, particularly with respect to the effect of that design upon surface water management.

Detailed surface water management information, including informational requirements for the Southwest Florida Water Management District (SWFWMD) and Polk County, and applicable drainage calculations, are presented in Appendices 10.5.4, 10.5.4.3, and 10.5.4.7.

3.8.1 Design Parameters

The major design parameter governing all facets of the project design is the design storm. Because the project intention is to operate as a zero discharge facility under any meteorological conditions, the design storm selected is the Probable Maximum Precipitation (PMP). As defined by the Bureau of Reclamation (Design of Small Dams, Bu Rec, U.S. Dept. of the Interior, 2nd Edition, 1973), "probable maximum precipitation values represent an envelopment of maximized intensity-duration values obtained from all types of storms." In other words, the PMP is an estimate which "judged by present knowledge, appears to be the limit of nature's capabilities." Based on Bu Rec (1973), the PMP is estimated to be about 31 inches within 6 hours for the Polk County Site.

To avoid surface water discharges, enough freeboard (empty space) must be maintained in the cooling ponds and other portions of the surface water management system between the maximum water level and the lowest point on the retaining dike. This freeboard needs to include room for both the 31-inch PMP, and also an allowance for wave runup due to sustained wind. For a maximum fetch of about 2 miles (diagonal of N-15) and a maximum wind speed of 120 mph (South Florida Building Code), a maximum wave height of 4 feet is estimated. Wave runup is estimated at 1.5 times wave height (Bu Rec 1973), or about 6 feet. Thus, the conservative freeboard design for the Polk County Site has been set at 8.6 feet.

3.8.2 Construction Phase Runoff

Reclamation activities are underway currently on certain parts of the Polk County Site. Reclamation efforts associated with modified reclamation plans which the mine companies have filed will run from approval through July 1996. These efforts involve dewatering SA-11, SA-12, SA-13, N-16, SA-8, SA-9, and N-9B.

The dewatering effluent will be sent to the IMC Noralyn mine via the existing mine water return system in Phosphoria, to the Estech permitted outfall in SA-11, or U.S. Agrichemical Corporation's existing mine water return system in N-9 (see Figure 3.8.2-1). Similarly, N-11A and N-13 will be dewatered through the off-site pond N-10 which is part of the other existing water return system for the IMC Noralyn Mine. The solid waste disposal areas west of CR 555 will remain as they presently are under reclamation, i.e., SA-10 will drain southwest to the Estech system and P-2, P-3, and Phosphoria will drain (under reclamation) into the western IMC Noralyn mine water return system. Of the three remaining parcels, N-11B will drain into N-16, N-11C will drain into N-15, and N-15 will drain into the western IMC Noralyn mine water return system. Because much of these waters will be input to the IMC Noralyn mine system, the mine's use of Upper Floridan Aquifer water can be expected to be less than the permitted value of 27 MGD.

After July 1996, with initial phase cooling pond construction complete, site runoff will be used to fill the N-16 cooling pond as much as is practical. During this same time frame, construction of the actual generating units will begin. Surface water flow patterns during this period are shown on Figure 3.8.2-2.

The plant island area will be graded as shown on Figure 4.1.1-1. The power block (generating and directly associated equipment) will be rough graded to approximate elevation 163 ft NGVD. The support area (future coal pile/rail/road/construction laydown and parking) will be rough graded to approximate elevation 160 NGVD. The storm water retention pond will be maintained at a normal pool with a water surface elevation of 154 ft NGVD, leaving sufficient volume to hold the 500-year 24-hour storm within the pond (for detailed calculations, see Appendix 10.5.4). During the PMP, water will overflow the pond but will be contained within the support area with no off-site discharge. The water surface elevation of 154 ft NGVD is maintained by pumping excess water to the cooling pond. This pumping will not collect surficial aquifer waters because all the surrounding areas are or will be reclaimed clay settling areas.

Drainage from the buffer areas (N-11A, N-13, and N-9B, but not Tiger Bay), the brine pond (SA-9), the initial SWDA (SA-8), one future SWDA (SA-10), and the future cooling pond areas (N-15, N-11C, and N-11B) will all be routed into the cooling pond to help fill it. The remaining SWDAs (P-3, Phosphoria, and P-2) will still contribute their drainage to the IMC Noralyn mine until about 1998 when mining operations in these areas will cease. Some reclaimed water may be available for use in filling the pond as well.

3.8.3 Operational Phase Storm Water Runoff

As described in Section 3.1, the operational phase will begin with the first unit scheduled to come on line in 1998. However, construction of additional units is predicted to continue for an additional 20 years, even though the site will have moved into an operational phase. The operational phase can be divided into two portions, based on phasing of the cooling pond development. The initial phase utilizes only N-16 as the cooling pond (see Section 3.5.1-1). Figure 3.8.3-1 depicts site drainage for this phase. The buffer areas (N-11A, N-13, N-9B, and Tiger Bay) will drain to the Camp Meeting Ground Branch watershed as non-point source runoff. This will be natural land surface runoff not subject to NPDES stormwater requirements. The brine pond (SA-9) and initial SWDA (SA-8) will be closed drainage systems with all rainfall retained. N-16 will be the cooling pond and the rest of the site will be used for water cropping. Each of the parcels west of CR 555 (P-3, P-2, SA-10, and Phosphoria) will be equipped with retention dikes and control devices so that they can each retain the PMP either without discharge or with discharges equal to the 25-year, 24-hour storm for which the surface water management pumping system has been designed (see Appendix 10.5.4.3). Prior to ultimate buildout, the areas N-15, N-11C, and N-11B will become part of the cooling pond (see Figure 3.8.3-2).

3.8.4 Parcel Descriptions

Clay Settling Area N-16. This area will be the initial cooling pond and will remain part of the cooling pond throughout the life of the project. The perimeter containment dams will have a top elevation of 172 ft NGVD. The bottom will be at about 146 ft NGVD and the water level will vary between 146 and 163 ft NGVD. It is described in more detail in Section 3.5.1.

Clay Settling Area SA-8. This area will serve as a water crop area during the initial filling of the cooling pond and will be the first area to be used as a solid waste disposal area during the operational phase. Prior to waste disposal, runoff from this area will be conveyed to the cooling

pond by pumping. The perimeter containment dams will have a top elevation of 175 ft NGVD. The consolidated clay surface will have an average elevation of 161 ft NGVD. This area will have 14 feet of freeboard, and will have adequate storage volume to store runoff from the 25-year storm and the PMP (31 inches) without discharging.

Clay Settling Area N-15. This area will be under reclamation during the initial operational phase and will serve as a water crop area. It will become part of the cooling pond system in later phases of the project. Runoff from this area will be conveyed into the cooling pond through a breach in the southern perimeter containment dam and by pumping. The perimeter containment dam has a top elevation of 175 ft NGVD. The clay surface elevation will average about 162 ft NGVD at the start of reclamation. This area will be hydraulically connected to the cooling pond at elevation 161 ft NGVD. When the cooling pond N-15, N-11B, and N-11C are treated as one system there is adequate storage volume available to store the runoff from the PMP plus maintain a minimum of 6 feet of freeboard throughout the system.

Clay Settling Area N-11B. This area will be under reclamation during the initial operational phase and will serve as a water crop area. It will become part of the cooling pond system in later phases of the project. Runoff from this area will be conveyed into the cooling pond through a breach in the southern perimeter containment dam and by pumping. The perimeter containment dam has a top elevation of 175 ft NGVD. The clay surface elevation will range from 157 ft to 164 ft NGVD at the start of reclamation. This area will be hydraulically connected to the cooling pond at elevation 161 ft NGVD. When the cooling pond, N-15, N-11B and N11-C are treated as one system there is adequate storage volume available to store the runoff from the 25-year storm and the PMP plus maintain a minimum of 6 feet of freeboard throughout the system.

Clay Settling Area N-11C. This area will be under reclamation during the initial operational phase period and will serve as a water crop area. It will become part of the cooling pond system in later phases of the project. Runoff from this area will be conveyed into N-11B through a breach in the shared dam between N-11C and N-11B. Runoff will eventually drain to the cooling pond through a breach in the southern perimeter containment dam of N-11B and by pumping. The perimeter containment dam of N-11C has a top elevation of 175 ft NGVD. The clay surface elevation will be 170 ft NGVD at the start of reclamation. The minimum top of dam elevation for the initial cooling pond is 171 ft NGVD. When the cooling pond and the N-11B, N-15, and N-11C areas are treated as one system there is adequate storage volume

available to store the runoff from the PMP plus maintain a minimum of 6 feet of freeboard throughout the system.

Clay Settling Area P-2. This area will serve as a water crop area during the initial operating phase and will be completely reclaimed prior to this period. Runoff from this area will be conveyed to the Triangle Lakes area through a sluice gate. The perimeter containment dams will have a minimum top elevation of 158 ft NGVD. The consolidated clay surface will have an average elevation of 150 ft NGVD. This area will have about 8 feet of freeboard, and will have adequate storage volume to store runoff from the PMP without discharging.

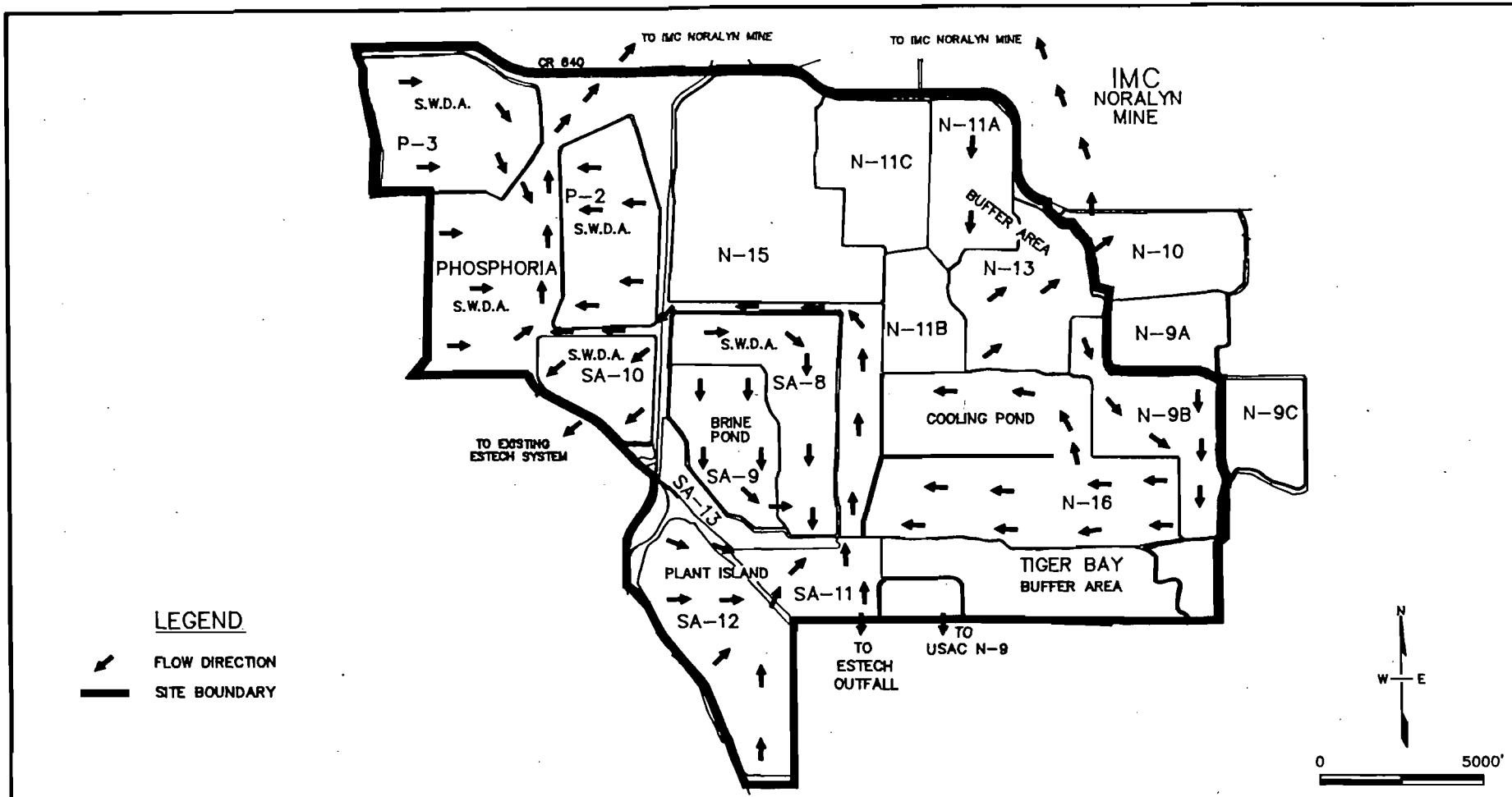
Clay Settling Area P-3. This area will serve as a water crop area during the initial operating phase and will be completely reclaimed prior to this period. Runoff from this area will be conveyed to the surface water management system through a sluice gate. The perimeter containment dams will have a minimum top elevation of 169 ft NGVD with the majority of the dams being above elevation 170 ft NGVD. The consolidated clay surface will range from 165 ft to 168 ft NGVD. This area will have adequate freeboard to store the runoff from the 25-year storm without discharging. The runoff from the PMP cannot be completely accommodated within P-3 as is without discharging. The minimum dam elevation will have to be raised to 171.1 ft NGVD in order to provide adequate capacity to store the PMP.

Triangle Lakes Water Crop Area. This area will serve as a water crop area and surge capacity for the surface water management system of the power plant. It is a reclaimed mine pit area. Runoff from this area will be conveyed to the cooling pond. The lowest rim elevation for the lakes is 151 ft NGVD and is located on the southern most lake adjacent to CR 555. Present ground water levels in the area indicate a normal water level of about 147 ft NGVD. A pump will maintain the normal water level in the Triangle Lakes at or below 147 ft NGVD. This area will have adequate volume to store the runoff from the PMP without discharging. Thus, this system is failsafe in that if the pump fails during a major storm all of the runoff will be contained within the lakes.

Phosphoria Water Crop Area. This area is the remainder of the Phosphoria section and will serve as a water crop area during the initial operating phase. It will be reclaimed prior to use as such. Runoff from this area is conveyed through a sluice gate into the surface water management system. The lowest rim elevation adjacent to this area is 163 ft NGVD and is located on the eastern side, adjacent to the east railroad. Present groundwater levels in the area

indicate a normal water level of about 160 ft NGVD. The Phosphoria area, when operated as part of the water collection and conveyance system, will have a normal operating level of 160 ft NGVD. This normal water level will be controlled by the sluice gate which will have an invert elevation of 160 ft NGVD. The Phosphoria area will have adequate volume to store the runoff from the 25-year storm without discharging. In order to have adequate volume to store the runoff from the PMP, this area will be reclaimed so that the lowest elevation on the rim of the area is 163.3 ft NGVD.

Clay Settling Area SA-10. This area will serve as a water crop area during the initial operating phase and will be under reclamation during this period. Runoff from this area will be conveyed to the surface water management system through a sluice gate. The perimeter containment dams presently have a minimum top elevation of 170 ft NGVD. The consolidated clay surface will range from 166 ft to 168 ft NGVD. This area will have adequate freeboard to store the runoff from the 25-year storm without discharging. The minimum dam elevation will have to be raised slightly to 170.5 ft NGVD in order to provide adequate capacity to store the PMP.

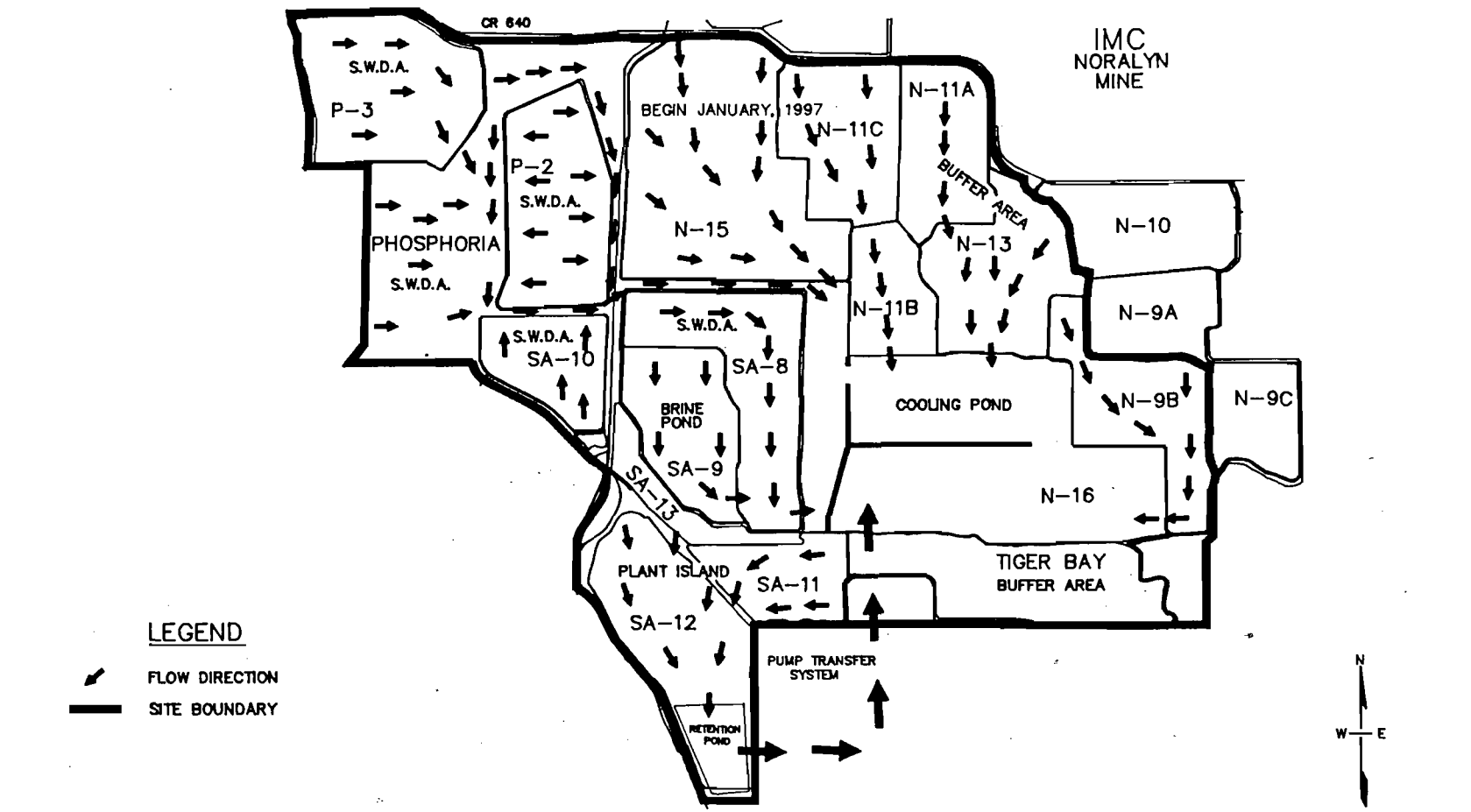


SOURCE: DAMES & MOORE, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 3.8.2-1
SURFACE WATER DRAINAGE (DURING RECLAMATION)

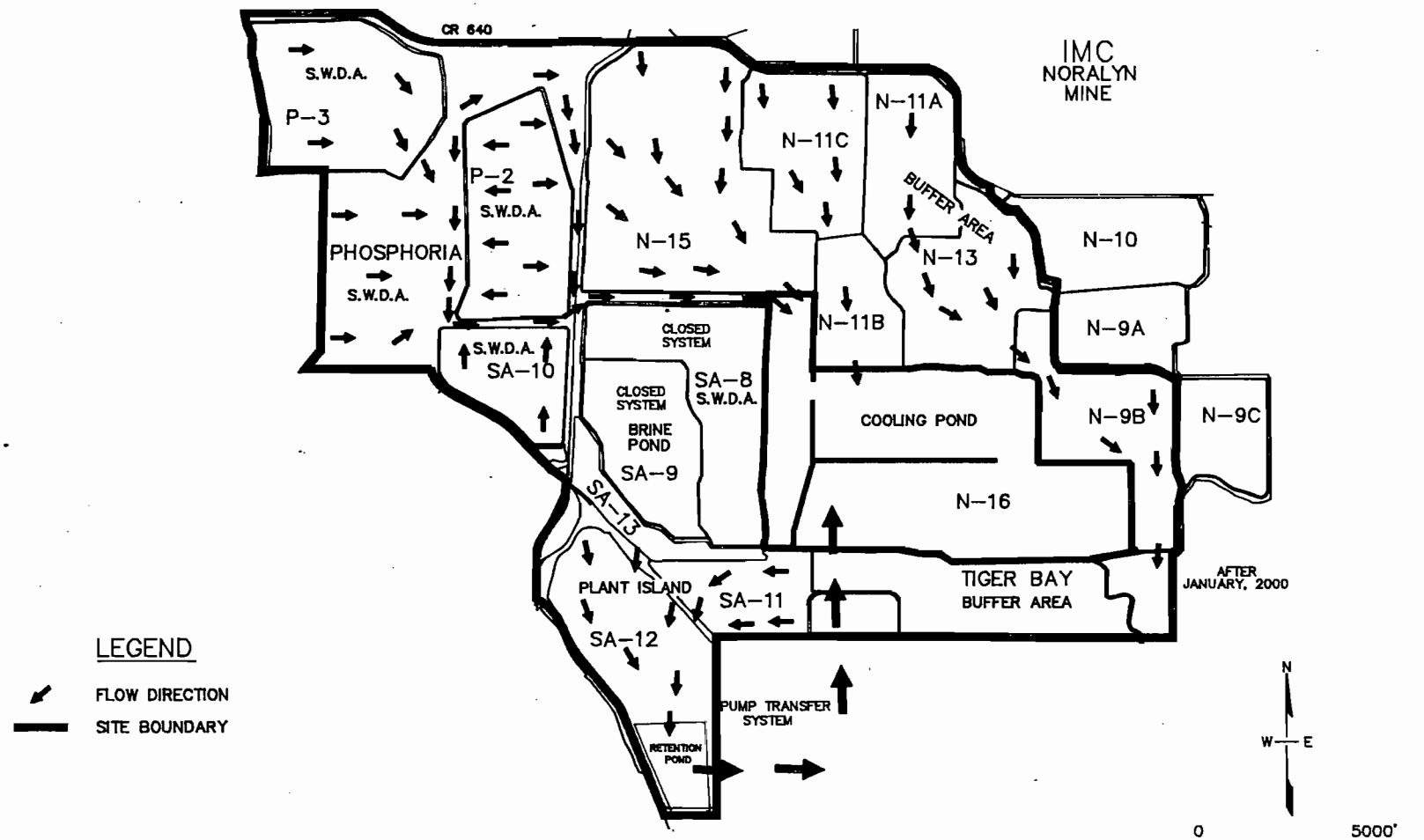


SOURCE: DAMES & MOORE, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 3.8.2-2
SURFACE WATER DRAINAGE
(DURING POWER PLANT CONSTRUCTION)

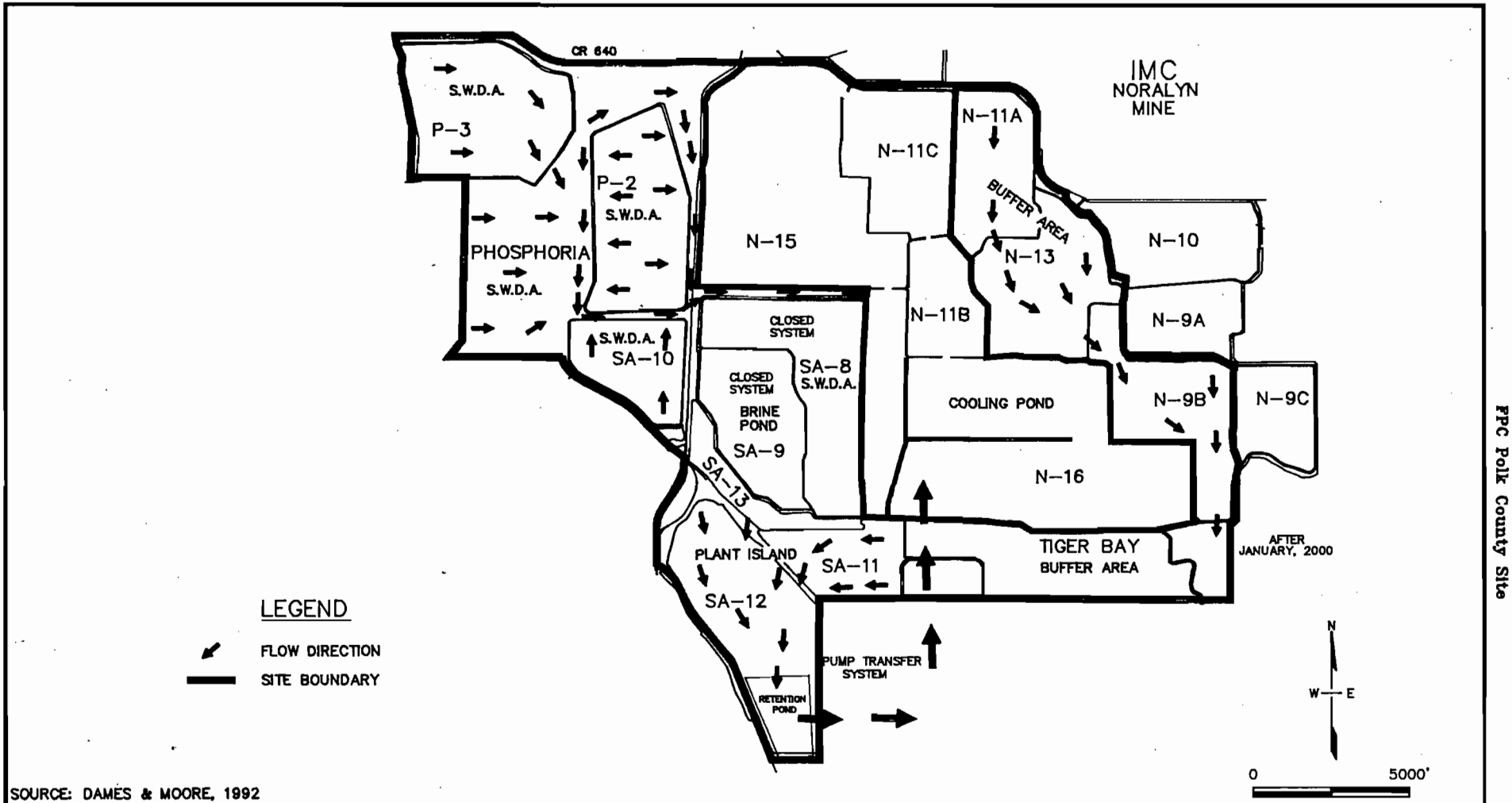


SOURCE: DAMES & MOORE, 1992

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Polk County Site

FIGURE 3.8.3-1
SITE DRAINAGE
INITIAL OPERATIONAL PHASE
(NOVEMBER 1998 - JULY 2006)



SOURCE: DAMES & MOORE, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 3.8.3-2
SITE DRAINAGE
ULTIMATE DEVELOPMENT OPERATIONAL PHASE
(POST JULY 2006)

3.9 MATERIALS HANDLING

3.9.1 Site Facilities

Major components to be constructed at the Polk County Site include the following:

- Combustion turbines
- Combustion turbine electrical generators
- Heat recovery steam generators
- Steam turbines
- Steam turbine electrical generators
- Transformers
- Bridge cranes
- Water treatment facilities
- Stacks
- Pulverized coal boilers (later phases)
- Gasifiers (later phases)
- Coal storage and handling system (later phases)
- Limestone storage and handling system (later phases)
- PC precipitator or baghouse/scrubber (later phases)

These components are expected to be delivered to the site by rail or truck. No off-site upgrading of either rail or road facilities is expected to be necessary to facilitate delivery of construction materials. However, as shown on Figure 3.2.1-2, which presents the typical proposed rail and road facilities, the site will require the installation of extensive on-site rail and road improvements. These improvements will facilitate delivery of construction components, as well as future maintenance and replacement components, if required.

Once on site, materials will be unloaded and transported by using mobile cranes and trucks. Some of the heaviest items will require rail delivery, multi-axle transport haul trailers, and special rigging for on-site handling.

Fuels for construction vehicles will be stored in fuel storage drums within a bermed area in accordance with regulations. Gasoline and diesel fuel for cars and trucks used during construction and operation will be stored in tanks. See Vehicular Fuel Storage on Figure 3.2.1-1. Spent lubricants, paints, and solvents will be removed from the site for recycling or for disposal.

The construction sanitary wastewater system will consist of portable, self contained chemical toilets until completion of the site sewage treatment plant. Wastes from these chemical toilets will be removed periodically, as needed. The sewage treatment plant described in Section 3.5.2 will be constructed early and will be utilized during the construction period.

Fugitive dust, surface water runoff, and waste disposal associated with material handling during construction will be controlled using the following techniques:

- Dust suppression will be accomplished by watering the roads, parking lots, and laydown areas, as needed.
- A stormwater retention pond described in Section 3.2 will be used to settle suspended sediment from rainfall runoff.
- A burn pit will be located on the power block site. Organic waste created by the clearing and grubbing of these areas will be burned as the site is cleared. Burn pits for construction wastes will be regulated in accordance to F.A.C. 17-256.
- Construction trash and other nonhazardous debris will be recycled, or will be collected for off-site disposal by a licensed disposal contractor.
- Commercial salvage of metal wastes will be implemented. If salvage is not feasible, these wastes will be removed from the site by a licensed contractor for recycling or disposal.

3.9.2 Operational Materials

The handling and storage of fuels and fuel additives (natural gas, fuel oil, coal-derived gas, coal, and limestone) are discussed in Section 3.3. Handling and storage of coal gasification and combustion by-products (slag, fly ash, bottom ash, sludge, and sulfur), wastewater treatment sludges, and other lesser-volume waste streams are discussed in Section 3.7.

Other operational materials include gaseous and liquified oxygen, sulfur removal and tail gas treating solvents, water and wastewater treatment chemicals, lubrication oils, combustion and ST coolant and purge gases, and HRSG blanketing gas.

Water and wastewater treatment chemicals (e.g., sulfuric acid, sodium hydroxide, and sodium hypochlorite) will be stored in tanks adjacent to the water and wastewater treatment buildings, respectively. The chemicals will be stored within a curbed area with drains routed to the neutralization basin.

Lubrication oil and greases will be stored in lube oil storage drums. The drums will be located within an enclosed curbed area designed to detain 110 percent of the stored material. A (normally closed) emergency drain system will route any spills within the curbed area to the plant oil/water separator.

Lubricating oil will be stored in equipment-associated lube oil tanks and system piping. This equipment and piping will either be enclosed in a containment area or will be within an area protected by a drain system to the oil/water separator.

Hydrogen, oxygen, nitrogen and carbon dioxide gases may be stored in bottles adjacent to the gas distribution system which serves the units.

3.10 AQUIFER STORAGE AND RECOVERY

The aquifer storage and recovery concept is not currently part of the proposed plant water system design. Therefore, discussion of this concept is not applicable.

TABLE OF CONTENTS

CHAPTER 5

EFFECTS OF PLANT OPERATION

Section/Title			Page
5.1	EFFECTS OF THE OPERATION OF THE HEAT DISSIPATION SYSTEM		5.1-1
5.1.1	Temperature Effect on Receiving Body of Water		5.1-1
5.1.2	Effects on Aquatic Life		5.1-1
5.1.3	Biological Effects of Modified Circulation		5.1-1
5.1.4	Effects of Offstream Cooling		5.1-3
	5.1.4.1	Fog	5.1-3
	5.1.4.2	Blowdown and Drift	5.1-3
5.1.5	Measurement Program		5.1-3
5.2	EFFECTS OF CHEMICAL AND BIOCIDE DISCHARGES		5.2-1
5.2.1	Industrial Wastewater Discharges		5.2-1
5.2.2	Cooling Tower Blowdown		5.2-1
5.2.3	Measurement Program		5.2-1
5.3	IMPACTS ON WATER SUPPLIES		5.3-1
5.3.1	Surface Water		5.3-1
	5.3.1.1	Peace River	5.3-2
	5.3.1.2	Tributaries	5.3-3
5.3.2	Ground Water		5.3-4

TABLE OF CONTENTS (Continued)

Section/Title		Page
5.3.2.1	Impacts of Groundwater Withdrawals for Supplemental Make-Up Water to the Cooling Pond	5.3-5
5.3.2.2	Cooling Pond and Brine Pond Seepage	5.3-13
5.3.2.3	Impacts of On-Site Solid Waste Disposal	5.3-20
5.3.3	Drinking Water	5.3-23
5.3.3.1	Impacts of Withdrawal from a Drinking Water Source	5.3-24
5.3.3.2	Impacts of Discharge to a Drinking Water Source	5.3-24
5.3.3.3	Water Reuse and Recycling	5.3-24
5.3.4	Leachate and Runoff	5.3-24
5.3.4.1	Material Handling Areas	5.3-24
5.3.4.2	Solid Waste Disposal Areas	5.3-25
5.3.5	Measurement Program	5.3-25
5.3.6	References	5.3-25
5.4	SOLID/HAZARDOUS WASTE DISPOSAL IMPACTS	5.4-1
5.4.1	Solid Waste	5.4-1
5.4.2	Hazardous Waste	5.4-2
5.5	SANITARY AND OTHER WASTE DISCHARGES	5.5-1
5.6	AIR QUALITY IMPACTS	5.6-1
5.6.1	Impact Assessment	5.6-1

TABLE OF CONTENTS (Continued)

Section/Title — Page

5.6.1.1 Introduction 5.6-1
5.6.1.2 Air Quality Regulatory Requirements Applicability . . 5.6-2
5.6.1.3 Modelling Approach 5.6-4
5.6.1.4 Meteorological Data 5.6-5
5.6.1.5 Proposed Source Emissions/Stack Parameters 5.6-5
5.6.1.6 Existing Source Emission Inventories 5.6-8
5.6.1.7 Receptor Locations 5.6-11
5.6.1.8 Background Concentrations 5.6-13
5.6.1.9 Air Quality Modelling Results 5.6-14
5.6.1.10 Supplementary PSD Class I Area Analyses 5.6-19
5.6.1.11 Additional Impacts Analysis 5.6-27

5.6.2 Monitoring Programs 5.6-47

5.6.2.1 Preconstruction Ambient Air Quality Monitoring . . . 5.6-47
5.6.2.2 Continuous Emissions Monitoring 5.6-48

5.6.3 References 5.6-51

5.7 NOISE 5.7-1

5.7.1 Receptors and Barriers 5.7-1
5.7.2 Noise Sources 5.7-2
5.7.3 Noise Modeling Results 5.7-2
5.7.4 Impact Assessment 5.7-3
5.7.5 References 5.7-4

5.8 CHANGES IN NONAQUATIC SPECIES POPULATION 5.8-1

5.8.1 Impacts 5.8-1
5.8.2 Monitoring 5.8-2

TABLE OF CONTENTS (Continued)

Section/Title			Page
5.9	OTHER PLANT OPERATION EFFECTS		5.9-1
5.9.1	Highway Traffic		5.9-1
	5.9.1.1	Study Area	5.9-2
	5.9.1.2	Year 2008 Non-Project Traffic	5.9-2
	5.9.1.3	Year 2018 Non-Project Traffic	5.9-3
	5.9.1.4	Plant Operations Traffic	5.9-3
	5.9.1.5	2008 Total Traffic Capacity Analysis	5.9-5
	5.9.1.6	2018 Total Traffic Capacity Analysis	5.9-5
	5.9.1.7	Recommendations	5.9-6
5.9.2	Rail Traffic		5.9-7
	5.9.2.1	Introduction	5.9-7
	5.9.2.2	Methodology	5.9-7
5.9.3	Benefits to On-Site Wetlands		5.9-11
5.9.4	References		5.9-11
5.10	ARCHAEOLOGICAL SITES		5.10-1
5.11	RESOURCES COMMITTED		5.11-1
	5.11.1	Physical Resources	5.11-1
	5.11.2	Biological Resources	5.11-1
	5.11.3	Economic and Cultural Resources	5.11-2
5.12	VARIANCES		5.12-1

LIST OF TABLES

Table/Title		Page
5.1.3-1	WATER QUALITY OF TIGER BAY AND N-16 (THREE PAGES)	5.1-4
5.1.3-2	WATER QUALITY CONSTITUENTS OF CONCERN - TIGER BAY AND N-16	5.1-7
5.1.3-3	DISSOLVED OXYGEN MEASUREMENTS	5.1-8
5.3.2-1	SUMMARY OF SWFWMD THRESHOLD VALUES FOR EVALUATING PROPOSED GROUNDWATER USE IMPACTS	5.3-28
5.3.2-2	NUMBER OF PERMITTED WELLS IN THE UPPER FLORIDAN AQUIFER WITH PREDICTED DRAWDOWN GREATER THAN 5 FEET	5.3-29
5.3.2-3	POTENTIALLY IMPACTED WELLS UNDER 26.6 AND 31.6 MGD SCENARIOS - PRE-DEVELOPMENT BASELINE (FOUR PAGES)	5.3-30
5.3.5-1	GROUNDWATER QUALITY PARAMETERS	5.3-34
5.6.1-1	AMBIENT AIR QUALITY STANDARDS AND PSD INCREMENTS	5.6-62
5.6.1-2	COMPARISON OF CASE B EMISSIONS WITH SIGNIFICANT EMISSION RATES	5.6-63
5.6.1-3	PSD *DE MINIMIS* AMBIENT AIR QUALITY IMPACT LEVELS	5.6-64
5.6.1-4	AIR TOXICS ESTIMATED MAXIMUM SHORT-TERM AND ANNUAL EMISSION RATES (CASE B)	5.6-65
5.6.1-5	COMBUSTION TURBINE (235MW) ESTIMATED PERFORMANCE ON COAL-DERIVED GAS	5.6-66

LIST OF TABLES (Continued)

Table/Title		Page
5.6.1-6	COMBUSTION TURBINE (235MW) ESTIMATED PERFORMANCE ON FUEL OIL	5.6-67
5.6.1-7	PULVERIZED COAL UNIT (600MW) ESTIMATED PERFORMANCE	5.6-68
5.6.1-8	THERMAL OXIDATION UNIT ESTIMATED PERFORMANCE	5.6-69
5.6.1-9	AUXILIARY BOILER ESTIMATED PERFORMANCE ON NATURAL GAS & FUEL OIL	5.6-70
5.6.1-10	DIESEL GENERATOR ESTIMATED PERFORMANCE ON FUEL OIL	5.6-71
5.6.1-11	FUGITIVE DUST SOURCES MODELLED AS AREA SOURCES	5.6-72
5.6.1-12	CLASS II PSD SOURCE INVENTORY - NO_x (TWO PAGES)	5.6-73
5.6.1-13	CLASS II PSD SOURCE INVENTORY - SO_2 (TWO PAGES)	5.6-75
5.6.1-14	CLASS II PSD SOURCE INVENTORY - PM (TWO PAGES)	5.6-77
5.6.1-15	CLASS I PSD SOURCE INVENTORY - NO_x (THREE PAGES)	5.6-79
5.6.1-16	CLASS I PSD SOURCE INVENTORY - SO_2 (THREE PAGES)	5.6-82
5.6.1-17	AAQS SOURCE INVENTORY - NO_x (THREE PAGES)	5.6-85
5.6.1-18	AAQS SOURCE INVENTORY - SO_2 (TWO PAGES)	5.6-88
5.6.1-19	AAQS SOURCE INVENTORY - PM (FOUR PAGES)	5.6-90
5.6.1-20	RECEPTOR GRID FOR PSD CLASS I AREA	5.6-94

LIST OF TABLES (Continued)

Table/Title		Page
5.6.1-21	WORST-CASE LOAD ANALYSIS RESULTS (PC UNITS)	5.6-95
5.6.1-22	MAXIMUM OFF-SITE IMPACTS OF AUXILIARY BOILER AND DIESEL GENERATOR	5.6-96
5.6.1-23	SUMMARY OF SIGNIFICANT IMPACT AREAS (CASE B)	5.6-97
5.6.1-24	SUMMARY OF MAXIMUM OFF-SITE IMPACTS (CASE B)	5.6-98
5.6.1-25	CLASS II PSD INCREMENT ANALYSES RESULTS	5.6-99
5.6.1-26	MAXIMUM PROJECT IMPACTS PREDICTED USING ISCST VERSUS CLASS I PSD SIGNIFICANCE VALUES	5.6-100
5.6.1-27	AAQS ANALYSES RESULTS	5.6-101
5.6.1-28	AIR TOXICS ANALYSIS	5.6-102
5.6.1-29	OPTIONS SELECTED FOR READ 56 PROGRAM PROPOSED FPC POLK COUNTY SITE	5.6-103
5.6.1-30	OPTIONS SELECTED FOR MESOPAC II PROGRAM PROPOSED FPC POLK COUNTY SITE (TWO PAGES)	5.6-104
5.6.1-31	OPTIONS SELECTED FOR MESOPUFF II PROGRAM PROPOSED FPC POLK COUNTY SITE (FOUR PAGES)	5.6-106
5.6.1-32	SUMMARY OF 1982 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT USING THE ISCST AND MESOPUFF II MODELS (TWO PAGES)	5.6-110

LIST OF TABLES (Continued)

Table/Title		Page
5.6.1-33	SUMMARY OF 1983 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT USING THE ISCST AND MESOPUFF II MODELS (TWO PAGES)	5.6-112
5.6.1-34	SUMMARY OF 1984 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT USING THE ISCST AND MESOPUFF II MODELS (TWO PAGES)	5.6-114
5.6.1-35	SUMMARY OF 1985 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT USING THE ISCST AND MESOPUFF II MODELS (TWO PAGES)	5.6-116
5.6.1-36	SUMMARY OF 1986 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT USING THE ISCST AND MESOPUFF II MODELS (THREE PAGES)	5.6-118
5.6.1-37	SUMMARY OF 1983 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT REMAINING AFTER MESOPUFF II MODEL, STEPS 3 AND 4	5.6-121
5.6.1-38	SUMMARY OF 1983 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT REMAINING AFTER MESOPUFF II MODEL, STEPS 3 AND 4, CASE 4	5.6-122
5.6.1-39	SUMMARY OF 1984 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT REMAINING AFTER MESOPUFF II MODEL, STEPS 3 AND 4	5.6-123
5.6.1-40	SUMMARY OF 1985 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT REMAINING AFTER MESOPUFF II MODEL, STEPS 3 AND 4	5.6-124

LIST OF TABLES (Continued)

Table/Title		Page
5.6.1-41	SUMMARY OF 1985 PREDICTED CONCENTRATIONS COMPARED TO THE SO_2 PSD CLASS I INCREMENT AFTER MESOPUFF II MODEL, STEPS 3 AND 4, CASE 4	5.6-125
5.6.1-42	SUMMARY OF 1986 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT REMAINING AFTER MESOPUFF II MODEL, STEPS 3 AND 4,	5.6-126
5.6.1-43	SUMMARY OF 1986 PREDICTED CONCENTRATIONS COMPARED TO THE SO_2 PSD CLASS I INCREMENT AFTER MESOPUFF II MODEL, STEPS 3 AND 4, CASE 4	5.6-127
5.6.1-44	ESTIMATED PROJECT IMPACTS AND BACKGROUND CONCENTRATIONS IN CLASS I AREA	5.6-128
5.6.1-45	ESTIMATED PROJECT IMPACTS AND BACKGROUND CONCENTRATIONS IN THE GENERAL VICINITY OF THE PROPOSED PROJECT	5.6-129
5.6.1-46	THRESHOLD NO_2 CONCENTRATIONS FOR VISIBLE INJURY TO PLANT SPECIES	5.6-130
5.6.1-47	RESPONSE OR SENSITIVITY RATING OF VEGETATION TYPICAL OF THE PROPOSED PROJECT TO NO_2	5.6-131
5.6.1-48	THRESHOLD SO_2 CONCENTRATIONS FOR VISIBLE INJURY TO SENSITIVE VEGETATION	5.6-132
5.6.1-49	RESPONSE OR SENSITIVITY RATING OF VEGETATION TYPICAL OF THE PROPOSED PROJECT TO SO_2 (TWO PAGES)	5.6-133

LIST OF TABLES (Continued)

Table/Title		Page
5.6.1-50	THRESHOLD O_3 CONCENTRATIONS FOR VISIBLE INJURY TO PLANT SPECIES	5.6-135
5.6.1-51	RESPONSE OR SENSITIVITY RATING OF VEGETATION TYPICAL OF THE PROJECT AREA TO OZONE	5.6-136
5.6.1-52	RESPONSE OR SENSITIVITY RATING OF VEGETATION TO MIXTURES OF SO_2 AND NO_2	5.6-137
5.6.1-53	RESPONSE OR SENSITIVITY RATING OF VEGETATION TO MIXTURES OF SO_2 AND O_3 (TWO PAGES)	5.6-138
5.6.1-54	SUMMARY OF ESTIMATED TRACE ELEMENT SOIL CONCENTRATIONS IN THE CLASS I AREA	5.6-140
5.6.1-55	SUMMARY OF ESTIMATED TRACE ELEMENT SOIL CONCENTRATIONS IN THE GENERAL VICINITY OF THE PROPOSED PROJECT	5.6-141
5.6.1-56	REPORTED EFFECTS IN WILDLIFE OF SELECTED AIR CONTAMINANTS	5.6-142
5.6.1-57	VISIBILITY ANALYSIS	5.6-143
5.7.1-1	NOISE RECEPTOR LOCATIONS	5.7-5
5.7.2-1	PROJECT EQUIPMENT SOUND LEVELS	5.7-6
5.7.3-1	NOISE MODELING RESULTS	5.7-7
5.7.4-1	DAY/NIGHT (LDN) NOISE LEVELS	5.7-8

LIST OF TABLES (Continued)

Table/Title		Page
5.9.1-1	OPERATIONS STUDY AREA	5.9-13
5.9.1-2	PEAK SEASON, PEAK HOUR, PEAK DIRECTION 2008 NON-PROJECT ROADWAY CONDITIONS	5.9-14
5.9.1-3	2008 NON-PROJECT PEAK HOUR INTERSECTION CONDITIONS	5.9-15
5.9.1-4	PEAK SEASON, PEAK HOUR, PEAK DIRECTION 2018 NON-PROJECT ROADWAY CONDITIONS	5.9-16
5.9.1-5	2018 NON-PROJECT PEAK HOUR INTERSECTION CONDITIONS	5.9-17
5.9.1-6	COMPARISON OF POWER PLANT TRIP GENERATION RATES PER EMPLOYEE	5.9-18
5.9.1-7	OPERATIONS TRIP GENERATION	5.9-19
5.9.1-8	PEAK SEASON A.M. PEAK HOUR 2008 TOTAL ROADWAY CONDITIONS	5.9-20
5.9.1-9	PEAK SEASON P.M. PEAK HOUR 2008 TOTAL ROADWAY CONDITIONS	5.9-21
5.9.1-10	2008 TOTAL PEAK HOUR TRAFFIC INTERSECTION CONDITIONS	5.9-22
5.9.1-11	PEAK SEASON A.M. PEAK HOUR 2018 TOTAL ROADWAY CONDITIONS	5.9-23
5.9.1-12	PEAK SEASON P.M. PEAK HOUR 2018 TOTAL ROADWAY CONDITIONS	5.9-24

LIST OF TABLES (Continued)

Table/Title		Page
5.9.1-13	2018 TOTAL PEAK HOUR TRAFFIC INTERSECTION CONDITIONS	5.9-25
5.9.2-1	INVENTORY OF AT-GRADE RAIL-HIGHWAY CROSSINGS	5.9-26
5.9.2-2	SUMMARY OF TRAIN TRAFFIC IMPACT AT RAIL-HIGHWAY CROSSINGS	5.9-27
5.9.2-3	LEVEL-OF-SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS	5.9-28

LIST OF FIGURES

Figure/Title		Page
5.1.3-1	DISSOLVED OXYGEN MEASUREMENTS PEACE RIVER AT BARTOW, FLORIDA	5.1-9
5.1.3-2	DISSOLVED OXYGEN MEASUREMENTS PEACE RIVER NEAR HOMELAND, FLORIDA	5.1-10
5.1.3-3	DISSOLVED OXYGEN MEASUREMENTS PEACE RIVER AT FORT MEADE, FLORIDA	5.1-11
5.1.3-4	DISSOLVED OXYGEN SATURATION PEACE RIVER AT FORT MEADE, FLORIDA	5.1-12
5.1.3-5	DISSOLVED OXYGEN SATURATION PEACE RIVER AT BARTOW, FLORIDA	5.1-13
5.3.1-1	PEACE RIVER BASIN MAP	5.3-35
5.3.2-1	GENERALIZED GEOLOGIC SECTION A-A', HYDROSTRATIGRAPHIC SECTION, AND CONCEPTUAL MODEL OF THE GROUNDWATER SUPPLY (GWS) MODEL DOMAIN	5.3-36
5.3.2-2	GENERALIZED GEOLOGIC SECTION B-B', HYDROSTRATIGRAPHIC SECTION, AND CONCEPTUAL MODEL OF THE GROUNDWATER SUPPLY (GWS) MODEL DOMAIN	5.3-37
5.3.2-3	PROJECTED WATER USE FOR POLK COUNTY YEARS 1990-2020	5.3-38

LIST OF FIGURES (Continued)

Figure/Title		Page
5.3.2-4	UPPER FLORIDAN DRAWDOWN FOR 20.6 MGD FPC WITHDRAWALS WITH PREDEVELOPMENT BASELINE	5.3-39
5.3.2-5	UPPER FLORIDAN DRAWDOWN FOR 26.6 MGD FPC WITHDRAWALS WITH PREDEVELOPMENT BASELINE	5.3-40
5.3.2-6	UPPER FLORIDAN DRAWDOWN FOR 31.6 MGD FPC WITHDRAWALS WITH PREDEVELOPMENT BASELINE	5.3-41
5.3.2-7	UPPER FLORIDAN DRAWDOWN FOR 20.6 MGD FPC WITHDRAWALS EXISTING USERS BASELINE	5.3-42
5.3.2-8	UPPER FLORIDAN DRAWDOWN FOR 26.6 MGD FPC WITHDRAWALS EXISTING USERS BASELINE	5.3-43
5.3.2-9	UPPER FLORIDAN DRAWDOWN FOR 31.6 MGD FPC WITHDRAWALS EXISTING USERS BASELINE	5.3-44
5.3.2-10	INTERMEDIATE AQUIFER DRAWDOWN FOR 20.6 MGD FPC WITHDRAWALS WITH PREDEVELOPMENT BASELINE	5.3-45
5.3.2-11	INTERMEDIATE AQUIFER DRAWDOWN FOR 26.6 MGD FPC WITHDRAWALS WITH PREDEVELOPMENT BASELINE	5.3-46
5.3.2-12	INTERMEDIATE AQUIFER DRAWDOWN FOR 31.6 MGD FPC WITHDRAWALS WITH PREDEVELOPMENT BASELINE	5.3-47
5.3.2-13	INTERMEDIATE AQUIFER DRAWDOWN FOR 20.6 MGD FPC WITHDRAWALS EXISTING USERS BASELINE	5.3-48

LIST OF FIGURES (Continued)

Figure/Title		Page
5.3.2-14	INTERMEDIATE AQUIFER DRAWDOWN FOR 26.6 MGD FPC WITHDRAWALS EXISTING USERS BASELINE	5.3-49
5.3.2-15	INTERMEDIATE AQUIFER DRAWDOWN FOR 31.6 MGD FPC WITHDRAWALS EXISTING USERS BASELINE	5.3-50
5.3.2-16	ESTIMATES OF POTENTIAL BRINE POND FILLING AND SEEPAGE RATES	5.3-51
5.3.2-17	PLAN VIEW OF SA-9 EMBANKMENTS SHOWING POTENTIAL SEEPAGE DIRECTIONS	5.3-52
5.3.2-18	N-16 POND SEEPAGE MODEL	5.3-53
5.3.2-19	BRINE POND SEEPAGE MODEL	5.3-54
5.3.5-1	DRINKING WATER MONITORING WELL LOCATIONS	5.3-55
5.3.5-2	CONCEPTUAL OPEN HOLE INTERMEDIATE OBSERVATION WELL	5.3-56
5.6.1-1	RECEPTOR GRID FOR SIGNIFICANT IMPACT AREA ANALYSES	5.6-144
5.6.1-2	COARSE RECEPTOR GRID FOR CLASS II PSD AND AAQS ANALYSES	5.6-145
5.6.1-3	LOCATIONS OF SELECTED NEAR-SITE MODELLED PM SOURCES AND WIND DIRECTION SECTOR CONSIDERED FOR BACKGROUND PM CONCENTRATIONS	5.6-146

LIST OF FIGURES (Continued)

Figure/Title		Page
5.6.1-4	MAXIMUM PREDICTED OFF-SITE 3-HOUR AVERAGE SO_2 PROJECT IMPACTS ($\mu g/m^3$)	5.6-147
5.6.1-5	MAXIMUM PREDICTED OFF-SITE 24-HOUR AVERAGE SO_2 PROJECT IMPACTS ($\mu g/m^3$)	5.6-148
5.6.1-6	MAXIMUM PREDICTED OFF-SITE ANNUAL AVERAGE SO_2 PROJECT IMPACTS ($\mu g/m^3$)	5.6-149
5.7.1-1	NOISE MODELING RECEPTOR LOCATIONS	5.7-9
5.9.1-1	2008 PEAK SEASON A.M. PEAK HOUR NON-PROJECT TRAFFIC	5.9-29
5.9.1-2	2008 PEAK SEASON P.M. PEAK HOUR NON-PROJECT TRAFFIC	5.9-30
5.9.1-3	2018 PEAK SEASON A.M. PEAK HOUR NON-PROJECT TRAFFIC	5.9-31
5.9.1-4	2018 PEAK SEASON P.M. PEAK HOUR NON-PROJECT TRAFFIC	5.9-32
5.9.1-5	OPERATION PROJECT TRIPS - A.M. PEAK HOUR	5.9-33
5.9.1-6	OPERATION PROJECT TRIPS - P.M. PEAK HOURS	5.9-34
5.9.1-7	2008 PEAK SEASON A.M. PEAK HOUR TOTAL TRAFFIC	5.9-35
5.9.1-8	2008 PEAK SEASON P.M. PEAK HOUR TOTAL TRAFFIC	5.9-36
5.9.1-9	2018 PEAK SEASON A.M. PEAK HOUR TOTAL TRAFFIC	5.9.-37

LIST OF FIGURES (Continued)

Figure/Title		Page
5.9.1-10	2018 PEAK SEASON P.M. PEAK HOUR TOTAL TRAFFIC	5.9-38
5.9.2-1	PROBABLE RAILWAY TRANSPORTATION ROUTES	5.9-39

5.1 EFFECTS OF THE OPERATION OF THE HEAT DISSIPATION SYSTEM

5.1.1 Temperature Effect on Receiving Body of Water

There will be no withdrawal of surface water or discharge of heated effluent to surface water from the project. Consequently, this section is not applicable.

5.1.2 Effects on Aquatic Life

There will be no release of heat to marine or fresh waters, and no water intake or discharge structures in waters of the state. Consequently, this section is not applicable.

5.1.3 Biological Effects of Modified Circulation

The only water bodies which would have their circulation modified as a result of power plant operation would be those in Tiger Bay. Presently, water circulation in Tiger Bay results from the in-seepage of water from N-16, and the out-seepage of water through the berm at the east end of Tiger Bay to the Camp Meeting Ground Branch. This seepage is currently estimated to be on the order of 10,000 gallons per day, and is expected to triple after commencement of power plant operation, as a result of the increased pressure differential associated with the higher water levels in the cooling pond. The net effect of this increased circulation is unquantifiable but positive. Accordingly, Florida Power Corporation (FPC) has chosen to not seal the southern dam of N-16 and to allow this seepage to occur. Based on the chemical concentrations estimated for the cooling pond (see Section 3.5.1), no deleterious impacts are expected.

Table 5.1.3-1 presents a description of the current water quality of Tiger Bay and N-16, the predicted maximum concentrations of these parameters in the cooling pond (including N-16), and the corresponding standards for Class III Waters (Tiger Bay, assuming Tiger Bay includes waters of the state). Table 5.1.3-2 lists the water quality constituents of concern during operation of the power plant. This list includes those constituents which do not meet Class III criteria, and those major constituents which do not have limits for Class III waters, but whose behavior is important with respect to nutrients and nuisance species.

Several conclusions can be drawn from an analysis of data shown in Tables 5.1.3-1 and 5.1.3-2. Strontium, phosphorus, calcium, magnesium, sodium, potassium, chloride, bicarbonate,

carbonate, aluminum, and sulfate are all reduced in concentration by their passage through the existing dam from N-16 to Tiger Bay. In particular, all of the sulfate, carbonate, potassium, aluminum, and strontium are removed. Specific conductance and chlorides are present in Tiger Bay at about half the concentrations found in N-16. Although these constituents have Class III limits relative to increases above "natural" levels, the present level cannot be considered "natural" because the major inflow to Tiger Bay at this time is seepage from a clay settling area. After reclamation of the total site area is complete, assuming no power plant, chloride, conductance and TDS would all be expected to rise to relatively high levels "naturally" due to evaporation. Therefore, the percent increase above "natural" criteria are not applicable as the "natural" level cannot be determined. With respect to nutrients, the level of phosphorus in Tiger Bay will likely be reduced, the levels of ammonia and nitrite will stay the same, and the level of nitrate will increase slightly. These changes are not expected to have a significant impact on water quality and the balance of natural populations of aquatic flora or fauna in Tiger Bay.

Table 5.1.3-3 summarizes the dissolved oxygen (DO) information obtained from the surface water hydrology field monitoring program. At first glance, these data appear to indicate that DO is at its minimum in the "natural" streams - McCullough Creek, Camp Meeting Ground Branch, and the Peace River. DO also appears to be at its maximum in the active mine water systems such as N-15, N-16, and SA-11. The DO in Tiger Bay appears to be variable but acceptable as far as the Class III water quality standards (17-302 Florida Administrative Code [F.A.C.]) are concerned. However, the wide range of DO levels in Tiger Bay do indicate photosynthetic activity. A historical perspective can be gained upon inspection of the U.S. Geological Survey (USGS) records on the Peace River. Figures 5.1.3-1 through 5.1.3-3 show the historical levels of DO within the Peace River in the project area. Figures 5.1.3-4 and 5.1.3-5 display the same data (as available) as a percent of saturation levels. These data indicate that DO levels in the Peace River are highly variable and undoubtedly influenced by photosynthetic activity.

As described in Section 2.3.6, the wetland areas of Tiger Bay are in poor condition, with symptoms generally attributable to insufficient water circulation. Although, based on the results of the surface water hydrology monitoring program, the water chemistry in Tiger Bay does not show any specific chemical or physical constituent which appears to be individually responsible for this condition, practical experience indicates that increased water circulation (increased flow-through or reduced retention time) can be expected to improve the quality of these wetlands. Further discussion of this subject is presented in Section 5.8.

5.1.4 Effects of Offstream Cooling

5.1.4.1 Fog

The cooling pond is expected to operate at temperatures not significantly higher than ambient water temperatures. As described in Section 3.5.1, the hottest water temperatures in the cooling pond are expected to be about 115°F at the condenser discharge and about 96°F at the condenser inlet. Because these temperatures are not greatly above ambient air and water temperatures (see Sections 2.3.4 and 2.3.7), the cooling pond is not expected to produce fog in greater than natural amounts. Because the cooling pond is elevated above nearby roadways (CR 555 and CR 640) and because the heat transfer from the cooling pond results in convective rising air flow, any fog produced would not be expected to manifest within the roadways.

5.1.4.2 Blowdown and Drift

Operation of the cooling pond system will produce neither blowdown nor drift. Although the recycling of reclaimed water is being proposed, because there is no drift, bacteria and viruses will not be spread by wastewater aerosols.

5.1.5 Measurement Program

During operation, FPC proposes to sample at the two Tiger Bay locations (see Figure 2.3.4-16) for the following parameters on a semiannual basis:

5-day Biochemical Oxygen Demand (BOD)	Ortho Phosphate
Chlorophyll A	Total Dissolved Solids
Fecal Coliform	Total Kjeldahl Nitrogen
Ammonia Nitrogen	Total Alkalinity
Nitrate Nitrogen	Total Coliform
Nitrite Nitrogen	Total Phosphorus

TABLE 5.1.3-1
WATER QUALITY OF TIGER BAY AND N-16

Constituent (mg/l unless noted otherwise)	Existing Level in Tiger Bay[1]	Existing Level in N-16[1]	Predicted Level in Cooling Pond[4]	Standards for Class III Waters[8]
Alkalinity (asCaCO3)	88	126	371.4	20[7]
Aluminum	BD	0.32	BD	N/A
Ammonia (as N)	BD	0.12	0.7	0.02[6]
Antimony	BD	BD	BD	N/A
Arsenic	BD	BD	BD	0.05
Barium	BD	BD	BD	N/A
Beryllium	BD	BD	BD	0.011
Boron	BD	BD	BD	N/A
Cadmium	BD	BD	BD	0.0008
Chromium	BD	BD	BD	0.05
Copper	BD	BD	BD	0.03
Cyanide	BF	BD	BD	0.005
Fecal Coliform (cfu per 100 ml)	18	6	BD	800
Fluoride	1.96	2.45	1.9	10
Iron	0.21	O.11	BD	1
Lead	BD	BD	BD	0.03
Manganese	BD	BD	BD	N/A
Mercury	BD	BD	BD	0.0002
Molybdenum	BD	BD	BD	N/A
Nickel	BD	BD	BD	0.1
Nitrate (as N)	0.04	0.05	0.13	See note [9]
Nitrite (as N)	BD	BD	BD	See note [9]

TABLE 5.1.3-1
WATER QUALITY OF TIGER BAY AND N-16

Constituent (mg/l unless noted otherwise)	Existing Level in Tiger Bay[1]	Existing Level in N-16[1]	Predicted Level in Cooling Pond[4]	Standards for Class III Waters[8]
Oil and Grease	0.1	0.1	0.1	5
pH (Std. Units)[2]	7.08-9.06	7.48-8.52	7.60-8.2	6.0-8.5[10]
Phenolics	BD	BD	BD	0.001
Selenium	BD	BD	BD	0.025
Silica	2.17	2.36	10.5	N/A
Silver	BD	BD	BD	0.00007
Strontium	BD	0.11	2.6	N/A
Surfactants	BD	BD	BD	0.5
TDS	117	406	844	N/A
Total Coliform (10/H)	N/A[3]	N/A[3]	N/A	2,400
Hardness, Total (as CaCO3)	250	110	199.3	N/A
Total Phosphorus	0.10	0.80	0.06	See note [9]
Total Sulfide	BD	0.16	11.3	N/A
TSS	6.8	16.5	BD	N/A
Turbidity (NTU)	28	6.4	N/A	29
Vanadium	BD	BD	BD	N/A
Zinc	BD	BD	BD	0.03
Specific Conductance	213	632	1,218	1,275[11]
Calcium	17.5	58	41.6	N/A
Magnesium	12.5	25	21.2	N/A
Sodium	8.0	44.5	30.6	N/A
Potassium	BD	3.2	2.9	N/A

TABLE 5.1.3-1
WATER QUALITY OF TIGER BAY AND N-16

Constituent (mg/l unless noted otherwise)	Existing Level in Tiger Bay[1]	Existing Level in N-16[1]	Predicted Level in Cooling Pond[4]	Standards for Class III Waters[8]
Chloride	9.6	18.8	32.8	10% Increase
Bicarbonate	87.9	116	468.5	N/A
Carbonate	BD	9.4	99.3	N/A
Sulfate	BD	163.5	212.9	N/A
Ra226 (pCi/l)	BD	0.85	3.54	5[5]
Ra228 (pCi/l)	BD	BD	BD	5[5]
Gross Alpha (pCi/l)	0.6	5.1	0.9	15
Strontium 90 (pCi/l)	0.1	3.8	N/A	N/A
Tritium (pCi/l)	22.5	0.1	N/A	N/A

Notes: BD indicates below detection
N/A indicates not applicable.

(1) Value shown is the average of wet and dry season from Table 2.3.4-4.
(2) Range is shown because average is inappropriate.
(3) Results are not available because of matrix interference.
(4) Value shown is average well water concentrated three times, from Table 3.5.1-7 or, if appropriate, 3 times the average value in Table 3.5.1-4.
(5) The actual standard is for Ra 226 + Ra 228.
(6) Standard is for the un-ionized component only.
(7) Standard is for value to be not less than 20.
(8) Standards are for predominantly fresh waters as defined in F.A.C. 17-302.
(9) Nutrients shall not cause an imbalance in natural populations of aquatic flora or fauna.
(10) If natural background pH is higher than 8.5 units, the pH shall not vary above natural background or vary more than one unit below natural background. If natural background pH is less than 6 units, the pH shall not vary below natural background or vary more than one unit above natural background.
(11) Value not to exceed 1,275 or 50% above natural.

Source: Ebasco Environmental, 1992
FDER, Rule 17-302.560, Criteria: Class III Waters

TABLE 5.1.3-2
WATER QUALITY CONSTITUENTS OF CONCERN
TIGER BAY AND N-16

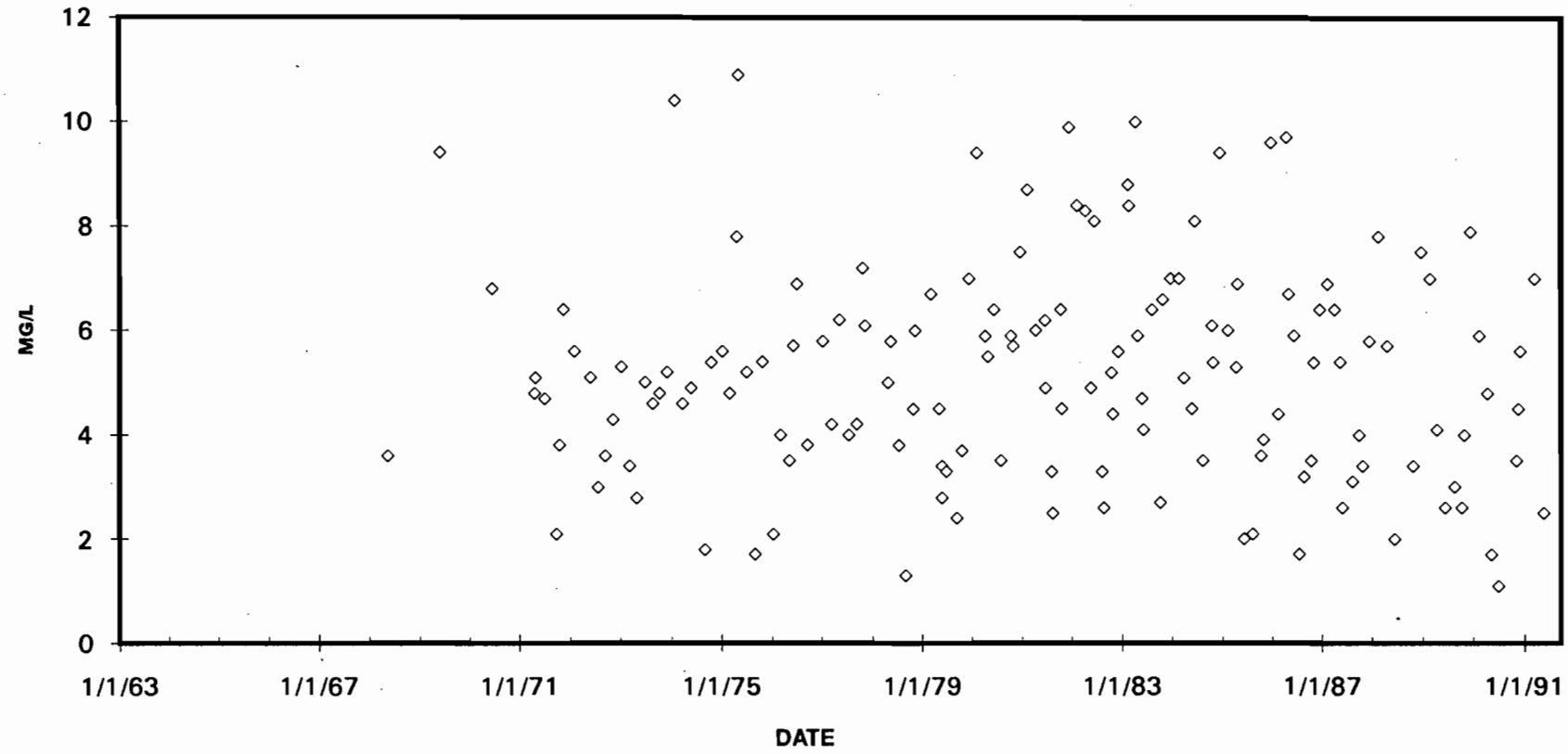
Constituent (mg/l unless noted otherwise)	Existing Level in Tiger Bay	Existing Level in N-16	Predicted Level in Cooling Pond	Standards for Class III Waters
Ammonia (as N)	<0.1	0.12	0.7	limit as nutrient
Nitrate (as N)	0.04	0.05	0.13	limit as nutrient
pH (Std. Units)	7.08 - 9.06	7.48 - 8.52	7.60 - 8.2	6-10.06
Total phosphorus (as P)	0.10	0.80	0.06	limit as nutrient
Calcium	17.5	58	41.6	N/A
Magnesium	12.5	25	21.2	N/A
Sodium	8.0	44.5	30.6	N/A
Potassium	<1	3.2	2.9	N/A
Chloride	9.6	18.8	32.8	N/A
Bicarbonate	87.9	116	468.5	N/A
Carbonate	<2	9.4	99.3	N/A
Sulfate	<1	163.5	212.9	N/A

Source: Ebasco Environmental, 1992
FDER, Rule 17-302.560, Criteria: Class III Waters

TABLE 5.1.3-3
DISSOLVED OXYGEN MEASUREMENTS

	September 1991 Measurements (Wet Season)	
Location	DO (mg/l)	Time
Tiger Bay (East)	5.8	4:15 PM
Camp Meeting Ground Branch	3.9	10:20 AM
Peace River	3.5	3:15 PM
McCullough Creek	2.8	10:00 AM
	May 1992 Measurements (Dry Season)	
Tiger Bay (West)	6.7	11:05 AM
Tiger Bay (East)	11.2	10:30 AM
Camp Meeting Ground Branch	4.0	11:50 AM
McCullough Creek	2.8	12:40 PM

Source: Ebasco Environmental, 1992



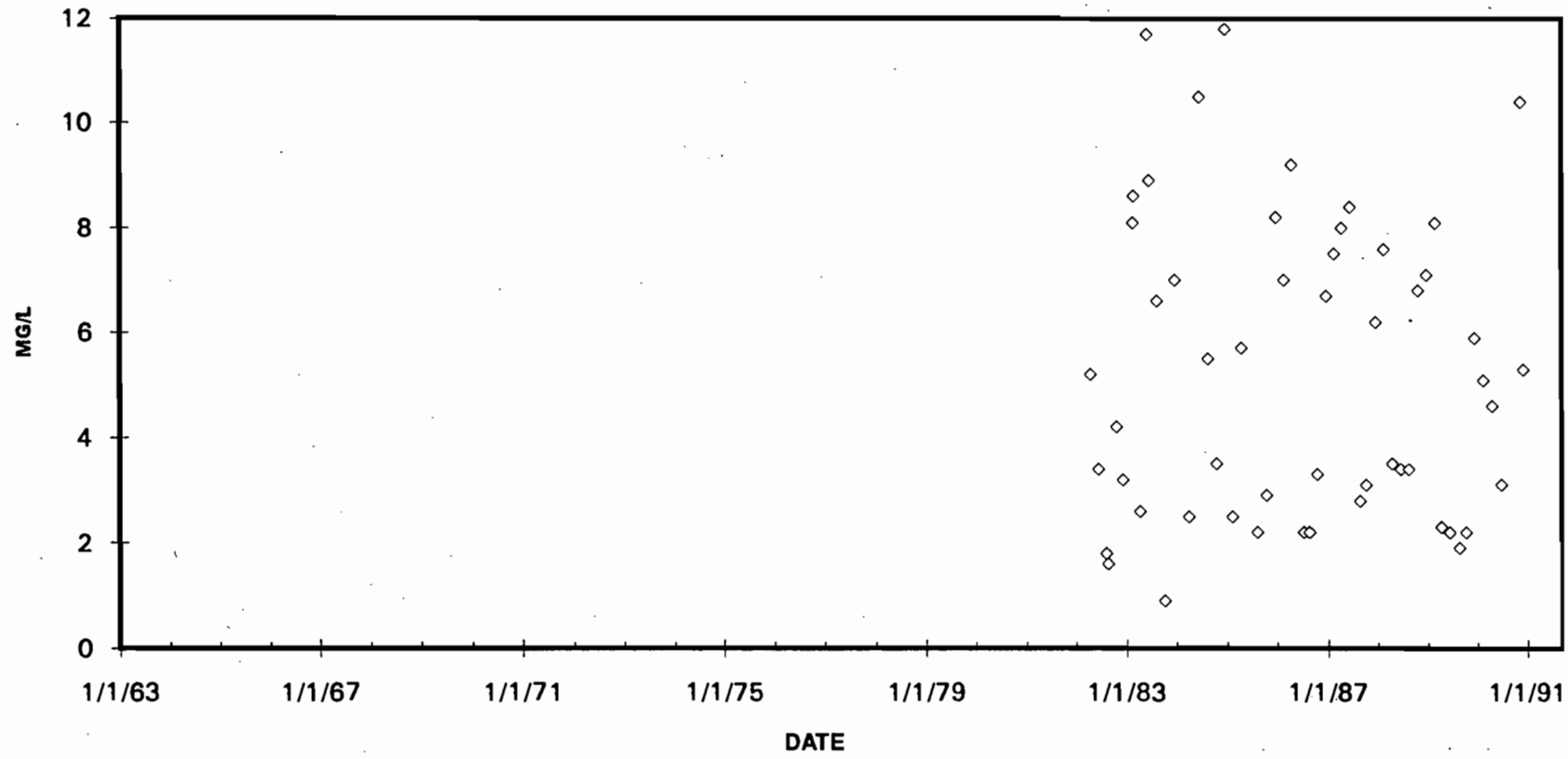
Source: USGS, 1992

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Polk County Site

FIGURE 5.1.3-1

DISSOLVED OXYGEN MEASUREMENTS
PEACE RIVER AT BARTOW, FLORIDA



Source: USGS, 1992

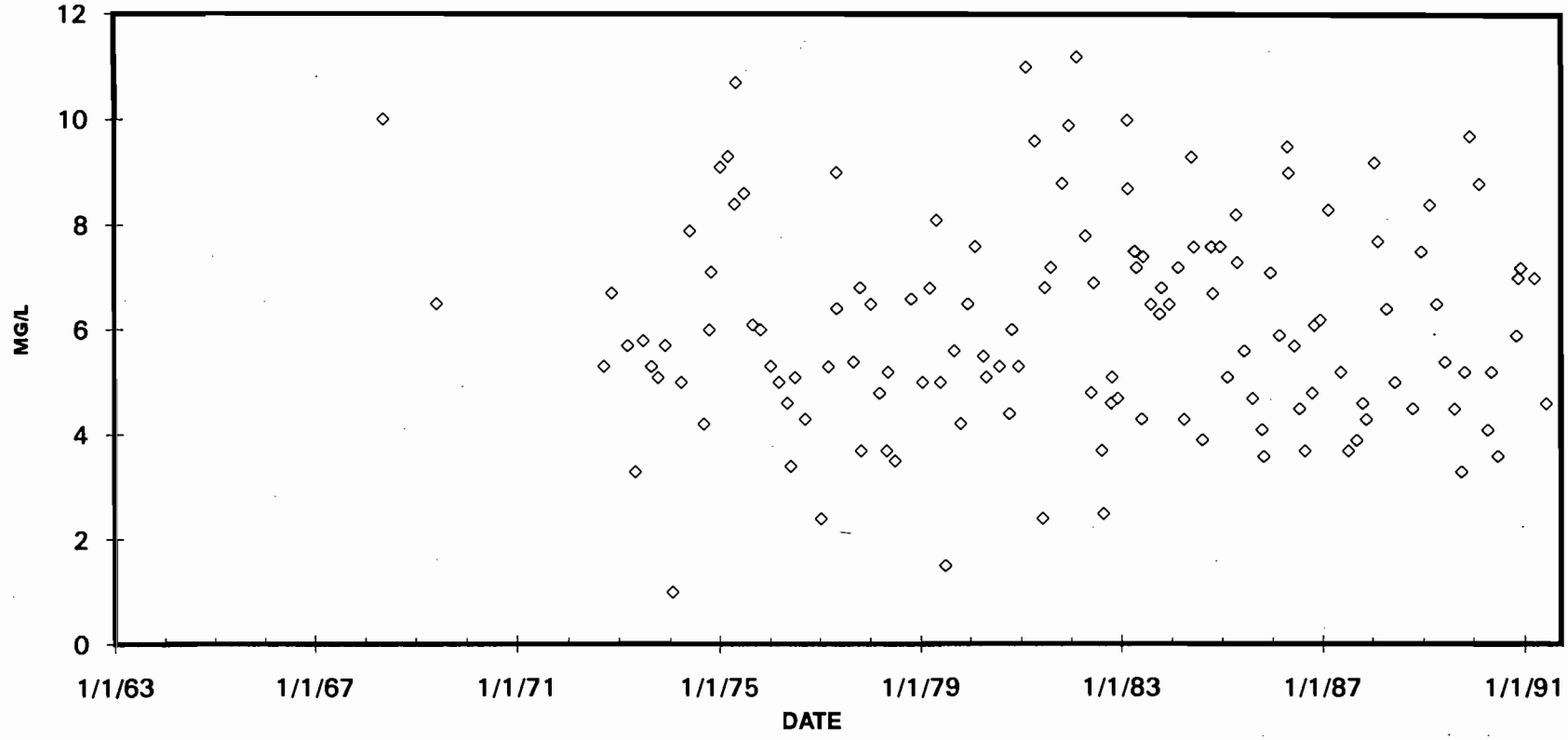
Florida Power CORPORATION

Polk County Site

FIGURE 5.1.3-2

DISSOLVED OXYGEN MEASUREMENTS

PEACE RIVER NEAR HOMELAND, FLORIDA

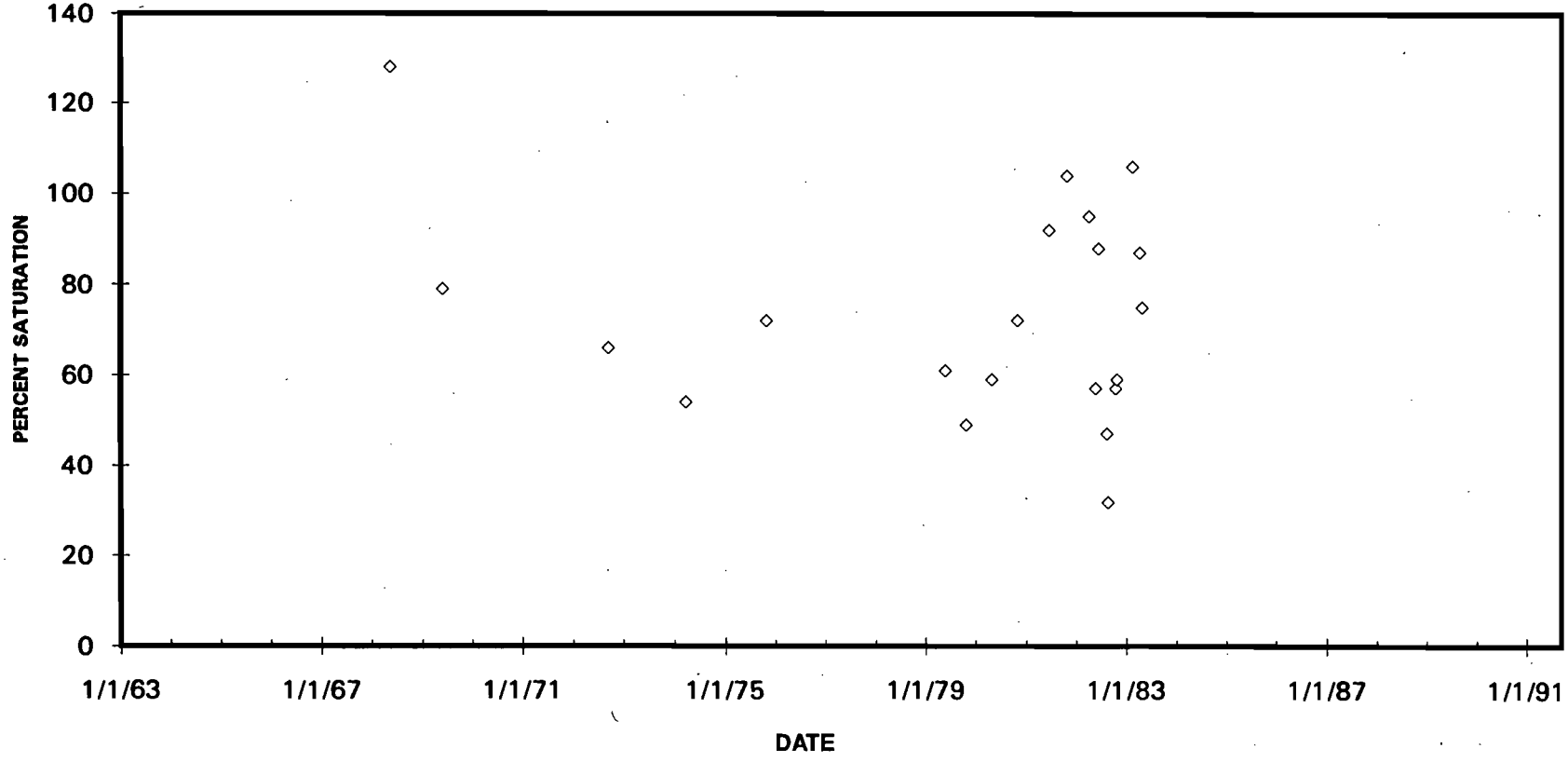


Source: USGS, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 5.1.3-3
DISSOLVED OXYGEN MEASUREMENTS PEACE RIVER AT FORT MEADE, FLORIDA

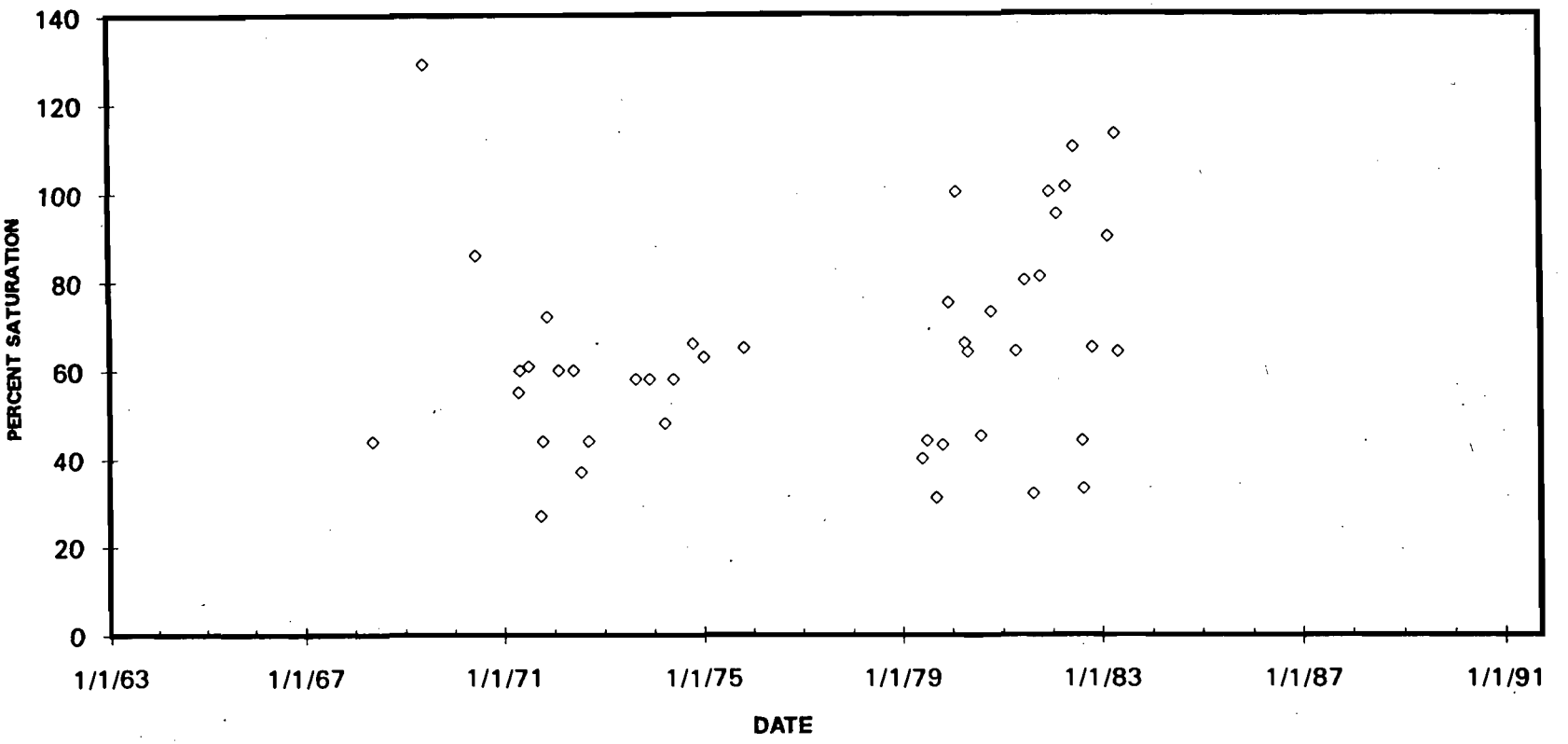


Source: USGS, 1992

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Polk County Site

FIGURE 5.1.3-4
DISSOLVED OXYGEN SATURATION
PEACE RIVER AT FORT MEADE, FLORIDA



Source: USGS, 1992

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Polk County Site

FIGURE 5.1.3-5
DISSOLVED OXYGEN SATURATION
PEACE RIVER AT BARTOW, FLORIDA

5.2 EFFECTS OF CHEMICAL AND BIOCIDE DISCHARGES

5.2.1 Industrial Wastewater Discharges

The project will have no industrial wastewater discharges. Consequently, this section is not applicable.

5.2.2 Cooling Tower Blowdown

The project will have no cooling tower blowdown. Consequently, this section is not applicable.

5.2.3 Measurement Program

The proposed surface water measurement program is described in Section 5.1.5.

5.3 IMPACTS ON WATER SUPPLIES

The Polk County Site has been designed to minimize the withdrawal of water from the Upper Floridan Aquifer and to maintain appropriate water quality in off-site water bodies. Key concepts included in the project design to achieve these aims include the following:

- Water cropping of all available non-buffer area property - Maximizing interception and reuse of runoff from on-site areas as cooling pond makeup minimizes ground water withdrawals. Off-site water quality/quantity considerations preclude water cropping from buffer areas.

- Recycle of process wastewaters within the generating units and associated processes - At its ultimate incorporation, wastewater recycling leads to zero discharge while minimizing ground water withdrawals. It also leads to elimination of pollutant discharges in compliance with both the intent and requirements of the federal Clean Water Act.

- Use of reclaimed water - Reclaimed water is treated municipal sewage effluent which would otherwise be discharged, with its associated pollutants, to waters of the state. Use of reclaimed water allows a one-for-one reduction in ground water withdrawals for every gallon of reclaimed water which is utilized while also removing the pollutants from the surface water bodies into which they would otherwise have been discharged.

5.3.1 Surface Water

Operation of the project will involve the interception and use of surface water runoff from much of the site. Without the project, a portion of this runoff would have been available for downstream use. These potential uses would include (SWFWMD, 1991):

- Public water supply and other potable uses
- Agricultural water
- Industrial water
- Mining water
- Recreational water

In addition to these uses, the hydrology of small watersheds which may be affected by the project must be considered.

5.3.1.1 Peace River

In all of the Peace River Basin, only two surface water withdrawals have been identified. These include the Peace River-Manasota Regional Water Supply Authority (PRMRWSA) water treatment plant near Ft. Ogden, approximately 35 miles south of the site, (see Figure 5.3.1-1), and, in Charlotte County, the City of Punta Gorda reservoir on Shell Creek, a tributary of the Peace River. In the future, Southwest Florida Water Management District (SWFWMD) (1992) recommends that an additional 25.0 million gallons per day (MGD) (34.3 MGD maximum) of withdrawal be developed from the Peace River, also at Ft. Ogden. The total withdrawal by 2020 would then be 37.0 MGD (average) or 48.7 MGD (peak), equivalent to a withdrawals of about 57.3 cfs (average) or 75.4 cfs (peak), respectively. The average flows are the appropriate quantity to compare because the withdrawal includes pumping water during high flows and storing it until needed. Average flows at Arcadia and Fort Meade are 1,084 cfs and 155 cfs, respectively. Therefore, runoff to the Peace River downstream of Fort Meade (929 cfs) is more than sufficient to supply the recommended surface water withdrawal.

As noted in Section 4.2.C.2 of the Basis of Review for Water Use Permit Applications (SWFWMD, 1989), the central component of SWFWMD's rules for stream withdrawals is a 10 percent guideline for evaluation of environmental impacts. The goal of this technical criterion is to allow for consumptive withdrawals of flowing waters, while protecting the ecological qualities of streams and estuaries. This has particular importance in southwest Florida where economically important sport and commercial marine fisheries are ecologically dependent on freshwater flows to coastal estuaries. Selection of the 10 percent guideline by SWFWMD was based on numerous hydrologic and ecological studies conducted on rivers and estuaries in southwest Florida.

The Peace River at Fort Meade has a drainage basin of 480 square miles (USGS, 1990). If the project removes 7,000 acres from that basin, or 10.9 square miles, it will not affect flows at that station by more than 2.3 percent. Thus, the zero discharge design of the site will not have a significant impact on flows in the Peace River, or to either existing or potential future users.

The proposed changes to the existing approved (pre-1992) reclamation plans will change the proposed east buffer areas (N-11A, N-13, and N-9B) from about 20 percent contributory to 100 percent contributory drainage to the Peace River (via Camp Meeting Ground Branch). Seepage from N-16 to Tiger Bay is expected to supply a base flow to Camp Meeting Ground Branch on the order of about 0.05 cfs. FPC is negotiating with Florida Department of Natural Resources (FDNR) to convert U.S. Agrichemical Company (USAC) properties (likely N-9 and N-4) and Mobil property (likely FM-1) to be contributory areas to McCullough Creek. Thus the project should not have any impact on flows in the portion of the Peace River upstream of Fort Meade.

5.3.1.2 Tributaries

Effects of project operation on tributaries to the Peace River are expected to occur as a result of reductions in flow to smaller streams, as compared with baseline conditions without the project. Tributaries which could be affected include:

- Camp Meeting Ground Branch
- McCullough Creek

CAMP MEETING GROUND BRANCH

This stream will lose the land-locked 1,250 acre drainage area that would have been reclaimed as part of N-16; however, this loss will be offset by the addition of 1,045 acres in the east buffer areas (N-11A, N-13, and N-9A) to its drainage area. The net result will be a positive gain because the buffer areas will all be contributory while the reclaimed N-16 would not. Even based on pre-mining drainage basin divides, the Camp Meeting Ground Branch drainage area within the site boundary will increase from 1,017 acres to 1,565 acres. The peak discharge for this basin as a whole is not expected to exceed the pre-mining peak discharge because off-site acreages have been greatly disturbed in this drainage basin.

MCCULLOUGH CREEK

As described in Section 2.3.4.1, the hydrology of McCullough Creek has been under detailed study by FDNR (Partney, et al., 1990). Based on that study, the total reclamation area in the McCullough Creek drainage basin is 16.6 square miles, while the pre-mining drainage basin was 14.5 square miles. The zero discharge design of the Polk County Site will reduce that area to

about 13.9 square miles, or to about 96 percent of the original pre-mining area. Further, FDNR believes that the fully reclaimed extent of the basin (including non-mandatory areas for which reclamation plans have not yet been developed) will be larger than the presently approved reclamation areas (mandatory areas and non-mandatory areas being reclaimed under the Old Lands Program)(Partney, et al., 1990). Therefore, reclamation of the remainder of the basin should allow the restoration of flow patterns very similar to those of pre-mining conditions, without the Polk County Site areas. As described above in Section 5.3.1.1, FPC is negotiating with FDNR and various mining companies to restore drainage to the McCullough Creek headwaters so that the 10 percent guideline will be met there as well.

SIX-MILE CREEK AND BARBER BRANCH

Six-Mile Creek and Barber Branch have been eliminated as a result of mining activities and are not proposed to be restored under the baseline condition. Consequently, they cannot be impacted by plant operation. Between them, the area included in their pre-mining drainage basins represents about 64 percent of the site.

5.3.2 Ground Water

This section describes the hydrogeologic analyses performed to assess the potential impacts from plant operations on the ground water resources of the area. The following plant activities have been considered:

- Withdrawal of water from the Upper Floridan Aquifer to be used as supplemental make-up water to the cooling pond (Section 5.3.2.1)
- Storage of water in N-16 and the brine pond (Section 5.3.2.2)
- Storage of solid waste on-site (Section 5.3.2.3)

Several computer models were employed to estimate the plant operational impacts. The details and procedures used to construct the computer models and to verify their results are included in Appendix 10.5.9. This section discusses the modeling approach and the resulting predicted impacts on the ground water systems. Water supply impacts are reflected as drawdowns in water levels or potentiometric head levels in the aquifers. In the analysis of potential impacts from N-

16, the brine pond, or the solid waste storage area, both flow and water quality changes are evaluated.

5.3.2.1 Impacts of Groundwater Withdrawals for Supplemental Make-Up Water to the Cooling Pond

Fossil fuel power plants generate electric power through the combustion of hydrocarbons. The conversion of heat energy into electric energy is not 100% efficient, and therefore the residual heat energy must be dissipated in some manner. The FPC Polk County Site will use a cooling pond as the primary heat sink with the pond being cooled by evaporation from the surface. The amount of evaporation from the pond will exceed rainfall on an average annual basis, thus requiring additional water to maintain the pond levels. Sources of water for the cooling pond include: stormwater captured from the pond's surface and surrounding areas, reclaimed water from nearby municipalities, recycled plant wastewater, and ground water. This section evaluates the impacts of groundwater withdrawals for cooling water make-up.

WATER USE REQUIREMENTS

Section 3.5.1 discusses the plant water requirements for cooling purposes. From a water supply perspective, the plant cooling water needs will be met first by sources such as plant wastewater recycling and stormwater capture. When these sources are insufficient to maintain the required levels in the cooling pond, ground water from the Upper Floridan Aquifer will be used. To evaluate the impacts of groundwater withdrawals on the existing natural resources, a finite difference groundwater flow model for the region was developed using a publicly available computer program created by the U.S. Geological Survey (USGS), popularly called "MODFLOW." This model was the primary tool used to evaluate the potential impacts of the withdrawals required to meet the demands of the various phases of the power generation operations.

The model is both detailed in design and comprehensive in scope. MODFLOW's program structure makes it possible to implement and modify independent subroutines called "modules" in a very effective and relatively simple manner. The code consists of a main program and a series of independent modules, or subroutines that are grouped into "packages". This highly flexible modular structure permits the development of new or additional modules, without modification of the source code or to existing modules. The MODFLOW code as applied to the

FPC site consisted of a three-dimensional finite difference grid extending 33.9 miles from east to west and 32.3 miles from north to south. In a vertical direction, the model was designed to include all significant surface water features, and layers representing the surficial, Intermediate and Upper Floridan aquifers with the intervening confining layers represented by vertical conductivity parameters. The conceptual model is shown on Figures 5.3.2-1 and 5.3.2-2. The details of the model construction, input parameters, calibration, and verification are included in Appendix 10.5.9. This appendix includes a discussion of the initial conditions, data calibration and verification runs and supporting discussion. Numerous simulations using varying initial conditions and a wide range of groundwater withdrawal rates were completed and are also included in Appendix 10.5.9. This section will address the outcome of the modeling efforts and the impact of plant operations as predicted by the groundwater model.

The quantity of water necessary to be withdrawn from the aquifer is dependent on the plant needs and climatic conditions. The power generating capacity of the site will not be at maximum capacity immediately, but will gradually increase as new generating units are added. It is anticipated that full build-out will occur by the year 2018. Because the water supply needs of the plant are dependent on the operating capacity, they will increase as the capacity increases. During the initial filling of the cooling pond, however, ground water pumpage will be at a rate of approximately 8 MGD for approximately 2 years. At full plant build-out, the maximum ground water needs are estimated to be 31.6 MGD.

IMPACT SIMULATIONS

The groundwater model was used to perform predictive simulations to estimate the impacts of groundwater withdrawals. As the conceptual design matured, a range of withdrawals from the Upper Floridan Aquifer was considered, with the groundwater make-up volume dependent on the quantity of alternative sources of water available and the equivalent blowdown required to maintain the necessary water quality in the cooling pond. The City of Bartow currently has about 3 MGD of treated effluent which could be available for the cooling water needs of the plant, and would be able to contribute approximately 5 MGD under expected growth conditions within ten years of plant startup. Assuming no other sources of reclaimed water are available this would reduce the maximum plant requirements to 26.6 MGD from the groundwater source. The groundwater model was used to evaluate the potential impact of the 31.6 MGD maximum withdrawal rate and of the anticipated 26.6 MGD withdrawal rate. The impact of a withdrawal rate of 20.6 MGD was also evaluated by simulation with this model. The 20.6 MGD simulated

rate has no basis in reality at this time, but would be realistic in the future if an additional 6 MGD of reclaimed water ultimately were available. The detailed supporting documentation for these alternative withdrawal rates is provided in Appendix 10.5.9.

Impacts from the withdrawal of ground water were evaluated by considering the following factors:

- SWFWMD technical performance standards
- Phasing of projected plant withdrawals (including water conservation efforts such as water cropping)
- Projected changes in water use demands in Polk County

SWFWMD PERFORMANCE STANDARDS. The SWFWMD utilizes a "three-prong" test, defined by Section 373-223 Florida Statutes, to evaluate a proposed water use. The test requires that the water use meet the following criteria:

- It must be reasonable and beneficial.
- It must not adversely interfere with any existing legal use of water.
- It must be consistent with the public interest.

Impacts (i.e., drawdowns) are evaluated against technical performance standards (SWFWMD, 1989). For some technical standards, SWFWMD has developed guidelines regarding the levels of significant impacts (i.e., threshold levels) to facilitate the impact evaluation process. If the threshold values are not exceeded the presumption is that no adverse impact has occurred. If the threshold values are exceeded, further analyses are needed. Those threshold values which are pertinent to this project have been identified and are shown in Table 5.3.2-1. The results of predictive simulations were evaluated against these threshold values. The most significant threshold value is the limitation of 5 feet of potentiometric level drawdown at an existing user in the confined aquifer.

PHASING OF PLANT WITHDRAWALS. The first generating unit is anticipated to begin operations in 1998, and thereafter, additional power units will be added gradually until full power (up to 3,200 MW) is achieved in approximately the year 2018. Phasing-in of the power

generation capacity and the corresponding increase in water requirements are discussed in Section 3.5.1. These requirements consider reductions due to the use of water cropping and plant recycling, but not of reclaimed water. Alternate water sources will be used first, with ground water supplying only that quantity not available from other feasible means.

PROJECTED CHANGES IN POLK COUNTY WATER USE DEMANDS. Figure 5.3.2-3 illustrates the predicted changes in water use demands by use sector in Polk County as estimated by SWFWMD (1992). Significant growth is anticipated in irrigation, public supply and in industrial use. The industrial use already includes 40 MGD for the proposed FPC Polk County facility. Mining use is predicted to decline sharply beyond 1995 until it represents less than 1/3 of its present use by 2020. The effect of these projections is an estimated net growth of approximately 18 percent in water use within Polk County through the year 2020 without considering conservation. Conservation efforts are expected to reduce overall demands, perhaps by as much as 20 percent according to SWFWMD's Needs and Sources document (1992).

To illustrate the potential significance of conservation efforts, the proposed FPC use is included in SWFWMD projections as 40 MGD, whereas conservation efforts and recycling efforts during the project's design have reduced this amount to between 26.6 MGD and 31.6 MGD. In summary, present ground water use in the area of the FPC site appears to be at a maximum. Mining use is expected to decline sharply in the near future, but general growth in other uses, such as public supply and irrigation, will increase. This growth in other segments such as public supply and irrigation will be distributed across the County and not concentrated in one area, whereas the declines for mining withdrawals will be concentrated mainly in the immediate vicinity of the Polk County Site.

IMPACT ASSESSMENT. The impact of the proposed FPC use was evaluated in two ways, first against a set of baseline conditions, consistent with SWFWMD standards represented by water levels in the aquifer in a predevelopment state, and second in comparison to all existing users pumping from the aquifer during a drought period. The procedures for the first methodology were:

Step 1: The potentiometric maps representing pre-development water levels were used to generate initial head boundary conditions. These values were input into the model and allowed to achieve steady state conditions.

Step 2: FPC wells were inserted into the model and allowed to pump for 90 days with the entire modeled area receiving zero recharge. Three pumping runs were completed with the FPC wells pumping at 20.6 MGD, 26.6 MGD, and 31.6 MGD.

Step 3: The drawdowns in the Upper Floridan, calculated as the difference between Step 1 and Step 2, were then plotted. Figures 5.3.2-4 through 5.3.2-6 illustrate the results.

The results of these runs established the area of impact of the FPC wells in the absence of all other users. This approach is very conservative because 90 days with zero discharge would be a very rare event.

The second approach evaluated the cumulative impact of the proposed use in conjunction with all existing users. This approach is a conservative analysis because the anticipated decline in mining withdrawals will result in a significantly reduced water demand in the area of the proposed plant site. By keeping mining company use at its present level and adding the proposed FPC use simultaneously, the cumulative impact analysis represents a worst case that will not, in fact, actually occur in the future.

The general procedure used to simulate FPC withdrawals with all current users was as follows:

Step 1: A 90-day transient simulation was executed, assuming the following conditions:

- No recharge will occur during the 90-day period of simulation.
- Starting heads are generated by the dry season historical calibration simulation.
- All wells (existing users) used in the dry season historical calibration well package are active.

Step 2: A second 90-day transient simulation was executed assuming the following conditions:

- No recharge will occur during the 90-day period of simulation.
- Starting heads are generated by the dry season historical calibration simulation.

- Well package incorporates the existing users and the proposed FPC withdrawals for the three scenarios of 20.6 MGD, 26.6 MGD, and 31.6 MGD.

Step 3: The simulated heads from Step 2 were subtracted from those of Step 1, resulting in the simulated drawdowns, or impacts, from the proposed FPC wells. Figures 5.3.2-7 through 5.3.2-9 illustrate the results.

DISCUSSION OF RESULTS

The results of the predictive simulations were evaluated in terms of the SWFWMD performance standards (Table 5.3.2-1). There was no indication of potential impacts to the Surficial Aquifer System as a result of FPC withdrawals. Therefore, no impact or exceedances of the SWFWMD threshold values are expected to occur in terms of drawdowns below ponds, streams, or wetlands or at individual user wells within this aquifer. The primary presumption exceeded by the simulated scenarios was the five-feet drawdown at a neighboring legal water supply well penetrating the Upper Floridan Aquifer. Wells that fell within the five-feet drawdown contour were classified, for purposes of these discussions, as potentially impacted wells.

Impacts on existing users were evaluated by plotting drawdown contours for each of the model simulations and superimposing the locations of existing permitted wells in the Upper Floridan Aquifer (Figures 5.3.2-4 through 5.3.2-9). The number of potentially impacted Upper Floridan wells (i.e., total number of wells and the number of wells by type-use category) has been summarized for each of the simulated FPC withdrawal rates (i.e., 20.6, 26.6, and 31.6 MGD) in Table 5.3.2-2. The total number of impacted wells is slightly lower under the pre-development baseline scenario than under the existing users baseline condition scenario. The 20.6 MGD simulations show 10 permitted wells potentially impacted under the pre-development baseline conditions and 22 wells under the existing users baseline conditions. Similarly, the 26.6 MGD simulations indicated that 62 and 65 wells, respectively, may be impacted under the corresponding baseline conditions. At the 31.6 MGD withdrawal, the predicted total impacted wells is 71 for the predevelopment case and 82 for the existing user case.

For all cases, between 40 and 50 percent of the impacted wells are classified as mining wells that are expected to be decommissioned before the full build-out phase. About 30 percent of the impacted wells are irrigation wells. The remaining 20 percent of the wells are primarily public supply and industrial wells. Based on the SWFWMD CUP database, information about the potentially impacted wells such as the owner's name, well depth, permit number, and type-use

classification for each potentially impacted user under the pre-development scenario for the 26.6 and 31.6 MGD withdrawals is presented in Table 5.3.2-3. The 82 potentially impacted wells belong to only 16 different users. IMC is listed as the owner of approximately 50 percent of the potentially impacted wells. Estech and Mobil are listed as the owners of 16 and 9 percent of the wells, respectively. The remaining 25 percent of the wells involve another 13 owners. It should also be noted from Table 5.3.2-3 that the well depth for eighty percent of the wells is greater than 600 feet. Therefore, although the five-feet drawdown presumption might be exceeded at these wells, there should not be any noticeable change in the withdrawal rates at these wells.

The potential impact of the FPC withdrawal represented in the Table 5.3.2-2 should be considered as a worst case that will likely never be realized. The assumptions of the model with respect to climatology are inherently conservative. That conservatism is compounded by using the simulated peak withdrawal of 31.6 MGD rather than the anticipated daily demand of about 26.6 MGD. Additionally, future reduction in use will occur in the immediate vicinity of this site as the neighbor mining companies cease mining. Most of the current mining wells shown as potentially impacted will in all likelihood not be in service when the FPC plant build out has reached the stage at which the maximum withdrawal will be reached, presently estimated as the year 2018. Furthermore, during the period the site groundwater pumpage is growing (1998 - 2018), the mining use of ground water in Polk County is projected by SWFWMD (1992) to decline by an even greater amount, as shown on Figure 5.3.2-3. Much of that mining use reduction will occur on the adjoining properties as IMC and USAC reduce production. The withdrawal permits of Estech and Mobil have already expired. In fact, the groundwater usage reduction by these neighboring facilities is expected to exceed the growth in usage on this site and should thereby offset, and essentially mitigate, the impact of FPC's withdrawals beyond the approximate site boundaries. Therefore, it is considered that the actual impact of this requested ultimate site withdrawal of 31.6 MGD on other Upper Floridan Aquifer users will, in fact, be minimal.

Although the Upper Floridan is the source aquifer for the requested 31.6 MGD withdrawal, the drawdown impact on the Intermediate Aquifer was also simulated. The drawdown simulation indicates that about eight permitted wells in the Intermediate Aquifer may be potentially impacted with drawdowns of about five feet at the 31.6 MGD withdrawal rate. Individual unpermitted residential wells in Homeland are thought to be mostly in the Intermediate Aquifer but it is not expected that the drawdown in these wells will exceed five feet. Using methodology

similar to that used for the analysis of impacts to the Upper Floridan Aquifer, drawdown contours for the Intermediate Aquifer have been developed and are presented on Figures 5.3.2-10 through 5.3.2-15.

The field measurements made during the Aquifer Performance Test and the results of these computer simulations consistently indicate that this requested withdrawal will have no effect on water table levels in the Surficial Aquifer. Therefore, no impact on surface water bodies, wetlands or on permitted or other legal users in the Surficial Aquifer is anticipated due to the requested withdrawal.

In no instance in any of the three aquifer systems at any stage of the plant build out is it anticipated that the FPC plant withdrawals will adversely impact the quantity of flow from the wells of current legal users.

RESPONSE TO THRESHOLD CRITERIA EXCEEDANCES

The following response actions are possible for any instances where exceedances of threshold criteria occur and further analysis is warranted:

- Examine the model structure and evaluate whether the predicted response is consistent with the actual physical systems.
- Include a monitoring program to investigate if predicted exceedances are real.
- Maximize alternative sources such as water cropping, waste water recycling and reclaimed water, and use cooling pond storage to reduce necessary withdrawals.
- Design mitigative measures for impacted users.

The Model. The model is a relatively conservative model with each of the model runs evaluated under relatively severe drought conditions. Average climatic conditions would increase recharge and thereby reduce the predicted drawdowns. Therefore, there is some assurance that the actual drawdowns to be experienced as a result of the power plant withdrawals usually will be less than the drawdowns predicted by the computer model.

Monitoring. A detailed ground water monitoring program is described in Section 4.3 for the groundwater resources of the area. This monitoring system will identify trends in water levels

well in advance of any potential impact. Appropriate actions would be developed in response to such results and mitigative response actions taken.

Alternative sources. Alternative sources will be maximized to the fullest extent practicable. The use of water cropping from solid waste disposal areas, the plant island, and, in the early stages of development, future cooling pond areas, is expected to reduce long-term ground water withdrawals by 5-10 MGD. Recycling of all internal plant wastewater streams, including cooling pond blowdown, is estimated to save another 5-10 MGD. Efforts are continuing to acquire rights to reclaimed water (effluent from municipal sewage treatment plants) that would further reduce the demand for ground water (see Appendix 10.11). Based on current information, the City of Bartow will be able to contribute from 3 MGD presently to 5 MGD ultimately of water as cooling pond makeup. Use of reclaimed water as makeup allows a one for one reduction in demand for ground water. Further reductions will thus occur as more reclaimed water becomes available.

Further, FPC has designed the cooling pond to include storage of about 7,000 acre-feet of water in N-16. This storage allows some pumping of ground water during non-drought conditions with subsequent lowering of cooling pond levels during drought conditions to reduce peak ground water demands. It is estimated that peak demands of ground water have been reduced by as much as 30 MGD because of this cooling pond storage.

Mitigative Measures. In the unlikely event that surrounding users are adversely impacted, as manifested by a lowering of potentiometric levels in these wells, FPC will implement mitigative measures. These measures can include lowering pumps, deepening wells, or providing an alternative water supply.

All of the above measures will be implemented, as appropriate, during the design and gradual development of the Polk County Site. As a condition of the CUP, FPC will provide Polk County with an annual report summarizing water use and conservation measures.

5.3.2.2 Cooling Pond and Brine Pond Seepage

This section describes the analyses performed to evaluate the quantities of seepage through the embankments of the N-16 cooling pond and the brine pond (see Figures 3.2.2-1 and 3.2.2-3).

The brine pond was analyzed to evaluate potential brine seepage even though seepage will be minimized by the underlying clays and by the synthetic liner to be installed along the inside perimeter of the embankment. N-16 was analyzed because it is the only part of the cooling pond not underlain by 30 feet or more of impermeable waste clay. The other cooling pond areas (N-15, N-11C and N-11B) will have greatly reduced seepage rates relative to N-16 because of their clay liners as described in Section 5.3.2.3. Further, horizontal seepage through the dam would be captured and recycled back to the cooling pond.

BACKGROUND

DESCRIPTION OF THE N-16 POND. The N-16 area will serve as the initial Stage I cooling reservoir. The existing topography of the area consists of flooded un-leveled overburden piles, and the northeastern corner has been partially filled with waste phosphatic clays. The topography in the N-16 area will be altered to level the overburden piles, construct the internal splitter dams and to refurbish the perimeter impoundment dams. Seepage through the south embankment is being allowed to augment the flows in Tiger Bay.

DESCRIPTION OF THE BRINE POND. A unique feature of the Polk County Site is the availability of waste clays and dams resulting from the previous phosphate mining. These features accommodate an evaporative pond which will receive the brine concentrated from the blowdown recycling treatment plant. The mining area designated SA-9 will be utilized to store the brine.

The brine pond (SA-9) is a 311 acre area with a storage capacity of approximately one billion gallons. The site area has an average net annual evaporation rate of 7.6 inches which indicates that the pond can receive up to 64 million gallons per year (MGY) without increasing the pond level. At ultimate development, it is estimated that the brine concentrate will be deposited in the pond at an average rate of 226,000 gallons per day (82.5 MGY). Considering the evaporative losses, the net annual increase after ultimate development will be 18.5 MGY. However, during the initial phase of site buildout for about 15.5 years, the net evaporation will exceed the brine production rate, as will be the case at the end of plant life when units are decommissioned. As shown on Figure 5.3.2-6, the brine production rate will exceed evaporation for an estimated 30 years from year 15.5 to about year 45.5. The brine accumulates and its level rises only when brine production exceeds the net evaporation. At the end of the mentioned

30-year period, the brine level is estimated to reach about 4.7 feet and thereafter decline. The brine is expected to have evaporated to a cake by about the time the last plant stops operating.

Seepage of brine from the pond will be restricted by the impermeable waste clay liner that forms the bottom of the pond and by a geomembrane on the inside slope of the dam. Seepage completely through the dam from SA-9 into SA-8 will be prevented by the SA-8 clays; any seepage into the dam between SA-9 and SA-8 will flow longitudinally toward its western and southern termini as shown on Figure 5.3.2-7. Further, the south and west perimeter SA-9 dam contains a drainage blanket that will collect any seepage should it migrate through the embankment or along the SA-9/SA-8 dividing dam. Such seepage would be pumped back into the brine pond.

METHOD OF ANALYSIS

Seepage through porous media can be analyzed by a variety of methods: analytical closed form solutions, laboratory analogies, flow net techniques, or numerical procedures, such as finite difference and finite element models. All of the alternatives were studied. The computer program, SEEP/G, a finite element model, was selected for analyzing seepage from N-16 because of its ability to simulate two dimensional seepage through a nonhomogeneous subsurface profile. In addition, it provides an efficient tool for evaluating the relative effect of each of the main input parameters in seepage problems. The flow net technique was also used to verify the results of the SEEP/G model.

DESCRIPTION OF THE SEEP/G PROGRAM. The SEEP/G computer code utilizes a finite element code to solve steady state seepage through porous media, in two-dimensional and axially symmetric problems. The program handles free surface and confined flow problems through anisotropic (materials that vary in different directions) and nonhomogeneous materials. Consequently, SEEP/G can be used to investigate two dimensional seepage, either planar or asymmetric, in confined or unconfined flow regions.

SEEP/G was derived from the program FREESURF 1, initially written by S.P. Neuman and P.A. Witherspoon (1970) at the University of California at Berkeley. Major modifications involving reorganization of the input data were made by P. Florentine in 1975. A personal computer code version converted by GEOSOFT Inc. was used to perform the seepage model simulations. The GEOSOFT code version has added utilities for full screen data input, plotting,

and viewing of the finite element mesh. The program was written in Fortran and the version used was compiled with the Microsoft Fortran 3.3 compiler.

DEVELOPMENT OF THE MODELS. The general procedure for model development of both N-16 and the brine pond consisted of 1) developing a conceptual model; 2) generating a finite element mesh; and 3) entering the appropriate data for each element. The conceptual models were designed to represent the subsurface conditions interpreted from the information obtained from the test boring investigation. Both conceptual models assumed that the soils were fully saturated and that temporal variations in flow conditions will not occur (i.e. steady-state flow conditions). It should be noted that this approach is conservative since the resulting seepage quantities are over-estimated.

N-16 POND MODEL DEVELOPMENT. The embankment and subsurface profile for the N-16 pond were represented by the conceptual model shown on Figure 5.3.2-8. A finite element mesh composed of 114 elements and 140 nodes was constructed to analyze the seepage quantities for the assumed geometric configuration and pool elevation. All elements in the model were made quadrangular. The size of the elements in the subsurface profile ranged from 20 feet by 25 feet under the base of the embankment to 25 feet by 40 feet at distances greater than 150 feet away from the center line of the embankment. Elements in the wet portion of the embankment ranged in size from 25 feet by 5 feet to 25 feet by 2 feet.

The N-16 pond water level will range from elevation 156 to 165 ft NGVD. The latter was taken as the design high water level scenario. The downstream groundwater level was taken to be elevation 145 ft NGVD. These levels were maintained constant throughout the analyses. The design slopes of the pond embankment varied from 6:1 to 2:1 (horizontal:vertical). The embankment was assumed, for modeling purposes, to have a 25-foot wide crest and 2.5:1 slopes between the embankment crest at elevation 175 ft NGVD, and the ground surface at elevation 145 ft NGVD. The subsurface profile was extended from the ground surface level at elevation 145 ft NGVD, to the assumed impervious boundary located at elevation 0 ft NGVD. In the horizontal direction, the subsurface profile was extended to a length of approximately 230 feet each side of the centerline of the embankment.

BRINE POND MODEL DEVELOPMENT. The southwestern face of the brine pond is the most critical for analysis because it could allow the greatest quantity of seepage and it is the side of the pond closest to the site boundary.

The average depth of the brine concentrate is estimated to reach a maximum depth of 4.7 ft at the end of 45 years of plant operation and will decline thereafter. During most years the depth of the pond fluid will be less; thus, actual seepage quantities during the life of the plant will be much lower than those computed using the worst case level.

The elevation of the SA-9 clay surface will vary after reclamation, being topographically lower in the southern section of the pond, as shown by the clay consolidation predictions presented on Figure 3.7.1-29. Similarly, the brine pond will be deeper in the southern section of SA-9. The worst case analyzed by the seepage model approximates this condition by assuming the clay liner surface at elevation 165 NGVD and a 7 foot brine depth. The average condition will be represented by a clay surface at about elevation 170 NGVD and a 4.7 foot brine depth at the time of maximum brine accumulation. A conservative groundwater elevation of 145 feet NGVD (ground surface) was assumed on the downstream side of the embankment to simulate saturated ground conditions below the ground surface. These levels were maintained constant throughout the analysis.

A finite element mesh composed of 261 elements and 289 nodes was constructed to perform the seepage analysis (Figure 5.3.2-9). All elements in the model were made either quadrangular or triangular. The size of the elements in the subsurface profile ranged from 2.5 by 12.5 feet near the center of the embankment to 15 by 25 feet away from the embankment. The size of elements in the wet portion of the embankment ranged from 1 by 15 feet near the embankment to 12.5 by 25 feet away from the embankment.

The design slopes of the brine pond embankment vary from 2.5:1 to 2.75:1; a conservative embankment slope of 2.5:1 was used throughout the brine pond seepage analyses. A geomembrane liner will be installed along the upstream face of the embankment and will extend 25 feet from the upstream embankment toe along the pond bottom. The geomembrane was modeled as low permeability elements following the proposed configuration.

The subsurface profile was extended from the ground surface level at elevation 165 ft NGVD, to the assumed impervious model boundary located at elevation 125 ft NGVD. In the horizontal direction, the subsurface profile was extended to a length of approximately 162 feet from each side of the embankment centerline. The embankment was designated, for modeling purposes, as having a 25 feet wide crest and to a 2.5:1 slope between the embankment crest at elevation 185 ft NGVD, and the ground surface elevation of 165 ft NGVD.

DISCUSSION OF RESULTS

N-16 POND RESULTS. The results obtained from the SEEP/G analyses for the N-16 pond indicate seepage rates will be 0.5 cubic feet per day per linear foot of pond embankment. At this rate, the seepage across the total length of the embankment around N-16 (approximately 37,600 feet) will be approximately 140,000 gallons per day. This value represents less than 0.5% of the maximum groundwater make-up requirements of 31.6 MGD and is, therefore, of little impact to the overall water budget for the plant. Part of this seepage will be along a 9,000 feet portion of the embankment between N-16 and Tiger Bay. Results of the seepage model indicates that the rate of seepage to Tiger Bay will approximate 30,000 gallons per day, and have the beneficial effect of augmenting the flow in Tiger Bay. The remaining 110,000 gpd of seepage into the embankment will be lost largely to evapotranspiration from the dams and also provide local recharge to the Intermediate Aquifer. Downward flow to the Intermediate Aquifer will be captured on-site within the aquifer drawdown cone and eventually returned to the cooling pond through the groundwater makeup. Therefore, no adverse impact due to this cooling pond seepage is anticipated.

BRINE POND RESULTS. The SEEP/G analyses for the brine pond indicate that at those locations along the southern dam where these worst case conditions are more likely to occur, the seepage may approximate 0.010 cubic feet per day per linear foot of brine pond embankment when, and if, the steady state conditions assumed by that model actually occur. However, the average condition in the pond is represented by a brine pool which is 4.7 feet deeper. With that average brine depth at maximum accumulation, the estimated average seepage rate will be about 0.008 cubic feet per day per linear foot of embankment length. Most of the seepage is expected to occur along a 7,600 foot long south and western portion of the brine pond embankment and would approach about 440 gallons per day under this worst case. Seepage through the clay into the 9,000 foot long dam section between SA-9 and SA-8 would occur, under the same assumed steady state conditions, at the average rate of about 185 gallons per day. Thus, the total flow out of the pond would be about 625 gallons per day under these assumptions.

However, the prediction of this steady state model case (which assumes no changes in driving head with time and full saturation) is extremely conservative and does not represent the actual condition. The extreme conservatism is due to the fact that the assumed driving head will not be reached until after more than 45 years of site operations, and further, because the pond level

will be lowered or the facility will be decommissioned before a steady state condition is reached. Therefore, the potential seepage will occur under transient rather than steady state conditions.

The seepage rates, volumes and velocities will gradually increase as the brine level in the pond slowly rises at a maximum rate of about 2.2 inches per year. When the plant capacity decreases, the pond level will fall due to the net evaporation, and the seepage rates, volumes, and velocities will immediately reduce proportionally, as illustrated conceptually on Figure 5.3.2-10. It is estimated that 5 to 10 years will be required to saturate the clay liner crust developed during reclamation. After saturation, the travel time of any seepage through the embankment is related to the average flow velocity. The seepage velocity will range from zero at the beginning of net brine accumulation to a maximum of about 0.0004 foot per day. During the approximately 45 years during which the pond has a net brine accumulation, the estimated average seepage velocity will be about 0.0003 ft per day. The distance travelled by the average particle through the clay liner during these 45 years will be about 5 feet. The brine will continue to migrate through the clay (after the pond is dry) due to the elevation head difference of the saturated clay zone. Taking the average head difference to be 10 feet, the time required for the average brine particle to travel the remaining 20 feet to the inside face of the perimeter dam is 124 years. This seepage would flow only toward the western and southern dams because there would presumably be no available driving head toward the north and east with the cooling pond at elevation 165. If the seepage front ever reached the perimeter berm (in about 185 years after start of operation), the estimated maximum seepage rate into the embankment is 320 gallons per day, which would slowly reduce and stop as the remaining elevation head is dissipated.

Therefore, it is not anticipated that any brine seepage will reach the downstream toe drainage blanket for hundreds of years, if ever. Even then, the total seepage quantity would be very small and would not constitute an impact of consequence to groundwater quality. Nevertheless, in the unexpected event that any appreciable seepage does flow through the embankment, it will be collected in the drainage blanket discharge and pumped back into the brine pond or to the site's treatment system.

Results from the computer finite element simulation were checked with flow net techniques to provide assurance of the validity of the analysis. This comparison validated the seepage volumes derived from the finite element model, SEEP/G.

5.3.2.3 Impacts of On-Site Solid Waste Disposal

This section presents a discussion of the potential impacts of the proposed on-site solid waste disposal areas on ground water. The solid waste to be stored on-site is primarily coal combustion by-products: slag from coal gasifiers, and fly ash, bottom ash, and FGD wastes from pulverized coal units. A total area of 2,179 acres has been designated for disposal of combustion waste materials as indicated in Section 3.2.2 and shown on Figure 3.2.2-1 (areas SA-8, SA-10, P-2, P-3 and Phosphoria). The waste disposal areas will be operated and closed in such a manner that no discharge of waste materials, leachate, or runoff occurs. The solid waste disposal areas will meet the criteria of a zero discharge site. There are several factors that contribute to meeting this objective:

- The site is underlain by thick layers of low permeability clays.
- The collection of surface water from these areas will minimize the amount of water which could seep into the waste and potentially form leachate.
- The waste is a chemically stable ash or slag that will most likely not produce a contaminated waste leachate.
- If a leachate is produced from the waste, the primary mobile chemicals will be metals. The clays below the site have a high cation exchange capacity that will absorb the ions and immobilize them within the clays.

Following is a more detailed discussion of these consideration.

CLAY LINER

The solid waste disposal areas are underlain by phosphatic waste clay deposits ranging from 20 to 40 feet thick near the surface, and additional thick sequences of marine clays continuing down to the Intermediate Aquifer. Geotechnical site investigations have found hydraulic conductivities for the phosphatic waste clays to range from 1×10^{-7} cm/sec to 1×10^{-9} cm/sec. Hydraulic conductivities for the underlying undisturbed marine clays have similar values. As the waste materials are deposited into the disposal area, the phosphatic clays will gradually consolidate, further decreasing their permeability and porosity. In their present condition, the porosity ranges from 45 to 70 percent. When closure of the waste storage area occurs, the porosity is expected

to be in the range of 35 to 45 percent. For the purposes of this analysis, the more conservative worst case values will be used to evaluate the potential impacts of the solid waste disposal areas.

The operation of the solid waste disposal area will follow the general goals for a monofill landfill. Waste will be handled under dry conditions and covered with soil and grassed. The active waste disposal area will be sloped such that rain falling on the area will drain away from the exposed waste. This will assist in maintaining the waste in a dry condition and reduce the generation or potential for generation of any leachate.

No synthetic liner is planned beneath the solid waste disposal area because of the thick layer of low permeability clays. These clays, with their low hydraulic conductivity values, provide greater protection than a synthetic liner would be able to provide. The clays have permeabilities relatively similar to synthetic liners, and are a minimum of 20 feet thick. This increased thickness, when compared to a common thickness for synthetic liners of 30 millimeters, provides a greater degree of containment than is provided by synthetic liners. In addition, as the phosphatic waste clays consolidate over time, there will be some differential settlement that a synthetic liner would not be able to accommodate. The phosphatic clays are highly plastic and will conform to irregularities and differential settlement without losing their containment properties.

SEEPAGE ESTIMATES

For the purposes of estimating potential rates and volumes of seepage should a leachate be produced, it is assumed that only a minimum of 20 feet of clay exists beneath the solid waste disposal areas. Moreover, the analysis assumes the waste might become saturated and a hydraulic head of 20 feet could develop with a gradient of one foot per 10 feet in a vertically downward direction. In the central areas where seepage will be essentially vertical, the downward vertical velocity of the leachate as it moves through the underlying clays was calculated to be 0.00008 ft/day and will require 677 years to penetrate the clay thickness.

At that seepage velocity, the seepage rate will amount to about 26 gallons per acre if the seepage emerges through the clay liner at the end of nearly 700 years. Around the perimeter of the solid waste disposal areas, the average hydraulic gradient is estimated to be about 10 percent of the gradients in the central area with a correspondingly reduced seepage velocity and rate. At this rate, the potential seepage through the embankment is estimated at less than 0.5 gallons per year

per linear foot of embankment. In addition, further protection is provided by other thick layers of marine clays underlying these clays and overlying producing zones of the Intermediate Aquifer. These seepage rates are so small and so far into the future that they do not present a potentially significant adverse impact.

CONTROL AND CONTAINMENT OF SURFACE RUNOFF

Operational procedures for the solid waste disposal area will include the control of site drainage to move runoff away from the active waste face to a collection area and then recycle it through the site water treatment system. No discharge will occur as a result of surface water runoff from the solid waste disposal area.

When a waste disposal area is filled, the entire area will be covered with soil and sloped to drain to an on-site drainage collection area. Surface runoff will then be recycled through the water recirculation system similar to the processes conducted during the operational phase of the waste disposal area.

CONCLUSIONS

Under both operational and closed conditions, neither surface water nor ground water will be impacted by the solid waste disposal area. While certain assumptions have been made for these calculations, actual values for the clay materials underlying the solid waste area have been found to be generally lower than the hydraulic conductivities used for these calculations. As the clays below the solid waste disposal area consolidate over time, they will reduce their porosity and hydraulic conductivity, resulting in even greater containment. Stormwater runoff control will limit the amount of water which could seep into the waste disposal area, thereby reducing the potential of leachate formation. Therefore, the impacts of the solid waste disposal to ground water are expected to be negligible.

Adequate groundwater monitoring wells will be in place during operation and following closure to detect any groundwater contamination. Appropriate response actions will be implemented if contamination is identified.

5.3.3 Drinking Water

SWFWMD is the agency responsible for assessing the water supply needs and sources of the counties within their jurisdiction. Their district has been divided into four major Water Demand Planning Areas (WDPAs) (SWFWMD, 1992). The Northern WDPA includes Citrus, Hernando, Lake, Levy, Marion, and Sumter Counties. The West-Central WDPA includes Hillsborough, Pinellas, and Pasco Counties and coincides with the jurisdictional area of the West Coast Regional Water Supply Authority. The Southern WDPA includes Desoto, Manatee, and Sarasota Counties, and the SWFWMD portion of Charlotte County, and is equivalent to the Peace/Manasota Regional Water Supply Authority. The East-Central WDPA includes Hardee County and the SWFWMD portions of Polk and Highlands Counties. The Polk County Site is within the East-Central WDPA.

SWFWMD has included a water demand by this project within its projected needs and has determined that demand can reasonably be met with the local sources, assuming local drawdown effects can be kept to an acceptable level. According to SWFWMD (1992):

> "Ground water presently supplies more than 90 percent of the current water supply needs in the SWFWMD. By far, the principal ground water bearing unit is the Floridan aquifer system. The Floridan aquifer system consists of a thick sequence of limestone and dolomite rocks of middle Miocene to Eocene age. A tight middle confining unit (intergranular evaporites) separates the Floridan aquifer system into the Upper and Lower Floridan aquifers. The middle unit and Lower Floridan aquifer generally contain saline water and are not considered as usable sources of water for purposes of this report. The thickness of the Upper Floridan aquifer varies from less than 500 feet in Levy county to about 1,400 feet in southern Manatee County. Wells that tap the Upper Floridan aquifer generally yield at least 500 gal/min and as much as 5,000 gal/min."

SWFWMD (1992) further states that "All future needs in the East-Central WDPA are recommended to be supplied by local sources."

5.3.3.1 Impacts of Withdrawal from a Drinking Water Source

Because the drinking water source is the Upper Floridan Aquifer, impacts of withdrawal from it have already been discussed in Section 5.3.2.

5.3.3.2 Impacts of Discharge to a Drinking Water Source

The aquiclude separating the bottom of the N-16 portion of the cooling pond from the Intermediate Aquifer is estimated to be about 30 feet thick. The seepage rate from that portion of the pond has been estimated to be on the order of 500,000 gallons per day. Assuming an aquiclude porosity of 20 percent, this seepage represents a velocity of about 0.0064 feet per day. At this rate, it would take about 13 years for the seepage to reach the Intermediate Aquifer. Based on the expected generally conical drawdown in the Intermediate Aquifer due to the project's withdrawal of Upper Floridan water (see Figures 5.3.2-4 through 5.3.2-9), all of this seepage will return to the cooling pond by being captured in the plant wells, and not leave the Polk County Site property.

The project has no other discharges to a drinking water source.

5.3.3.3 Water Reuse and Recycling

Water reuse and recycle are described and quantified in Sections 3.5 and 3.6. With the exception of the buffer areas, the project will retain for reuse all on-site rainfall runoff. Instead of discharging a cooling pond blowdown to limit dissolved solids, and adding sufficient makeup (groundwater withdrawal) to replace that blowdown, the project will treat and reuse the blowdown. In addition, in order to avoid excessive short-term groundwater withdrawals, the project will use on-site storage in the cooling pond to levelize the withdrawals.

5.3.4 Leachate and Runoff

5.3.4.1 Material Handling Areas

The material handling areas will include coal and limestone storage areas which will be underlain by a synthetic liner (see Section 3.7.1). These areas are served by recycle basins in which all

runoff and leachate are captured and recycled to plant process water use. The liquid wastes from the treatment are disposed to the brine pond.

5.3.4.2 Solid Waste Disposal Areas

The solid waste disposal areas are underlain by massive consolidated clays which will prevent any leachate from leaving these areas vertically (see Sections 3.7.1 and 5.3.2.3). Horizontal seepage and runoff are handled by the surface water management system (see Section 3.8) and are all returned to the cooling pond (less than 0.8 percent of the average expected water crop), except for runoff from the active solid waste disposal area. That runoff is retained internally within the solid waste disposal area in question, or recycled within plant process water systems for consumptive use.

5.3.5 Measurement Program

Figure 5.3.5-1, shows four monitoring wells proposed for the Intermediate Aquifer. Wells numbered 1, 2, and 3 are planned around the periphery of the waste disposal areas, while well number 4 is in the plant island. Constituents listed in Table 5.3.5-1 will be tested for on a quarterly basis. Well construction details are shown on Figure 5.3.5-2.

5.3.6 References

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TABLE 5.3.2-1
SUMMARY OF SWFWMD THRESHOLD VALUES FOR EVALUATING PROPOSED GROUNDWATER USE IMPACTS

Potentially Impacted Environmental Features	Criteria	Threshold
WETLANDS	Lowering of Water table (Surficial Aquifer)	Drawdown ≤ 1 ft.
LAKES	Lowering of Water Table (Surficial Aquifer)	Drawdown ≤ 1 ft.
STREAMS	Reduction in daily flow rate along point in drainage system	< 10%
EXISTING LEGAL USERS	Lowering of potentiometric level at an affected well	Drawdown ≤ 5 ft.
	Lowering of water table at an affected well	Drawdown ≤ 2 ft.

Source: SWFWMD, 1992

TABLE 5.3.2-2
NUMBER OF PERMITTED WELLS IN UPPER FLORIDAN AQUIFER
WITH PREDICTED DRAWDOWN GREATER THAN 5 FEET

DRAWDOWN COMPUTATIONS BASELINE SCENARIO	FPC WELLS WITHDRAWAL RATE (MGD)	NUMBER OF WELLS IMPACTED (BY TYPE USE CATEGORY)*							TOTAL NUMBER OF WELLS IMPACTED
		1	2	3	4	5	6	7	
PREDEVELOPMENT BASELINE	20.6	5	4	0	0	1	0	0	10
	26.6	26	16	11	0	8	1	0	62
	31.6	32	19	11	0	8	1	0	71
EXISTING USERS BASELINE	20.6	10	5	4	0	3	0	0	22
	26.6	27	17	11	0	9	1	0	65
	31.6	36	22	11	0	14	1	0	82

*Type use category
1. Mining
2. Irrigation
3. Public Supply
4. Livestock
5. Industrial
6. Essential Services
7. Recreational

Source: Dames & Moore, 1992

TABLE 5.3.2-3
POTENTIALLY IMPACTED WELLS UNDER 26.6 AND 31.6 MGD SCENARIOS
PRE-DEVELOPMENT BASELINE

Owner	Well Depth (ft)	Type Use	Permit Number
IMC Fertilizer Inc.(1)	300	Mining	03049-04
Farmland Industries, Inc	813	Industrial	01539-02
Farmland Industries, Inc	815	Industrial	01539-02
Farmland Industries, Inc	857	Industrial	01539-02
Farmland Industries, Inc	785	Industrial	01539-02
IMC Fertilizer Inc.	262	Mining	03049-04
IMC Fertilizer Inc.(1)	NA	Mining	03049-04
Polk Co. Board of County	600	Irrigation	08751-00
IMC Development Corporation	300	Irrigation	06747-01
IMC Fertilizer Inc.(2)	180	Mining	3049-04
IMC Fertilizer Inc.	390	Mining	03049-04
IMC Fertilizer Inc.(2)	175	Mining	03049-04
IMC Fertilizer Inc.	NA	Public Supply	03049-04
IMC Fertilizer Inc.	NA	Public Supply	03049-04
IMC Fertilizer Inc.	870	Mining	03049-04
IMC Fertilizer Inc.	NA	Mining	03049-04
IMC Fertilizer Inc.	307	Mining	03049-04
IMC Fertilizer Inc.	NA	Mining	03049-04
IMC Fertilizer Inc.	NA	Public Supply	03049-04
City of Bartow	740	Public Supply	00341-02

TABLE 5.3.2-3
POTENTIALLY IMPACTED WELLS UNDER 26.6 AND 31.6 MGD SCENARIOS
PRE-DEVELOPMENT BASELINE

IMC Fertilizer Inc.	NA	Public Supply	03049-04
City of Bartow	740	Public Supply	00341-02
IMC Fertilizer Inc.	790	Mining	03049-04
IMC Fertilizer Inc.	355	Mining	03049-04
IMC Fertilizer Inc.	600	Industrial	03049-04
IMC Fertilizer Inc.	378	Mining	03049-04
IMC Fertilizer Inc.	NA	Public Supply	03049-04
IMC Fertilizer Inc.	700	Mining	03049-04
IMC Fertilizer Inc.	805	Mining	03049-04
IMC Fertilizer Inc.	750	Mining	03049-04
IMC Fertilizer Inc.	780	Mining	03049-04
IMC Fertilizer Inc.	NA	Public Supply	03049-04
IMC Fertilizer Inc.	NA	Public Supply	03049-04
IMC Fertilizer Inc.	NA	Public Supply	03049-04
IMC Fertilizer Inc.	NA	Mining	03049-04
IMC Fertilizer Inc.	375	Mining	03049-04
IMC Fertilizer Inc.	NA	Mining	03049-04
IMC Fertilizer Inc.	NA	Mining	03049-04
IMC Fertilizer Inc.	NA	Public Supply	03049-04
IMC Fertilizer Inc.	969	Mining	03049-04
IMC Fertilizer Inc.(2)	200	Mining	03049-04

TABLE 5.3.2-3
POTENTIALLY IMPACTED WELLS UNDER 26.6 AND 31.6 MGD SCENARIOS
PRE-DEVELOPMENT BASELINE

IMC Fertilizer Inc.	950	Mining	03049-04
IMC Fertilizer Inc.	NA	Mining	03049-04
IMC Fertilizer Inc.	NA	Mining	03049-04
Estech Inc.	833	Irrigation	03841-04
Estech Inc.	788	Industrial	03841-04
Estech Inc.	776	Industrial	03841-04
Estech Inc.(2)	203	Industrial	03841-04
IMC Fertilizer Inc.	NA	Mining	03049-04
Estech Inc.	900	Irrigation	03841-04
IMC Fertilizer Inc.	764	Mining	03049-04
IMC Fertilizer Inc.	NA	Mining	03049-04
Estech Inc.	900	Irrigation	03841-04
Estech Inc.	822	Industrial	03841-04
Estech Inc.	900	Irrigation	03841-04
Estech Inc.	900	Irrigation	03841-04
Kaplan Industries Inc.(1)	960	Irrigation	02407-03
Estech Inc.	800	Irrigation	03841-04
Weyand, Gus(2)	125	Irrigation	01602-01
Page, O.G.	360	Irrigation	00548-01
Fussell, Mrs. Irene(2)	180	Irrigation	00713-01
Page, O.G.	360	Irrigation	00548-01

TABLE 5.3.2-3
POTENTIALLY IMPACTED WELLS UNDER 26.6 AND 31.6 MGD SCENARIOS
PRE-DEVELOPMENT BASELINE

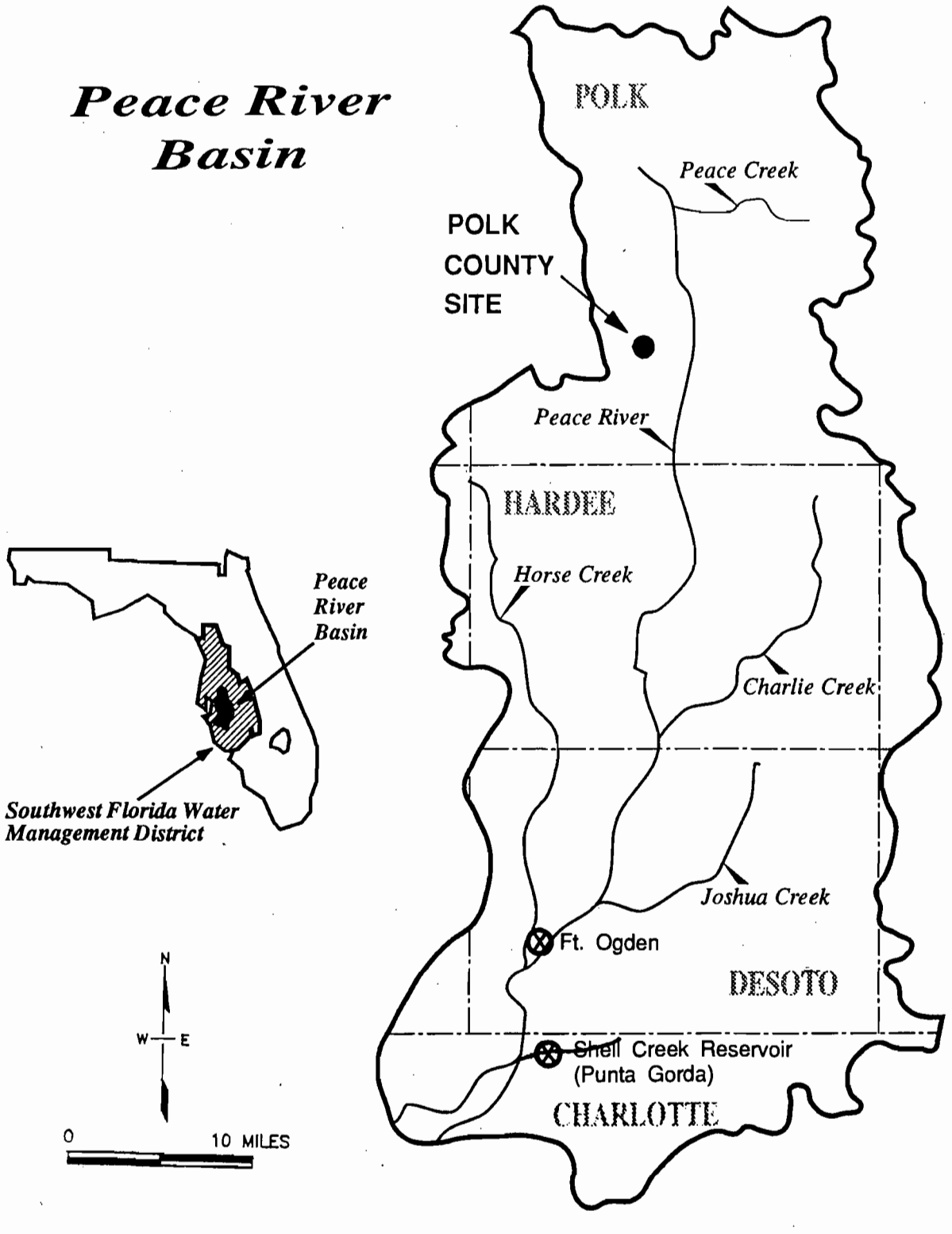
Snell, Mrs. Mary	285	Irrigation	01255-01
Wilson, Verne	365	Irrigation	02797-01
Estech Inc.	778	Irrigation	03841-04
Estech Inc.	850	Irrigation	03841-04
Smith, B. W.	600	Irrigation	03555-01
Heartland Supply Inc.	800	Essential	10011-00
Heartland Supply Inc.(2)	180	Public Supply	10011-00
Estech Inc.	778	Irrigation	03841-04
Rhymes, James E.(2)	217	Irrigation	02596-01
Mobil Mining & Minerals Company	NA	Mining	02318-02
Mobil Mining & Minerals Company	NA	Mining	02318-02
Mobil Mining & Minerals Company	NA	Mining	02318-02
Goochland Nurseries Inc.(1)	830	Irrigation	01467-01
Goochland Nurseries Inc.(1)	830	Irrigation	01467-01
Mobil Mining & Minerals Company(1)	0	Mining	02318-02
Mobil Mining & Minerals Company(1)	815	Mining	02318-02
Mobil Mining & Minerals Company(1)	0	Mining	02318-02
Mobil Mining & Minerals Company(1)	775	Mining	02318-02

NOTE: (1) Well not impacted under 26.6 MGD withdrawal.
(2) Well is in the Intermediate Aquifer.

Source: Dames & Moore, 1992

TABLE 5.3.5-1
GROUNDWATER QUALITY PARAMETERS

Physical	Minor/Trace Elements	Organics
Color	Antimony	Benzene
pH	Arsenic	Detergents
Turbidity	Barium	1,2-Dichloroethane
Specific Conductance	Beryllium	Ethylene dibromide
Dissolved Oxygen	Boron	Oil and Grease
(minimum)	Cadmium	Phenols
	Chromium	Phthalate Esters
General Inorganics	Copper	PCBs
Total Suspended Solids	Iron	Tetrachloroethylene
Total Dissolved Solids	Lead	1,1,1-Trichloroethane
Hardness (as $CaCO_3$)	Manganese	Trichloroethane
Alkalinity (as $CaCO_3$)	Mercury	Vinyl Chloride
Nitrate (as N)	Molybdenum	Total Trihalomethanes
Nitrite (as N)	Nickel	
Ammonia (as N)	Selenium	Pesticides
Total Phosphates (as P)	Silver	Aldrin plus Dieldrin
Silica (as SiO_2)	Strontium	Chlordane
Cyanide (as CN)	Vanadium	Chlorophenoxy
Fluoride (as F)	Zinc	2,4-D
Aluminum		2,4,5-TP
Sulfides	Major Cations	Demeton
	Calcium	Endosulfan
Radioactive Substances	Magnesium	Endrin
Gross Alpha Radioactivity	Sodium	Guthion
Radium 226	Potassium	Heptachlor
Radium 228		Lindane
Strontium-90	Major Anions	Malathion
Tritium	Chloride	Methoxychlor
	Bicarbonate	Myrex
	Carbonate	Parathion
	Sulfate	Toxaphene

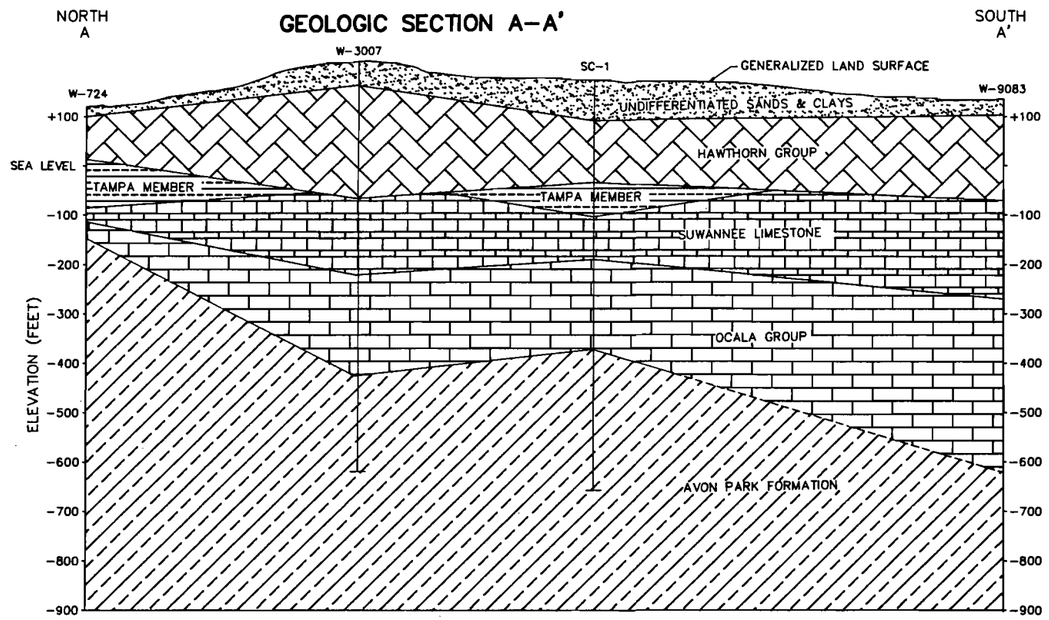


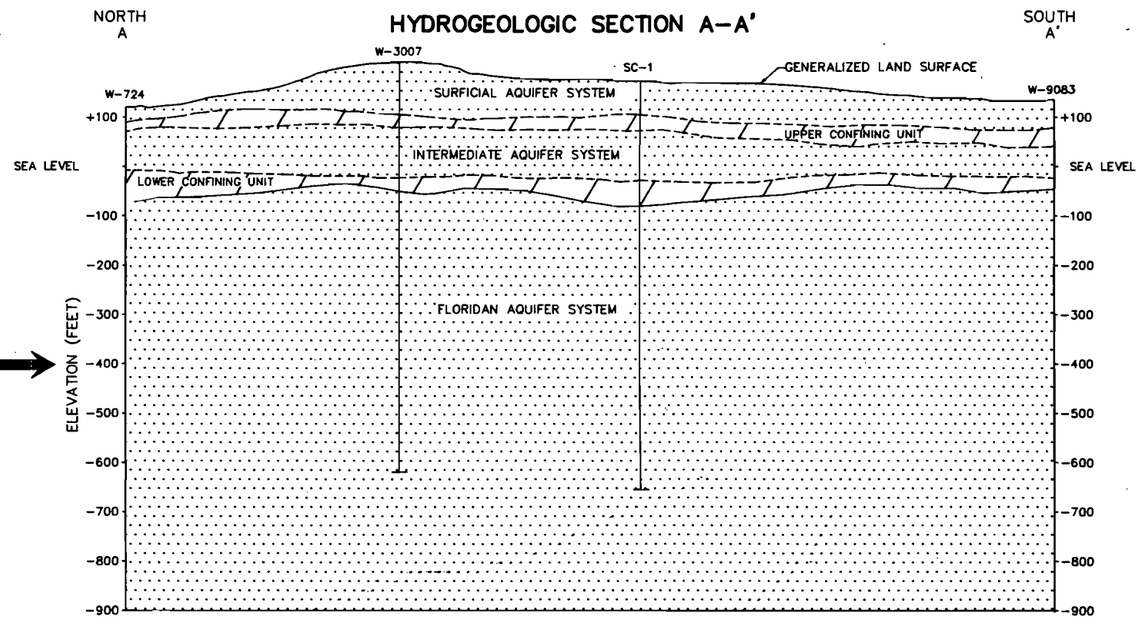
Source: Ebasco Environmental, 1992

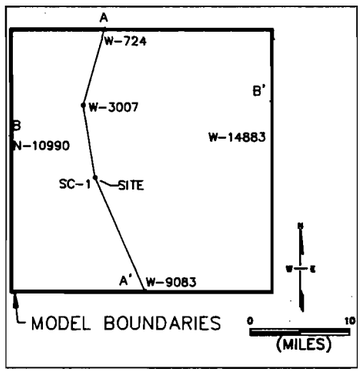
Florida Power CORPORATION

Polk County Site

FIGURE 5.3.1-1
PEACE RIVER BASIN MAP





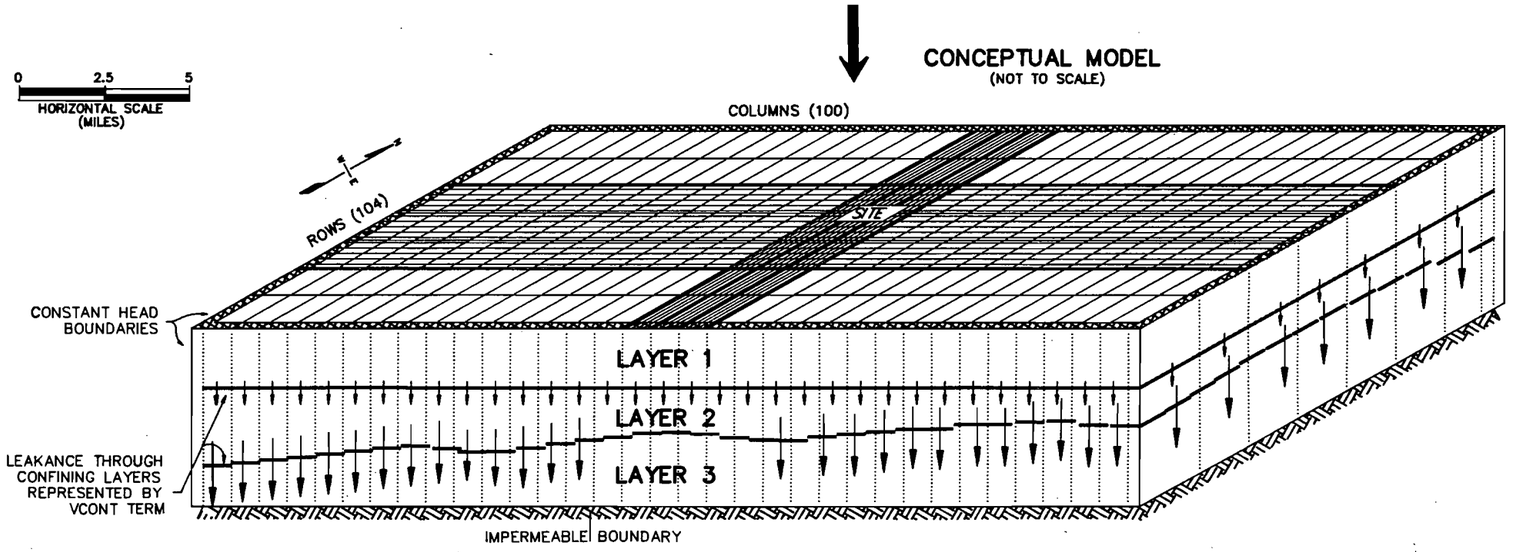


NOTES:

1) THE SUBSURFACE CONDITIONS SHOWN REPRESENT AN INTERPRETATION OF PROBABLE CONDITIONS BASED ON AVAILABLE WELL LOGS FROM THE FLORIDA GEOLOGICAL SURVEY DATA-BASE AND PROJECT DATA BASE. HOWEVER, CONDITIONS ARE KNOWN ONLY AT WELL LOCATIONS AND DEVIATIONS FROM THE ESTIMATED CONDITIONS MAY OCCUR.

2) VERTICAL SCALE IS GREATLY EXAGGERATED.

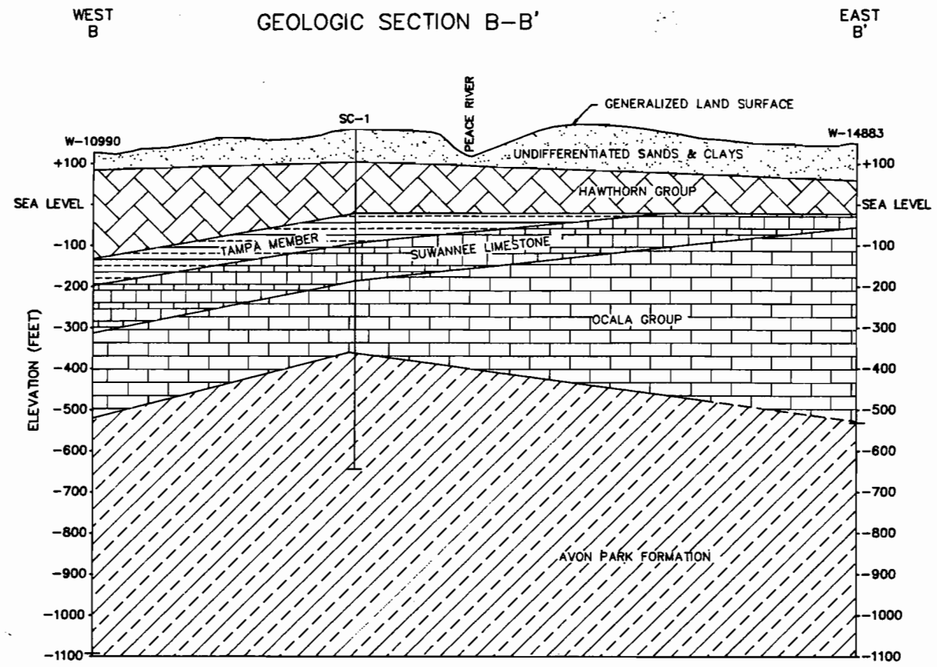
SOURCE: DAMES & MOORE, 1992

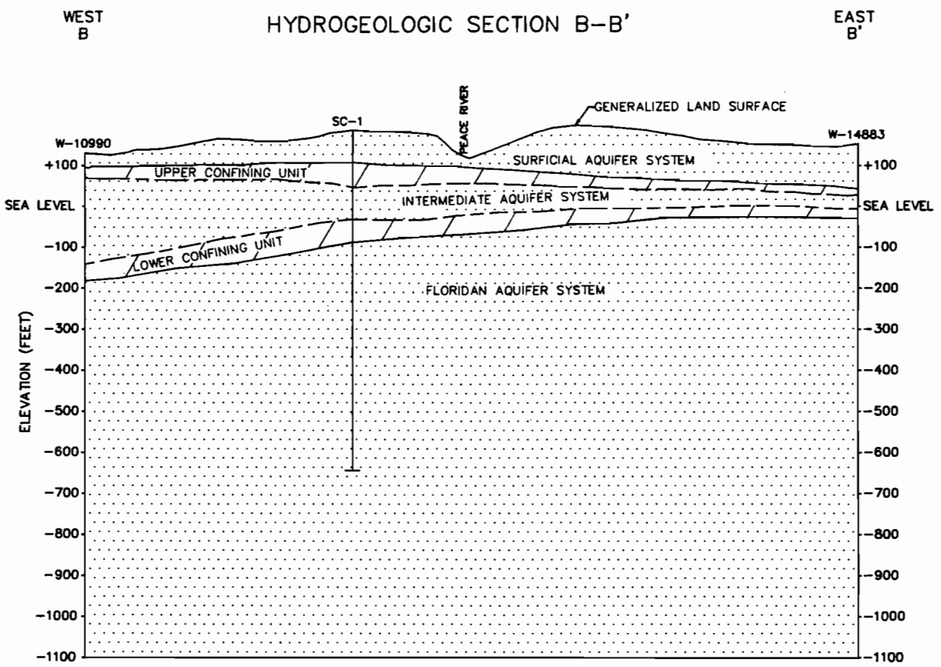


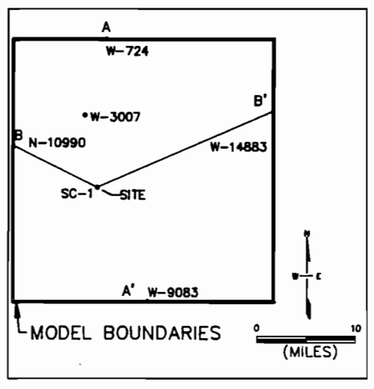
Florida Power CORPORATION

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FIGURE 5.3.2-1
GENERALIZED GEOLOGIC SECTION A-A', HYDROSTRATIGRAPHIC SECTION, AND CONCEPTUAL MODEL OF THE GROUNDWATER SUPPLY (GWS) MODEL DOMAIN



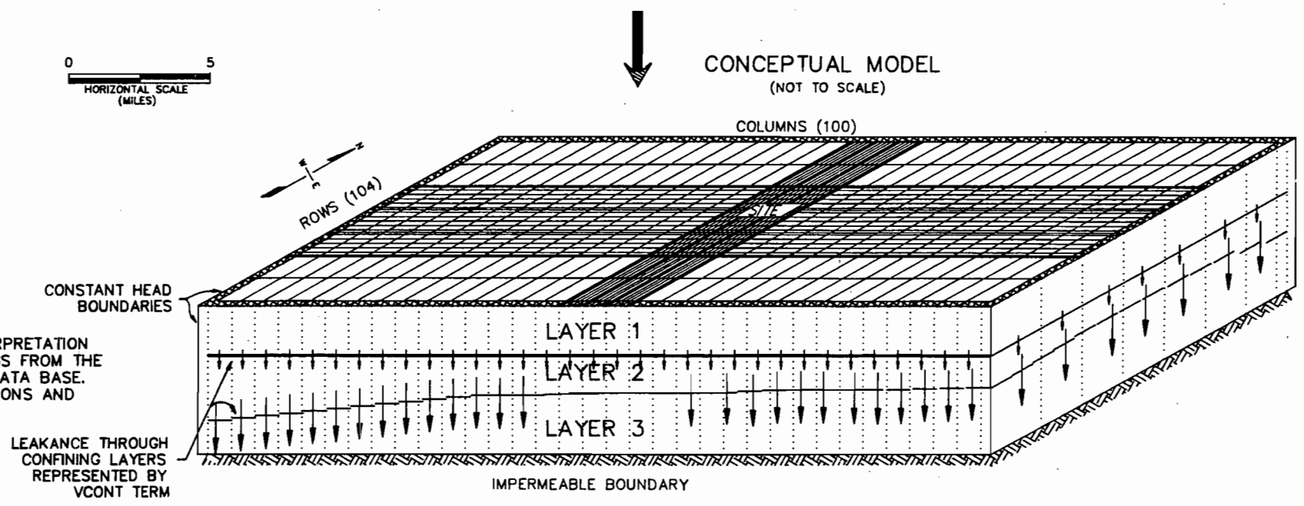




NOTES:

1) THE SUBSURFACE CONDITIONS SHOWN REPRESENT AN INTERPRETATION OF PROBABLE CONDITIONS BASED ON AVAILABLE WELL LOGS FROM THE FLORIDA GEOLOGICAL SURVEY DATA–BASE AND PROJECT DATA BASE. HOWEVER, CONDITIONS ARE KNOWN ONLY AT WELL LOCATIONS AND DEVIATIONS FROM THE ESTIMATED CONDITIONS MAY OCCUR.

2) VERTICAL SCALE IS GREATLY EXAGGERATED.

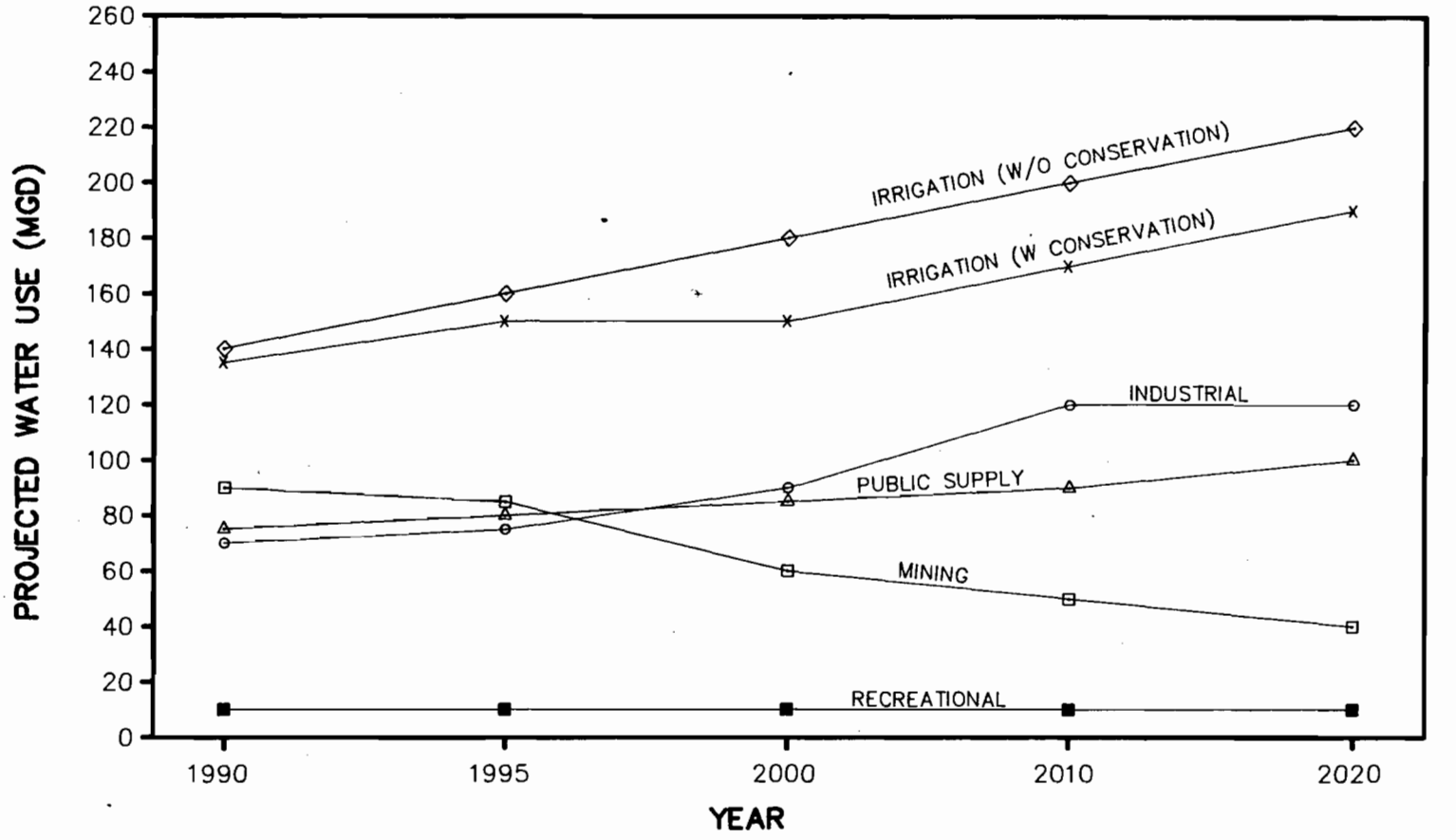


SOURCE: DAMES & MOORE, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 5.3.2-2
GENERALIZED GEOLOGIC SECTION B-B', HYDROSTRATIGRAPHIC SECTION, AND CONCEPTUAL MODEL OF THE GROUNDWATER SUPPLY (GWS) MODEL DOMAIN

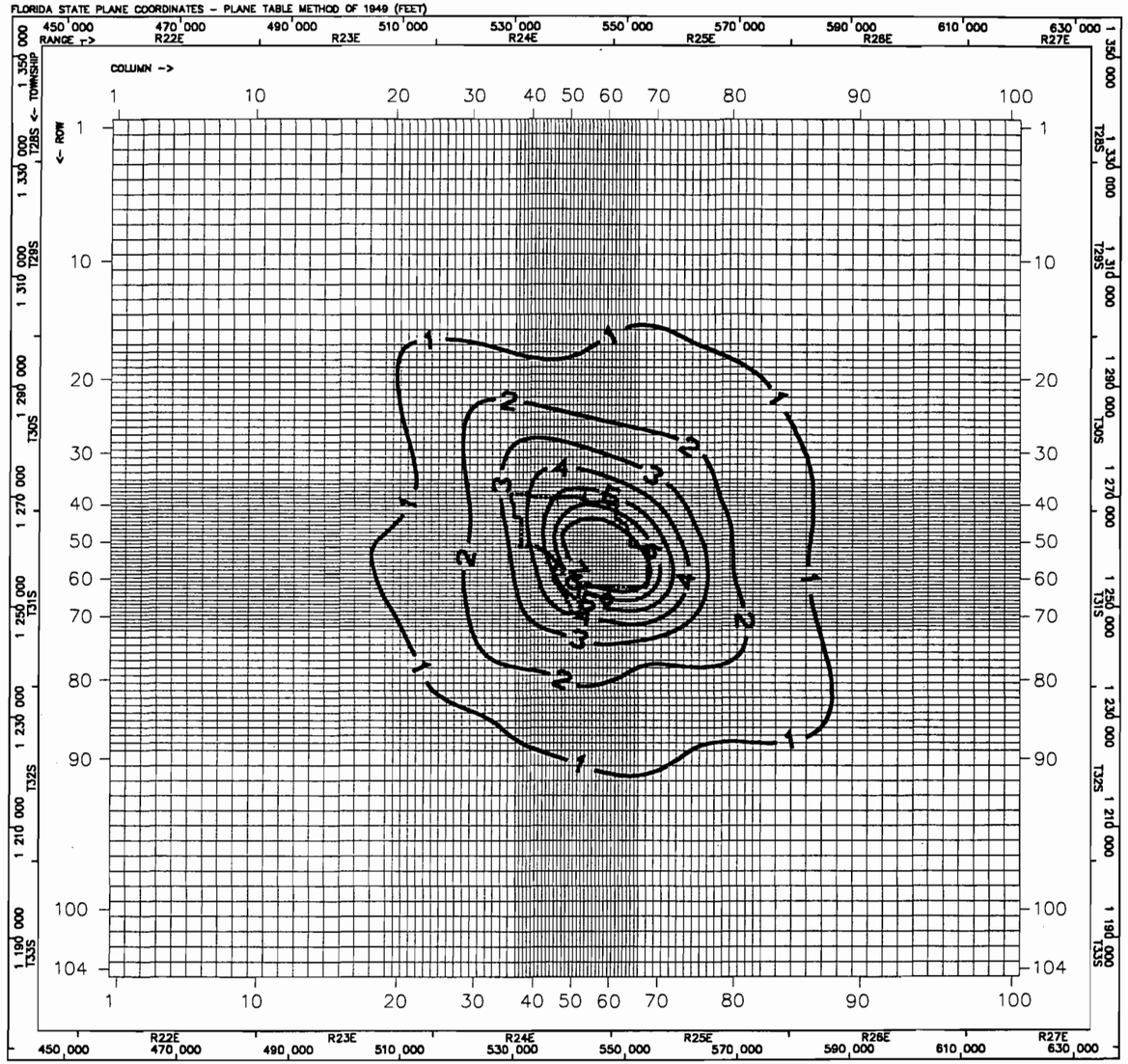


SOURCE: SWFWMD, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 5.3.2-3
PROJECTED WATER USE FOR POLK COUNTY YEARS 1990-2020

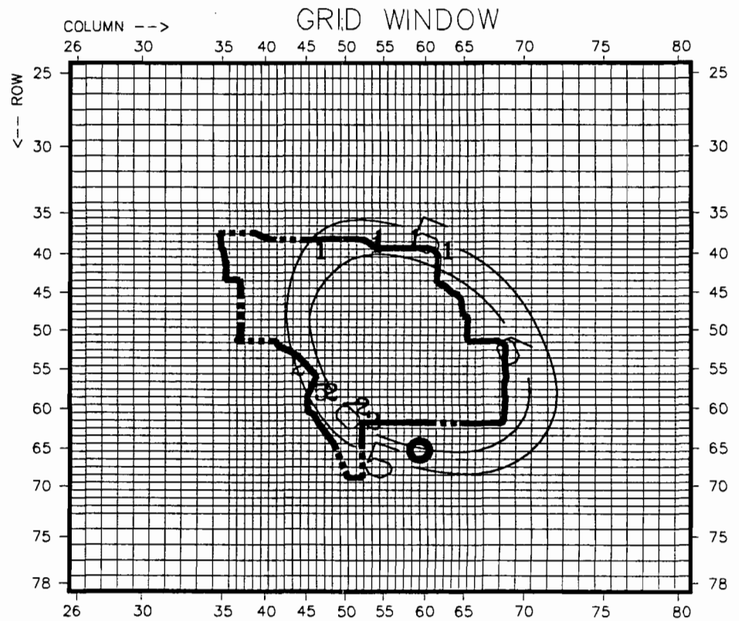


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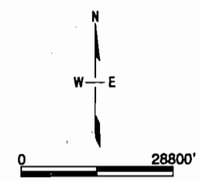
- PROPERTY BOUNDARY
- USGS GAGING STATION
- MODELED RIVER REACHES (LAYER 1)
- 2 PERMITED WATER SUPPLY WELLS
- X = 547304.7740 Y = 1251615.6109 TIE-IN COORDINATE
- 1 DRAWDOWN CONTOUR

The number by the permited water supply wells is as follows:

1. Mining
2. Irrigation
3. Public Supply
4. Livestock
5. Industrial
6. Essential Services
7. Recreational



NOTE: WINDOW SCALE IS TWICE THE SIZE OF THE FULL GRID DRAWING SCALE.

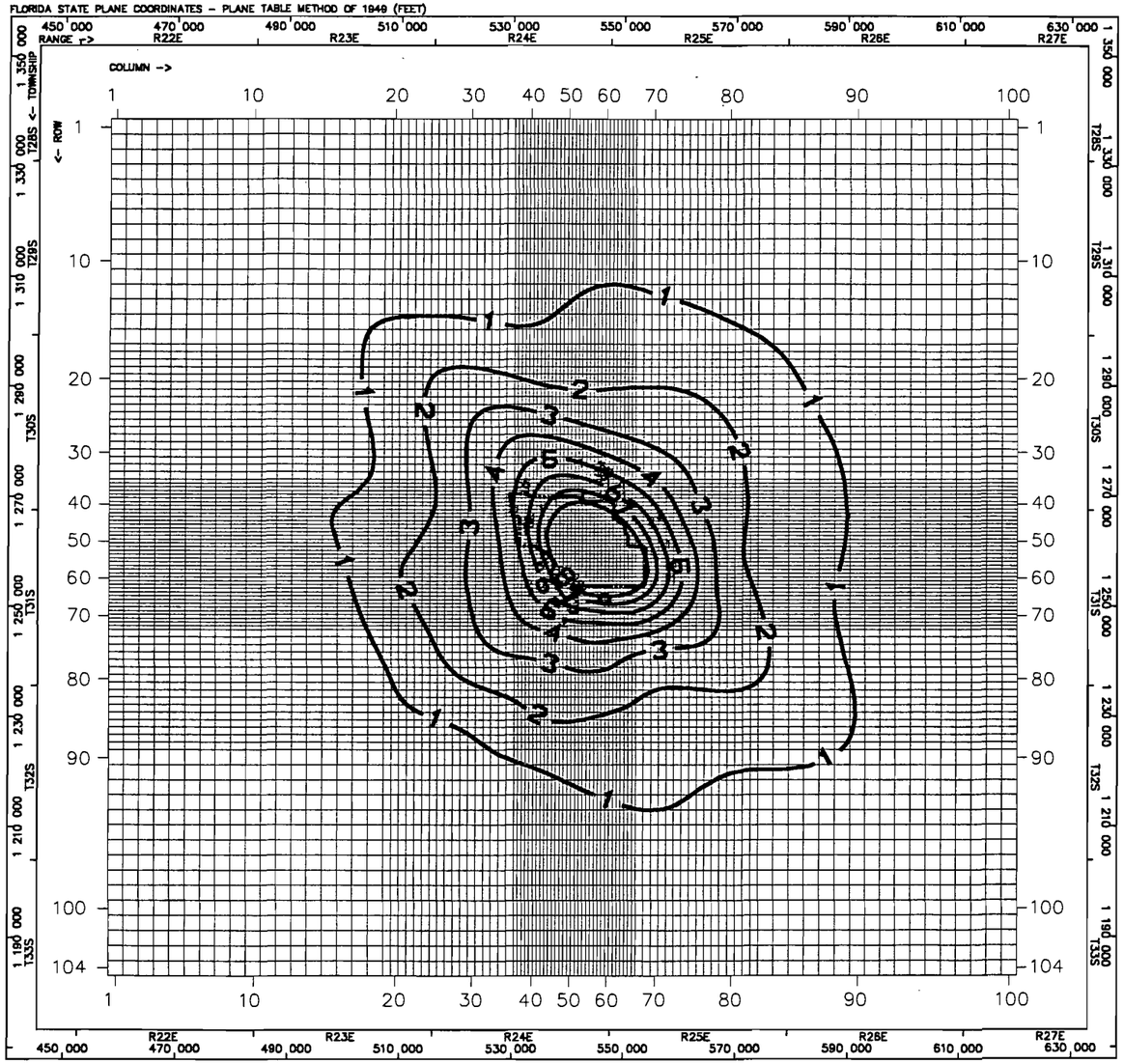


SOURCE: DAMES & MOORE, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 5.3.2-4
UPPER FLORIDAN DRAWDOWN FOR 20.6 MGD FPC WITHDRAWALS WITH PREDEVELOPMENT BASELINE

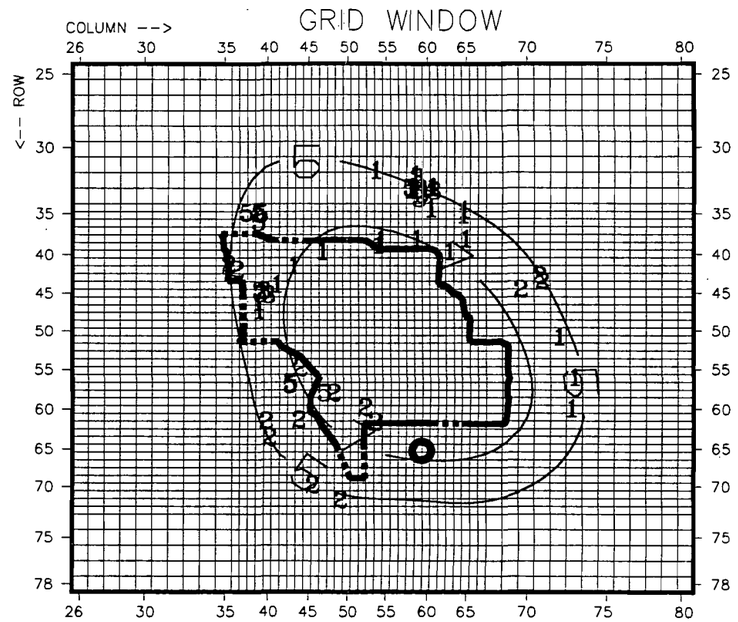


LEGEND

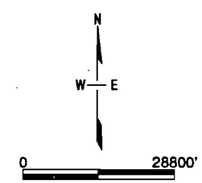
- PROPERTY BOUNDARY
- USGS GAGING STATION
- MODELED RIVER REACHES (LAYER 1)
- 2 — PERMITED WATER SUPPLY WELLS
- X = 547304.7740, Y = 1251615.6109 — TIE-IN COORDINATE
- 1 — DRAWDOWN CONTOUR

The number by the permited water supply wells is as follows:

1. Mining
2. Irrigation
3. Public Supply
4. Livestock
5. Industrial
6. Essential Services
7. Recreational



NOTE: WINDOW SCALE IS TWICE THE SIZE OF THE FULL GRID DRAWING SCALE.

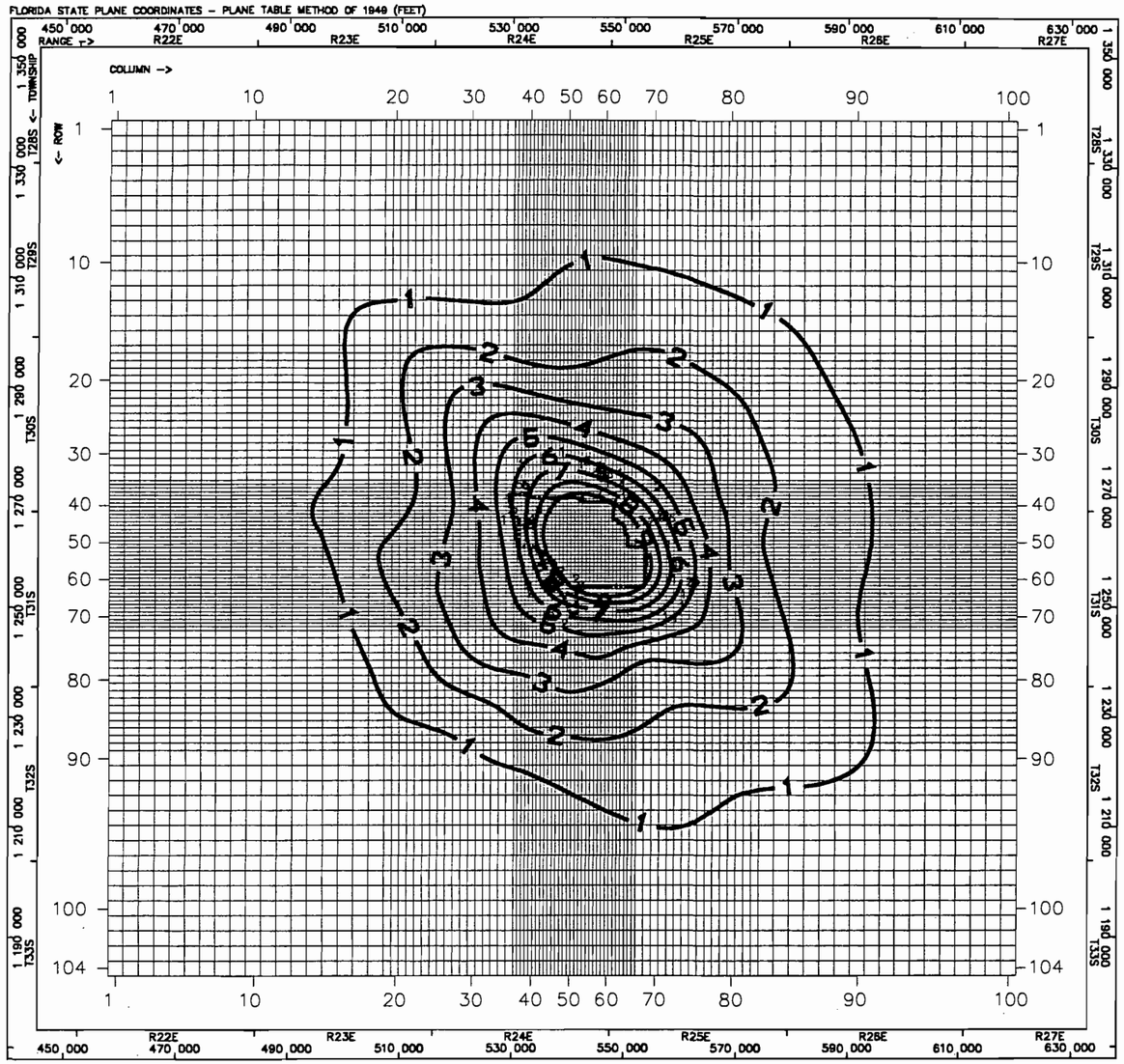


SOURCE: DAMES & MOORE, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 5.3.2-5
UPPER FLORIDAN DRAWDOWN FOR 26.6 MGD FPC WITHDRAWALS WITH PREDEVELOPMENT BASELINE

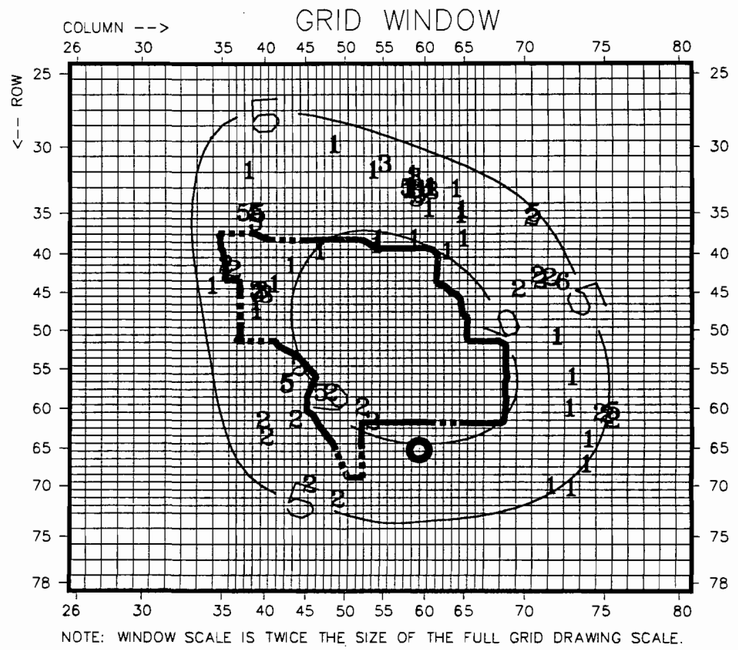


LEGEND

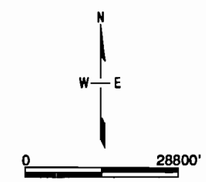
- PROPERTY BOUNDARY
- USGS GAGING STATION
- MODELED RIVER REACHES (LAYER 1)
- 2 — PERMITED WATER SUPPLY WELLS
- X = 547304.7740 TIE–IN COORDINATE
  Y = 1251615.6109
- 1 — DRAWDOWN CONTOUR

The number by the permited water supply wells is as follows:

1. Mining
2. Irrigation
3. Public Supply
4. Livestock
5. Industrial
6. Essential Services
7. Recreational



NOTE: WINDOW SCALE IS TWICE THE SIZE OF THE FULL GRID DRAWING SCALE.

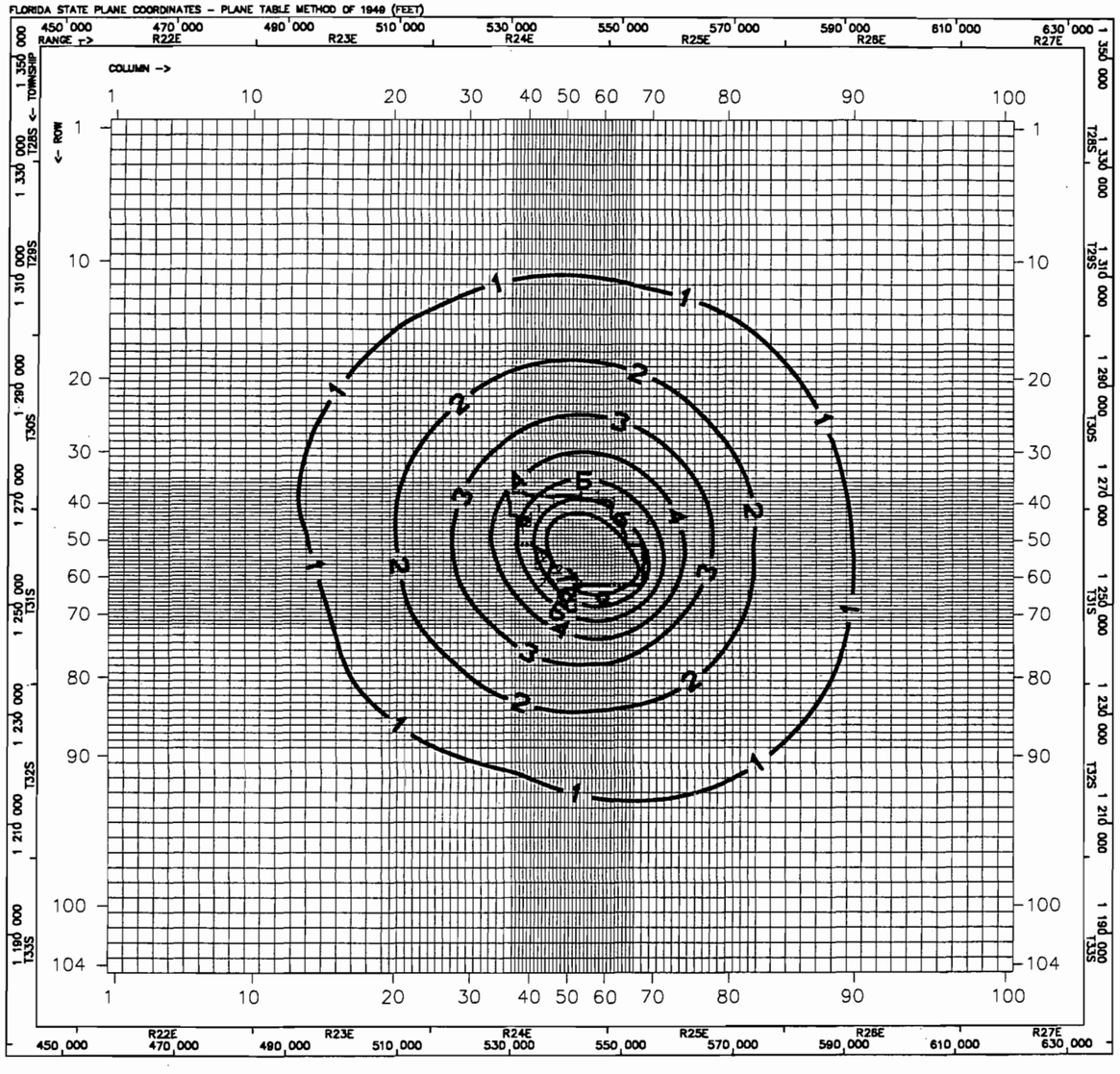


SOURCE: DAMES & MOORE, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 5.3.2-6
UPPER FLORIDAN DRAWDOWN FOR 31.6 MGD FPC WITHDRAWALS WITH PREDEVELOPMENT BASELINE

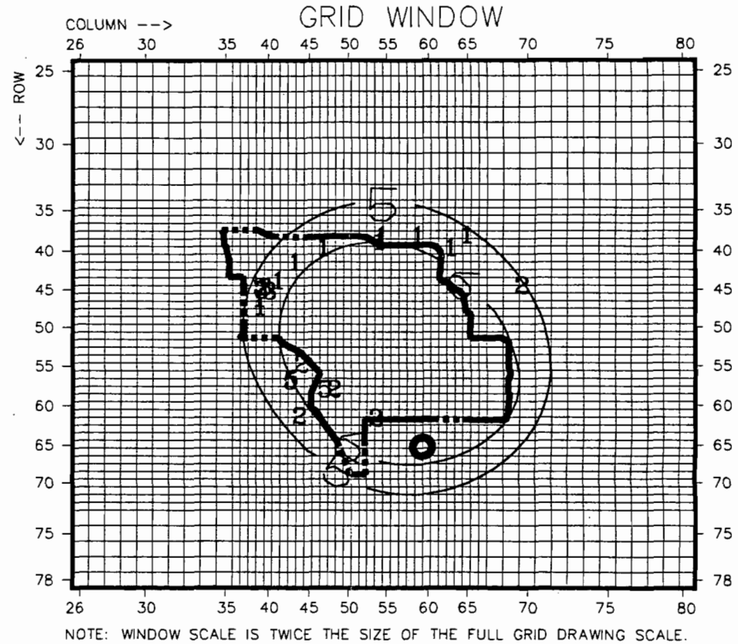


LEGEND

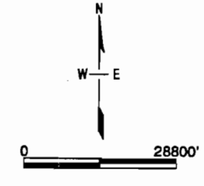
- PROPERTY BOUNDARY
- USGS GAGING STATION
- MODELED RIVER REACHES (LAYER 1)
- 2 — PERMITED WATER SUPPLY WELLS
- X = 547304.7740 Y = 1251615.6109 — TIE-IN COORDINATE
- 1 — DRAWDOWN CONTOUR

The number by the permited water supply wells is as follows:

1. Mining
2. Irrigation
3. Public Supply
4. Livestock
5. Industrial
6. Essential Services
7. Recreational



NOTE: WINDOW SCALE IS TWICE THE SIZE OF THE FULL GRID DRAWING SCALE.

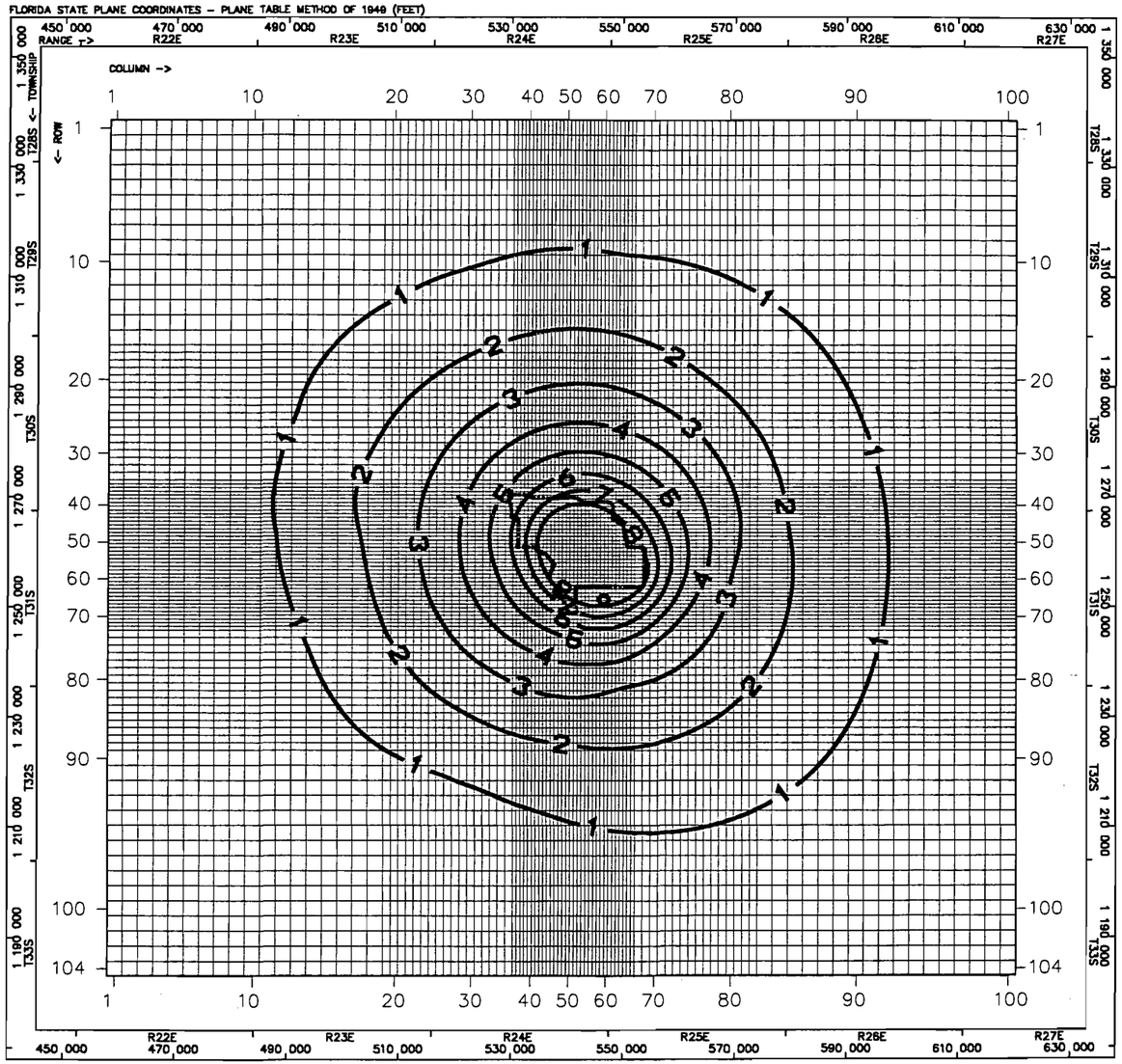


SOURCE: DAMES & MOORE, 1992

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Polk County Site

FIGURE 5.3.2-7
UPPER FLORIDAN DRAWDOWN FOR 20.6 MGD FPC WITHDRAWALS
EXISTING USERS BASELINE

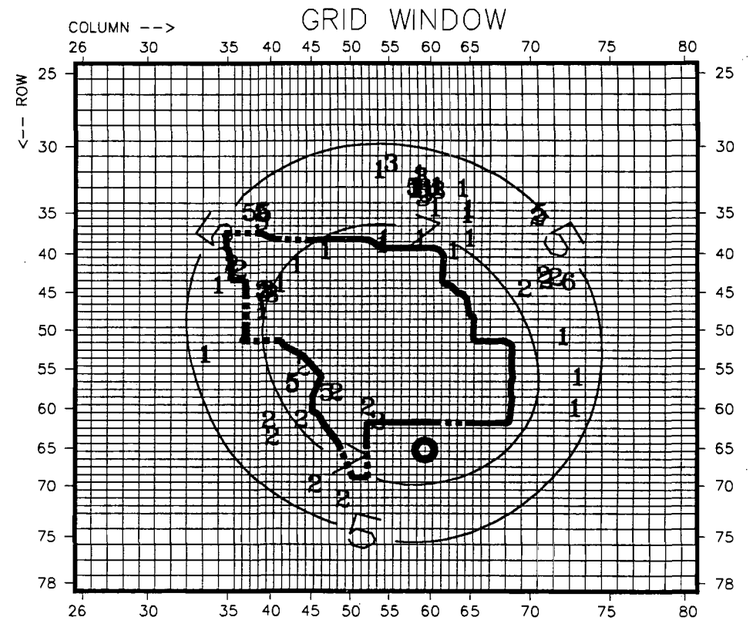


LEGEND

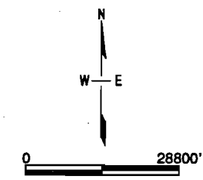
- PROPERTY BOUNDARY
- USGS GAGING STATION
- MODELED RIVER REACHES (LAYER 1)
- 2 — PERMITED WATER SUPPLY WELLS
- X = 547304.7740, Y = 1251615.6109 — TIE–IN COORDINATE
- 1 — DRAWDOWN CONTOUR

The number by the permited water supply wells is as follows:

1. Mining
2. Irrigation
3. Public Supply
4. Livestock
5. Industrial
6. Essential Services
7. Recreational



NOTE: WINDOW SCALE IS TWICE THE SIZE OF THE FULL GRID DRAWING SCALE.

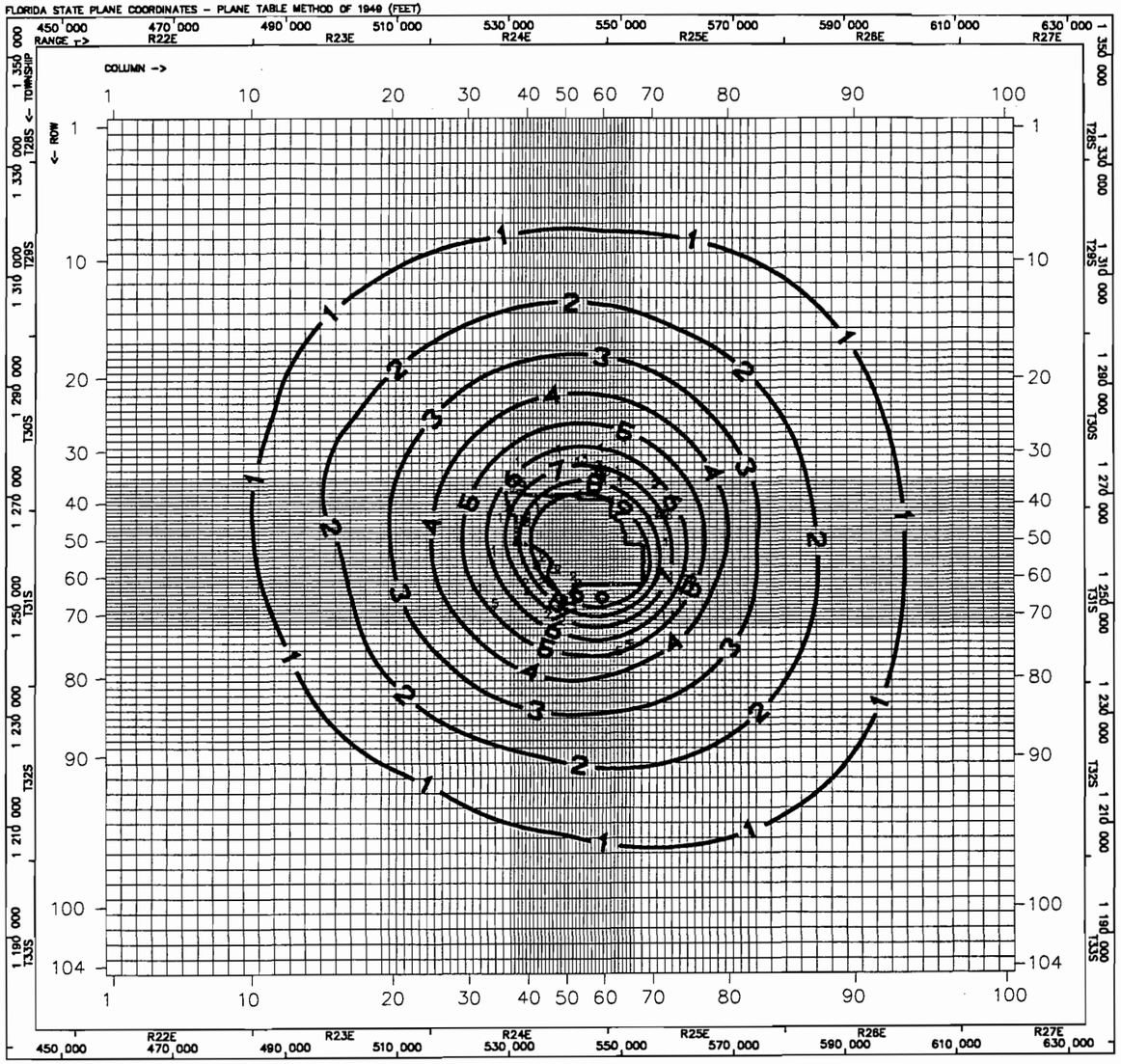


SOURCE: DAMES & MOORE, 1992

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FIGURE 5.3.2-8
UPPER FLORIDAN DRAWDOWN FOR 26.6 MGD FPC WITHDRAWALS
EXISTING USERS BASELINE

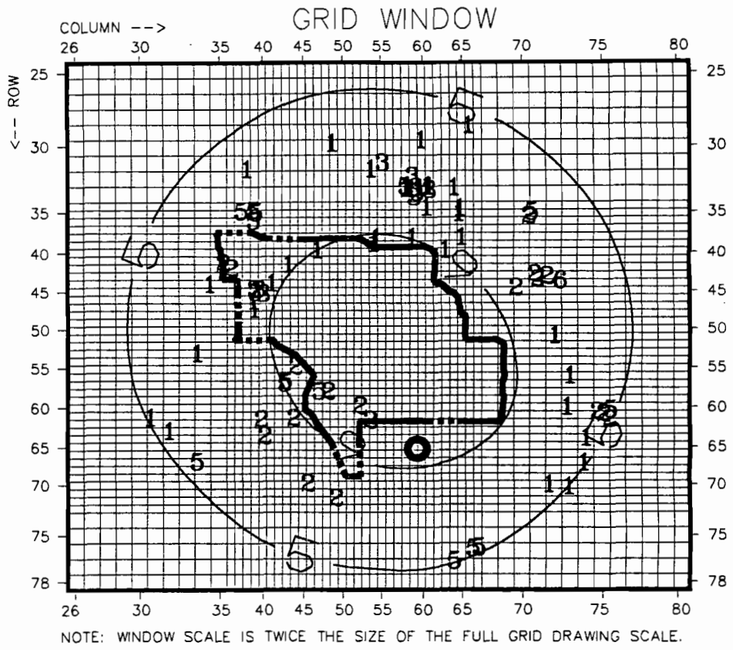


LEGEND

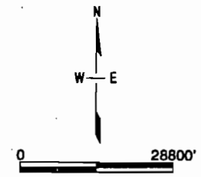
- PROPERTY BOUNDARY
- USGS GAGING STATION
- MODELED RIVER REACHES (LAYER 1)
- 2 — PERMITED WATER SUPPLY WELLS
- X = 547304.7740 Y = 1251615.6109 — TIE-IN COORDINATE
- 1 — DRAWDOWN CONTOUR

The number by the permited water supply wells is as follows:

1. Mining
2. Irrigation
3. Public Supply
4. Livestock
5. Industrial
6. Essential Services
7. Recreational



NOTE: WINDOW SCALE IS TWICE THE SIZE OF THE FULL GRID DRAWING SCALE.

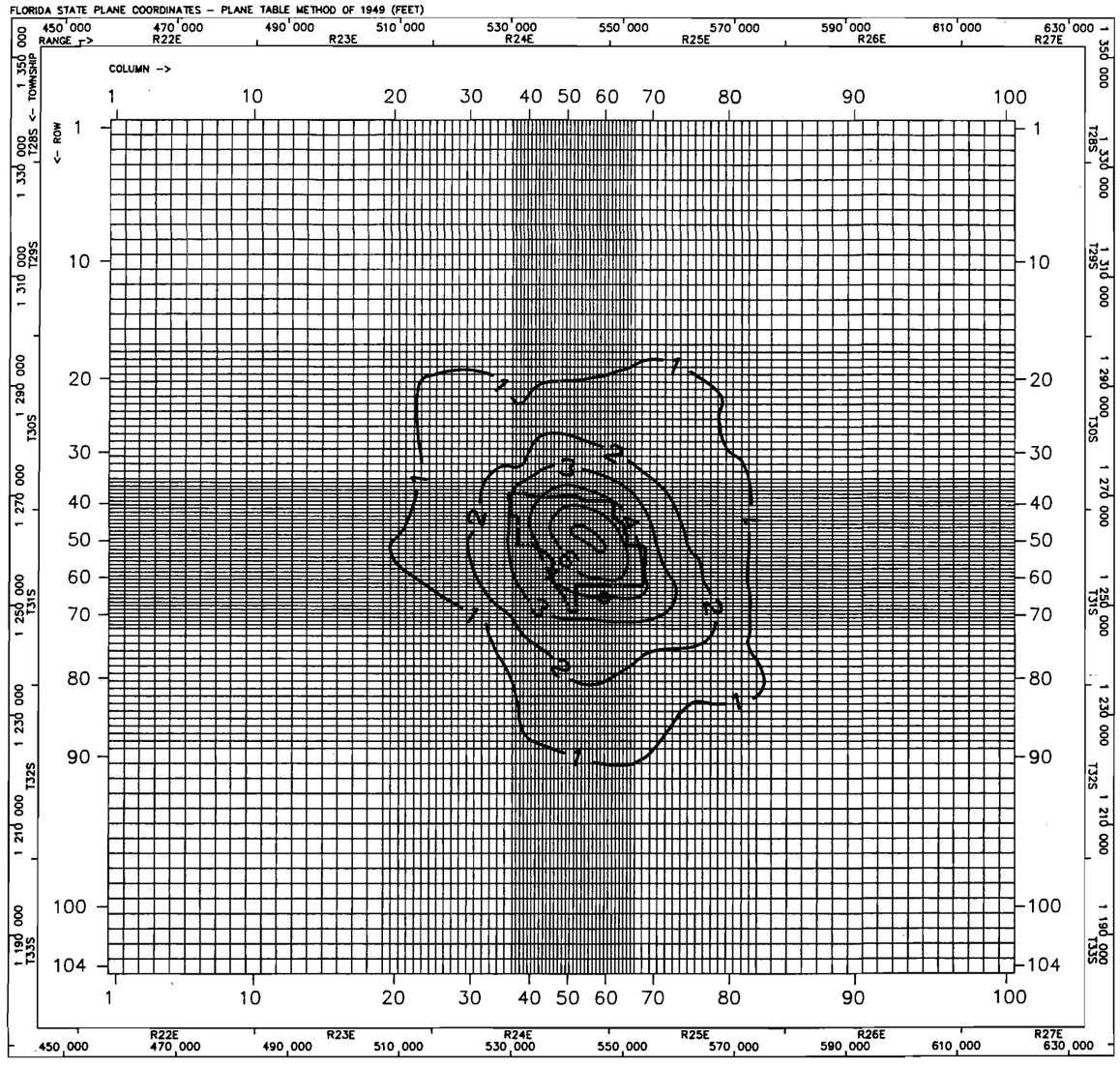


SOURCE: DAMES & MOORE, 1992

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Polk County Site

FIGURE 5.3.2-9
UPPER FLORIDAN DRAWDOWN FOR 31.6 MGD FPC WITHDRAWALS
EXISTING USERS BASELINE



LEGEND

PROPERTY BOUNDARY

USGS GAGING STATION

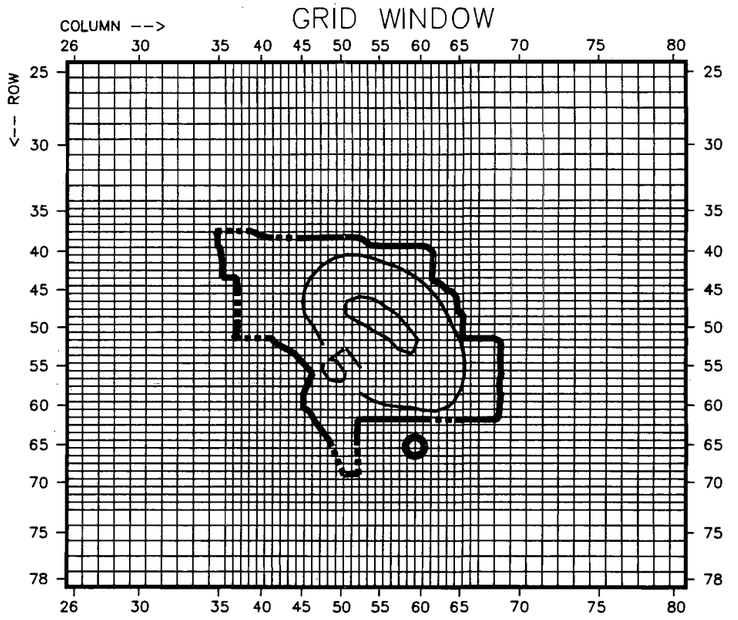
MODELED RIVER REACHES (LAYER 1)

2 PERMITED WATER SUPPLY WELLS

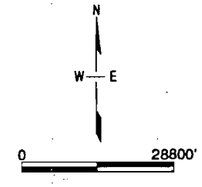
X = 547304.7740 TIE-IN COORDINATE
Y = 1251615.6109

1 DRAWDOWN CONTOUR

The number by the permited water supply wells is as follows:
1. Mining
2. Irrigation
3. Public Supply
4. Livestock
5. Industrial
6. Essential Services
7. Recreational



NOTE: WINDOW SCALE IS TWICE THE SIZE OF THE FULL GRID DRAWING SCALE.

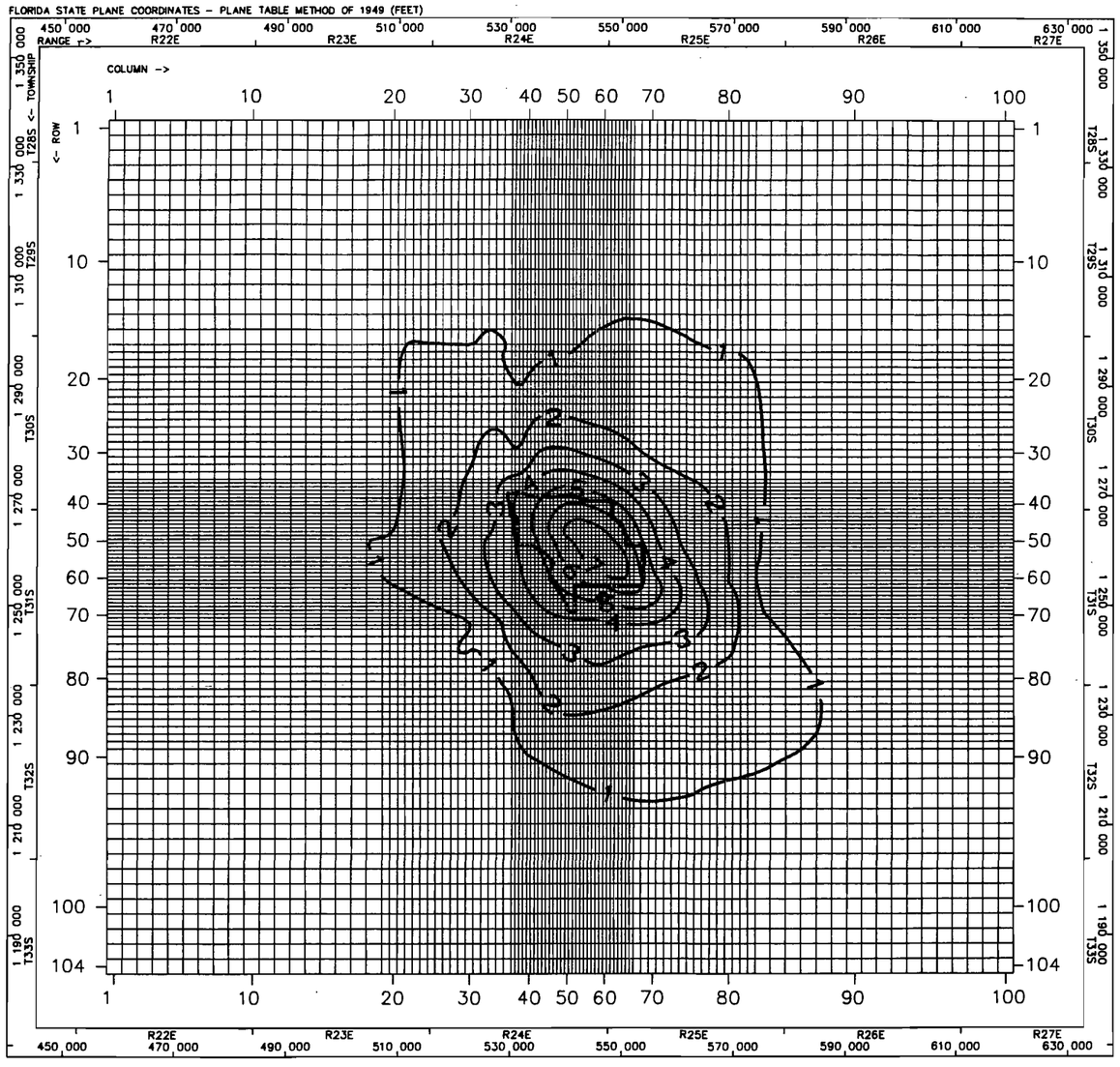


SOURCE: DAMES & MOORE, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 5.3.2-10
INTERMEDIATE AQUIFER DRAWDOWN FOR 20.6 MGD FPC WITHDRAWALS WITH PREDEVELOPMENT BASELINE



LEGEND

PROPERTY BOUNDARY

USGS GAGING STATION

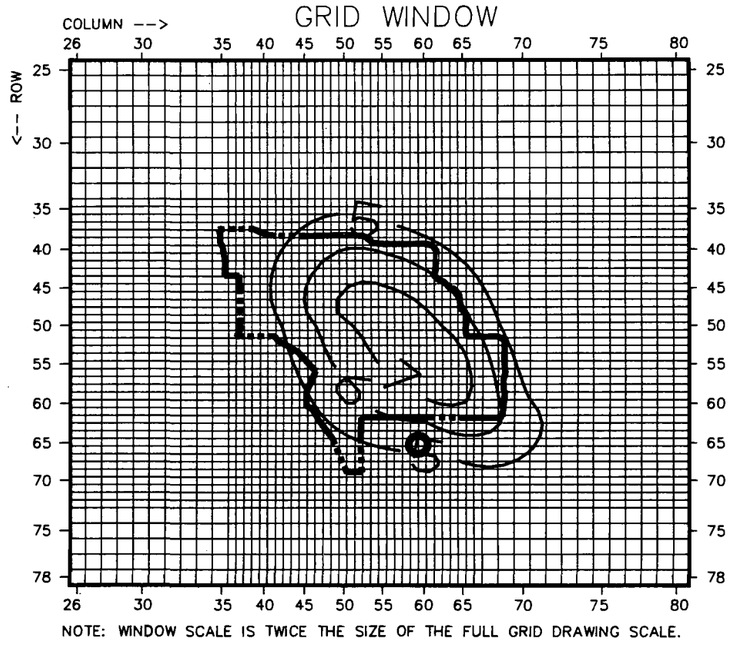
MODELED RIVER REACHES (LAYER 1)

2 PERMITED WATER SUPPLY WELLS
X = 547304.7740 TIE-IN COORDINATE
Y = 1251615.6109

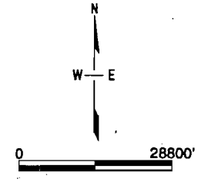
1 DRAWDOWN CONTOUR

The number by the permited water supply wells is as follows:

1. Mining
2. Irrigation
3. Public Supply
4. Livestock
5. Industrial
6. Essential Services
7. Recreational



NOTE: WINDOW SCALE IS TWICE THE SIZE OF THE FULL GRID DRAWING SCALE.

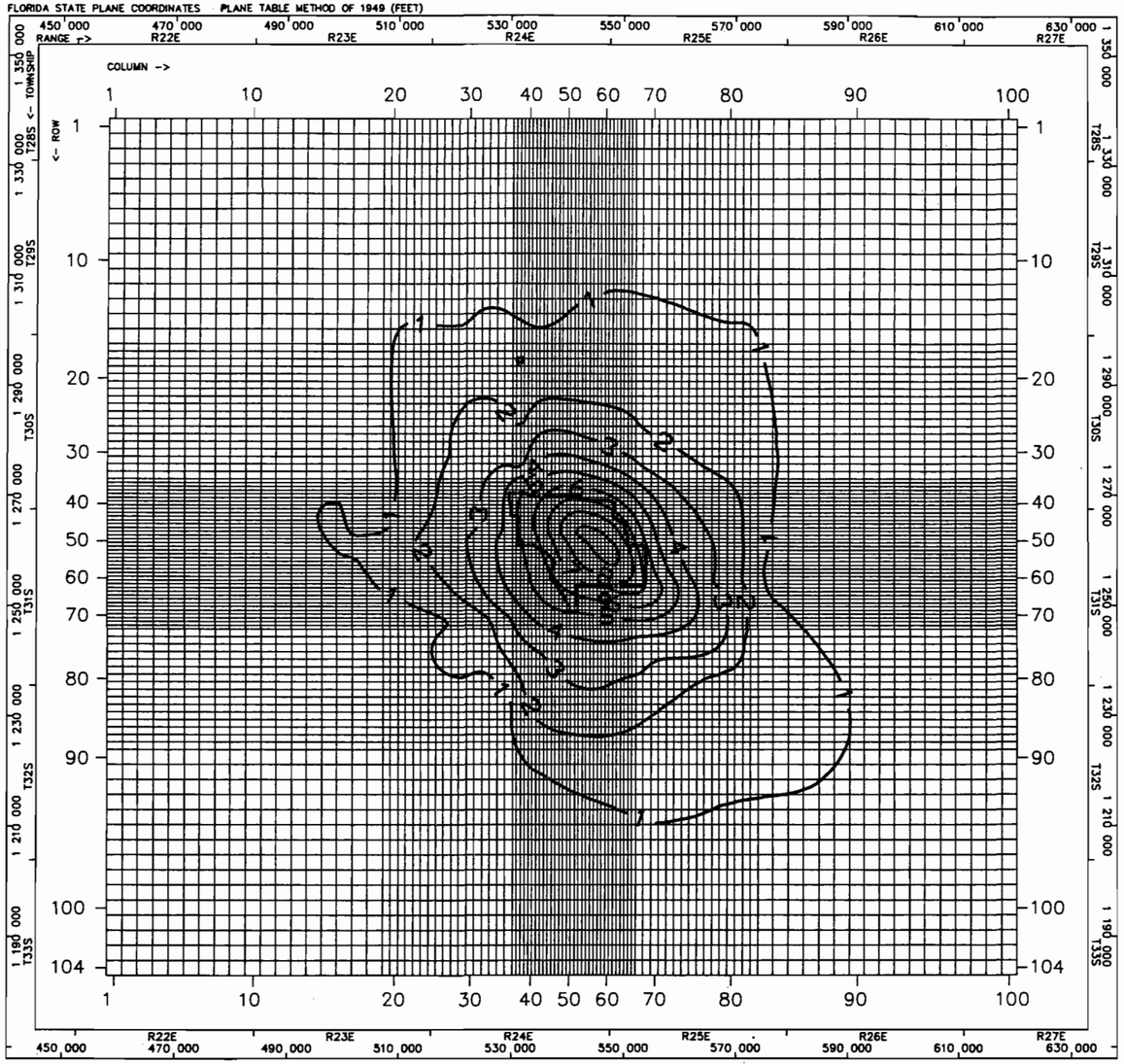


SOURCE: DAMES & MOORE, 1992

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Polk County Site

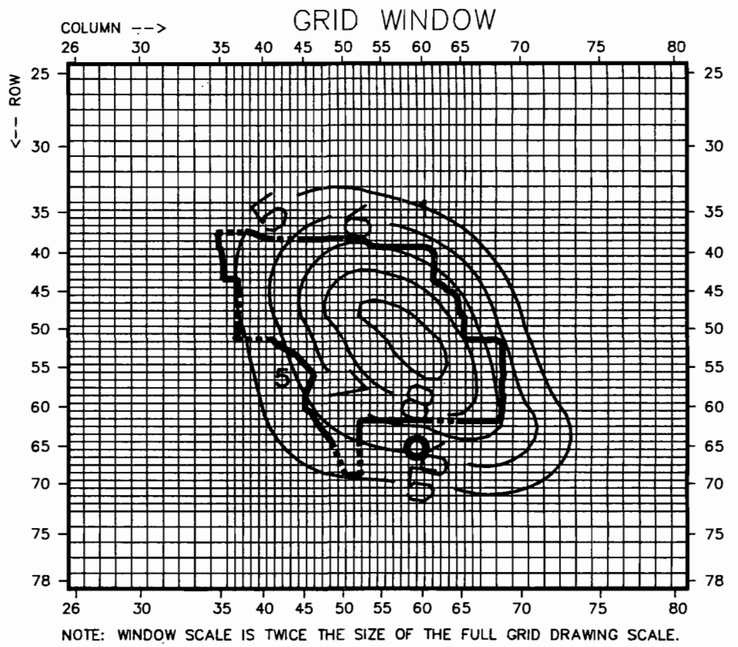
FIGURE 5.3.2-11
INTERMEDIATE AQUIFER DRAWDOWN FOR 26.6 MGD FPC WITHDRAWALS WITH PREDEVELOPMENT BASELINE



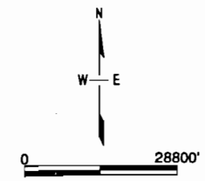
LEGEND

- PROPERTY BOUNDARY
- USGS GAGING STATION
- MODELED RIVER REACHES (LAYER 1)
- 2 PERMITED WATER SUPPLY WELLS
- X = 547304.7740 Y = 1251615.6109 TIE-IN COORDINATE
- 1 DRAWDOWN CONTOUR

The number by the permited water supply wells is as follows:
1. Mining
2. Irrigation
3. Public Supply
4. Livestock
5. Industrial
6. Essential Services
7. Recreational



NOTE: WINDOW SCALE IS TWICE THE SIZE OF THE FULL GRID DRAWING SCALE.

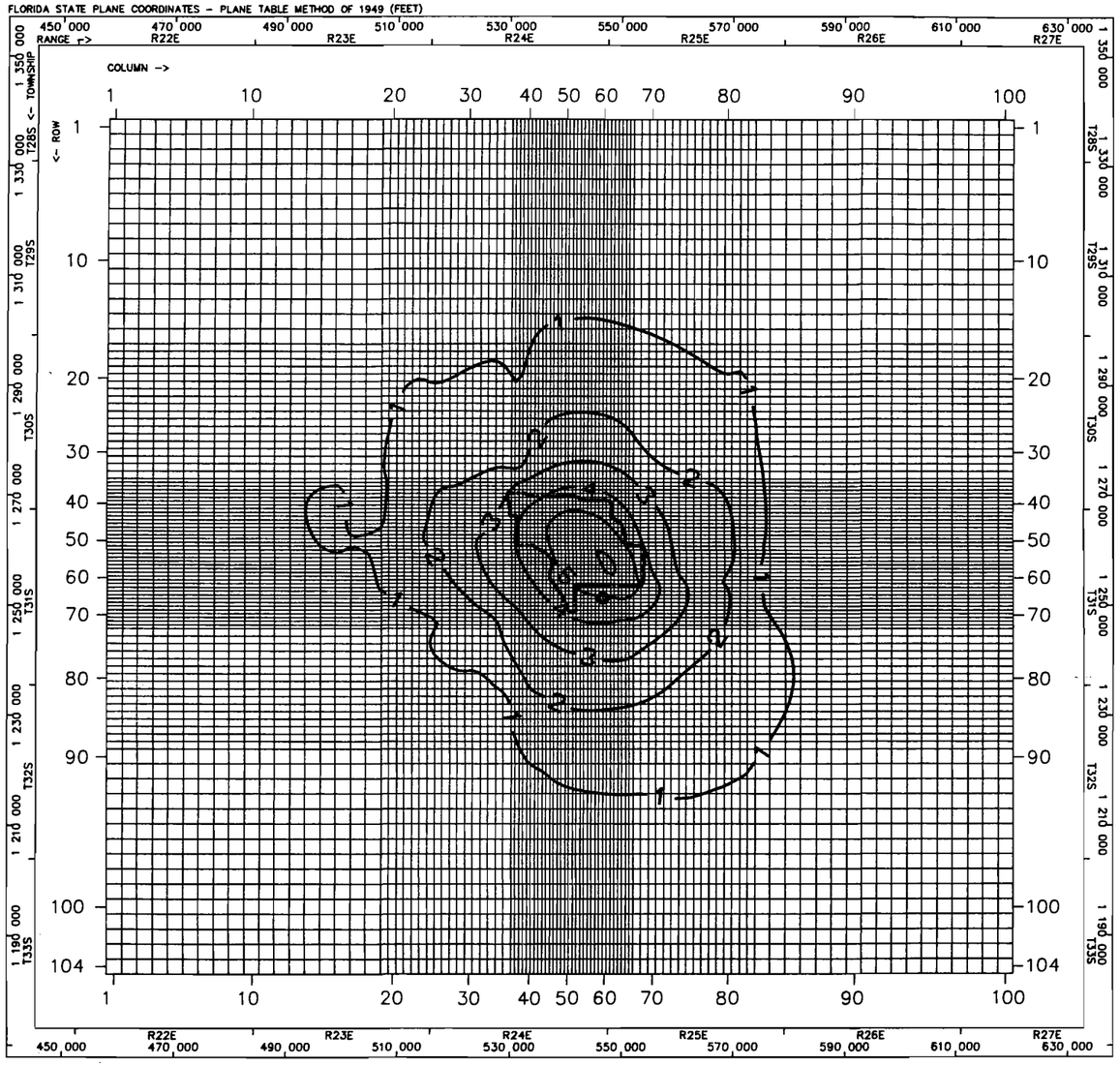


SOURCE: DAMES & MOORE, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 5.3.2-12
INTERMEDIATE AQUIFER DRAWDOWN FOR 31.6 MGD FPC WITHDRAWALS WITH PREDEVELOPMENT BASELINE



LEGEND

PROPERTY BOUNDARY

USGS GAGING STATION

MODELED RIVER REACHES (LAYER 1)

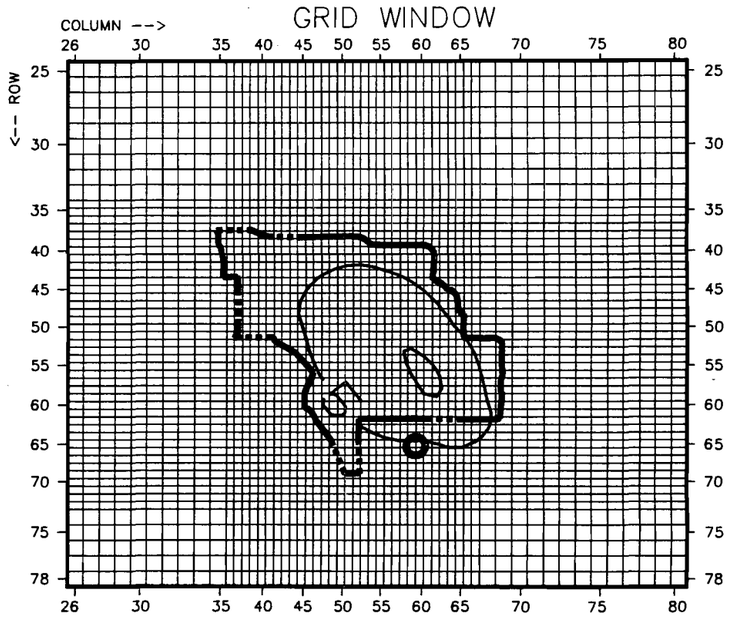
2 PERMITED WATER SUPPLY WELLS

X = 547304.7740 TIE-IN COORDINATE
Y = 1251615.6109

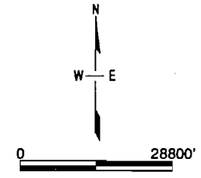
1 DRAWDOWN CONTOUR

The number by the permited water supply wells is as follows:
1. Mining
2. Irrigation
3. Public Supply
4. Livestock
5. Industrial
6. Essential Services
7. Recreational

GRID WINDOW



NOTE: WINDOW SCALE IS TWICE THE SIZE OF THE FULL GRID DRAWING SCALE.

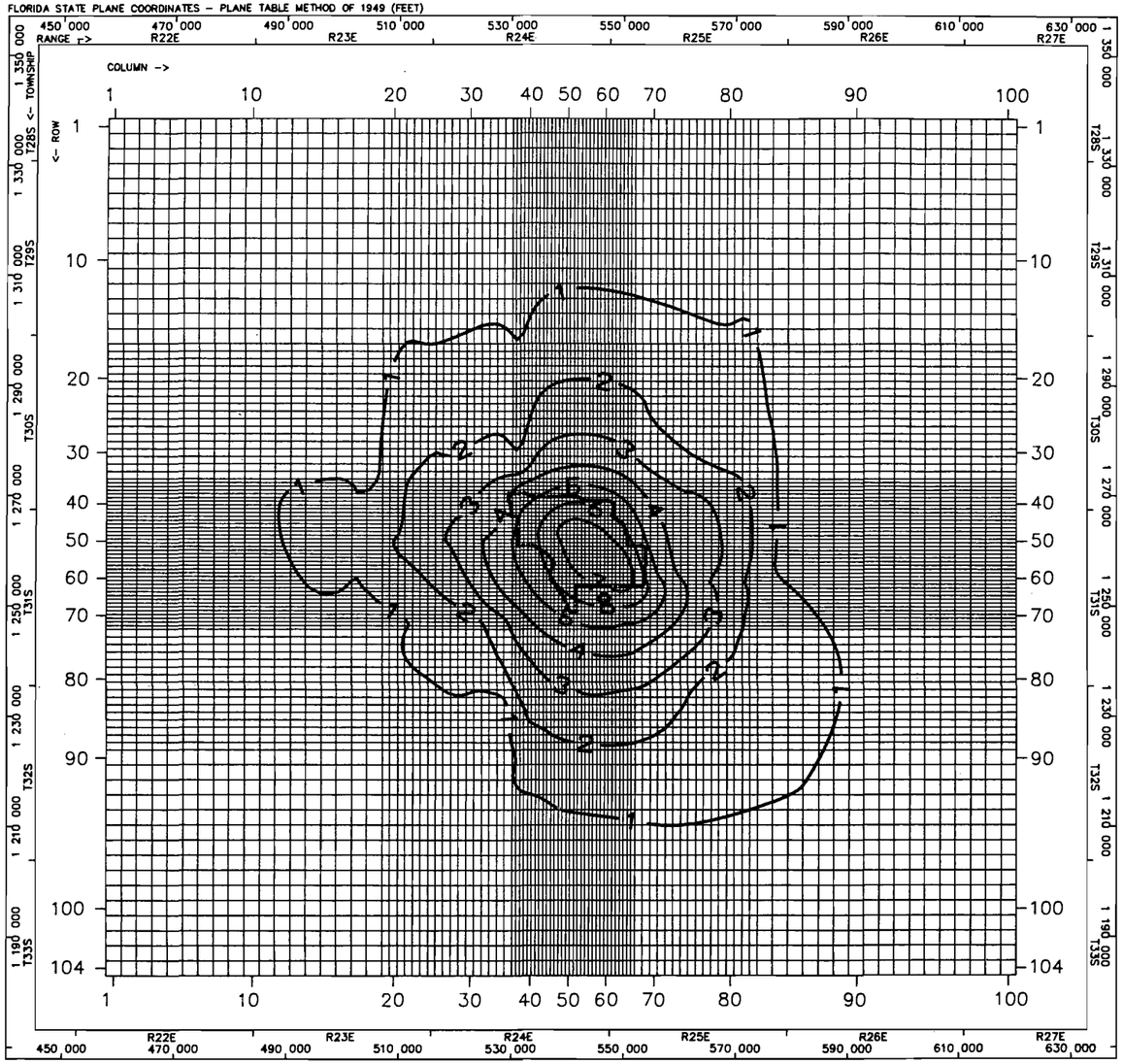


SOURCE: DAMES & MOORE, 1992

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Polk County Site

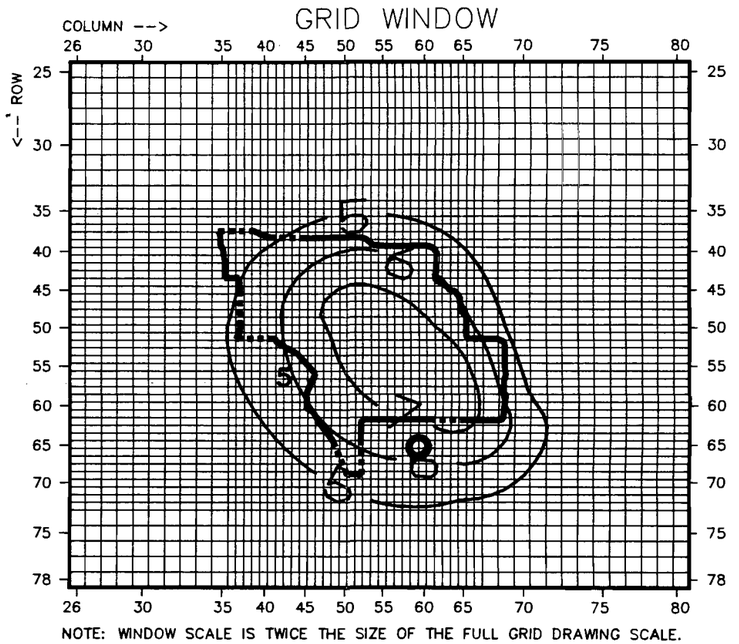
FIGURE 5.3.2-13
INTERMEDIATE AQUIFER DRAWDOWN FOR 20.6 MGD FPC WITHDRAWALS EXISTING USERS BASELINE



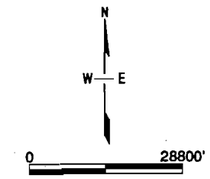
LEGEND

- PROPERTY BOUNDARY
- USGS GAGING STATION
- MODELED RIVER REACHES (LAYER 1)
- 2 — PERMITED WATER SUPPLY WELLS
- X = 547304.7740, Y = 1251615.6109 — TIE-IN COORDINATE
- 1 — DRAWDOWN CONTOUR

The number by the permited water supply wells is as follows:
1. Mining
2. Irrigation
3. Public Supply
4. Livestock
5. Industrial
6. Essential Services
7. Recreational



NOTE: WINDOW SCALE IS TWICE THE SIZE OF THE FULL GRID DRAWING SCALE.

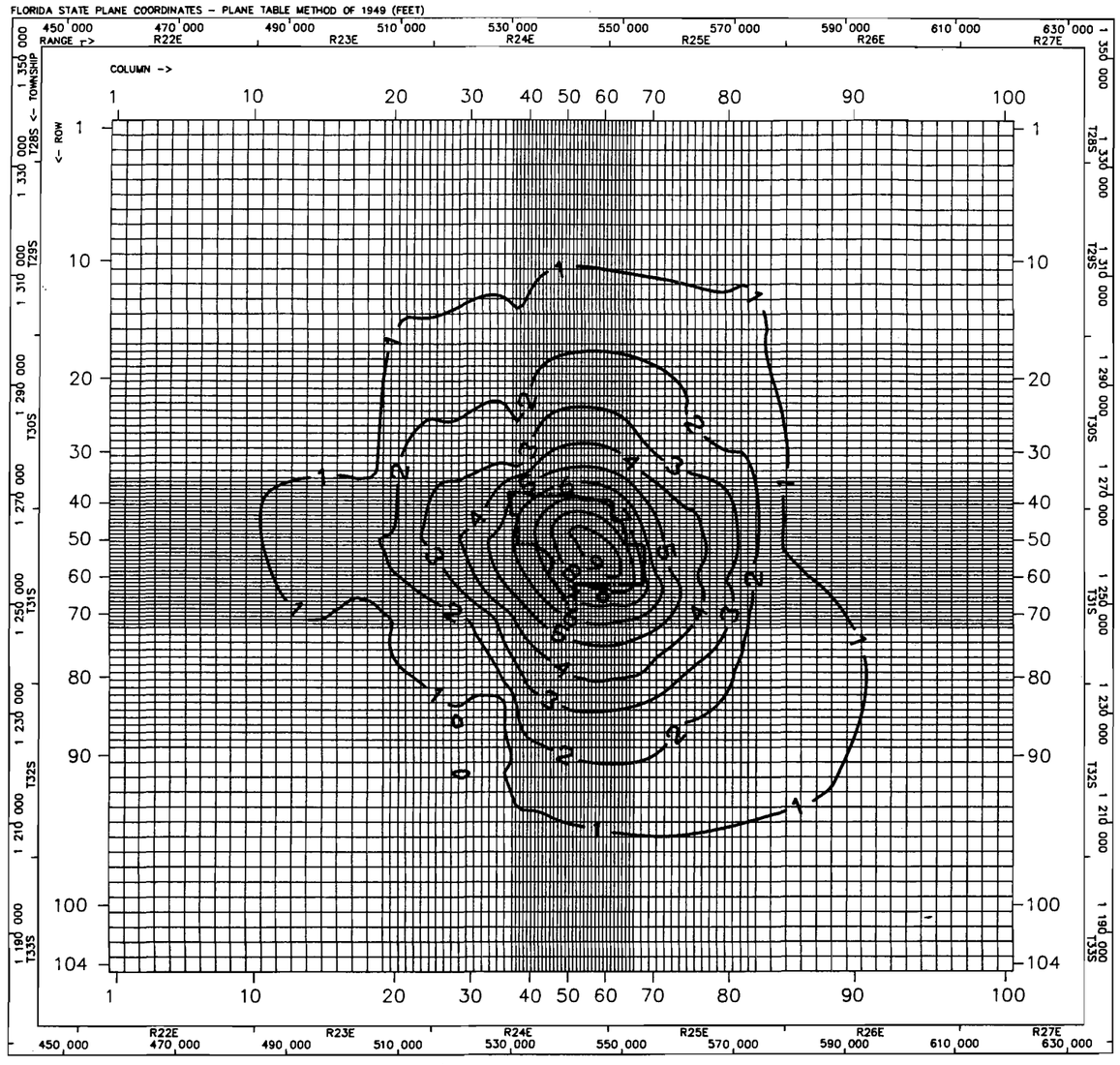


SOURCE: DAMES & MOORE, 1992

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Polk County Site

FIGURE 5.3.2-14
INTERMEDIATE AQUIFER DRAWDOWN FOR 26.6 MGD FPC WITHDRAWALS EXISTING USERS BASELINE



LEGEND

PROPERTY BOUNDARY

USGS GAGING STATION

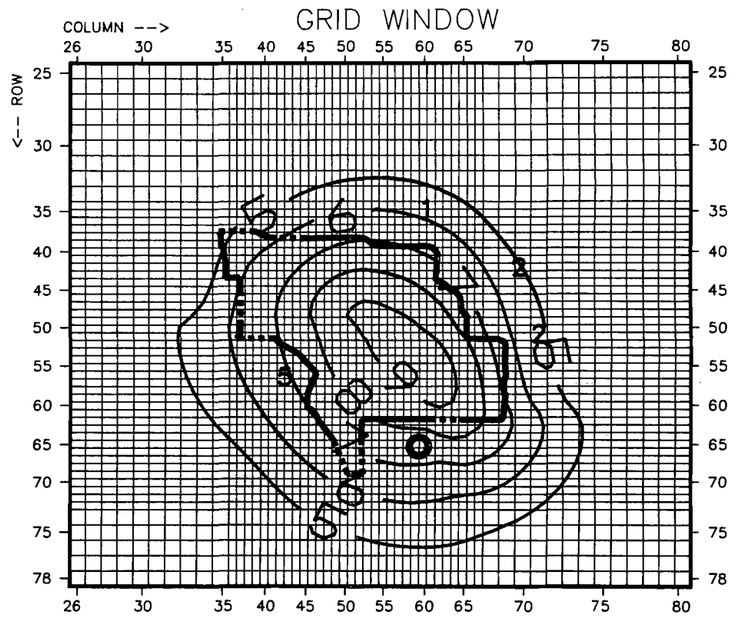
MODELED RIVER REACHES (LAYER 1)

2 PERMITED WATER SUPPLY WELLS

X = 547304.7740 TIE–IN COORDINATE
Y = 1251615.6109

1 DRAWDOWN CONTOUR

The number by the permited water supply wells is as follows:
1. Mining
2. Irrigation
3. Public Supply
4. Livestock
5. Industrial
6. Essential Services
7. Recreational



NOTE: WINDOW SCALE IS TWICE THE SIZE OF THE FULL GRID DRAWING SCALE.

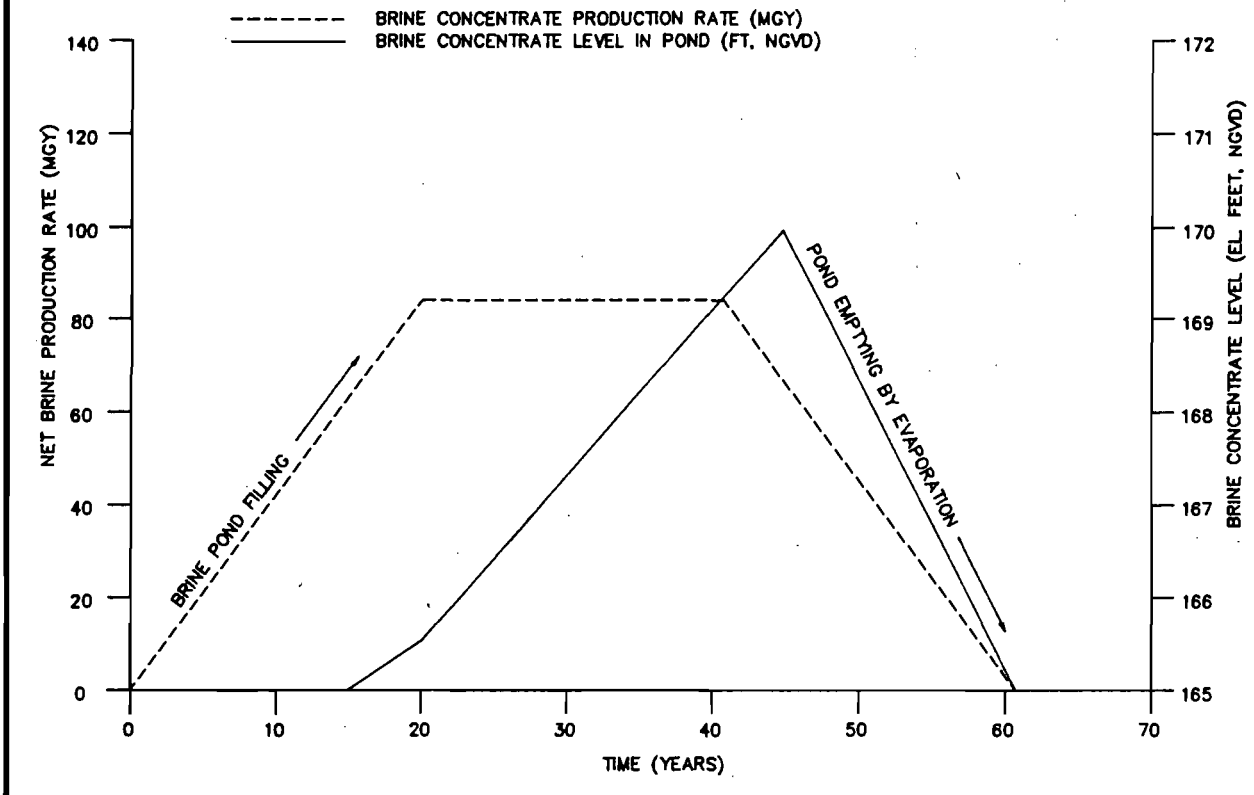
N
W E
0 28800'

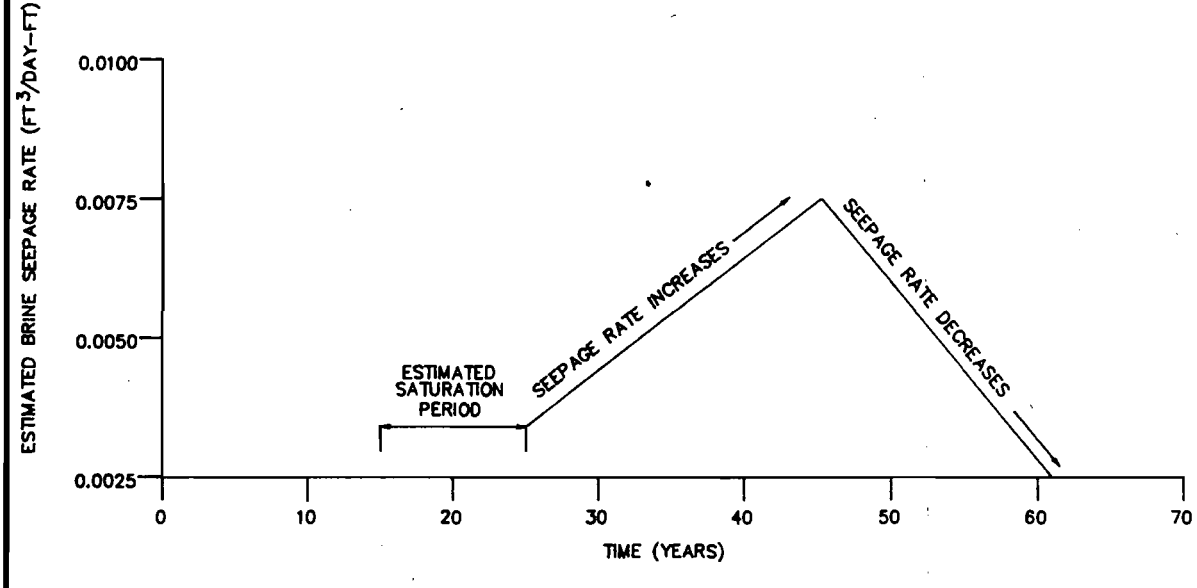
SOURCE: DAMES & MOORE, 1992

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FIGURE 5.3.2-15
INTERMEDIATE AQUIFER DRAWDOWN FOR 31.6 MGD FPC WITHDRAWALS EXISTING USERS BASELINE



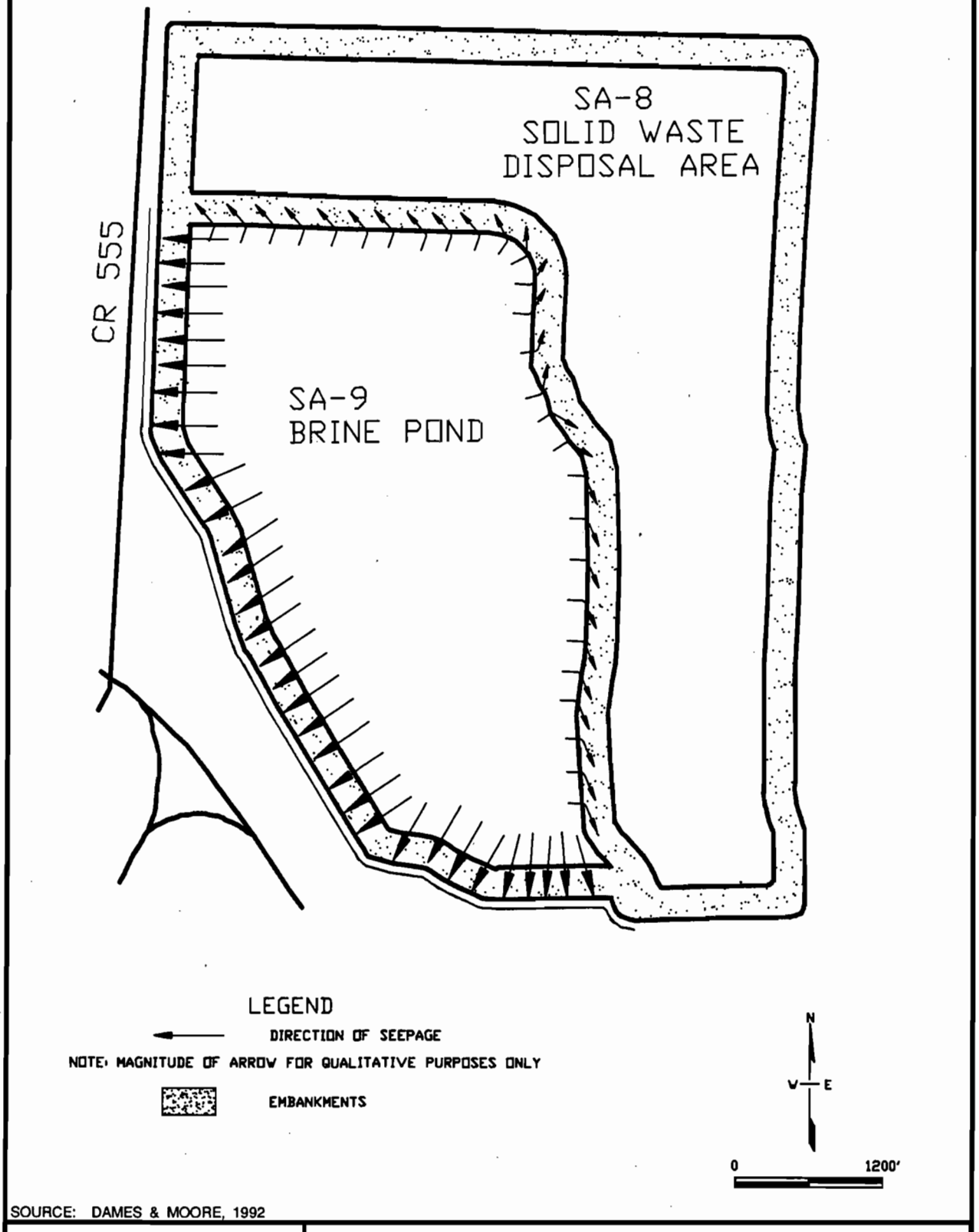


SOURCE: DAMES & MOORE, 1992

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FIGURE 5.3.2-16
ESTIMATES OF POTENTIAL BRINE POND FILLING AND SEEPAGE RATES

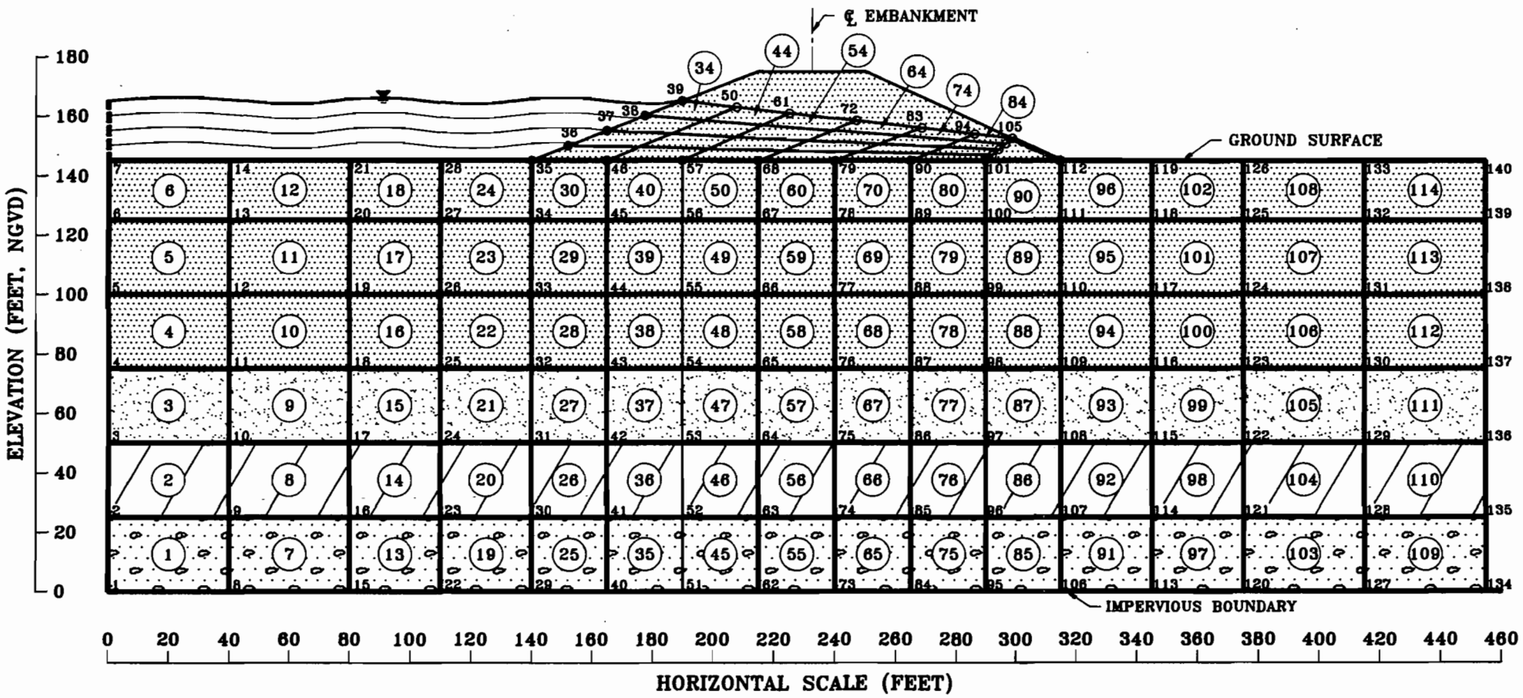


SOURCE: DAMES & MOORE, 1992

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FIGURE 5.3.2-17
PLAN VIEW OF SA-9 EMBANKMENTS SHOWING POTENTIAL SEEPAGE DIRECTIONS



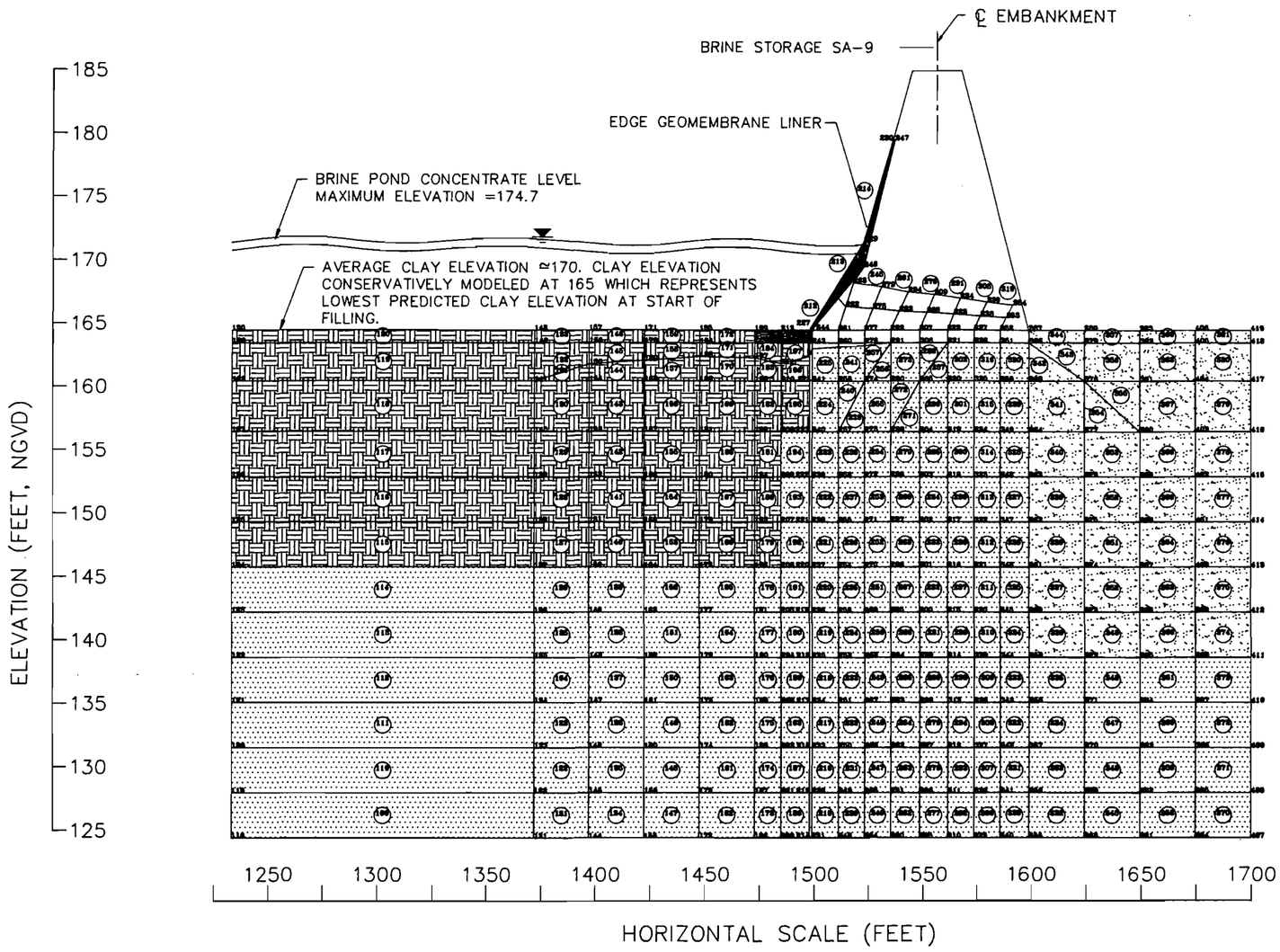
LEGEND:

- MATERIAL WITH HYDRAULIC CONDUCTIVITY, K = $3X10^{-2}$ FT/DAY
- MATERIAL WITH HYDRAULIC CONDUCTIVITY, K = $3X10^{-1}$ FT/DAY
- MATERIAL WITH HYDRAULIC CONDUCTIVITY, K = $3X10^{-6}$ FT/DAY
- MATERIAL WITH HYDRAULIC CONDUCTIVITY, K = 3 FT/DAY
- N – 16 PROCESS WATER
- FINITE ELEMENT MESH: (1) = ELEMENT NUMBER, 1 = NODE NUMBER

SOURCE: DAMES & MOORE, 1992

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Polk County Site

FIGURE 5.3.2-18
N-16 POND SEEPAGE MODEL



LEGEND:

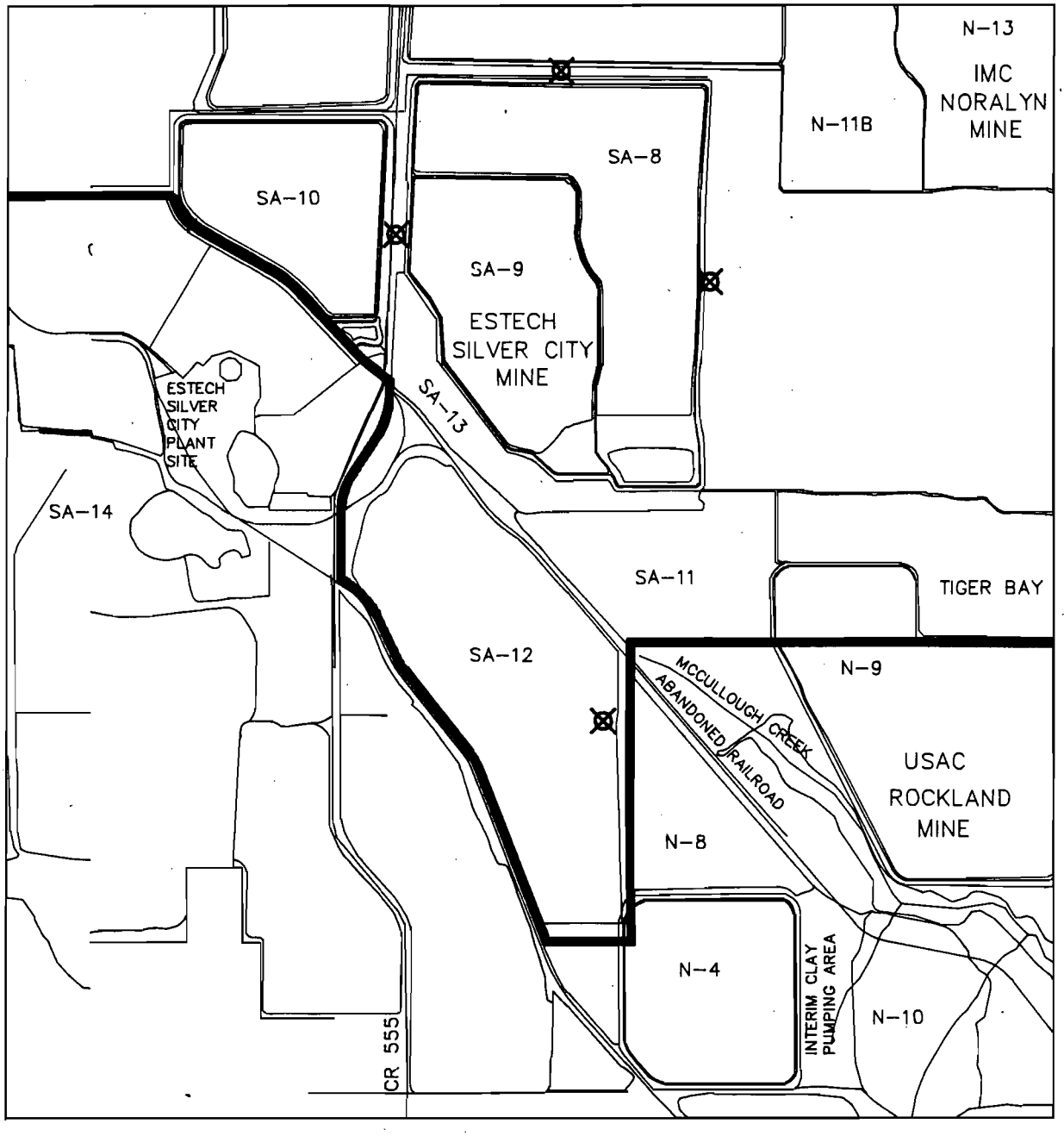
- EDGE GEOMEMBRANE LINER WITH HYDRAULIC CONDUCTIVITY, $K = 3X10^{-8}$ FT/DAY
- CAST OVERBURDEN WITH HYDRAULIC CONDUCTIVITY, $K = 3X10^{-2}$ FT/DAY
- CLAY WITH HYDRAULIC CONDUCTIVITY, $K = 3X10^{-4}$ FT/DAY
- NATURAL GROUND HYDRAULIC CONDUCTIVITY, $K = 3X10^{-3}$ FT/DAY
- ROLLED OVERBURDEN WITH HYDRAULIC CONDUCTIVITY, $K = 3X10^{-2}$ FT/DAY
- BRINE CONCENTRATE
- FINITE ELEMENT MESH: (1) = ELEMENT NUMBER, 1 = NODE NUMBER

SOURCE: DAMES & MOORE, 1992

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FIGURE 5.3.2-19
BRINE POND SEEPAGE MODEL

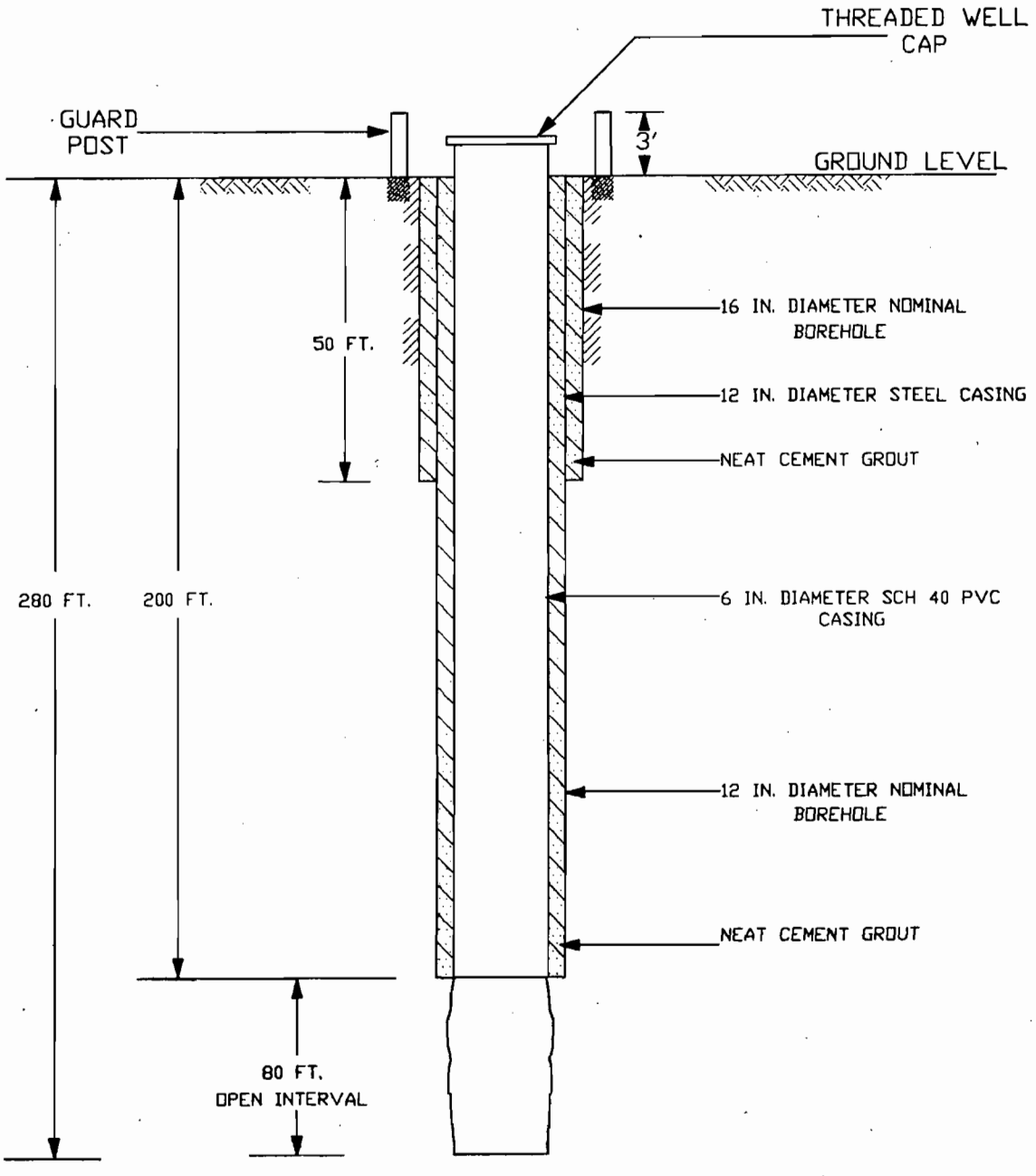


SOURCE: EBASCO ENVIRONMENTAL, 1992

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FIGURE 5.3.5-1
DRINKING WATER MONITORING WELL LOCATIONS



NOTE:
ACTUAL DEPTH TO BE DETERMINED BY TESTING PROGRAM.

Source: Dames & Moore, 1991

NOT TO SCALE

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Polk County Site

FIGURE 5.3.5-2
CONCEPTUAL OPEN HOLE INTERMEDIATE OBSERVATION WELL

5.4 SOLID/HAZARDOUS WASTE DISPOSAL IMPACTS

5.4.1 Solid Waste

The disposal of solid wastes on-site will ultimately alter the topography of the designated solid waste disposal areas (SWDA). For the purpose of this application, the brine disposed to the SA-9 area will also be considered as a solid waste. The impacts created by the disposal of solid wastes on-site not already covered in Section 5.3 include the topographic impact and the stratigraphic impact.

The topographic impact is simply the fact that the land surface will be elevated approximately 30 feet in the SWDA. Typically, the solid waste will be placed as shown on Figure 3.7.1-37. The outer edge of each lift will be placed on a 1V to 4H slope. There is a minimum 150-foot flat area between lifts. The solid waste will not be visible from off-site because of the surrounding above-grade dams.

The stratigraphic impact will be the result of the loading that the solid waste will place on the waste clay. Although consolidated, these clays will still contain 70 to 75 percent water. As such, they would be unable to support heavy loads, because ordinary reclamation does not dewater the waste clays beyond this level. However, the pressure gradually applied by the solid waste (up to about 2,000 to 3,000 pounds per square foot) and then maintained over a span of many years, can be expected to further "squeeze" the water from these clays. The results are expected to be twofold:

1) As the clay layer consolidates, its surface subsides, thereby providing more room for solid waste.

2) As the clay layer consolidates, it will become stronger and will be capable of supporting heavier loads.

Application of solid wastes at the rates and with the techniques described in Section 3.7.1.3 would be stable, and would not result in the mixing of the solid wastes with the consolidated clays intended to serve as liners.

As described in Section 3.7, if it is assumed conservatively that no solid waste is sold off-site, the first area (SA-8) would be expected to be filled by the year 2014. At that time, it would be

capped with a 2-foot thick soil layer and grassed, and would be sloped so that runoff would be directed to the cooling pond.

The brine pond is expected to last the life of the Polk County Site. By limiting the inflow to 64.2 million gallons per year (see Section 3.6.2.3), the liquid inflow will be removed by evaporation. Although relatively high by water quality standards, the estimated total dissolved solids content of 40,000 mg/l by weight is actually relatively small by volume (about 1 percent or less). An annual solids addition of 642,000 gallons per year would represent only about 0.006 feet in SA-9 (311 acres). At this rate, it would only fill the bottom 4.3 inches in 60 years.

Solid wastes to be disposed off-site will be limited to used combustion turbine (CT) air inlet filters and general office wastes. These will be disposed at the Polk County North Central Landfill, located on S.R. 540 between Lakeland and Winter Haven. This landfill has a capacity of 24,362,900 cubic yards, according to the Polk County Comprehensive Plan. It began operation in 1980, and consists of 120 acres, 17 of which have been filled. The volume of air filter and office wastes is expected to be approximately 314 cubic yards per year, or 0.0013 percent of the landfill's original capacity.

The potential for reuse of solid wastes produced at the facility by selling them to off-site users is under investigation. Obvious benefits resulting from the recycling of these wastes are:

- Production of revenue derived from sale of solid wastes
- Reduced landfill space needed for on-site disposal
- Reduced consumption of natural resources

5.4.2 Hazardous Wastes

The only wastes produced during operation of the Coal Gasification Combined Cycle (CGCC) and PC units which could be categorized as listed hazardous wastes are low volume spent acidic and basic solutions produced in the regeneration of the demineralizer resin bed ion exchangers. However, these wastes will be treated in a totally enclosed elementary neutralization unit, which qualifies these wastes for exemption from obtaining a Resource Conservation Recovery Act (RCRA) permit. Other wastes generated during operation of the CGCC and pulverized coal

(PC) units which could be considered hazardous are metal cleaning wastes resulting from cleaning of the boiler tubes. These wastes will be recycled on-site or will be disposed of off-site in an approved manner by a licensed boiler cleaning contractor (see Section 3.7.2).

Coal quality and specific design features of the coal gasifer and gas cleaning process will have a direct impact on the hazardous characteristics and volumes of another group of wastes produced by the CGCC units. These wastes include:

- Wastewater treatment wastes
- Acid gas removal system wastes (filter cake)
- Claus sulfur recovery wastes (spent refractory)
- Tail gas treatment wastes (filter cake, spent catalyst)

Appropriate tests will be conducted prior to disposal of these wastes to determine if they are hazardous. Pending this determination, these wastes will be handled as hazardous waste and stored in accordance with the requirements of 40 CFR 262.34. If found to be hazardous, they will be shipped off-site for treatment or disposal by a licensed hazardous waste contractor. Pending shipment off-site, the hazardous wastes will be stored temporarily on-site in accordance with the generator standards contained in 40 CFR 262.34. No hazardous wastes will be treated at the site unless the treatment occurs in an "elementary treatment facility," or a "wastewater treatment unit" as defined by Florida Department of Environmental Regulation (FDER) and U.S. Environmental Protection Agency (EPA) hazardous waste regulations. In addition, hazardous waste will not be stored on-site in excess of the time requirements of 40 CFR 262.34.

In summary, as noted in Section 3.7.2, hazardous waste will not be treated or disposed of on-site. Except for those treated as noted previously, and which are excluded from permit requirements as hazardous wastes as defined in 40 CFR 270.1(c)(2), such wastes will be accumulated and shipped off-site for disposal in a licensed hazardous waste treatment or disposal facility in full compliance with the generator standards contained in 40 CFR 262. There are not expected to be any on-site impacts from these activities.

5.5 SANITARY AND OTHER WASTE DISCHARGES

The FPC Polk County Site is being designed as a zero wastewater discharge facility. In the absence of a publicly-owned treatment work (POTW), which could be used for the off-site treatment of sanitary wastes, these wastes will be treated on-site and the effluent will be reclaimed as makeup water for the cooling pond. The nearest POTW which could be used to treat site sanitary wastes is the City of Fort Meade sewage treatment plant. FPC is considering the possibility of connecting to the City of Fort Meade sewage system and utilizing the Fort Meade sewage treatment plant for treatment of sanitary wastes generated at the site.

If treated on-site, treatment would include secondary (extended aeration activated sludge) and tertiary (sand filtration) treatment as described in Section 3.5.2. The resulting effluent would be comparable to municipal effluent meeting 5 mg/l limits for both BOD and total suspended solids (TSS) and would be discharged to the cooling pond. Waste solids from filter backwashing would be disposed to the SWDA with other water treatment solid wastes.

5.6 AIR QUALITY IMPACTS

5.6.1 Impact Assessment

5.6.1.1 Introduction

This section provides an air quality impact assessment of the worst-case possibility for the site described in Section 3.1; that is, Case B consisting of eight CTs with associated HRSGs, STs, and coal gasification (CG) units, plus two PC units, each of nominal 600 MW size, for a total site capacity of 3,200 MW. This case would have higher emissions of air pollutants than the other possible case presented (Case A - 3,000 MW of CGCC) and is therefore considered to be the worst-case possibility from an air quality standpoint. The initial 940 MW, consisting of four natural gas fired CC units (with fuel oil as back-up fuel) is analyzed in detail in the PSD application provided in Appendix 10.1.5, and that analysis is not repeated in this section. Thus, this section focuses exclusively on the ultimate site capacity and is provided to demonstrate that the site is capable of supporting 3,200 MW after the application of best available control technology (BACT) to limit air pollutant emissions.

This section provides a discussion of the pollutants analyzed and provides the rationale for not considering certain pollutants in the analyses. The modelling methodology is described along with the meteorological data used as input. The emission parameters for the proposed units are provided as are listings of other sources included in the analyses. The receptor grids used in the modelling are presented and the background concentrations used in the ambient air quality standards (AAQS) analyses are specified. Finally, the results of the modelling analyses are provided, with comparisons to the allowable Prevention of Significant Deterioration (PSD) increments, AAQS, and draft No Threat Levels (for air toxics). A supplementary analysis is provided of projected impacts on the nearest PSD Class I area and an additional impacts analysis is included which summarizes air quality impacts due to induced growth; air quality impacts on vegetation, soils, and wildlife; and air quality impacts on visibility.

5.6.1.2 Air Quality Regulatory Requirements Applicability

AMBIENT STANDARDS/PSD INCREMENTS

The applicable national and Florida AAQS are presented in Table 5.6.1-1. The primary NAAQS/FAAQS were promulgated to protect the public health, and the secondary NAAQS/FAAQS were promulgated to protect the public welfare from any known or anticipated adverse effects associated with the presence of certain "criteria" pollutants in the ambient air. Areas of the country in violation of the NAAQS are designated by EPA as non-attainment areas. Any new or modified existing sources to be located in or near a non-attainment area may be subject to stringent air quality permitting requirements. Polk County is an attainment area for all criteria pollutants.

In promulgating the 1977 Clean Air Act (CAA) Amendments, Congress specified that certain incremental increases above air quality "baseline concentration" levels for SO_2 and TSP would constitute "significant deterioration." The magnitude of the allowable increment depends on the classification of the area in which a new or modified source will be located or have an impact. Three classifications were designated based on criteria established in the CAA Amendments. Initially, Congress designated PSD areas as Class I (international parks, national wilderness areas, and memorial parks larger than 5,000 acres, and national parks larger than 6,000 acres) or as Class II (all areas not designated as Class I). No Class III areas, which would allow greater deterioration than Class II areas, were designated. EPA subsequently incorporated the requirements for classifications and area designation into the PSD regulations.

On October 17, 1988, the EPA promulgated additional regulations to prevent significant deterioration due to NO_X emissions and established PSD increments for NO_2 concentrations. The allowable PSD increments for SO_2, TSP, and NO_2 are also presented in Table 5.6.1-1. The FDER has adopted the EPA PSD classification scheme and the allowable PSD increments for SO_2, TSP, and NO_2.

Polk County is designated as Class II from a PSD standpoint. The nearest Class I area to the proposed site is the Chassahowitzka National Wilderness Area (NWA), located between 118 km to 137 km to the northwest. The NWA is that portion of the Chassahowitzka National Wildlife Refuge which has been officially designated as wilderness. There are no other Class I areas within 200 km of the proposed site.

POLLUTANT APPLICABILITY

According to the SCA guidelines (DER Form 17-1.211(1)), the air quality impact assessment must demonstrate that the operation of the proposed project will not cause or contribute to a violation of any PSD increment or AAQS pursuant to Rules 17-2.500(5)(d) and (e), F.A.C., which cover the ambient impact analysis and additional impact analyses, respectively. The pollutants subject to new source review, and thus these analyses, are covered by Rule 17-2.500(2)(f), F.A.C., "Pollutants Subject to New Source Review," which indicates that pollutants emitted in quantities greater than those listed in FDER Table 500-2 must be analyzed. A comparison of the maximum emission levels for Case B with the significant emission rates of FDER Table 500-2 is provided in Table 5.6.1-2. As indicated in the table, the proposed facility will exceed the significant emission rates for CO, NO_x, SO_2, PM_{10}, TSP, VOC, Pb, Be, Hg, fluorides, sulfuric acid mist, arsenic, and radionuclides.

As indicated in Table 5.6.1-2, there will be a significant increase in VOC emissions, triggering air quality review for ozone. However, ozone formation cannot be simulated with a simple Gaussian dispersion model. The U.S. EPA Guideline on Air Quality Models (EPA, 1990a) indicates that "the use of models incorporating complex chemical mechanisms should be considered only on a case-by-case basis with proper demonstration of applicability. These are generally regional models not designed for the evaluation of individual sources but used primarily for region-wide evaluations." The proposed facility is located in an attainment area for ozone. Thus, it is not subject to a VOC emissions impact assessment and an ozone modelling analysis is not appropriate.

The proposed source emissions of Be, Hg, fluorides, sulfuric acid mist, benzene, arsenic, and radionuclides are shown in Table 5.6.1-2 to be above the specified significant emission rates. However, the PSD regulations and FDER do not define significant impact levels for some of these pollutants (see Table 5.6.1-3), nor are ambient air quality standards established for these pollutants. Hence, the air quality impact assessment for these pollutants is limited to prediction of the maximum impacts from the proposed facility alone.

Some additional pollutants that are not subject to PSD review (and not regulated under the Clean Air Act) are included in the air quality impact analysis in order to provide additional information for the air toxics analysis, and to serve as input to the additional impacts analysis. The additional noncriteria pollutants for which emission estimates were available for this project

(mainly trace elements) are: antimony, barium, boron, cadmium, calcium, chromium, cobalt, copper, formaldehyde, magnesium, manganese, nickel, selenium, vanadium, and zinc. Emission estimates for these substances are presented in Table 5.6.1-4.

5.6.1.3 Modelling Approach

The air quality impact assessment consists of a proposed source worst-case operating scenario analysis, a significant impact area analysis, a PSD increment consumption analysis, an ambient air quality standards impact analysis, an air toxics analysis, and an additional impacts analysis. These analyses are discussed in greater detail in the following paragraphs under specific modelling methodologies. The modelling approach followed EPA and FDER modelling guidelines for determining compliance with applicable PSD increments and ambient air quality standards. A modelling protocol was prepared by the applicant as a part of the Plan of Study (FPC, 1991) and submitted to FDER for review. The FDER approved the modelling protocol prior to commencement of the air quality impact assessment. A separate protocol was submitted for the supplementary PSD Class I area analysis (FPC, 1992b); that protocol and model are described in Section 5.6.1.10.

The Polk County Site has been determined to be a rural area based upon the technique for urban/ rural determinations documented in the EPA "Guideline on Air Quality Models" (U.S. EPA, 1990a) which applies land use criteria. Based upon this determination, the refined Industrial Source Complex Short-Term (ISCST) dispersion model (Version 90346) was selected for application in the air quality impact analysis used to support the PSD permit application. The ISCST model (U.S. EPA, 1987a) is a referenced EPA dispersion model recommended for use in rural areas, and for application to point, area, and volume sources. The ISCST model can predict the maximum as well as the highest, second-highest concentration and period of occurrence for 1-hour, 3-hour, 8-hour, 24-hour, and annual averaging periods at each receptor for each full year of hourly meteorological data used.

The program control parameter data used in the ISCST model are consistent with running the model in the regulatory default mode. The model was applied without terrain adjustment data because the area in which the Polk County Site is located has very little relief (e.g., a net change in ground level elevation in the range of only 10 feet). The ISCST model's building downwash options were applied because the stacks for some of the proposed sources will be less than the GEP stack heights.

Based on a discussion with FDER personnel, the decision was made to collocate several stacks for the proposed facility in the modelling analysis, which is a conserative (worst-case) approach. The decision was also made to separately model emissions from the diesel generator and auxiliary boiler, since they are small compared to the main units' emissions and will not occur when the main units are in normal operation, except for very brief periods of testing. The ISCST model was run separately for the existing PSD sources and the existing baseline sources to determine those source impacts in combination with the proposed source impacts.

The air quality impact assessment for PM assumed that all PM emissions were PM_{10} emissions (i.e., PM = TSP = PM_{10}). This assumption simplified the PM modelling analysis and makes for a conservative approach to modelling PM impacts.

5.6.1.4 Meteorological Data

The air quality modelling analysis used hourly preprocessed National Weather Service (NWS) surface meteorological data from Tampa, Florida, and concurrent twice-daily upper air soundings from Ruskin, Florida, for the years 1982-1986. The meteorological data were supplied by FDER in the preprocessed format required by the ISCST model. The preprocessed hourly meteorological data file for each year of record used in the analysis contains randomized wind direction, wind speed, ambient temperature, atmospheric stability using the Turner (1970) stability classification scheme, and mixing heights. The anemometer height of 6.7 meters, used in the modelling analysis, was obtained from NWS Local Climatological Data summaries for Tampa (NOAA, 1989). A joint frequency distribution of wind directions and speeds by atmospheric stability class is provided in Appendix 10.5.6.1.

The supplementary PSD Class I area analysis used an additional meteorological data set. It is described separately in Section 5.6.1.10.

5.6.1.5 Proposed Source Emissions/Stack Parameters

FPC's philosophy for the construction, operation, and maintenance of generating facilities is to focus on safety, reliability, and cost effectiveness, while maintaining an environmentally responsible posture. In keeping with this philosophy and examining the worst-case scenario (Case B) for the ultimate site capacity, this section presents the emission levels and stack parameters associated with the CC units, PC units, and CG units. In addition, this section

presents emission levels and modelling parameters for the auxiliary boiler, diesel generator, and the fugitive dust sources.

COMBINED CYCLE UNITS

Estimated emission levels and stack parameters for a CC unit are presented in Tables 5.6.1-5 and 5.6.1-6, when fired on coal gas and fuel oil (back-up), respectively. Information is presented at ambient temperatures of 40°F, 72°F, and 95°F for full load operation. Emission levels are based on the application of BACT as discussed in Section 3.4. Modelling analyses (Section 10.1.5 - PSD Application) revealed the 40°F temperature scenario as being worst case from the standpoint of air quality impacts, and emission rates at this temperature have been used in subsequent modelling analyses. During any given year, brief excursions below the 40°F temperature may occur at the site resulting in slightly higher emissions.

PULVERIZED COAL UNITS

Estimated emission levels and stack parameters for a PC unit are presented in Table 5.6.1-7. Information is presented at unit loads of 50 percent, 75 percent, and 100 percent. Emission levels are based on the application of BACT as discussed in Section 3.4. Modelling analyses revealed the 100 percent load scenario as being worst case from the standpoint of air quality impacts (Section 5.6.1.9).

GASIFICATION UNITS

Estimated emission levels and stack parameters from the exhaust of the thermal oxidation units used to control tail gas emissions from the gasification units are presented in Table 5.6.1-8. Emission levels are based on the application of BACT as discussed in Section 3.4. The modelling analysis was conducted using emission rates representative of an ambient temperature of 40°F. This was chosen as the worst-case scenario since maximum fuel input rates for the CC units correspond to this temperature.

AUXILIARY BOILER/DIESEL GENERATOR

Estimated emission levels and stack parameters for the auxiliary boiler and diesel generator are presented in Tables 5.6.1-9 and 5.6.1-10, respectively. Emission levels for the auxiliary boiler

are based on the maximum heat input rate of 99 mmBTU/hr when fired on natural gas or fuel oil and the application of BACT as described in Section 3.4. Emission levels for the diesel generator are based on full load. Worst-case emissions from both the auxiliary boiler and diesel generator are associated with the firing of low sulfur fuel oil. Both sources were modelled separately from the CC units, PC units, and thermal oxidation units.

FUGITIVE DUST SOURCES

Estimated emission levels and modelling parameters associated with the coal and limestone handling systems are presented in Table 5.6.1-11. Emission levels have been established for four fugitive dust sources based on the application of BACT as discussed in Section 3.4. All fugitive dust sources were modelled as area sources using TSP rather than PM_{10} emission factors. This approach is conservative and is consistent with the worst-case modelling methodology utilized.

A preliminary material handling conceptual design study was performed to develop approximate fugitive dust source modelling parameters for the worst-case plant scenario of two coal gasification plants and two PC boilers. The throughput rates developed for various aspects of the plant material handling systems are based on current estimates of maximum hourly fuel burn rates for each combustion source, daily fuel and limestone consumption, and the annual plant capacity factor. It should be noted that results of the conceptual design study indicate that two coal stacker/reclaimer devices may be required so that coal receiving/stockout and coal reclaiming can take place simultaneously.

Both maximum hourly and annual average emission rates for each source are shown in the tables. The hourly (worst-case) emission rate is based on material handling at the design operating capacity of the device, such as the belt capacity. The annual emission rate is based on the estimated annual material throughput, which accounts for the plant capacity factor.

Both TSP and PM_{10} emission estimates were developed by applying an appropriate emission factor and control efficiency to each potential material handling particulate emission source. The emission factors used are those found in EPA's emission factor reference document, AP-42 (EPA, 1988a). Standard control efficiencies applicable to the various planned mitigation measures are also based on standard EPA reference documents. It is assumed that baghouse particulate collectors will be utilized at all material drop points except for coal and limestone

railcar unloading, coal stacker/reclaimer, and limestone reclaiming. Wet suppression will be utilized at the coal railcar unloading and stacker/reclaimer. All other sources such as conveying and limestone receiving and reclaiming will be controlled through total or partial enclosure.

GEP STACK HEIGHT CONSIDERATIONS

GEP stack heights for the CC units, PC units, and CG units were determined by use of the Breezewake computer model (Trinity Consultants, 1989). The Breezewake computer model output specified a GEP stack height of approximately 625 feet (190.5 m) for all stacks. As proposed, the CC units (213 feet), the PC units (625 feet) and the CG units (353 feet) stacks have been designed at or below GEP stack height.

AIR TOXICS

Estimated maximum short-term emission rates and annual emission rates for the CC units, PC units, and thermal oxidation units are contained in Table 5.6.1-4. Emission levels are based on the application of BACT as discussed in Section 3.4. The short-term emission rates were used in the Air Quality Related Values (AQRV) analysis and the FDER No Threat Level (NTL) analysis. Trace metal emission estimates not specifically addressed by the BACT analysis were obtained from emission factors for fuel oil combustion and coal combustion (EPA, 1988 and 1989) and from Cool Water Project data (Black & Veatch, 1992).

5.6.1.6 Existing Source Emission Inventories

The results of the proposed source significant impact area analysis (described in Section 5.6.1.9) indicated that the proposed facility's air quality impacts could be above the significant impact levels for NO_2, SO_2, and PM at off-site locations. The ISCST model projected significant impact areas as 33, 50, and 12 km radius circles centered on the proposed source for these three pollutants, respectively. Therefore, the PSD and background source emission inventories for these pollutants were prepared from available databases considering these areas of impact.

The FDER Air Pollutant Information System (APIS) computer printouts of the emissions for facilities located within approximately a 100 km radius of the proposed source location were searched. This information was supplemented with data from air quality permits, PSD permit applications, and previous air quality modelling analyses to identify all significant sources

(emissions greater than 25 tons/year) within the areas of impact and 50 km wide annual rings outside of the areas of impact.

A screening technique known as the "Screening Threshold" method (North Carolina DNR, 1985) was applied to sources located within the 50 km wide annular rings. The method is designed to objectively eliminate from the emission inventory those sources which are not likely to have a significant interaction with the source undergoing evaluation. According to the method, sources that should be considered in the modelling analyses are those with emissions greater than Q (in tons/year), which is calculated by the following equation:

$$Q = 20 X D$$

where:

D = the distance in kilometers from the particular source to the source undergoing evaluation.

Those sources with maximum allowable emissions below the calculated "screening threshold" were eliminated from consideration in the modelling analysis. The remaining sources not screened out comprised the existing source emission inventory to be used in the modelling analysis.

The resulting existing source emission inventories were also established separately for PSD increment consuming sources and all sources for the AAQS analysis. In general, the PSD regulations define PSD sources as those sources which commenced construction after the baseline date for a specified pollutant. Baseline sources are defined as those sources which commenced construction prior to the baseline date for a specified pollutant. In a discussion with FDER (Linn, 1992), the PSD baseline date for major sources (greater than 100 tons/year) of SO_2 and PM was indicated as January 6, 1975, and the minor source (less than 100 tons/year) PSD baseline date for this pollutant is December 27, 1977. For NO_2, the major and minor source baseline date is February 8, 1988.

The completed existing source emission inventories were submitted to FDER for review and were determined to be acceptable for input to the ISCST model (Linn, 1992a&b). The existing source emission inventories used in the Class II area PSD modelling analyses are presented in Tables 5.6.1-12, 5.6.1-13, and 5.6.1-14 for NO_X, SO_2 and PM, respectively. The emissions

for all applicable pollutants in those tables are in terms of maximum allowable or potential emissions in order to evaluate a worst-case emissions scenario for those sources from a PSD increment standpoint. Sources with negative emission rates are increment expanding sources (i.e., baseline sources which reduced emissions or shut down, thereby expanding the available PSD increment).

Separate source inventories were used for the analysis of NO_2 and SO_2 impacts on the NWA, which is the nearest Class I PSD area. The source inventories for the Class I PSD analysis (Tables 5.6.1-15 and 5.6.1-16) consisted of not only the PSD sources near the proposed source but also a large number of additional PSD increment consuming sources in the area. They were compiled from a source list provided by FDER and augmented with additional sources. The resulting inventories were reviewed and approved by FDER (Linn, 1992a&b). Two minor changes were made in the SO_2 inventory after these FDER approvals. These involved the elimination of Source #63, which has been dismantled, and changes in stack parameters for Source #4 based on stack tests more representative of full load conditions. These changes were also discussed with and verbally approved by FDER.

Source inventories were also established for the AAQS analyses for NO_X, SO_2, and PM. These are presented in Tables 5.6.1-17, 5.6.1-18, and 5.6.1-19, respectively. They were compiled in the same manner as the PSD sources and were similarly reviewed and approved by FDER (Linn, 1992a&b). Again, a few minor changes were made in emission rates and stack parameters after these FDER approvals which involved corrections to erroneous emission rates for several particulate sources.

The existing PSD source and AAQS source emission inventories were based on combined stack collocation wherever reasonable. Multiple-stack facility emissions were combined and assumed to be emitted from the stack with the lowest "*K*" factor, an arbitrary parameter accounting for the relative influence of stack height, plume rise, and emission rate on concentrations (U.S. EPA, 1977). The parameter, *K*, was computed using the following formula:

$$K = hVT_s / Q$$

where:

h = stack height (m)
V = stack gas volume flow rate = $(\pi/4)d^2 V_S$ (m^3/sec)
d = stack exit diameter (m)
V_S = stack gas exit velocity (m/sec)
T_S = stack gas exit temperature ($°K$)
Q = pollutant emission rate (g/sec)

For example, application of this method to Source No. 7 on Table 5.6.1-18 provided the following "K" factors, indicating that the stack parameters for the third source listed would be used for modelling that facility.

K FACTOR EXAMPLE					
Stack Height (m)	**Stack Diameter (m)**	**Stack Temperature ($°K$)**	**Exit Velocity (m/sec)**	**Emission Rate (g/sec)**	**"K" Factor**
23.2	1	349.7	20.1	11.5	11,137
20.7	1	458	11.3	8.3	10,137
18.9	1.1	458	9.5	8	9,769

5.6.1.7 Receptor Locations

The general modelling approach discussed previously included a worst-case operating scenario analysis, an area of impact analysis, a coarse grid analysis, and a refined modelling analysis to assess air quality impacts on the applicable ambient air quality standards and PSD increments. Descriptions of the receptor grids used in these modelling analyses are presented below.

RECEPTOR GRID FOR PROPOSED SOURCE WORST-CASE OPERATING SCENARIO

The worst-case operating scenario analysis used the same combination polar/Cartesian grid consisting of 455 receptors described below for the coarse grid analysis receptors.

SIGNIFICANT IMPACT AREA ANALYSIS RECEPTOR GRIDS

The significant impact area modelling analyses initially used a polar receptor grid with rings beginning at 2.5 km and extending out to cover a 50 km radius area centered over the proposed source. The polar grid consisted of 36 radials, each separated by 10-degree increments and extending outward at ring distances of 2.5, 5.0, 10.0, 15.0, 20.0, 25.0, 30.0, 35.0, 40.0, 45.0, and 50.0 km with respect to the proposed source location. This receptor grid consisted of a total of 396 receptors and is shown in Figure 5.6.1-1.

When the modelling exercise with this grid indicated no significant impact for selected pollutants at or beyond the 2.5 km ring, additional rings were added at a finer grid resolution moving towards the closest plant boundary (at 500 meters to the south). Additional runs were completed at 1.0 km increments to identify significant impact areas to the nearest 1.0 km when significant impacts were noted within the 50 km radius grid.

COARSE GRID ANALYSIS RECEPTORS

A coarse grid analysis is used to identify the maximum impacts for the long-term (annual) averaging times and to identify the short-term impact areas that require further investigation with a fine grid. The coarse grid utilized consisted of a Cartesian coordinate grid with a 500 m spacing between points surrounded by three rings of a polar grid out to a maximum of 14 km from the proposed source. This grid was reviewed and approved by FDER (Linn, 1992a) and is depicted in Figure 5.6.1-2. As indicated in the figure, on-site locations are not included in the grid since access to the site by the public will be restricted.

FINE GRIDS

For areas of maximum short-term impacts predicted by the model using the coarse receptor grid described above, a series of fine grids were employed to obtain the final maximum predicted concentrations. These grids consisted of a maximum of 11 rows and 11 columns of points (i.e., 121 points) spaced 100 meters apart and centered over the maximum impact points from the coarse grid. Again, points within the site boundaries were excluded from consideration.

RECEPTOR GRID FOR CLASS I PSD ANALYSIS

The modelling for the PSD Class I area analysis used a 13-point receptor grid. This grid consisted of a series of regularly spaced points (approximately 2 km apart) located along the boundary of the Class I area. The coordinates of these points are listed in Table 5.6.1-20.

5.6.1.8 Background Concentrations

The background concentrations were determined according to the procedure documented at Section 9.2.3 in the Guideline on Air Quality Models (U.S. EPA 1990a). This procedure calls for a determination of a modelled background concentration component and an ambient air quality monitoring data-derived background concentration component. The modelled background concentration component was derived from the modelled impact for all applicable background sources identified in Tables 5.6.1-17, 5.6.1-18, and 5.6.1-19 for NO_X, SO_2, and PM, respectively.

The ambient air quality monitoring data-derived background concentration component was based on ambient air quality monitoring data from the on-site PSD monitoring program discussed in Section 2.3.7.2. Initially, the highest or second-highest monitored concentration for each applicable criteria air pollutant and averaging time was selected based on the four months of on-site monitoring data summarized in Table 2.3.7-7, Section 2.3.7.2. The total background concentrations for NO_X and SO_2 were determined by modelling all applicable background sources, and adding the monitored concentration as discussed above. This approach may result in "double counting" the impacts of the existing sources since their impacts are also accounted for in the monitoring data. This simple approach is conservative and was approved by the FDER (Linn, 1991). The total background concentrations are summarized under the results of the modelling analysis in Section 5.6.1.9.

For PM, this simple approach was determined to be too conservative, and an alternative approach described in the modelling protocol (FPC, 1991) and approved by FDER (Linn, 1992c) was employed. To avoid double counting, only PM data collected during days when on-site winds were not from directions including sources within 20 miles upwind for at least 18 out of 24 hours were selected. Figure 5.6.1-3 depicts the locations of nearby modelled PM sources and the wind direction sector considered to be not overly influenced by emissions from these sources. Upon application of this method to the four months of on-site data, the revised

monitored components of the background concentrations for PM were determined to be 13 $\mu g/m^3$ as the second-highest 24-hour average and 12 $\mu g/m^3$ as the long-term average.

5.6.1.9 Air Quality Modelling Results

This section summarizes the results of the modelling analyses conducted as described in Section 5.6.1.3. It is organized into subsections dealing with the predicted impacts of the proposed project by itself, predicted PSD increment consumption, predicted concentrations with respect to the AAQS, and predicted concentrations of air toxics versus FDER's draft No Threat Levels.

WORST-CASE OPERATION ANALYSIS

As indicated in Section 5.6.1.5, the proposed CGCC facility was evaluated for both the primary fuel, coal gas, and the back-up fuel, fuel oil, to determine the worst-case impacts. Since the emissions on coal gas are higher for most of the criteria pollutants than for fuel oil, the analysis of short-term impacts focused on the coal gas case. Based on previous experience in modelling CGCC units, it was assumed that 100 percent load would produce the maximum ground-level impacts. Therefore, no partial load cases were run for the CGCC units.

Based upon previously conducted modelling for the CC units in the Phase I analysis (see Appendix 10.1.5 - PSD application), the 40°F case was selected as the "worst-case" scenario since it typically produces the greatest impact for CC units. Parameters associated with this scenario were utilized in all further modelling. Subsequent runs for annual averages were made using the coal gas emissions and stack parameters associated with the 40°F case. However, for selected pollutants with worst-case emissions on fuel oil, the modelling took into account the maximum of 500 hours per year of fuel oil firing and added 8,260 hours per year of emissions from coal gas firing.

Unlike the CGCC units, the PC units may be run at reduced loads and, due to lower plume rise, it is possible that the worst-case ambient impacts might be associated with lower loads. This was evaluated by modelling the emissions from the PC units at 50 percent, 75 percent, and 100 percent loads. The results for one year of meteorological data are presented in Table 5.6.1-21. As indicated, maximum impacts clearly occurred with the 100 percent load emission parameters. As a result, all subsequent runs were based on the 100 percent load scenario for the PC units.

Since the proposed auxiliary boiler and emergency diesel generator will not be operated simultaneously with the CGCC units or PC units, except for brief periods of testing, the emissions from these sources have not been considered as a part of the worst-case operating scenario. The auxiliary boiler and emergency diesel generator have been modelled by themselves and their maximum off-site impacts are summarized in Table 5.6.1-22. These sources will be used only during cold start conditions to help limit the emissions from the CGCC units in this mode. Thus, ignoring the emissions from these facilities in the main units' air quality impact analysis does not compromise the conservative, worst-case nature of the analysis.

SIGNIFICANT IMPACT AREA ANALYSIS

Once the worst-case operating scenario was determined, the next step in the analysis was to determine the significant impact area for each pollutant with an associated PSD increment or AAQS. The significant impact area is defined in the EPA Guidance Manual (EPA, 1990b) as the circular area whose radius is equal to the greatest distance from the proposed source to which modelling shows that the proposed source will have a significant impact, based upon EPA defined significance values which are pollutant specific. The significant impact areas are important because they define the distances beyond which the impacts from the proposed source will be insignificant and need not be analyzed in conjunction with existing sources.

The results of the significant impact area analyses are presented in Table 5.6.1-23. For simplicity, all eight CGCC unit stacks and both PC unit stacks were assumed to be collocated for this analysis. The receptor grids used were as described in Section 5.6.1-7. As indicated in Table 5.6.1-23, the only pollutants for which there were predicted significant impacts off of plant property were NO_2, SO_2, and PM. They have significant impact areas of radius 33 km, >50 km, and 12 km, respectively. Because of insignificant off-site impacts, no further analysis was required for any of the other pollutants. Thus, the remainder of this section, with the exception of the air toxics and vegetation/soils analyses, focuses on NO_2, SO_2, and PM.

SUMMARY OF IMPACTS - PROPOSED SOURCE ONLY

In addition to providing the significant impact areas, Table 5.6.1-23 also provides a summary of maximum predicted impacts due to the proposed sources alone. For SO_2 and PM, the predicted highest short-term concentrations are not relevant for comparison with PSD increments and AAQS. A summary of maximum off-site impacts using highest annual and highest, second-

highest short-term concentrations for the proposed source alone is presented in Table 5.6.1-24. As indicated, predicted source impacts are small compared to PSD increments and AAQS.

The locations and areas of the maximum predicted plant impacts for SO_2 are depicted in Figures 5.6.1-4, 5.6.1-5, and 5.6.1-6 for the 3-hour, 24-hour, and annual averaging periods, respectively.

CLASS II AREA PSD INCREMENT ANALYSES

Coarse grid analyses were run for Class II PSD increment consumption for NO_2, SO_2, and PM (TSP). The analyses included the worst-case emissions from the proposed FPC sources, described in Section 5.6.1.5, and the existing PSD increment consuming (and increment expanding) sources described in Section 5.6.1.6. The results of these analyses are presented in Table 5.6.1-25.

For short-term concentrations of SO_2 and PM (TSP), the maximum values were investigated in greater detail using more closely spaced receptors (fine grids). The results of the short-term fine grid analyses revealed that the locations of the maximum impacts did not change from those of the coarse grid analyses. As a result, no further fine grid analyses were conducted. As indicated in Table 5.6.1-25, all concentrations are within the allowable increments.

CLASS I AREA PSD INCREMENT ANALYIS

Although the proposed project will be located approximately 118 km from the nearest boundary of the NWA, the impacts of the proposed project were initially modelled with ISCST to determine if the project would have a significant impact on the area. The PSD regulations and guidelines do not contain specific significance values for use in determining whether a detailed analysis of Class I PSD increment consumption is warranted. EPA is only now in the process of developing such values. However, in the interim, EPA has indicated that significance values developed by the Virginia Department of Air Pollution Control represent "a reasonable interpretation of the relevant statutory and regulatory requirements..." and can be used as interim guidance by each state (EPA, 1991). The Virginia values are based taking the ratio of the minimum Class II significance values to the Class II increments and applying that to the Class I increments. Since FDER is still considering its options in this regard, the interim EPA values

are being used in this application as a basis for determining the significance of the project's predicted impacts on the Class I area with respect to PSD increment consumption.

A summary of the project's predicted impact on the Class I area receptors (see Table 5.6.1-20) is presented in Table 5.6.1-26. As indicated, the predicted maximum impacts are below the significance values for TSP and no further analysis is warranted for that pollutant. Predicted maximum project impacts are above the significance values for NO_2 and SO_2, and additional analyses were performed for these pollutants.

For NO_2, an analysis was conducted with the ISCST model of Class I area impacts using the NO_2 emission inventory in Table 5.6.1-15 together with the NO_2 emissions from the proposed FPC project. The results indicated that the maximum annual average increment consumption is 0.73 $\mu g/m^3$ at receptor # 1 in 1985. This is well below the allowable Class I NO_2 increment of 2.5 $\mu g/m^3$ and no further analysis is required.

For SO_2, an analysis was conducted with the ISCST model of Class I area impacts using the entire emission inventory contained in Table 5.6.1-16 in addition to the proposed project. The results of that analysis indicated that the maximum annual average increment consumption is 1.24 $\mu g/m^3$ at receptor # 5 in 1986, which is below the allowable increment of 2 $\mu g/m^3$. However, the short-term PSD Class I increments are predicted to be exceeded on several days per year at many of the Class I area receptor points. The impacts of the proposed FPC project were modelled with ISCST to determine if they were above the significance values during the specific periods and at the specific receptors with predicted violations. There were 71 days in the five-year period modelled where this was the case and, thus, a more detailed analysis was performed using a model more appropriate for long-range transport. This analysis and its results are described in Section 5.6.1.10.

AAQS ANALYSIS

The AAQS analysis consisted of modelling the impacts of the proposed source together with background concentrations to determine if the totals will be within the allowable NAAQS and FAAQS. Background concentrations consist of a modelled component (modelled impacts of significant existing sources) and a monitored component (as described in Section 5.6.1.8). The existing sources which were included in the modelling were identified in Tables 5.6.1-17,

5.6.1-18, and 5.6.1-19 for NO_X, SO_2, and PM, respectively. The results of the analysis using a coarse receptor grid are summarized in Table 5.6.1-27.

As was the case with PSD, the locations and magnitudes of maximum predicted short-term concentrations were investigated in greater detail using more closely spaced receptor points (fine grids). The results of the short-term fine grid analyses indicated that the SO_2 values were once again at the same locations as indicated by the coarse grid analyses. For the 24-hour PM_{10} concentration, a fine grid was not run as modelling indicated that the proposed FPC sources had zero contribution to the concentration for the day and receptor shown. As indicated in Table 5.6.1-27, all concentrations are within the allowable standards.

AIR TOXICS ANALYSIS

Ambient concentrations for each of the pollutants identified in Table 5.6.1-4 were estimated using the ISCST dispersion model. Because of the large number of pollutants involved in the analysis separate computer runs for each pollutant were not completed. Instead a more conservative approach to estimating ambient concentrations was taken. This approach consisted of modelling the CC units, PC units and thermal oxidation units separately based on meteorology for the years 1982 through 1986. Highest predicted impacts for the 8-hour, 24-hour and annual averaging periods from each source group were identified. It is important to note that for most cases, the highest predicted impact from the different source groups did not occur at the same receptor, nor on the same day. However using this conservative approach, receptor locations and days were ignored. Maximum predicted pollutant impacts from each source group were scaled based on emission levels and summed. The results of the analysis are presented in Table 5.6.1-28. With the exception of arsenic and total chromium, all predicted impacts are below the FDER's draft No Threat Levels (FDER, 1992).

The maximum predicted 8-hour and 24-hour ambient impacts for arsenic were below the FDER's draft No Threat Levels. The maximum predicted annual ambient impact was 0.00047 $\mu g/m^3$ which is approximately twice that of the FDER's draft No Threat Level of 0.00023 $\mu g/m^3$.

The draft No Threat Level for arsenic was established based on an EPA unit risk value of 0.0043 and a cancer risk of 1 in a million. Unit risk values are expressed in terms of a person's probability of acquiring a cancer related illness if continuously exposed to 1 $\mu g/m^3$ of a pollutant

for a period of seventy years. In this case the proposed project is estimated to pose a cancer risk of 0.87 in a million based on the project's economic life of thirty years. This assumes continuous outdoor exposure for 30 years at a point just beyond the site boundary, which is over 2 miles from the nearest residence. The conservative modelling also indicates that the maximum annual arsenic concentration (and correspondingly the risk) drops to about half of FDER's draft No Threat Level at the location of the nearest resident even without taking into account the plant lifetime. More refined modelling would undoubtedly reduce this impact further.

The maximum predicted 8-hour and 24-hour ambient impacts for total chromium were below the FDER's draft No Threat Levels. The maximum predicted annual impact was 0.010 $\mu g/m^3$ which is approximately five times that of the FDER's draft No Threat Level of 0.002 $\mu g/m^3$.

As was the case with arsenic, the annual No Threat Level was based on an EPA unit risk value. However, in this case the unit risk value was established for chromium VI which is a subset of the total chromium emission estimates used for the analysis. Total chromium was used as a conservative approach since the Cool Water Gasification project reported total chromium emissions. A review of EPA emission factors (EPA, 1988) for total chromium (1.88×10^{-3} lb/mmBtu) and chromium VI (4.25×10^{-6} lb/mmBtu) from bituminous coal combustion revealed that chromium VI emissions were approximately 0.23 percent of the total chromium emissions. In this case, speciating the chromium VI emissions produces a predicted annual ambient impact of 0.000023 $\mu g/m^3$ which is approximately 100 times lower than the draft No Threat Level.

Accordingly the air pollutant emissions from the project are not expected to pose any significant health threats.

5.6.1.10 Supplementary PSD Class I Area Analyses

INTRODUCTION

A long-range transport modelling analysis was used as a supplemental air quality evaluation to determine compliance with the PSD Class I increment consumption for sulfur dioxide (SO_2) concentrations at the NWA. This modelling analysis used a long-range transport model, MESOPUFF II, to address impacts from the proposed FPC facility as well as other PSD increment consuming sources. The analysis is based on the Mesopuff II Modelling Protocol submitted to FDER, EPA Region IV, and the National Park Service (NPS) for review in

March 1992 (FPC, 1992b). Based upon comments by the NPS and the U.S. Fish and Wildlife Service (FWS) to FDER in May 1992 (NPS,1992), clarifications were made to the protocol by FPC (FPC, 1992c). The NPS and the FWS provided final approval for the modelling protocol in June, 1992 (FWS, 1992).

As discussed in Sections 5.6.1.9, ambient air quality analyses have been performed to demonstrate the compliance of the proposed project with AAQS and PSD Class I and II increments. The air dispersion model used in these analyses was the ISCST model, which is intended to predict impacts out to 50 km from a source. This model is referenced in Appendix A ("Appendix A" model) of the modelling guidelines (EPA, 1990a), which means that the model may be used without justifying the use of technical methods and procedures provided the recommended regulatory options are selected. Because the proposed FPC facility is more than 100 km from the Class I area, the ISCST model may not be appropriate for addressing impacts at the Class I area. However, the modelling guideline does not specify a preferred model or protocol for long-range transport beyond 50 km.

Based on discussions with and approval of the protocol by FDER, NPS, and the FWS, the reviewing agencies recommended the use of a long-range transport model, such as the MESOPUFF II model, to address impacts for this application. Although the MESOPUFF II model is not an "Appendix A" model, it is referenced in Appendix B ("Appendix B" model) of the modelling guidelines and can be used on a case-by-case basis provided it can perform critical calculations or routines that are not available from an "Appendix A" model. In this case, the ISCST model, an "Appendix A" model, does not have the necessary dispersion and transport routines to adequately address long-range transport of plumes from emission sources. Since the proposed facility is more than 50 km from the critical receptors, the MESOPUFF II model is an appropriate method for addressing impacts at the NWA.

The modelling methods and assumptions used in the MESOPUFF II model, which conform with those presented in the modelling protocol for this project, and the model results are presented in the following sections.

GENERAL DESCRIPTION OF MESOPUFF II MODEL

MESOPUFF II is a long-range transport model that is currently recommended by EPA for determining source impacts at distances greater than 100 km. Based on discussions with FDER,

EPA and NPS, this model can be used for the PSD Class I increment consumption analysis in support of air permit applications for emission sources located more than 50 km from a Class I area. The MESOPUFF II model has two preprocessor programs, READ56 and MESOPAC II, and one postprocessor program, MESOFILE II. The READ56 program is a preprocessor program to MESOPAC II, which is designed to read upper air (i.e., sounding) data obtained from the National Climatic Data Center (NCDC) in Asheville, North Carolina, and to reformat the data for use in the MESOPAC II program. The READ56 program also identifies missing data records. Missing data identified by READ56 must be filled in manually before input to the MESOPAC II program.

The MESOPAC II program is the meteorological preprocessor program for MESOPUFF II. The MESOPAC II program reads the upper air data file output from the READ56 program, as well as hourly surface meteorological data and hourly precipitation data collected at stations within the modelling area. Other data required for the MESOPUFF II model include land use and surface roughness lengths for each receptor grid point to be modelled.

The MESOPUFF II model provides concentration results for user-specified averaging times. The results can be processed by the MESOFILE II program to obtain additional statistical information about the concentrations produced from MESOPUFF II (e.g., annual average values). Postprocessor programs are used to produce highest, second-highest short-term concentrations from MESOPUFF II model's output. The annual average and highest, second-highest concentrations for the 3-hour and 24-hour averaging periods can be compared directly to allowable PSD Class I increments.

METEOROLOGICAL DATA

The general grid in which the meteorological data were prepared and processed consisted of a model domain that covered an area of 78,400 km^2, extending a total of 280 km in the east-west and north-south directions. There are a total of 196 cells within the grid, with each cell covering a 400-km^2 area or 20 km in the east-west and north-south directions. The southwest corner of the model domain is located at UTM coordinates of 250 km, East, and 3,000 km, North in UTM Zone 17. The Class I area and emission sources are located within the grid and generally are 100 km or more from the grid's edges.

The upper air data used in the analysis were read by the READ56 program to identify missing soundings and missing data for specific levels within a sounding. The program was modified to account for the data format changes that have occurred since the program originally was developed. The options selected for this program are presented in Table 5.6.1-29.

Meteorological data for the 5-year period of 1982 to 1986 from the NWS stations located within or near the grid were used in the analysis. This time period corresponds to the same period which was used for the ISCST modelling analysis (see Section 5.6.1.4).

Upper air rawinsonde data from the following upper air NWS stations were used:

1. Ruskin, Florida (located within the grid);
2. West Palm Beach, Florida (located to the southeast of the grid); and
3. Waycross, Georgia (located to the north of the grid).

These stations were selected because they are the nearest upper air stations to the study area. The data were reduced into 1-year records suitable for input to the READ56 program. Each station-year was run with the READ56 model to determine any missing data. The missing data were filled in by assuming data persistence from the previous valid observation (e.g., if data for the 12Z sounding were missing, the 00Z sounding from the previous day was used) or data from a lower level. Because the program expects data from the mandatory levels of 850, 700, and 500 millibars (mb), data were inserted at these levels by persisting wind data from a lower level or temperature data for the same level from the previous sounding.

The MESOPAC II program was run to process the surface and upper air meteorological data for a format acceptable to the MESOPUFF II model. The options selected for this program are presented in Table 5.6.1-30. The program was modified to account for the data format changes that have occurred since the program originally was developed. The surface meteorological data were obtained for the 5-year period of 1982 to 1986, when available, from the following NWS stations, all located within the grid:

1. Tampa (located in the southwestern quadrant);

2. Orlando (located near the center of the grid); and

3. Gainesville (located in the northern portion of the grid) for 1984 to 1986, and Jacksonville (located to the northeast of the grid) for 1982 and 1983, because digitized data were not available from Gainesville for 1982 or 1983.

Hourly precipitation data were also obtained for each surface meteorological station. However, the wet deposition option which uses the precipitation data was not considered in the initial model runs. Land use data were developed for this grid from existing data developed by Argonne National Laboratory (Sheih, et al., 1979). Since the model allows only a single land use type to be specified for each grid square, the land use category covering the greatest fraction of the total area within each grid square was selected.

MESOPUFF II MODELLING APPROACH

The MESOPUFF II model was used to predict ambient concentrations at the same PSD Class I receptor locations in the NWA described in Section 5.6.1.7. The model was run for selected periods identified by the ISCST model as having potential impacts greater than the allowable PSD Class I increment and for which the proposed project impacts were significant (see Section 5.6.1.9). The options selected for the MESOPUFF II model are presented in Table 5.6.1-31. Based on recommendations by the NPS and EPA, the distance to which the Turner dispersion parameters apply was set to 50 km (the model default distance is 100 km). After that distance, the dispersion parameters are based on time-dependent equations.

Emission and stack parameters for all SO_2 PSD increment consuming sources were processed into the MESOPUFF II model input format. This inventory consisted of the most current inventory available (see Section 5.6.1.6) with concurrence from FDER for the NWA airshed plus the proposed FPC source. Concentrations were predicted at 13 discrete receptors along the boundary of the PSD Class I area which have been approved for use by FDER. Predicted highest and highest, second-highest SO_2 concentrations for each year were determined from a postprocessor program.

As indicated in Section 5.6.1.9, for PSD Class I increment consumption purposes, an emission source is deemed not to have a significant impact in the Class I area if the predicted impacts are less than the interim EPA significance levels for Class I areas. These interim levels for SO_2

concentrations are 1.23, 0.275, and 0.1 ug/m^3 for the 3-hour, 24-hour, and annual averaging periods, respectively. If a source's impacts are predicted to be less than the Class I significance levels, then a source's emissions are assumed to not cause or contribute to a predicted exceedance and the source can be permitted regardless of the impacts from other sources.

The modelling approach consisted of the following parts, steps, and cases:

1. Concentrations were calculated at the Class I area using the ISCST model for the 5-year period of meteorological data collected at the NWS station in Tampa (see Section 5.6.1.9).

2. Based on the results of the ISCST model, concentrations that were predicted to be greater than the PSD Class I increment were identified at specific receptors and during specific time periods. The sources that contributed to these predicted exceedances were identified and grouped into two categories based on the distance from the applicable receptor. The first category included those sources at or within 50 km of the Class I area while the second category included those sources greater than 50 km from the Class I area. The proposed source's contribution was also identified and compared to EPA's significance levels. If the proposed source's impacts were predicted to be less than significant, no additional modelling was necessary. If the proposed source's predicted impacts were significant, additional modelling was performed with the MESOPUFF II model.

3. The MESOPUFF II model calculations were performed in this part of the analysis without using chemical transformation processes, or wet or dry deposition. This is referred to as the **inert mode** of model operation.

   Step 1 of the MESOPUFF II modelling involved predicting concentrations for the FPC source for those periods identified in Part 2. Concentrations were calculated with the MESOPUFF II model for the specific periods identified in Part 2 and at least 3 days before and 2 days after those periods. Concentrations were not evaluated for averaging times or receptors during which predicted impacts by the ISCST model were less than the allowable increments. For example, if the ISCST model predicted impacts greater than the allowable Class I increment for a specific receptor location and 24-hour averaging period in 1986, the MESOPUFF II model results were evaluated for that receptor location and 24-hour averaging period.

   These predicted concentrations for the proposed source were substituted for the ISCST model results and added to the predicted impacts produced for all other sources with the ISCST model. If the proposed source's impacts using MESOPUFF II model were less than the significant impact levels or the total predicted concentrations were less than the Class I increment, no additional modelling was required.

If exceedances were predicted after Step 1, **Step 2** of the MESOPUFF II modelling was performed, which involved using the results from Step 1 and performing additional modelling with the MESOPUFF II model for those sources located more than 50 km from the Class I area. These predicted concentrations were substituted for the ISCST model results for those sources. These MESOPUFF II model concentrations were added to those produced with the ISCST model for sources located at or within 50 km of the Class I area and MESOPUFF II model results from the proposed source to determine the total PSD Class I increment consumption. If the total predicted concentrations were less than the Class I increment, no additional modelling was required.

4. Additional model runs were performed for selected periods during which potential impacts were still above the Class I increments after Step 2. These model runs incorporated the use of chemical transformation processes, wet and dry deposition, and vertical concentration distributions. This is referred to as the **enhanced mode** of model operation.

   The following four cases were considered in the modelling which incorporated additional model features with each subsequent modelling analysis:

   Case 1 - chemical transformation, dry deposition, and Gaussian vertical concentration distribution;

   Case 2 - included model features in Case 1 plus wet deposition;

   Case 3 - included model features in Case 2 plus the feature allowing for 3 vertical layers used for deposition; and

   Case 4 - included model features in Case 3 plus the feature allowing for uniform vertical concentration distribution instead of Gaussian.

   Similar to Steps 1 and 2 presented in Part 3, the analysis in this part also involved two steps. **Step 3** of the MESOPUFF II modelling involved predicting concentrations for the FPC source using the features identified in Cases 1 through 4 for those periods for which a predicted impact above the allowable Class I increment remained after Step 2. After application of the MESOPUFF II model, if the proposed source's impacts were less than the significant impact levels or the revised total predicted concentrations were less than the Class I increment, no additional modelling was required.

   Step 4 of the MESOPUFF II modelling involved using the results from Step 3 and performing additional modelling with the MESOPUFF II model using features in Cases 1 through 4 for those sources located more than 50 km from the Class I area. These predicted concentrations were substituted for the MESOPUFF II model results presented in Step 2.

MESOPUFF II MODEL RESULTS - INERT MODE

Summaries of the potential impacts greater than the allowable PSD Class I increments for SO_2 concentrations predicted using the ISCST model for 1982 through 1986 and for which the proposed source's impacts were greater than the significant impact levels are presented in Tables 5.6.1-32 through 5.6.1-36. These summaries also contain the predicted concentrations from Steps 1 and 2 of the MESOPUFF II modelling in the inert mode. As indicated, most of the predicted impacts greater than allowable increments using the ISCST model occurred for the 24-hour averaging period when the proposed source had a predicted significant impact; there was only one predicted impact greater than the allowable 3-hour average increment when the proposed source had a significant impact.

Step 1 of the MESOPUFF II modelling predicted many of the total PSD concentrations to be less than the Class I increment or the proposed source's impacts to be less than significant. Step 2 of the MESOPUFF II modelling predicted a total of 25 potential incidents at various receptors when the impacts were greater the allowable 24-hour PSD Class I increment and the proposed source had a significant impact. None of these impacts occurred during 1982 and, as such, no further steps were taken for this year. These predicted impacts occurred for seven 24-hour periods over the 5 years of meteorological data used in the modelling. The highest 24-hour average concentration was predicted to be 7.64 ug/m^3 of which nearly 40 percent was due to predicted impacts using the ISCST model from sources within 50 km of the Class I area. In many instances, sources within 50 km of the Class I area were predicted to consume 1 to 2 ug/m^3 of the 24-hour average PSD Class I increment of 5 ug/m^3.

MESOPUFF II MODEL RESULTS - ENHANCED MODE

Summaries of the maximum SO_2 concentrations predicted using Steps 3 and 4 of the MESOPUFF II modelling approach for 1983 through 1986 are presented in Tables 5.6.1-37 through 5.6.1-43. These analyses included model features that incorporated chemical transformation processes, wet and dry deposition, and Gaussian or uniform vertical concentration distribution. These features are identified as Cases 1 through 4 and are applied to assess their effects on predicted concentrations. As shown in these tables, after Step 4, Case 3 of the MESOPUFF II modelling was performed, a total of 8 potential impacts greater than the 24-hour PSD Class I increment were predicted during which the proposed source had a significant impact. These predicted impacts occurred during three 24-hour periods (i.e., two in 1983 and

one in 1985). The highest 24-hour average concentration was predicted to be 7.16 ug/m^3 of which nearly 40 percent was due to predicted impacts using the ISCST model from sources within 50 km of the Class I area. The uniform vertical concentration distribution model feature (Case 4, Tables 5.6.1-38 and 5.6.1-41) predicts that the maximum concentrations are less than the 24-hour average PSD Class I increment of 5 ug/m^3 for all of those periods.

These results demonstrate that, based on modelling methods approved by FDER, EPA, and NPS, it can be shown that the proposed project does not cause or contribute to a violation of the Class I PSD increment. Therefore, the project can be permitted as proposed in this ultimate site capacity analysis.

5.6.1.11 Additional Impacts Analysis

The SCA guidelines indicate that, in addition to demonstrating that the proposed source will neither cause nor contribute to violations of the applicable PSD increments and AAQS, an additional impacts analysis must be conducted for those pollutants subject to PSD review. As indicated in Table 5.6.1-2, those pollutants include CO, NO_X, SO_2, PM, VOC (O_3), Pb, Be, Hg, sulfuric acid mist, inorganic arsenic and radiouclides. The additional impacts analysis presented in this section includes an analysis of air quality impacts due to growth induced by the project, an analysis of air quality impacts on soils and vegetation, and an analysis of project impacts on visibility.

The focus of the visibility, vegetation, and soils portions of the additional impacts analysis section is typically on any nearby Class I area. As has been demonstrated in Sections 5.6.1.9 and 5.6.1.10 of this application, the proposed project will neither cause nor contribute to violations of the Class I PSD increments (nor the AAQS) at the NWA, located from 118 to 135 km from the proposed source. In spite of this distance, FPC has agreed to provide an impact on air quality-related values (AQRV) analysis as a part of the application. The FWS has identified some vegetation, wildlife, and visibility considerations for the NWA (FWS, 1992). Therefore, the additional impacts analysis section has been broadened to cover these AQRV issues as well as the traditional issues. Furthermore, consideration is given to a wide range of pollutants that will be emitted by the project in small quantities rather than restricting the analyses to those pollutants subject to PSD review.

IMPACTS DUE TO GROWTH

The growth analysis considers air quality impacts due to emissions resulting from the industrial, commercial, and residential growth associated with the project. Only impacts related to permanent growth are considered; emissions from temporary sources and mobile sources are not addressed in the growth analysis. The analysis of socioeconomic effects, presented in Chapter 7.0, serves as the basis for this growth analysis.

Up to 1,200 people will be employed at the Polk County Site during one year of construction. Approximately 510 permanent jobs will be created at buildout for a CGCC facility. Assuming that 55 to 60 percent of these employees are new to the area, and that each employee represents an average household, 291 new households would be formed. This would result in an additional 736 people, which is less than 1 percent of the population increase expected in Polk County between 1990 and 2020.

A considerable amount of residential and commercial development will be associated with this population influx (construction of new homes and rental property; establishment of new businesses to provide goods and services). However, the permanent, nonmobile source emissions and impacts of this development will likely be small and have impacts on different areas than those affected by emissions of the new facilities at the Polk County Site.

Development of industries supporting the new facilities are expected to be negligible. Raw materials consumed by the facility (fuels, supplies, etc.) will be delivered to the site in usable form from outside of the region. Further processing, such as water treatment, will be accomplished entirely on-site.

Electricity sales, on the other hand, will be spread out over a large region as part of FPC's generating capacity that will serve to meet increasing residential, commercial, and industrial demand throughout its system, which covers a large portion of the state of Florida.

In summary, there will be residential growth associated with the FPC project, but there is little potential for new industrial development nearby as a result of the new facility. Although it is not possible to reliably quantify the emissions and impacts resulting from the new development, they are expected to be small and well-distributed throughout the area. Any large industries

proposed will be subject to the most stringent requirements associated with locating a PSD facility near another existing PSD source.

IMPACTS ON VEGETATION

Except for visibility, AQRVs have not been specifically defined by the FWS for the NWA. However, soil, flora, fauna, cultural resources, geological features, water, and climate often have been identified by land managers as AQRVs to be addressed in these types of analyses. Since specific AQRVs have not been identified for the NWA, this AQRV analysis evaluates the effects of air quality on general vegetation types found in the NWA.

Vegetation type AQRVs and their representative species types have been defined as:

- Marshlands - black needlerush, saw grass, salt grass, and salt marsh cordgrass
- Marsh Islands - cabbage palm and eastern red cedar
- Estuarine Habitat - black needlerush, salt marsh cordgrass, wax myrtle
- Hardwood Swamp - red maple, red bay, sweet bay and cabbage palm
- Upland Forests - live oak, scrub oak, longleaf pine, slash pine, wax myrtle and saw palmetto
- Mangrove Swamp - red, white and black mangrove

A screening approach was used which compared the maximum predicted ambient concentrations of air pollutants in the NWA with effect threshold limits for both vegetation and wildlife as reported in the scientific literature. A literature search was conducted which specifically addressed the effects of air contaminants on plant species reported to occur in the NWA. While the literature search focused on such species as cabbage palm, eastern red cedar, lichens and species of the hardwood swamplands and mangrove forest, no specific citations that addressed these species were found. It was recognized that effect threshold information is not available for all species found in the NWA, although studies have been performed on a few of the common species and on other similar species which can be used as models. In conducting the assessment, both direct (fumigation) and indirect (soil accumulation/uptake) exposures were considered for flora, and direct exposure (inhalation) was considered for wildlife. Maximum

(worst-case) concentrations and depositions were predicted using the ISCST model (and without using the refined MESOPUFF results) and 5 years of meteorological data as described in Sections 5.6.1.3 and 5.6.1.4.

Predicted project impacts for the various averaging times and estimated annual average background concentrations at the NWA are presented in Table 5.6.1-44. Predicted impacts and background concentrations for the site vicinity are presented in Table 5.6.1-45, since air quality impacts on vegetation in the site vicinity are also addressed.

Since background air quality monitoring data are not available for the NWR, background values for the criteria pollutants were estimated (Table 5.6.1-44) based on data from regional air quality monitoring locations (a conservative approach since the monitors are either near point sources or in more urban areas). The SO_2 and TSP data were averages from two Crystal River Power Plant monitors (FPC, 1992a). The O_3 data are from Gainesville for 1987 and 1988 (ESE, 1988, 1989). The NO_2 data are an average from Gainesville (ESE, 1987, 1988). Values for CO (annual) were estimated based on short-term monitoring data for the Tampa area (FDER, 1991) and the lead values were from Tampa (FDER, 1991). Background data for the site vicinity (Table 5.6.1-45) were from the more appropriate of these sources or the on-site monitoring data.

The effects of air contaminants on vegetation occur primarily from sulfur dioxide, nitrogen dioxide, ozone, fluoride, and particulates. Effects from minor air contaminants such as chlorine, hydrogen chloride, ethylene, ammonia, hydrogen sulfide, carbon monoxide, and pesticides have been reported in the literature. However, most of these air contaminants have not resulted in major effects (i.e., crop damage). Some air contaminants, such as ethylene, are widely distributed but, due to low concentrations, do not result in injury to plants. Others such as CO do not cause damage at concentrations normally found under ambient concentrations.

The effects of contaminants are dependent both on the concentration of the contaminant and the duration of the exposure. The term "injury," as opposed to damage, is commonly used to describe all plant responses to air contaminants and will be used in the context of this analysis. Air contaminants are thought to interact primarily with plant foliage which is considered to be the major pathway of exposure. For purposes of this analysis, it was assumed that 100 percent of each air contaminant of concern is accessible to the plants.

Injury to vegetation from exposure to various levels of air contaminants can be termed acute, physiological or chronic. Acute injury occurs as a result of a short-term exposure to a high contaminant concentration and is typically manifested by visible injury symptoms ranging from chlorosis (discoloration) to necrosis (dead areas). Physiological or latent injury occurs as the result of a long-term exposure to contaminant concentrations below that which results in acute injury symptoms, while chronic injury results from repeated exposure to low concentrations over extended periods of time, often without any visible symptoms, but with some effect on the overall growth and productivity of the plant.

NITROGEN DIOXIDE. Acute nitrogen dioxide (NO_2) injury symptoms are manifest as water-soaked lesions, which first appear on the upper surface, followed by rapid tissue collapse. Low-concentration, long-term exposures as frequently encountered in polluted atmospheres often do not induce the lesions associated with acute exposures but may still result in some growth suppression.

The maximum ground-level NO_2 concentration (annual average) predicted to occur in the NWA during the operation of the proposed project is 10.18 $\mu g/m^3$ (10 $\mu g/m^3$ estimated background plus 0.18 $\mu g/m^3$ project impact). This maximum concentration is $2.2x10^{-2}$ the estimated threshold values (Tables 5.6.1-46 and 5.6.1-47), assuming a value of 470 $\mu g/m^3$ as the threshold value for an annual average. The 1-hour, 3-hour, 8-hour, and 24-hour predicted NO_2 project impacts at the point of maximum impact in the NWA are 33.4, 16.2, 7.5 and 2.9 $\mu g/m^3$, respectively. Even when combined with annual average background concentration of 10 $\mu g/m^3$, these values are approximately $9.2x10^{-4}$ to $4.7x10^{-5}$ of the levels reported in the literature (Table 5.6.1-47) as resulting in minimal effects on relatively sensitive species.

The maximum ground-level NO_2 concentration (annual average) predicted to occur in the vicinity of the proposed project is 29.6 $\mu g/m^3$ (25 $\mu g/m^3$ estimated background plus 4.6 $\mu g/m^3$ project impact). This maximum concentration is $6.3x10^{-2}$ the estimated threshold values (Tables 5.6.1-46 and 5.6.1-47), assuming a value of 470 $\mu g/m^3$ as the threshold value for an annual average. The maximum 1-hour and 8-hour predicted NO_2 project impacts are 1,517 and 315 $\mu g/m^3$, respectively. Together with the estimated background of 25 $\mu g/m^3$ the totals are $3.3X10^{-3}$ and $9.0X10^{-4}$ of the levels reported in the literature (Table 5.6.1-47) as resulting in minimal effects.

SULFUR DIOXIDE. The predicted maximum ground level 1-hour, 3-hour, 8-hour, 24-hour and annual mean concentrations in the NWA resulting from operation of the proposed project, are

29.5, 12.7, 6.0, 2.4, and 0.22 $\mu g/m^3$, respectively (Table 5.6.1-44). Combining the predicted maximum ground-level concentration with an annual SO_2 value of 3 $\mu g/m^3$ results in total concentrations that are $2.5x10^{-2}$, $3.9x10^{-2}$, and $6.9x10^{-2}$ of the lowest 1-hour, 3-hour, and 8-hour injury threshold concentrations (1,300, 400, and 131 $\mu g/m^3$) for sensitive vegetation as reported in the literature (Table 5.6.1-48). The annual average of 3.22 $\mu g/m^3$ (3 $\mu g/m^3$ estimated background plus 0.22 $\mu g/m^3$ project impact) is $2.7x10^{-2}$ of the value (118 $\mu g/m^3$) reported as resulting in no foliar injury on maples during a growing season (Table 5.6.1-49). The 1-hour and 3-hour predicted concentrations in the NWA (32.5 and 15.7 $\mu g/m^3$) are $1.2x10^{-2}$ and $9.9x10^{-3}$ of the 1-hour and 3-hour SO_2 concentrations used to identify southern pines as sensitive to SO_2. Under these predicted ambient concentrations, no injury symptoms could be expected in the areas of maximum concentration in the NWA. The potential for physiological or chronic injury occurring cannot be predicted with certainty. The predicted maximum annual increment from operation of the proposed project is 0.22 $\mu g/m^3$. Most evidence in the literature suggests that levels around 118 $\mu g/m^3$ may be responsible for physiological or chronic injury. Since there is a 114.8 $\mu g/m^3$ difference between the predicted ambient concentration (3.22 $\mu g/m^3$) and the reported threshold concentration, the probability of physiological or chronic injury is low.

The predicted maximum ground-level 1-hour, 3-hour, 8-hour, 24-hour and annual mean concentrations in the vicinity of the proposed project resulting from operation of the proposed project, are 1,044, 263, 219, 65.5 and 4.8 $\mu g/m^3$, respectively (Table 5.6.1-45). Combining the predicted maximum ground level concentration with an annual SO_2 value of 5 $\mu g/m^3$ results in total concentrations that are $8.1x10^{-1}$, $6.7x10^{-1}$, and 1.7 of the lowest 1-hour, 3-hour, and 8-hour injury threshold concentrations (1,300, 400, and 131 $\mu g/m^3$) for sensitive vegetation as reported in the literature (Table 5.6.1-48). While the maximum 8-hour average is above the lowest end of the range for sensitive vegetation, it is less than half the threshold values reported by Jacobsen (1977) and Linzon (1973) for this averaging period and only $1.7x10^{-1}$ of the higher end of the range of threshold values reported in EPA (1973). The annual average of 9.8 $\mu g/m^3$ (5 $\mu g/m^3$ estimated background plus 4.8 $\mu g/m^3$ project impact) is $8.3x10^{-2}$ of the value (118 $\mu g/m^3$) reported as resulting in no foliar injury on maples during a growing season (Table 5.6.1-49). The 1-hour and 3-hour predicted concentrations in the vicinity of the proposed project (1,049 and 268 $\mu g/m^3$) are $4.0x10^{-1}$ and $1.7x10^{-1}$ of the 1-hour and 3-hour SO_2 concentrations used to identify southern pines as sensitive to SO_2. Under these predicted ambient concentrations, injury symptoms are unlikely in the areas of maximum concentration in the vicinity of the proposed project.

The potential for physiological or chronic injury occurring cannot be predicted with certainty. The predicted maximum annual increment from operation of the proposed project is 4.8 $\mu g/m^3$. Most evidence in the literature suggests that levels around 118 $\mu g/m^3$ may be responsible for physiological or chronic injury. Since there is a 108 $\mu g/m^3$ difference between the predicted ambient concentration (9.8 $\mu g/m^3$) and the reported threshold concentration, the probability of physiological or chronic injury is low.

Sulfur can also be added to soil through washout of atmospheric SO_2 by precipitation. In a study in Minnesota, annual sulfur additions from atmospheric SO_2 washout were found to range from 100 lbs/acre in urban areas to 5 lbs/acre in rural areas. In southern states, the annual average is about 5 lbs/acre (Kamprath, 1972). In some cases, the amount of sulfur deposition is sufficient to meet crop requirements, although in rural areas, the amount of sulfur deposition is sufficient to meet only about 20 to 30 percent of crop needs.

OZONE. Ozone (O_3) will not be a direct by-product from the combustion of fuel at the proposed project, but instead results from a complex photochemical reaction involving nitrogen oxides and hydrocarbons. Ozone formation is not well understood, although it is generally believed that it is a phenomenon occurring at long downwind distances from, but not in the immediate vicinity of a source, such as the proposed project. This is attributed to the kinetics and time-dependent nature of the necessary photochemical reaction.

It is difficult to predict what effect the proposed project emissions will have on ambient ozone concentrations at local or regional scales. It is anticipated that any potential increase in ozone concentration would be more detectable on a regional scale as opposed to a local one. The estimated annual average background ozone concentration in the area is 55 $\mu g/m^3$ based on monitoring by FDER and the Florida Acid Deposition Study (ESE, 1988, 1989). This value is below the range of threshold concentrations reported to be injurious to vegetation sensitive to O_3 (Tables 5.6.1-50 and 5.6.1-51).

Since it is not possible to model how the emissions from the proposed project will affect the ambient O_3 concentration in the NWA or in the vicinity of the proposed project, it was assumed for purposes of this analysis that the levels potentially occurring in the NWA and in the vicinity of the proposed project would be equal to the ambient concentrations monitored at Gainesville, FL (ESE, 1988-89). This approach is based on the assumption that the levels monitored at Gainesville are representative of O_3 concentrations in rural locations as influenced by emissions

from urban areas, and that this would be similar to the potential influence from the proposed project and all other sources. The average O_3 concentration monitored at Gainesville is 55 $\mu g/m^3$ (28 ppb) for an annual average, and the second highest 1-hour concentration was 176 $\mu g/m^3$ (90 ppb). These values fall within the levels that would allow permitting in the absence of evidence of actual or predicted effects to the resource. Currently, there are no studies indicating actual harm to the resources of the NWA or vegetation in the vicinity of the of the proposed project (Shaw, 1992). Given the location and distance of the proposed project and its relatively small contribution of O_3 precursors to regional totals, it can reasonably be predicted that the addition of the proposed project would not cause any harm to the resources in the NWA or vegetation in the vicinity of the proposed project.

PARTICULATES. The maximum predicted concentration of particulates (in the form of TSP) at the NWA from the proposed project is 0.03 $\mu g/m^3$ for annual average. The existing background concentration in the vicinity of the proposed project based on data from the FPC Crystal River monitoring program, is 29 $\mu g/m^3$ for an annual average. Combined with existing background, the predicted maximum concentrations will be 29.03 $\mu g/m^3$ on an annual basis. By comparing predicted concentrations with the few injury threshold values reported in the literature (Darley, 1966; Krause and Kaiser, 1977), no potential effects on vegetation are predicted, because this concentration is below the values reported to adversely affect plants.

In the vicinity of the proposed project, the predicted maximum annual contribution from the stacks of the proposed project is 0.91 $\mu g/m^3$. Combined with the existing background of 12, the predicted maximum concentration will be 12.91 $\mu g/m^3$, which is below the values reported to adversely affect plants.

CARBON MONOXIDE. Concentrations of carbon monoxide even in polluted atmospheres are not detrimental to vegetation (EPA, 1976). Carbon monoxide has not been found to produce detrimental effects on plants at concentrations below 100 ppm (114,500 $\mu g/m^3$) for exposures from one to three weeks (EPA, 1976). Existing background concentrations (1,700 $\mu g/m^3$) plus contribution of the proposed project to CO concentrations in the NWA (0.1 $\mu g/m^3$) or an annual average would be 1.5×10^{-2} of values reported to cause detrimental effects.

In the vicinity of the proposed project, the annual CO concentration is predicted to be 3.4 $\mu g/m^3$ which combined with an estimated background of 1,700 would be 1.48×10^{-2} of the values reported to cause detrimental effects.

FLUORIDE. The toxicity of atmospheric fluorides depends on how readily it is absorbed into the plant tissue. Gaseous forms such as hydrogen fluoride are thought to be primarily responsible for fluoride injury to vegetation (Treshow and Pack, 1970). Fluoride injury results from the gradual accumulation of fluoride in the plant tissue over time. Accordingly, the duration of exposure as well as the atmospheric concentrations are important in determining the severity of injury. Different plant species, varieties or clones of a single variety or plants from different seed lots differ in sensitivity to fluoride. Extremely sensitive plants (Chinese apricot and certain varieties of gladiolus) may be marked by exposure to hydrogen fluoride (HF) concentrations below 0.1 ppb. Most species will show no effects from concentrations several times higher than 0.1 ppb (Treshow and Pack, 1970).

MacLean et al. (1968) exposed six citrus varieties and six ornamental species of economic importance to central Florida to high-concentration-short-duration exposures of gaseous HF. Hamlin and Valencia oranges were fumigated with 18 exposures of HF ranging from 0.5 ppm for one hour to 10 ppm for four hours. The lowest exposure was not injurious to Valencia, but tip and marginal necrosis was observed in 20 percent of the young leaves of Hamlin oranges. The most acute exposure resulted in injury on all species tested.

Pack (1972) fumigated strawberry plants in growth chambers to HF at concentrations averaging 0.55, 2.0, 5.0, and 10.4 $\mu g/m^3$ throughout flowering and fruiting. At 2.0 $\mu g/m^3$ and higher, the average fruit weights were reduced. At 5.0 and 10.4 $\mu g/m^3$, the proportion of flowers that turned into fruit was smaller. No foliar injury symptoms were observed at 0.5$\mu g/m^3$ and only mild symptoms at 2.0 $\mu g/m^3$. Brewer (1960) reports that citrus foliage was injured when fluorine was in excess of 50 ppm in leaves. Matsushima and Brewer (1972) did not find any injury symptoms even though 144 fluoride ppm was found in leaves of Koethan oranges. Concentrations of 1 or 2 ppb in the air are thought to result in accumulations of several hundred ppm in leaf tissue.

Taylor (undated) reports that HF has been identified as an important air pollutant in the citrus region of central Florida where it is a by-product of the phosphate industries. Leonard and Graves (1970) report that phosphate manufacturing plants in Polk, Hillsborough and Manatee Counties scrub waste gases to remove fluorine, but fluoride releases from surfaces of waste ponds are not controlled and add to problems observed in citrus groves near the ponds. Treshow, et al. (1970) have found that commercial species of citrus are generally classified as intermediate in sensitivity to fluoride injury. Taylor (undated) suggests that long-term exposure

(growing season) to 0.5 to 1 ppm (409 to 818 $\mu g/m^3$) HF may result in yield reduction due to excessive accumulations in the leaf.

The maximum ground-level fluoride concentration predicted to occur in the NWA on an annual basis is 0.000029 $\mu g/m^3$. Assuming all fluoride emissions are transformed into HF, this value is $1.6x10^{-5}$ of the lowest level reported to cause injury to vegetation (2 $\mu g/m^3$). The maximum predicted ground-level fluoride concentration (annual average) for the vicinity of the proposed project is 0.00075 $\mu g/m^3$. This value, again assuming all fluorides are transformed to HF, is $1.9x10^{-6}$ of the lowest value reported to cause phytotoxicity in citrus (409 $\mu g/m^3$). Thus, no injury to vegetation would be expected from fluoride emissions.

SYNERGISTIC RESPONSES

SO_2 - NO_2 Synergism. It has been demonstrated in the literature (Tingey et al., 1971) that NO_2 in combination with certain concentrations of SO_2 can result in synergistic plant responses (i.e., leaf injury is observed at concentrations below the injury thresholds for each of these air contaminants in isolation). Maximum annual SO_2 and NO_2 concentrations are predicted to be 3.22 and 10.18 $\mu g/m^3$, respectively in the NWA. Maximum annual SO_2 and NO_2 concentrations in the vicinity of the proposed project are predicted to be 9.8 and 29.6 $\mu g/m^3$, respectively. Considered in isolation, the maximum predicted annual concentrations for both SO_2 and NO_2 are well below the threshold level for sensitive vegetation. Maximum short-term concentrations are in the range of concentrations where SO_2-NO_2 synergistic effects have been reported to occur for certain species, none of which occur on or adjacent to the NWA (Table 5.6.1-52).

There is not significant evidence in the literature to either support or negate the possibility that synergistic effects may occur within the NWA as a result of the predicted annual ambient concentrations of SO_2 and NO_2. However, the predicted SO_2 and NO_2 concentrations (annual average) for both the NWA and the vicinity of the proposed project appear to be much less than that resulting in a synergistic response over longer exposure periods. Tingey et al. (1971) report that the concentrations of SO_2 and NO_2 found to cause injury in their studies were similar to those found in urban areas and may result in reduced yields of crops grown under field conditions. However, it should be noted that synergistic effects from SO_2-NO_2 have rarely been observed in the field. In addition, data on the effects on vegetation due to mixtures of SO_2 and NO_2 are limited and the general consensus of most investigators is that more research is required

before SO_2-NO_2 synergism is completely understood and potential effects predicted for field situations with any degree of certainty.

SO_2 - O_3 Synergism. Tingey et al. (1973a and 1973b) have observed that mixtures of SO_2 and O_3 at concentrations typically found in urban areas have resulted in synergistic or additive plant responses (i.e., plant leaf injury is observed at concentrations below the injury threshold levels for each of these air contaminants in isolation). There are no generalized injury threshold concentrations of SO_2-O_3 (in mixture) listed in the literature that would apply specifically to those species characteristic of the NWA. However, Jensen and Dochinger (1989) have exposed red maple to low concentrations of both SO_2 and O_3 and determined that red maple is sensitive and exhibits some growth reduction (Table 5.6.1-53) when exposed to these levels.

The maximum annual SO_2 concentration is predicted to be 3.22 $\mu g/m^3$ at the NWA and 9.8 $\mu g/m^3$ in the vicinity of the proposed project (background plus proposed project contribution). The annual O_3 concentration was assumed to be 55 $\mu g/m^3$ (based on monitoring by FDER and the Florida Acid Deposition Study (ESE, 1988, 1989). Since it is not possible to model how the emissions from the proposed project will affect the ambient O_3 concentration in either the NWA or the vicinity of the proposed project, it was assumed for purposes of this analysis that the levels potentially occurring in the NWA and the vicinity of the proposed project would be equal to the ambient concentrations monitored at Gainesville, Florida (ESE, 1988, 1989).

As a result of this inability to predict ambient O_3 concentrations, it is difficult to predict with certainty that synergistic effects may or may not occur on all species in the NWA as a result of the proposed project. However, the SO_2 and O_3 concentrations (3.22 and 55 $\mu g/m^3$, respectively) in the NWA and (9.6 and 55 $\mu g/m^3$, respectively) in the vicinity of the proposed project, are below the concentrations reported as causing growth reductions in red maple (52 and 137 $\mu g/m^3$), a species found within the NWA. In addition, the anticipated SO_2 and O_3 values in the NWA are a only small percentage of the SO_2-O_3 synergism values reported in the literature (Table 5.6.1-53).

SULFUR AND NITROGEN DEPOSITION. Due to the growing awareness of decline in the health and vigor of forests, current research is focusing upon the effects of the addition of sulfur and nitrogen and associated generally pollutants to forest ecosystems. Sulfur and nitrogen additions are thought to affect forests through soil influences, foliar leaching, carbon allocation, winter injury, reproduction and regeneration, and insect and pathogen influences (Fox et al.,

1989). The U.S. Forest Service (Fox et al., 1989) in developing a model for evaluating proposed new source contributions to pollution loadings in Class I areas, has considered the soil influence effects of sulfur and nitrogen deposition, expressed in kilograms per hectare per year (kg/ha/yr).

The maximum predicted annual SO_2 concentration of 3.22 $\mu g/m^3$ (background plus proposed project contribution) and maximum predicted annual NO_2 concentration of 10.18 $\mu g/m^3$ (background plus proposed project contribution) yields a total sulfur and nitrogen contribution of 3.3 and 6.4 kg/ha/yr, respectively. These values are equal to or below the green line values developed by Fox et al. (1989), which enables the land manager of the Class I area to recommend that a permit be issued. It should be noted that these values are based on total concentrations (background values plus proposed project contribution) and that the proposed project contribution is several orders of magnitude lower than the background values used.

In the vicinity of the proposed project, the maximum predicted annual SO_2 concentration is 9.8 $\mu g/m^3$ (background of 5 plus proposed project contribution of 4.8) and the maximum predicted annual NO_2 concentration is 29.6 $\mu g/m^3$ (background of 25 plus proposed project contribution of 4.6). These values would yield a total sulfur and nitrogen contribution of 10.2 and 18.7 kg/ha/yr, respectively.

IMPACTS ON SOILS

Air contaminants can affect soils through fumigation by gaseous forms, accumulation of compounds transformed from the gaseous state, or by the direct deposition of particulate matter or particulate matter to which certain contaminants are absorbed. Gaseous fumigation of soils does not directly affect the soil but rather the organisms found in the soil. Concentrations several orders of magnitude higher than the predicted values are required before any adverse effects from fumigation are observed. It is more likely that effects on soils and the organisms (plants and animals) found in the soils could occur from the deposition of trace elements over the life of the project. Thus, this analysis of effects on soils specifically addresses the deposition of trace elements and potential pathways for movements into the vegetation.

The contribution to the ambient concentrations of lead, beryllium, mercury, arsenic, antimony, barium, boron, cadmium, calcium, chromium, cobalt, copper, manganese, nickel, selenium, vanadium, and zinc in the NWA and in the vicinity of the proposed project from the proposed

project has been estimated by the ISCST dispersion model. Assuming a deposition velocity of 0.66 cm/sec (Edgerton and Lavery, 1990), the deposition flux is the product of this deposition velocity and the ambient trace element concentration. The deposition velocity assumed equal fractions for wet and dry depositions. Further assuming that the trace elements deposited on the soil surface accumulate within the first 25 cm, a basis is provided for predicting average annual increases in soil trace element levels that could potentially result in the NWA and in the proposed plant vicinity from operation of the proposed project. A summary of the analysis of soil concentration increases is presented in Tables 5.6.1-54 and 5.6.1-55. In order to provide some perspective for the comparison of trace element concentration increases in soils of both the NWA and the vicinity of the proposed project, and lacking specific trace element concentration data for these soils, typical background trace element concentrations for soils of the eastern U.S. as reported by Shacklette and Boerngen (1984) and Dvorak et al. (1978) were used. In each reference, mean values were used with Shacklette and Boerngen (1984) as the primary data source and Dvorak et al. (1978) used to supplement data not found in Shacklette and Beorngen (1984).

Studies of model power plants by Dvorak et al. (1978), Dvorak and Pentecost et al. (1977), and Vaughan et al. (1975) predicted increases in soil trace element levels of less than 10 percent of the total endogenous concentrations over the life of the model plant. It was concluded that uptake by vegetation could not increase dramatically unless the forms of the deposited trace elements were considerably more available than the endogenous forms (Dvorak and Lewis et al., 1978; Environmental Research and Technology, 1978).

The estimated percent increases over the anticipated 30 years of plant operation, assuming that the elements remained in the top 25 cm of soil over this period, ranged from 4.8×10^{-6} to 0.58 percent for the NWA and 1.6×10^{-4} to 21.5 percent in the vicinity of the proposed project. The assessment of these estimated increases was based on a number of worst case conditions, which are not likely to occur during typical operation of the proposed project. Accordingly, an increase in the levels of all the evaluated trace elements in soil should not be perceptible on an annual basis in the NWA or in the general vicinity of the proposed project.

ARSENIC. Arsenic toxicity in plants is dependent on the concentration of soluble arsenic and not the total arsenic concentration in soils (Valkovic, 1975). Most plants can tolerate arsenic concentrations in soils ranging from 1 to 40 ppm. Soil arsenic concentrations greater than 2 ppm, soluble form, have been shown to cause damage to alfalfa and barley (Van de Caveye et

al., 1936). Naturally occurring levels of arsenic in plants range from 0.01 to 5.0 mg/kg (EPA, 1989). The estimated soil concentration increases of $1.37x10^{-5}$ and $4.38x10^{-4}$ mg/yr per kg of soil should not increase the existing soil arsenic levels to toxic concentrations in the NWA or the vicinity of the proposed project.

ANTIMONY. Studies have indicated that plants can contain antimony levels ranging from 7 to 50 mg/kg without any symptoms of phytotoxicity (Gough et al., 1979). The annual deposition of antimony ($4.62x10^{-6}$ and $1.52x10^{-4}$ mg/yr per kg of soil for the NWA and vicinity of the proposed project, respectively) even when combined with typical soil background levels should not result in phytotoxicity symptoms.

BARIUM. Lawrey (1978) reports that naturally occurring levels of barium in plants range from 7.5 to 165 mg/kg. The estimated soil concentration increases of $8.59x10^{-5}$ and $2.48x10^{-3}$ mg/yr per kg of soil (for the NWA and vicinity of the proposed project, respectively) should not elevate the soil concentrations of barium to levels where plants are affected adversely.

BERYLLIUM. Beryllium is considered very toxic to plants. Toxic beryllium levels for bush beans were found to range from 3 to 5 ppm in nutrient solutions and in excess of 1 ppm in soil (Romney et al., 1962). The estimated soil concentration of $8.24x10^{-7}$ and $2.74x10^{-5}$ mg/yr per kg of soil (for the NWA and vicinity of the proposed project, respectively) would be an insignificant increase and would not result in a soil concentration that exceeds the levels toxic to plants.

BORON. Boron is an essential element for plant growth. The difference between essential and toxic amounts of boron is relatively small. Boron concentrations of 0.05 to 0.10 ppm in solution culture are reported as safe for plants, while concentrations of 0.5 to 1 ppm are toxic for boron sensitive plants (Kothny, 1973). Corn exhibits boron injury symptoms when the boron concentration is 25 ppm, while cotton leaves can accumulate 1,625 ppm boron before symptoms are manifest (Kothny, 1973). The estimated soil concentration increase of $3.35x10^{-6}$ and $1.10x10^{-4}$ mg/yr per kg of soil (for the NWA and vicinity of the proposed project, respectively) is insignificant and should not result in concentrations that would prove toxic to plants.

CADMIUM. Cadmium is not an essential element for plant growth. Cadmium concentrations of 1 ppm are considered to be non-toxic (Valkovic, 1975 and Hutchinson and Czyrska, 1972). It is reported that 3 to 5 mg/kg retards the growth of plants (Gough et al., 1979). The estimated

soil concentration increase of 4.25×10^{-6} and 1.49×10^{-4} mg/yr per kg of soil (for the NWA and vicinity of the proposed project, respectively) should not result in a soil concentration that limits plant growth.

CALCIUM. Calcium is an essential element for plant growth. The addition of 3.84×10^{-5} and 1.26×10^{-3} mg/yr per kg of soil (for the NWA and vicinity of the proposed project, respectively) should not result in either a positive or negative effect on plant growth. It is recognized that there is a growing concern that a supply of essential nutrients outside of the normal growing season may actually extend the growing season to the extent that the plant becomes more susceptible to disease or insect damage. The insignificant amount to be added from the operation of the proposed project should not be sufficient to result in any nutrient imbalances.

CHROMIUM. Chromium toxicity of plants is a function of the chemical form, solubility, and concentration. Chromium, as chromic or chromate, in concentrations of 8 to 16 ppm has been found to cause chlorosis in sugar beets (Chapman, 1966). Chromate at concentrations between 0.03 and 64 ppm have been observed to inhibit the growth of algae, while some mosses or bryophytes have been observed to accumulate amounts of chromate as high as 12,000 ppm without exhibiting injury symptoms (NAS, 1974). Gough et al. (1979) report that a soil concentration of 1,370 to 2,740 mg/kg chromium caused chlorosis in citrus, while liquid cultures that contained 150 mg/kg were toxic to seedlings. The estimated soil concentration increase of 1.71×10^{-4} and 8.86×10^{-3} mg/yr per kg of soil (for the NWA and vicinity of the proposed project, respectively) will not result in soil concentrations toxic to plants.

COBALT. Cobalt is not an essential element for plant growth and is reported to be extremely toxic to plants (Bowen, 1966). Allen et al. (1990) reports that black gum (Nyssa slyvatica) and broomsedge (Andropogon spp.) are sensitive to excess cobalt concentrations as small as 1 to 216 mg/kg and 0.05 to 0.91 mg/kg, respectively. Other plants from other families can accumulate large concentrations of cobalt (2,500 to 17,700 mg/kg) through cobalt tolerance. The addition of 2.28×10^{-5} and 6.46×10^{-4} mg/yr per kg of soil (for the NWA and vicinity of the proposed project, respectively) will not result in soil concentrations that exceed the plant toxicity level.

COPPER. Copper is commonly regarded as a micronutrient, that which is essential for plant growth. Typically the problems encountered with copper pertain to deficiencies rather than toxicities. Gough et al. (1979) report that citrus seedlings exhibited chlorosis when exposed to approximately 150 mg/kg of copper. Toxic symptoms have been observed when tissue

concentrations reach 20 ppm (Chapman, 1966 and Valkovic, 1975). In comparison, the annual estimated soil concentration increase of $5.46x10^{-5}$ and $1.97x10^{-3}$ mg/yr per kg of soil (for the NWA and vicinity of the proposed project, respectively) will not result in a soil concentration toxic to plants.

LEAD. Lead is found naturally occurring in all plants, although it is nonessential for growth (Chapman, 1966; Valkovic, 1975; Gough and Shacklette, 1976). Plants vary in their sensitivity to lead. Many plants tolerate high concentrations of lead, while others exhibit retarded growth at 10 ppm in solution culture (Valkovic, 1975). Orange seedlings grown on soils with lead concentrations ranging from 150 to 200 ppm did not exhibit adverse effects (Chapman, 1966). Gough et al. (1979) reported that a lead soil concentration of 30 to 100 mg/kg generally retarded the growth of plants. In comparison, the estimated soil concentration increase of $1.41x10^{-4}$ and $4.63x10^{-3}$ mg/yr per kg of soil (for the NWA and vicinity of the proposed project, respectively) will not result in a soil concentration toxic to plants.

MANGANESE. Manganese is an essential element for plant growth. It can be toxic in high concentrations, although it is less toxic than a number of other trace elements. Reuther et al. (1949) found that 1,000 ppm manganese in leaves of valencia oranges was toxic. Alfalfa grown in acid soil with more than 50 ppm exchangeable manganese exhibited toxicity symptoms (Foy, 1964). Gough et al. (1979) found that manganese toxicity occurs at levels of 400 to 500 mg/kg. The estimated soil concentration increase of $3.22x10^{-5}$ and $1.45x10^{-3}$ mg/yr per kg of soil (for the NWA and vicinity of the proposed project, respectively) is a minute amount compared to the levels reported to be toxic.

MERCURY. Mercury is not an essential element for plant growth. It is typically used as a seed fungicide. In general, mercury is not concentrated in plants grown on soils containing normal levels. Soil bound mercury is typically not available for plant uptake, although many plants cannot prevent the uptake of gaseous mercury through the roots (Huckabee and Jansen, 1975). Most higher vascular plants are resistant to toxicity from high mercury concentrations even though high concentrations are present in plant tissue. Concentrations of 0.5 to 50 ppm, as mercuric chloride, were found to inhibit the growth of cauliflower, lettuce, potato, and carrots (Bell and Rickard, 1974). Gough et al. (1979) noted apparently healthy spanish moss plants with a mercury content of 0.5 mg/kg. The estimated soil concentration increase of $1.57x10^{-5}$ and $5.85x10^{-4}$ mg/yr per kg of soil (for the NWA and vicinity of the proposed project, respectively) will not result in concentrations toxic to plants.

NICKEL. Nickel is not an essential element for plant growth. Nickel enters plants primarily through the root system and is deposited in leaf tissue (Chapman, 1966; Tiffin, 1971). It has been reported that nickel concentrations in excess of 50 ppm in plants are toxic, although some plants endemic to serpentine soils may contain up to 6,100 ppm (NAS, 1975). Concentrations of nickel reported to result in yield reductions are 60 ppm for oats (500 ppm in the soil), 28 ppm in oat straw, and 44 ppm in alfalfa (NAS, 1975). The estimated soil concentration increase of 1.12×10^{-4} and 5.76×10^{-3} mg/yr per kg of soil (for the NWA and vicinity of the proposed project, respectively) will not result in the soil concentrations that are toxic to plants.

SELENIUM. Selenium is a nonessential element for plant growth, although it has been reported to stimulate the growth of a few plants at very low concentrations (Chapman, 1966). The absorption and accumulation of selenium by plants is dependent upon the concentration and distribution of selenium in the soil, chemical nature, seasonal variation in rainfall, plant species, growth stage, physiological condition of the plant, and the presence of other soil components. The primary indication of excess selenium in plants is growth inhibition. In grains, toxicity symptoms may be manifested by a chlorosis of some or all the leaves. It is reported in the literature that cereal grains and onions may accumulate 30 ppm selenium without toxic effects, although grasses, clovers, and vegetables have a much lower tolerance (5 ppm) (Lisk, 1972). The estimated annual increase in soil concentrations (2.57×10^{-5} and 7.56×10^{-4} mg/yr per kg of soil for the NWA and vicinity of the proposed project, respectively) will not result in toxic soil concentrations.

VANADIUM. Vanadium can accumulate to high levels (50 ppm) in plants without the plants exhibiting toxicity symptoms (Gough and Shacklette, 1976). The addition of 10 ppm vanadium (calcium vanadate) to sandy soil was found to result in a decrease in the growth of orange seedlings (Chapman, 1966). All plants died when concentrations were increased to 150 ppm. Aller et al. (1990) reported phytotoxic responses in plants grown in soils containing 140 mg/kg. The estimated annual soil concentration increase of 5.24×10^{-5} and 1.42×10^{-3} mg/yr per kg of soil (for the NWA and vicinity of the proposed project, respectively) will not result in soil concentrations of vanadium reported to be toxic to plants.

ZINC. Zinc is an essential element for plant growth, although toxicity symptoms can occur at elevated levels reported to be as high as 300 mg/kg. Gough and Shacklete (1976) report that 12.5 percent total zinc in soil will stunt most vegetation. However, toxicity levels were found to vary considerably between species. Toxicity symptoms were observed in oat leaves when

ZINC. Zinc is an essential element for plant growth, although toxicity symptoms can occur at elevated levels reported to be as high as 300 mg/kg. Gough and Shacklete (1976) report that 12.5 percent total zinc in soil will stunt most vegetation. However, toxicity levels were found to vary considerably between species. Toxicity symptoms were observed in oat leaves when concentrations ranged from 1,700 to 7,500 ppm, and in tomato leaves when concentrations ranged from 526 to 1,489 ppm (Chapman, 1966). Zinc toxicity has also been found to vary with soil type, with sandy soils as the most toxic and clay-loam soils as the least (Chapman, 1966). The estimated soil concentration increase of 5.24×10^{-4} and 1.79×10^{-2} mg/yr per kg of soil (for the NWA and vicinity of the proposed project, respectively) will not result in soil concentrations toxic to plants.

In each case, the projected soil concentration increase is at least an order of magnitude less than reported soil concentrations. These small additions from the proposed project should not increase existing soil concentrations to levels toxic to plants.

IMPACTS ON WILDLIFE

Compared with other threats to wildlife, such as pesticides, the toxicological relationships between air pollution and effects on wildlife are not well understood (Newman and Schreiber, 1988). The limited understanding is based primarily on reports of symptoms observed in the field and on information extrapolated from laboratory studies. Information on controlled wildlife studies is limited in the scientific literature. Most studies report symptoms of various air pollutants but do not provide toxicity levels. Those studies that do provide toxicity levels are limited to four air contaminants, SO_2, NO_2, O_3, and particulates. Accordingly, this analysis addresses only those air contaminants for which sufficient data exist.

Effects on wildlife from air pollutants are summarized in Table 5.6.1-56. It should be noted that most of the effects noted occur below the national secondary ambient air quality standards. In comparison to information in Table 5.6.1-56, the predicted annual SO_2 concentration of 3.22 $\mu g/m^3$ (estimated background plus predicted increment in the NWA) is less than 25 percent of the concentration (13 to 157 $\mu g/m^3$, continually for 5 months) that resulted in a decreased abundance of deer mice. The predicted annual NO_2 concentration of 10.18 $\mu g/m^3$ (estimated background plus predicted increment in the NWA) is less than 15 percent of the concentration (96 to 958 $\mu g/m^3$, 8 hours per day for 122 days) reported to cause respiratory stress in guinea pigs. The estimated annual O_3 concentration in the NWA (55 $\mu g/m^3$), based on existing

background levels in the vicinity of the NWA, cannot be assessed as there are no commensurate data for an annual averaging period. The estimated annual particulate concentration in the NWA (29.03 $\mu g/m^3$), based on the estimated background plus predicted increment in the NWA, is approximately one third of the concentration reported to cause respiratory stress. In conclusion, it is highly unlikely, given the small predicted increment from the proposed project, that ambient levels would increase to those where effects in wildlife would be noted.

In comparison to information in Table 5.6.1-56, the predicted annual SO_2 concentration of 9.8 $\mu g/m^3$ (estimated background plus predicted increment in the vicinity of the proposed project) is 6-75 percent of the concentrations (13 to 157 $\mu g/m^3$, continually for 5 months) that resulted in a decreased abundance of deer mice. The predicted annual NO_2 concentration of 29.5 $\mu g/m^3$ (estimated background plus predicted increment in the vicinity of the proposed project) is 3 to 31 percent of the concentration (96 to 958 $\mu g/m^3$, 8 hours per day for 122 days) reported to cause respiratory stress in guinea pigs. The estimated annual O_3 concentration in the vicinity of the proposed project (55 $\mu g/m^3$), based on existing background levels in Gainesville, cannot be assessed as there are no commensurate data for an annual averaging period. The estimated annual particulate concentration in the vicinity of the proposed project (12.88 $\mu g/m^3$), based on the estimated background plus predicted increment due to stack emissions in the vicinity of the proposed project, is approximately one eighth of the concentration reported to cause respiratory stress. In conclusion, it is unlikely, given the relatively small predicted increment from the proposed project, that ambient levels would increase to those where effects in wildlife would be noted.

In addition to the impacts on wildlife from the primary pollutants, the FWS is concerned about the effects on wildlife resulting from acid deposition (FWS, 1992). Existing acid deposition conditions in Florida were investigated during the five year Florida Acid Deposition Study (ESE, 1986 and 1987) and the two year follow-on program called the Florida Acid Deposition Monitoring Program (ESE, 1988 and 1989). The data collected in these programs indicate that Florida precipitation is only about two-thirds as acidic as precipitation across the southeastern United States and less than half as acidic as precipitation in the midwestern and northeastern United States (ESE, 1988). There is no evidence of a temporal trend in precipitation acidity since the late 1970s (ESE, 1989). The Clean Air Act Amendments of 1990 require significant reductions in SO_2 and NO_2 emissions from existing uncontrolled utility plants nationwide and some of these reductions will occur at plants in the general vicinity of the NWA. TECO's Big Bend plant will have significant reductions by 1995 and other plants, including FPC's Crystal

River plant, will reduce emissions by the year 2000. These emission reductions will undoubtedly improve on the already relatively good estimated acid deposition conditions in the NWA, although the extent of the improvement is not readily quantifiable.

It is not possible at this time to accurately quantify the impacts of the proposed project on acid deposition conditions in the NWA and the resulting impacts on aquatic organisms. As indicated in the "National Acid Precipitation Assessment Program 1990 Integrated Assessment Report" (NAPAP, 1991), it is very difficult to determine explicitly which sources are influencing specific receptors due to the many physical and chemical process which occur simultaneously in the atmosphere. Regional models have been developed which has improved the overall understanding of these processes. However, as stated in "Acid Deposition: State of the Science and Technology" (NAPAP, 1991a), ". . . we are not yet in a position to make reliable estimates of the relationships between hydrogen ion deposition and the precursor emissions." On a qualitative basis, it can be said that due to the small emission increases that will be caused by the proposed project, increases, if any, in acid deposition will be very small.

IMPACTS ON VISIBILITY

Section 169A of the CAA Amendments of 1977 provide for implementation of guidelines to prevent visibility impairment in mandatory PSD Class I areas. The guidelines are intended to project the aesthetic quality of these pristine areas from reduction in visual range and atmospheric discoloration due to various pollutants. Potential project impacts on visibility in the nearest Class I area were estimated using the VISCREEN Version 1.01 (88341) model (U.S. EPA, 1988b). Impacts were calculated for particulates and nitrogen dioxide. Impacts were not calculated for sulfur dioxide because, according to the model, sulfur dioxide conversion to sulfates that can impact visibility is not significant at distances less than 200 km, and the NWA is located between 118 and 135 km from the proposed project. The results of the VISCREEN analysis are presented in Table 5.6.1-57 Based on these results, the project will not significantly impair visibility in the NWA.

5.6.2 Monitoring Programs

5.6.2.1 Preconstruction Ambient Air Quality Monitoring

The preconstruction ambient air quality monitoring program is described in Section 2.3.7. There are no plans to resume ambient air quality monitoring after construction is complete, unless representative data are not available from the FDER or other air quality monitoring stations, in accordance with Special Condition 20 of the Polk County Conditional Use Permit. The monitoring data from the PSD preconstruction monitoring program quarterly reports indicate that the maximum short-term concentrations for SO_2, PM_{10}, and O_3 are well below the applicable NAAQS/FAAQS.

EPA's Ambient Monitoring Guidelines for PSD (U.S. EPA, 1987) indicate that the permit granting authority may require postconstruction air quality monitoring if:

- The proposed facility is a major source for purposes of new source review
- There is an apparent threat to the ambient air quality standards
- The proposed source impact is uncertain or unknown (e.g., source located in complex terrain, presence of fugitive emissions, or uncertain characteristics in source or emissions)
- There is a potential adverse impact on a Class I PSD area.

Each of these issues is addressed in the following paragraphs.

MAJOR SOURCE CONCERN

The proposed FPC project is a major source for new source review. However, the implementation of BACT is expected to minimize air quality impacts.

THREAT TO AMBIENT AIR QUALITY STANDARDS

The EPA considers the ambient air quality standards threatened if the projected air quality in the vicinity of the proposed source is equal to or greater than 90 percent of the AAQS after construction. The Polk County Site is located in an attainment area for all criteria air pollutants. The air quality impact analyses described in Section 5.6.1 indicate that the emissions produced by the proposed project, combined with the various existing and proposed source emissions, produce air quality impacts that do not exceed the NAAQS/FAAQS although impacts from existing sources were predicted by the model to be relatively high in some cases. However, the applicable AAQS are unlikely to be threatened by construction of the proposed units.

UNCERTAINTY OF CGCC AND PC UNIT EMISSIONS CHARACTERISTICS

The proposed CGCC and PC units will be well-defined point sources based on a known fuel scenario and vendor(s) design specifications. Fugitive emissions of air pollutants are not expected to be a major concern. Therefore, the proposed CGCC and PC unit emissions characteristics will be well defined.

IMPACT ON CLASS I PSD AREAS

The Polk County Site is located approximately 118 km from the NWA. As demonstrated in Section 5.6.1.10, the proposed source will not cause or contribute to a violation of the allowable Class I increments.

For the reasons in the above paragraphs, postconstruction air quality monitoring should not be required at the FPC Polk County Site. However, it is recognized that the ultimate site capacity will be developed over a period of approximately 25 years, and that potential future monitoring requirements will need to be addressed in supplemental applications.

5.6.2.2 Continuous Emissions Monitoring

This section describes the proposed continuous emission monitoring system for the proposed project. The proposed CGCC monitoring program is consistent with the requirements of 40 CFR 60, Subpart GG, Standards of Performance for Stationary Gas Turbines and the Florida Air Pollution Rules for new sources, Rule 17-2.660, F.A.C., which adopts 40 CFR 60,

Subpart GG, by reference. For the gasification plant, the requirements associated with 40 CFR 60, Subpart J, Standards of Performance for Petroleum Refineries, will be used as a guideline, even though these standards do not directly apply to the project. For the PC units, the requirements associated with 40 CFR 60, Subpart Da, Standards of Performance for Electric Utility Steam Generating Units for Which Construction Is Commenced After September 18, 1978, and the Florida Air Pollution Rules for New Sources, Rule 17-2.660, F.A.C., will be met.

CGCC CONTINUOUS MONITORING

NO_x. A continuous monitoring system for NO_2 will be operated. The nitrogen content of the back-up fuel (No. 2 oil) being fired in the turbine will be determined on each occasion that this fuel is transferred to the storage tank from any other source (40 CFR 60, Subpart GG). Since there will be four storage tanks, it may be possible to isolate a tank until it has received an entire delivery in order to minimize the number of samples that must be taken.

SO_2. The sulfur content of coal-derived gas will initially be determined and recorded daily. Since the amount of sulfur in the gas is expected to be consistently low, it should be possible to develop a less frequent program of gas monitoring after the quality and consistency of the gas has been demonstrated.

The sulfur content of the back-up fuel (No. 2 oil) being fired in the turbine will be determined following completion of each delivery or shipment of fuel to the storage tank.

OTHER POLLUTANTS. Since the CGCC units do not include particulate collection devices or CO and VOC control systems, continuous monitoring of these pollutants and opacity is inappropriate.

SULFUR RECOVERY INCINERATOR CONTINUOUS MONITORING

SO_2. The SO_2 concentration in gases discharged from the sulfur recovery incinerator (tail gas treating) will be monitored using the requirements associated with 40 CFR 60, Subpart J, Standards of Performance for Petroleum Refineries, as a guideline.

OTHER POLLUTANTS. Since the sulfur recovery process does not include NO_x, particulates, CO, and VOC control systems, continuous monitoring of these pollutants is not required.

PULVERIZED COAL CONTINUOUS MONITORING

OPACITY. A continuous opacity monitor is not planned to be installed on either PC unit since interference due to water droplets may exist in the stack. Instead, alternate parameters such as pressure drop across the scrubbing modules, scrubber liquor flow rate and feed pressure will be measured (40 CFR 60.47a(b)).

SO_2. A continuous emission monitor for SO_2 will be installed and operated on both the PC units. The system will be capable of monitoring the inlet and outlet SO_2 concentrations of the FDG system. In lieu of the inlet monitors, an "as fired" fuel monitoring system may be employed (40 CFR 60.47a(b)).

NO_x. A continuous emission monitor for NO_x will be installed and operated on both PC units (40 CFR 60.47a(c)).

O_2 or CO_2. A continuous emission monitor for either 0_2 or CO_2 will be installed and operated on both PC units (40 CFR 60.47a(d)).

OTHER PENDING REQUIREMENTS. In addition to the current requirements of 40 CFR 50 Subpart Da, the EPA has proposed additional monitoring requirements in Part 75. A review of these proposed requirements reveals that continuous monitoring of the volumetric flow may be required in addition to the monitoring requirements above. Once these proposed requirements are promulgated, any additional monitoring requirements applicable to the PC units will be met.

PERFORMANCE TESTS

NO_x, fuel sulfur content, particulates, CO, O_2, and VOC performance emission tests will be performed after plant startup and testing in accordance with Florida Air Pollution Rule 17-2.700, F.A.C., which requires sampling for those pollutants for which a BACT analysis is required.

Test methods to be used for the performance testing will be determined by mutual agreement between FDER and FPC. The performance monitoring equipment used will be temporary in nature and removed upon conclusion of the testing program.

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TABLE 5.6.1-1
AMBIENT AIR QUALITY STANDARDS
AND PSD INCREMENTS

Pollutant	Averaging Time	Federal NAAQS ($\mu g/m^3$)	Florida FAAQS ($\mu g/m^3$)	Class I PSD Increment ($\mu g/m^3$)	Class II PSD Increment ($\mu g/m^3$)
CO	1-hour	40,000	40,000	NA	NA
	8-hour	10,000	10,000	NA	NA
NO_2	Annual	100	100	2.5	25
SO_2	3-hour	1,300[1]	1,300[1]	25	512
	24-hour	365	260	5	91
	Annual	80	60	2	20
PM[2]	24-hour	150	150	10	37
	Annual	50	50	5	19
O_3[3]	1-hour	235	235	NA	NA
Pb	Calendar Quarter	1.5	1.5	NA	NA

(1) The 3-hour average SO_2 ambient air quality standard is a secondary (welfare-related) standard. All of the other federal and Florida ambient air quality standards are primary (health-related) standards.

(2) Ambient air quality standards are for PM_{10} and PSD increments are for total suspended particulates (TSP) until such a time as EPA promulgates PM_{10} PSD increments. On October 5, 1989, EPA proposed increments of 8 $\mu g/m^3$ (24-hr) and 4 $\mu g/m^3$ (annual) for Class I areas and 30 $\mu g/m^3$ (24-hr) and 17 $\mu g/m^3$ (annual) for Class II areas (FR, 1989). PM_{10} ambient standard and TSP PSD increment impacts were evaluated based on TSP modelled impacts.

(3) Ozone values are associated with emissions of VOCs.

Note: Short-term standards (i.e., those with averaging times less than annual) and increments can be exceeded once per year.

NA = No PSD increments exist for these pollutants.

Sources: Federal Register, 1989; 40 CFR 50, Rules 17-2.300 and 310, F.A.C.

TABLE 5.6.1-2
COMPARISON OF CASE B EMISSIONS WITH SIGNIFICANT EMISSION RATES [1]

Pollutant	8 CTs [2] (TPY)	2 PCs (TPY)	4 TOUs (TPY)	Auxiliary Boiler [3] (TPY)	Diesel Generator [3] (TPY)	Totals (TPY)	Significant Emission Rate (TPY)
CO	3,504	7,814	78	0.25	0.6	11,396	100
NO_x	6,022	8,852	999	0.99	2.65	15,873	40
SO_2	6,798	15,102	447	0.264	0.044	22,347	40
PM (TSP)	1,261	1,042	26	0.25	0.024	2,329	25
PM (PM_{10})	1,261	1,042	26	0.25	0.024	2,329	15
VOC	420	780	Neg.	0.05	0.014	1,200	40
Pb	9.45	0.87	0.035	0.000044	0.000008	10.355	0.6
Asbestos	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	0.007
Beryllium	0.054	0.0057	0.0006	0.000013	0.0000022	0.0603	0.004
Mercury	0.77	0.52	0.11	0.000015	0.0000026	1.400	0.1
Vinyl Chloride	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	1
Fluorides	Neg.	4.00	Neg.	Neg.	Neg.	4.00	3
Sulfuric Acid Mist	762	2,277.6	6.7	0.0041	0.00065	3,046	7
H_2S	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Any
Total Reduced Sulfur	Neg.	Neg.	Neg.	Neg.	Neg.	10	10
Benzene [4]	Neg.	Neg.	Neg.	0.00034	Neg.	0.00034	Any
Inorganic Arsenic	0.56	0.898	0.021	0.00002	0.0000037	1.479	Any
Radionuclides	Neg.	11.5 mC_i/yr	Neg.	Neg.	Neg.	11.5 mC_i/yr	Any

Notes:
(1) Emission rates based on the application of BACT as discussed in Section 3.4.
(2) Emission rates based on worst-case scenario for combination of fuel usage (i.e., coal gas 8,260 hrs/yr and fuel oil 500 hrs/yr).
(3) Auxiliary boiler and diesel generator totals are not included in the totals column (except for benzene) since these sources will not be operated simultaneously with the CTs or PCs, except during startup and for brief periods of testing.
(4) Emission rate based on natural gas combustion (EPA, 1989).

CTs = Combustion Turbines PCs = Pulverized Coal Units TOUs = Thermal Oxidation Units Neg. = Negligible

Source: Black & Veatch, 1992

TABLE 5.6.1-3
PSD *DE MINIMIS* AMBIENT AIR QUALITY
IMPACT LEVELS

Pollutant	Air Quality Impact *De Minimis* Level ($\mu g/m^3$) and Averaging Time
Carbon Monoxide	575 (8-hour)
Nitrogen Dioxide	14 (Annual)
Sulfur Dioxide	13 (24-hour)
Particulate Matter (PM_{10})	10 (24-hour)
Particulate Matter (TSP)	10 (24-hour)
Volatile Organic Compounds (Ozone)	(1)
Lead	0.1 (3-month)
Beryllium	0.001 (24-hour)
Mercury	0.25 (24-hour)
Vinyl Chloride	15 (24-hour)
Total Fluorides	0.25 (24-hour)
Hydrogen Sulfide	0.2 (1-hour)

(1) No specific air quality impact *de minimis* level is prescribed for ozone. An impact analysis including monitoring is not required when a proposed source's VOC emissions are less than 100 tons/year.

Source: U.S. EPA, 1987c; FDER Table 500-3

TABLE 5.6.1-4
AIR TOXICS
ESTIMATED MAXIMUM SHORT-TERM AND ANNUAL EMISSION RATES (CASE B)[1]

Pollutants	Emission Rate 8-CTs		Emission Rate 2-PCs		Emission Rate 4-TOUs		Total Annual Emissions (TPY)
	(g/s)	(TPY)	(g/s)	(TPY)	(g/s)	(TPY)	
Trace Metals:							
Antimony	0.0064	0.289	0.002	0.07	0.0001	0.0105	0.37
Arsenic	0.016	0.556	0.026	0.898	0.0006	0.139	1.59
Barium	0.0624	2.167	0.246	8.61	0.001	0.0347	10.81
Beryllium	0.0045	0.0544	0.00016	0.0057	0.0000126	0.000438	0.061
Boron	0.118	0.234	Neg.	Neg.	Neg.	Neg.	0.234
Cadmium	0.0199	0.247	0.0024	0.083	0.0004	0.0139	0.345
Calcium	1.357	2.689	Neg.le	Neg.	Neg.	Neg.	2.689
Chromium	0.232	8.058	0.032	1.111	0.102	3.543	12.712
Cobalt	0.029	0.321	0.081	2.80	0.0006	0.0208	3.142
Copper	0.508	3.025	0.036	1.248	0.0072	0.250	4.523
Lead	0.277	9.447	0.025	0.87	0.001	0.0347	10.35
Magnesium	0.421	0.835	Neg.	Neg.	Neg.	Neg.	0.835
Manganese	0.0254	0.679	0.069	2.396	0.0152	0.528	3.60
Mercury	0.055	0.764	0.015	0.52	0.0033	0.114	1.40
Nickel	0.309	4.018	0.102	3.541	0.068	2.36	9.92
Selenium	0.044	0.834	0.057	1.97	Neg.	Neg.	2.804
Vanadium	0.126	0.251	0.219	7.62	0.0008	0.0278	7.9
Zinc	0.705	24.5	0.619	21.5	0.048	1.67	47.67
Volatile Organic Compounds:							
Formaldehyde	0.745	1.49	0.038	1.323	Neg.	Neg.	2.813

(1) Emission estimates based on the application of BACT as discussed in Section 3.4.
(2) Emission rates based on highest rate for CTs depending upon fuel type.

Source: Black & Veatch, 1992 Neg. = Negligible

TABLE 5.6.1-5
COMBUSTION TURBINE (235MW)
ESTIMATED[1] PERFORMANCE ON COAL-DERIVED GAS

CONDITIONS			
Ambient Temperature (°F)	40	72	95
Ambient Relative Humidity (%)	70	80	48
Load Condition (%)	100	100	100
Elevation (ft) (above MSL)	163	163	163
Maximum Heat Input Rate (mmBtu/hr)	1,779.9	1,661.3	1,569.7
EMISSIONS (lb/hr)			
Carbon Monoxide (30 ppm)	100	92	88
Nitrogen Oxides (at 15% O_2) (25 ppm)[2]	163	152	144
Sulfur Dioxide	194	181	171
Particulate Matter (PM_{10})	36	34	32
Volatile Organic Compounds	12	11.2	10.4
Lead	0.27	0.25	0.24
Asbestos	Neg.	Neg.	Neg.
Beryllium	0.0014	0.0013	0.0012
Mercury	0.022	0.021	0.019
Vinyl Chloride	Neg.	Neg.	Neg.
Total Fluorides	Neg.	Neg.	Neg.
Sulfuric Acid Mist	21.75	20.30	19.18
Hydrogen Sulfide	Neg.	Neg.	Neg.
Total Reduced Sulfur	Neg.	Neg.	Neg.
Benzene	Neg.	Neg.	Neg.
Inorganic Arsenic	0.016	0.0152	0.0143
Radionuclides	Neg.	Neg.	Neg.
STACK PARAMETERS			
Stack Height (ft)	213	213	213
Stack Diameter (ft)	13.5	13.5	13.5
Stack Gas Temperature (°F)[3]	200	200	200
Stack Gas Exit Velocity (ft/sec)	125	117	111

Notes: [1] Emission estimates based on application of BACT as discussed in Section 3.4.
[2] Not corrected to ISO reference conditions.

MSL = Mean Sea Level Neg. = Negligible

Source: Black & Veatch, 1992

TABLE 5.6.1-6
COMBUSTION TURBINE (235MW)
ESTIMATED[1] PERFORMANCE ON FUEL OIL

CONDITIONS			
Ambient Temperature (°F)	40	72	95
Ambient Relative Humidity (%)	70	80	48
Load Condition (%)	100	100	100
Elevation (ft) (above MSL)	163	163	163
Maximum Heat Input Rate (mmBtu/hr)	1,799.8	1,644.5	1,532.8
EMISSIONS (lb/hr)			
Carbon Monoxide (30 ppm)	96	89	84
Nitrogen Oxides (at 15% O_2) (42 ppm)[2]	318	291	271
Sulfur Dioxide	98	90	83
Particulate Matter (PM_{10})	17	17	17
Volatile Organic Compounds	12	11.2	10.4
Lead[3]	0.016	0.0146	0.0136
Asbestos	Neg.	Neg.	Neg.
Beryllium[3]	0.0045	0.0041	0.00383
Mercury[3]	0.0054	0.0049	0.0046
Vinyl Chloride	Neg.	Neg.	Neg.
Total Fluorides	Neg.	Neg.	Neg.
Sulfuric Acid Mist	10	9	8
Hydrogen Sulfide	Neg.	Neg.	Neg.
Total Reduced Sulfur	Neg.	Neg.	Neg.
Benzene	Neg.	Neg.	Neg.
Inorganic Arsenic[3]	0.00756	0.00691	0.00644
Radionuclides	Neg.	Neg.	Neg.
STACK PARAMETERS			
Stack Height (ft)	213	213	213
Stack Diameter (ft)	13.5	13.5	13.5
Stack Gas Temperature (°F)	260	260	260
Stack Gas Exit Velocity (ft/sec)	133	125	117

Notes: [1] Emission estimates based on application of BACT as discussed in Section 3.4.
[2] Not corrected to ISO reference conditions.

MSL = Mean Sea Level Neg. = Negligible

Source: Black & Veatch, 1992

TABLE 5.6.1-7
PULVERIZED COAL UNIT (600MW)
ESTIMATED[1] PERFORMANCE

CONDITIONS			
Ambient Temperature (°F)	40	40	40
Ambient Relative Humidity (%)	70	70	70
Load Condition (%)	50	75	100
Elevation (ft) (above MSL)	163	163	163
Maximum Heat Input Rate (mmBtu/hr)	3,272.68	4,780.99	5,945
EMISSIONS (lb/hr)			
Carbon Monoxide	491	717	892
Nitrogen Oxides	556	813	1,011
Sulfur Dioxide	949.1	1386.5	1,724
Particulate Matter (PM_{10})	66	96	119
Volatile Organic Compounds	49	72	89
Lead	0.054	0.08	0.10
Asbestos	Neg.	Neg.	Neg.
Beryllium	0.00036	0.00053	0.00065
Mercury	0.033	0.048	0.06
Vinyl Chloride	Neg.	Neg.	Neg.
Total Fluorides	0.252	0.368	0.457
Sulfuric Acid Mist	143.1	209.1	260
Hydrogen Sulfide	Neg.	Neg.	Neg.
Total Reduced Sulfur	Neg.	Neg.	Neg.
Benzene	Neg.	Neg.	Neg.
Inorganic Arsenic	0.056	0.0820	0.102
Radionuclides (mCi/hr)	0.3605	0.527	0.655
STACK PARAMETERS			
Stack Height (ft)	625	625	625
Stack Diameter (ft)	21.5	21.5	21.5
Stack Gas Temperature (°F)	160	160	160
Stack Gas Exit Velocity (ft/sec)	80	80	80.0

Notes: [1] Emission estimates based on the application of BACT as discussed in Section 3.4

MSL = Mean Sea Level Neg. = Negligible

Source: Black & Veatch, 1992

TABLE 5.6.1-8
THERMAL OXIDATION UNIT
ESTIMATED[1] PERFORMANCE

CONDITIONS	
Ambient Temperature (°F)	40
Ambient Relative Humidity (%)	70
Load Condition (%)	N/A
Elevation (ft) (above MSL)	163
Maximum Heat Input Rate (mmBtu/hr)	N/A
EMISSIONS (lb/hr)	
Carbon Monoxide	4.5
Nitrogen Oxides	57.00
Sulfur Dioxide	25.50
Particulate Matter (PM_{10})	1.5
Volatile Organic Compounds	Neg.
Lead	0.002
Asbestos	Neg.
Beryllium	0.000033
Mercury	0.0065
Vinyl Chloride	Neg.
Total Fluorides	Neg.
Sulfuric Acid Mist	0.38
Hydrogen Sulfide	Neg.
Total Reduced Sulfur	Neg.
Benzene	Neg.
Inorganic Arsenic	0.0012
Radionuclides	Neg.
STACK PARAMETERS	
Stack Height (ft)	352.6
Stack Diameter (ft)	7.54
Stack Gas Temperature (°F)	1,200.2
Stack Gas Exit Velocity (ft/sec)	27.88

Note: [1] Emission estimates based on application of BACT as discussed in Section 3.4.

MSL = Mean Sea Level
N/A = Not Applicable
Neg. = Negligible

Source: Black & Veatch, 1992

TABLE 5.6.1-9
AUXILIARY BOILER
ESTIMATED[1] PERFORMANCE ON NATURAL GAS & FUEL OIL

CONDITIONS	Natural Gas	Fuel Oil
Ambient Temperature (°F)	72	72
Ambient Relative Humidity (%)	80	80
Load Condition (%)	100	100
Elevation (ft) (above MSL)	163	163
Maximum Heat Input Rate (mmBtu/hr)	99.0	99.0
EMISSIONS (lb/hr)		
Carbon Monoxide	4.9	4.9
Nitrogen Oxides	9.9	19.8
Sulfur Dioxide	0.0641	5.27
Particulate Matter (PM_{10})	0.5	4.9
Volatile Organic Compounds	0.5	0.99
Lead	Neg.	0.000881
Asbestos	Neg.	Neg.
Beryllium	Neg.	0.00025
Mercury	Neg.	0.00030
Vinyl Chloride	Neg.	Neg.
Total Fluorides	Neg.	Neg.
Sulfuric Acid Mist	0.00099	0.082
Hydrogen Sulfide	Neg.	Neg.
Total Reduced Sulfur	Neg.	Neg.
Benzene	0.00673	Neg.
Inorganic Arsenic	Neg.	0.000415
Radionuclides	Neg.	Neg.
STACK PARAMETERS		
Stack Height (ft)	60	60
Stack Diameter (ft)	2.5	2.5
Stack Gas Temperature (°F)	332	329
Stack Gas Exit Velocity (ft/sec)	109	106

Notes: [1] Emission estimates based on application of BACT as discussed in Section 3.4.

MSL = Mean Sea Level Neg. = Negligible

Source: Black & Veatch, 1992

TABLE 5.6.1-10
DIESEL GENERATOR
ESTIMATED[1] PERFORMANCE ON FUEL OIL

CONDITIONS	
Ambient Temperature (°F)	72
Ambient Relative Humidity (%)	80
Load Condition (%)	100
Elevation (ft) (above MSL)	163
Maximum Heat Input Rate (mmBtu/hr)	17.38
EMISSIONS (lb/hr)	
Carbon Monoxide	12
Nitrogen Oxides	53
Sulfur Dioxide	0.91
Particulate Matter (PM_{10})	0.48
Volatile Organic Compounds	0.27
Lead	0.00016
Asbestos	Neg.
Beryllium	0.000044
Mercury	0.000052
Vinyl Chloride	Neg.
Total Fluorides	Neg.
Sulfuric Acid Mist	0.014
Hydrogen Sulfide	Neg.
Total Reduced Sulfur	Neg.
Benzene	Neg.
Inorganic Arsenic	0.000073
Radionuclides	Neg.
STACK PARAMETERS	
Stack Height (ft)	25
Stack Diameter (ft)	1.5
Stack Gas Temperature (°F)	980
Stack Gas Exit Velocity (ft/sec)	143

Notes: [1] Emission estimates based on application of BACT as discussed in Section 3.4.

MSL = Mean Sea Level Neg. = Negligible

Source: Black & Veatch, 1992

TABLE 5.6.1-11
FUGITIVE DUST SOURCES MODELLED AS AREA SOURCES

Source	Emission Rate[1] ($g/sec/m^2$)	Location[2] (x,y) (m)	Size (m)	Drop Height (m)
Stacker Reclaim 1	.0008305	-1573, -10	27.4 x 27.4	21.34
Stacker Reclaim 2	.0005515	-1624, -37.8	27.4 x 27.4	18.29
Coal Car Unloading Building	.0001240	-1207, -622	38.2 x 38.2	1.5
Limestone Pile Stacker/Reclaim Hopper	.0001040	-1122, 37	68.1 x 68.1	9.4

Notes: (1) Emission estimates obtained from AP-42 (EPA 1988a)
(2) With respect to zero point of 414.30 kmE; 3073.88 kmN

Source: Black & Veatch, 1992

TABLE 5.6.1-12
CLASS II PSD SOURCE INVENTORY - NO_x

No.	County	Source Name	UTM Coordinates East (km)	UTM Coordinates North (km)	Distance (km)	Emissions (TPY)	Screen (Q=20*D)	Model? (Yes/No)	Comments
1	Glades	ER Janna Lime Dryer (No PSD #)	386.7	3155.8	86.5	0.3	1730	No	No No_x
2	Hardee	TECO Hardee Station (#140)	404.8	3057.4	19.0	1419	380	Yes	
3	Hillsborough	Cargill (Gardinier) (#178)	363.4	3082.5	52.0	0	1040	No	No No_x
4	Hillsborough	CF Industries (#155)	388.0	3116.0	49.6	0	992	No	No No_x
5	Hillsborough	CLM Chloride Metals (Closed)	361.8	3088.3	54.3	0	1087	No	Closed
6	Hillsborough	Hillsborough County Resource Recovery (#104)	368.2	3092.7	49.7	Not PSD	994	No	Date < 88
7	Hillsborough	IMC - Ft. Lonesome (#88)	389.6	3067.9	25.3	Not PSD	506	No	Date < 88
8	Hillsborough	McKay Bay Res. Rec. (#86)	360.0	3091.9	57.1	Not PSD	1142	No	Date < 88
9	Hillsborough	TECO Big Bend 4 (#40)	361.9	3075.0	52.3	Not PSD	1046	No	Date < 88
10	Orange	Orlando Utilities Stanton #1	483.5	3150.6	103.0	Not PSD	2060	No	Date < 88
11	Orange	Orlando Utilities Stanton #2	483.5	3150.6	103.0	3188	2060	Yes	
12	Osceola	FPC Intercession City 7EA and 7FA Turbine (#180)	446.3	3126.0	61.2	1748	1224	Yes	
13	Osceola	Kissimmee Util (#182)	460.1	3129.3	71.9	0	1439	No	PSD for SO_2
14	Pasco	Couch Const - Odessa (No PSD #)	340.7	3119.5	86.5	251	1730	No	
15	Pasco	Couch Const - Zephyrhills (No PSD #)	390.3	3129.4	60.4	69	1209	No	
16	Pasco	DRIS Paving (Asphalt) (No PSD #)	340.6	3119.2	86.4	Approx. 100	1728	No	
17	Pasco	Evans Packing (Shutdown)	383.3	3135.8	69.2	0	1384	No	Shut Down
18	Pasco	NP Richy Hosp Boiler 1 (No PSD #)	331.2	3124.5	97.2	Too far	1944	No	Too far
19	Pasco	Overstreet Paving (No PSD #)	355.9	3143.7	90.9	Too far	1819	No	Too far
20	Pasco	Pasco CoGen (#177)	385.6	3139.0	71.1	405	1422	No	
21	Pasco	Pasco Co. RRF. (#127)	347.1	3139.2	93.6	Too far	1873	No	Too far
22	Pinellas	Pinellas Co. RRF (#11)	335.2	3084.1	79.7	Not PSD	1593	No	Date < 88
23	Pinellas	Pinellas Co. RRF (#98)	335.2	3084.1	79.7	Not PSD	1593	No	Date < 88
24	Pinellas	Stauffer (Shut Down) (Increment Expanding)	325.6	3116.7	98.4	Too far	1968	No	Too far
25	Polk	Agrico - S. Pierce - New SAP 10,11 (#179)	407.5	3071.3	7.2	118.2	142	Yes	

TABLE 5.6.1-12
CLASS II PSD SOURCE INVENTORY - NO_x

No.	County	Source Name	UTM Coordinates East (km)	UTM Coordinates North (km)	Distance (km)	Emissions (TPY)	Screen (Q=20*D)	Model? (Yes/No)	Comments
26	Polk	Agrico - S. Pierce - Old SAP 10,11 (#179)	407.5	3071.3	7.2	-102.4	142	Yes	
27	Polk	AMAX (Mobil Big 4) (#1)	394.8	3067.7	19.7	Not PSD	395	No	Date<88
28	Polk	AMAX (Mobil Big 4) (#94)	394.9	3069.8	19.7	Not PSD	395	No	Date<88
29	Polk	CF Bartow - SAP 4	408.5	3083.0	10.7	0	215	No	No No_x
30	Polk	CF Bartow - SAP 3,4 (Shutdown)	408.5	3083.0	10.7	0	215	No	Shut Down
31	Polk	Conserve (#76)	398.7	3084.2	18.6	Not PSD	372	No	Date<88
32	Polk	Farmland SAP 5	409.5	3079.5	7.3	52	156	Yes	
33	Polk	Farmland #143 SAP 1,2 (Shutdown)	409.5	3079.5	7.3	0	156	No	
34	Polk	IMC New Wales (#170)	396.7	3078.9	18.3	190.5	367	Yes	
35	Polk	Lakeland CT's	409.2	3102.8	29.3	1860	584	Yes	
36	Polk	Lakeland Power McIntosh 3 (#008)	408.5	3105.8	32.4	Not PSD	648	No	Date<88
37	Polk	Mobil (#102)	398.4	3085.3	19.5	Not PSD	390	No	Date<88
38	Polk	Royster (#106)	406.8	3085.1	13.4	Not PSD	268	No	Date<88
39	Polk	Seminole (WR Grace) (#157)	409.7	3086.0	12.9	35	258	Yes	
40	Polk	Seminole (WR Grace) (#68)	409.3	3086.9	13.4	Not PSD	269	No	Date<88
41	Polk	US Agrichem - Fort Meade (#107)	416.2	3068.7	5.6	Not PSD	111	No	Date<88
42	Polk	US Agrichem - Fort Meade (#64)	416.2	3068.7	5.6	Not PSD	111	No	Date<88
43	Sumter	FDOC Boiler #3 (No PSD #)	382.2	3166.1	97.6	Too far	1952	No	Too far

TABLE 5.6.1-13
CLASS II PSD SOURCE INVENTORY - SO_2

No.	County	Source Name	UTM Coordinates		Distance (km)	Emissions (TPY)	Screen (Q=20*D)	Model? (Yes/No)
			East (km)	North (km)				
1	Pasco	Pasco CoGen	385.6	3139.0	71	175	1420	No
2	Hardee	TECO Hardee Station	404.8	3057.4	19.0	9641	380	Yes
3	Pinellas	Pinellas Co Resource Recovery Facility (2 Sources)	335.2	3084.1	79.7	2162	1593	Yes
4	Hillsborough	CF Industries (Cent. Phos) (4 Sources)	388.0	3116.0	49.6	292	992	No
5	Hillsborough	Cargill (Gardinier) (3 Sources)	362.9	3082.5	52.0	-7304	1040	Yes
6	Hillsborough	TECO - Big Bend (3 Sources)	361.9	3075.0	52.3	-104176	1046	Yes
7	Hillsborough	McKay Bay Resource Recovery Facility (2 Sources)	360.0	3091.9	57.1	372	1142	No
8	Hillsborough	Hillsborough County Resource Recovery Facility	368.2	3092.7	49.7	743	994	No
9	Hillsborough	IMC - Ft. Lonesome (2 Sources)	389.6	3067.9	25.3	1375	506	Yes
10	Polk	Conserv (2 Sources)	398.7	3084.2	18.6	931	372	Yes
11	Polk	Agrico - S. Pierce (2 Sources)	407.5	3071.5	7.1	1316	142	Yes
12	Polk	Farmland (3 Sources)	409.5	3080.1	7.8	1896	156	Yes
13	Polk	Seminole (WR Grace) (2 Sources)	409.7	3086.0	12.9	-4946	258	Yes
14	Polk	Seminole (WR Grace)	409.5	3086.5	13.4	2501	269	Yes
15	Polk	IMC - New Wales (10 Sources)	396.7	3079.4	18.3	4869	367	Yes
16	Polk	Royster (2 Sources)	406.8	3085.1	13.4	-7707	268	Yes
17	Polk	Mobil - Nichols	398.4	3085.3	19.5	85	390	No
18	Osceola	FPC Intercession City 7EA Turbine (2 Sources)	446.3	3126.0	61.2	20387	1224	Yes
19	Pasco	Pasco Co Resource Recovery Facility	347.1	3139.2	93.6	490	1873	No
20	Osceola	Kissimmee Utilities (Existing)	460.1	3129.3	71.9	1115	1439	No
21	Pinellas	Stauffer (Shut Down)	325.6	3116.7	98.4	-1808	1968	No
22	Polk	City of Lakeland - McIntosh 3	408.5	3105.8	32.4	17369	648	Yes
23	Pasco	Evans Packing	383.3	3135.8	69.2	7	1384	No
24	Polk	City of Lakeland - Combustion Turbines	409.2	3102.8	29.3	1011	587	Yes
25	Polk	CF Bartow (3 Sources)	408.5	3083.0	10.7	-1858	215	Yes

TABLE 5.6.1-13
CLASS II PSD SOURCE INVENTORY - SO_2

No.	County	Source Name	UTM Coordinates		Distance (km)	Emissions (TPY)	Screen (Q=20*D)	Model? (Yes/No)
			East (km)	North (km)				
26	Hillsborough	CLM Chloride Metals	361.8	3088.3	54.3	729	1087	No
27	Polk	US Agrichem - Fort Meade (3 Sources)	416.2	3068.7	5.6	1639	111	Yes
28	Polk	AMAX (Mobil) Big 4 Mine (2 Sources)	394.9	3069.8	19.7	589	395	Yes
29	Sumter	FDOC boiler #3	382.2	3166.1	97.6	104	1952	No
30	Glades	ER Janna Lime Dryer	386.7	3155.9	86.5	28	1730	No
31	Pasco	DRIS Paving (asphalt)	340.6	3119.2	86.4	8	1728	No
32	Pasco	Overstreet Paving	355.9	3143.7	90.9	127	1819	No
33	Pasco	New Port Richy Hospital Boiler 1 (2 Sources)	331.2	3124.5	97.2	3	1944	No
34	Pasco	Couch Construction - Odessa	340.7	3119.5	86.5	252	1730	No
35	Pasco	Couch Construction - Zephyrhills	390.3	3129.4	60.4	123	1209	No

TABLE 5.6.1-14
CLASS II PSD SOURCE INVENTORY - PM

No.	County	Source Name	UTM Coordinates East (km)	UTM Coordinates North (km)	Distance (km)	Emissions (TPY)	Screen (Q=20*D)	Model? (Yes/No)	Comments
1	Glades	ER Janna Lime Dryer (No PSD #)	386.7	3155.9	86.5	Too far	1730	No	Too far
2	Hardee	TECO Hardee Station (#140)	404.8	3057.4	19.0	131	380	No	
3	Hillsborough	Cargill (Gardinier) (#178)	362.9	3082.5	52.0	0	1040	No	No PM
4	Hillsborough	CF Industires (#155)	388.0	3116.0	49.6	84	992	No	
5	Hillsborough	CLM Chloride Metals (Closed)	361.8	3088.3	54.3	0	1087	No	Closed
6	Hillsborough	Hillsborough County Resource Recovery (#104)	368.2	3092.7	49.7	90	994	No	
7	Hillsborough	IMC - Fort Lonesome (#88)	389.6	3067.9	25.3	175	506	No	
8	Hillsborough	McKay Bay Resource Recovery (#86)	360.0	3091.9	57.1	244	1142	No	
9	Hillsborough	TECO Big Bend 4 (#40)	361.9	3075.0	52.3	1897	1046	Yes	
10	Orange	Orlando Utilities Stanton #1	483.5	3150.6	103.0	548	2060	No	Too far
11	Orange	Orlando Utilities Stanton #2	483.5	3150.6	103.0	375	2060	No	Too far
12	Osceola	FPC Intercession City 7EA Turbine (#180)	446.3	3126.0	61.2	108	1224	No	
13	Osceola	Kissimmee Utility (#182)	460.1	3129.3	71.9	Too far	1439	No	Too far
14	Pasco	Couch Construction - Odessa (No PSD #)	340.7	3119.5	86.5	Too far	1730	No	Too far
15	Pasco	Couch Construction - Zephyrhills (No PSD #)	390.3	3129.4	60.4	45	1209	No	
16	Pasco	DRIS Paving (Asphalt) (No PSD #)	340.6	3119.2	86.4	Too far	1728	No	Too far
17	Pasco	Evans Packing (Shutdown)	383.3	3135.8	69.2	Too far	1384	No	Too far
18	Pasco	NP Richy Hosp Boiler 1 (No PSD #)	331.2	3124.5	97.2	Too far	1944	No	Too far
19	Pasco	Overstreet Paving (No PSD #)	355.9	3143.7	90.9	Too far	1819	No	Too far
20	Pasco	Pasco CoGen (#177)	385.6	3139.0	71.1	27	1422	No	
21	Pasco	Pasco Co. RRF. (#127)	347.1	3139.2	93.6	Too far	1873	No	Too far
22	Pinellas	Pinellas Co RRF (#11)	335.2	3084.1	79.7	Too far	1593	No	Too far
23	Pinellas	Pinellas Co RRF (#98)	335.2	3084.1	79.7	Too far	1593	No	
24	Pinellas	Stauffer (Shut Down) (Increment Expanding)	325.6	3116.7	98.4	Too far	1968	No	Too far
25	Polk	Agrico - S. Pierce (#61)	407.5	3071.5	7.1	0	142	No	No PM

TABLE 5.6.1-14
CLASS II PSD SOURCE INVENTORY - PM

No.	County	Source Name	UTM Coordinates East (km)	UTM Coordinates North (km)	Distance (km)	Emissions (TPY)	Screen (Q=20*D)	Model? (Yes/No)	Comments
26	Polk	AMAX (Mobil Big 4) (#1, #94)	394.9	3069.8	19.7	38	395	No	
27	Polk	CF Bartow - DAP 4	408.5	3083.0	10.7	171	215	Yes	
28	Polk	CF Bartow - SAP 3,4 (Shutdown)	408.5	3083.0	10.7	-42	215	Yes	
29	Polk	Conserve (#76)	398.7	3084.2	18.6	1004	372	Yes	
30	Polk	Farmland SAP 3,4	409.5	3080.1	7.8	30	156	Yes	
31	Polk	Farmland #143 SAP 1,2 (Shutdown)	409.5	3080.1	7.8	-764	156	Yes	
32	Polk	IMC New Wales (#114)	396.7	3079.4	18.3	56	367	Yes	
33	Polk	IMC New Wales (#170)	396.7	3079.4	18.3	222	367	Yes	
34	Polk	IMC New Wales (#34)	396.7	3079.4	18.3	129	367	Yes	
35	Polk	City of Lakeland - CT (#166)	409.2	3102.8	29.2	74.0	584.0	No	
36	Polk	Lakeland Power McIntosh 3 (#008)	408.5	3105.8	32.4	1420	648	Yes	
37	Polk	Mobil (#102)	398.4	3085.3	19.5	108	390	No	
38	Polk	Royster (#106)	406.8	3085.1	13.4	135	268	No	
39	Polk	Seminole (WR Grace) (#157)	409.7	3086.0	12.9	0	258	No	No PM
40	Polk	Seminole (WR Grace) (#68)	409.5	3086.5	13.4	157	269	No	
41	Polk	US Agrichem - Ft. Meade (#107)	416.2	3068.7	5.6	0	111	No	Not PSD-PM too small
42	Polk	US Agrichem - Ft. Meade (#64)	416.2	3068.7	5.6	0	111	No	Not PSD-PM too small
43	Sumter	FDOC Boiler #3	382.2	3166.1	97.6	Too far	1952	No	Too far

TABLE 5.6.1-15
CLASS I PSD SOURCE INVENTORY - NO_X

No.	Name	UTM Coordinates East	UTM Coordinates North	Distance to Polk Site (km)	Nearest Class I Recept. (km)	NO_X Emissions (TPY)	Comments
1	FPC/Debary Prop Turbines (No PSD #)	467.5	3197.2	134.3	125.2	4794	
2	FPC Intercession City Prop. Turbines 7 EAs (#180)	446.3	3126.0	61.2	113.2	616	
3	FPC Intercession City Prop. Turbines 7 FAs (#180)	446.3	3126.0	61.2	113.2	1132	
4	Florida Crushed Stone Kiln 1 * changed 12/26/91 (#90, #91)	360.0	3162.4	103.8	20.0	--	Date <88
5,7	CF Ind. Baseline C, D (Increment Expanding)	388.0	3116.0	49.6	68.9	--	
6,8	CF Ind. Proposed C, D (#155)	388.0	3116.0	49.6	68.9	0	No NO_X
9	Florida Mining & Materials Kiln 2 (#124)	356.2	3169.9	112.2	14.6	711	
10	TECO Big Bend - Unit 4 (#040)	361.9	3075.0	52.3	93.2	--	Date <88
11	TECO Big Bend - Units 1 & 2 (24-hr) * combined 1/3/92 (Increment Expanding)	361.9	3075.0	52.3	93.2	0	
12	TECO Big Bend- Unit 3 (24-hr) (Increment Expanding)	361.9	3075.0	52.3	93.2	0	
13	Pasco County Resource Recovery Facility (#127)	347.1	3139.2	93.6	27.4	1183	
14,15	FPC - Crystal River 4, 5 (#33)	334.2	3204.5	153.2	21.1	--	Date <88
16	FPC - Crystal River 1 (#007)	334.2	3204.5	153.2	21.1	--	Date <88
17	FPC - Crystal River 2 (#007)	334.2	3204.5	153.2	21.1	--	Date <88
18	Orlando Utility Stanton 1 (#84)	483.5	3150.6	103.4	142.5	--	Date <88
19	Orlando Utility Stanton 2	483.5	3150.6	103.4	142.5	3188	
20	Kissimmee Utility Existing (#182)	460.1	3129.3	71.9	125.2	0	PSD for SO_2 only
21	TECO Hardee Station (#140)	404.8	3057.4	19.0	126.1	1419	
22	Stauffer (Shut Down) (Increment Expanding)	325.6	3116.7	98.4	51.2	-28	
23	City of Lakeland - McIntosh 3 (#008)	408.5	3105.8	32.4	90.8	--	Date <88
24	Hillsborough County Resource Recovery Facility (#104)	368.2	3092.7	49.7	78.1	--	Date <88
25	Pinellas County Resource Recovery Facility (#098, #11)	335.3	3084.4	79.6	81.5	--	Date <88
26	Evans Packing (Shut Down)	383.3	3135.8	69.2	52.4	0	

TABLE 5.6.1-15
CLASS I PSD SOURCE INVENTORY - NO_X

No.	Name	UTM Coordinates East	UTM Coordinates North	Distance to Polk Site (km)	Nearest Class I Recept. (km)	NO_X Emissions (TPY)	Comments
27	Asphalt Pavers No. 4 * changed 1/3/92 * changed 12/26/91 (Not PSD)	361.4	3168.4	108.3	20.0	Approx. 40	Estimated
28	Asphalt Pavers No. 3 * changed 1/3/92 * added 12/26/91 (Not PSD)	359.9	3162.4	103.8	19.9	Approx. 40	Estimated
29	City of Lakeland - Combustion Turbines (#166)	409.2	3102.8	29.3	93.3	1860	
30	IMC - New Wales SAP #1, 2, 3 Baseline	396.6	3078.9	18.3	103.5	--	
31	IMC - New Wales SAP #1, 2, 3 Projected (#170)	396.6	3078.9	18.3	103.5	190.5	
32	IMC - New Wales SAP #4, 5 Projected (#170)	396.6	3078.9	18.3	103.5	--	Date <88
33	IMC - New Wales DAP (#114)	396.6	3078.9	18.3	103.5	--	Date <88
34	Proposed Pasco County Cogeneration Facility (#177)	385.6	3139.0	71.1	52.6	404.7	
35	Proposed Lake County Cogeneration Facility (#176)	434.0	3198.8	126.5	92.6	404.7	
36	CF Bartow Retired SAP (Increment Expanding)	408.5	3083.0	10.7	107.2	0	
37	CF Bartow DAP (#155)	408.5	3083.0	10.7	107.2	0	
38	CF Bartow #7 SAP (#155)	408.5	3083.0	10.7	107.2	0	
39	CLM Chloride Metals (Closed)	361.8	3088.3	54.3	80.3	--	
40	Conserve (Increment Expanding)	398.4	3084.2	18.9	100.1	--	
41	Conserve No. 1 SAP (#076)	398.4	3084.2	18.9	100.1	--	Date <88
42	Farmland SAP 1, 2 (Increment Expanding)	409.5	3079.5	7.3	110.5	0	
43	Farmland SAP 3, 4 (No PSD #)	409.5	3079.5	7.3	110.5	--	Date <88
44	Farmland SAP 5 (#143)	409.5	3079.5	7.3	110.5	52.2	
45	IMC - Lonesome Mine Dry 1 (#088)	389.6	3067.9	25.4	109.5	--	Date <88
46	IMC - Lonesome Mine Dry 2 (#088)	389.6	3067.9	25.4	109.5	--	Date <88
47	Royster #1 (#106)	406.7	3085.2	13.6	104.4	--	Date <88
48	Royster #2 (#106)	406.7	3085.2	13.6	104.4	--	Date <88
49,50	US Agrichem Fort Meade SAP 1, 2 (#107)	416.1	3068.6	5.6	123.2	--	Date <88

TABLE 5.6.1-15
CLASS I PSD SOURCE INVENTORY - NO_X

No.	Name	UTM Coordinates East	UTM Coordinates North	Distance to Polk Site (km)	Nearest Class I Recept. (km)	NO_X Emissions (TPY)	Comments
51	US Agrichem Fort Meade SAP X (Increment Expanding)	416.2	3068.7	5.5	123.1	--	
52	Seminole (WR Grace) Retired SAP (Increment Expanding)	409.7	3086.0	12.9	105.7	0	
53	Seminole (WR Grace) Gas Turbine (#157)	409.7	3086.0	12.9	105.7	35	
54	Seminole (WR Grace) 2 46 17 (#68)	409.5	3086.5	13.4	105.2	--	Date <88
55	Cargill (Gardinier) SAP 4, 5, 6 (Increment Expanding)	363.4	3082.4	51.5	86.4	--	
56,57	Cargill (Gardinier) SAP 7 Existing, Modification (#178)	363.4	3082.4	51.5	86.4	0	
58	AMAX (Mobil Big 4) (#1, #094)	394.8	3067.7	20.4	112.1	--	Date <88
59	AMAX (Mobil Big 4) (#1, #094)	394.9	3069.8	19.8	110.4	--	Date <88
60	Mobil - Nichols (#102)	398.3	3084.3	19.0	7.0	--	Date <88
61	FDOC Boiler #3 * changed 1/3/92 * changed 1/8/92 (No PSD #)	382.2	3166.1	97.6	40.4	Approx. 50	Estimated
62	ER Jahna (Lime Dryer) (No PSD #)	386.7	3155.8	86.4	47.4	0.3	
63	Oman Construction (Asphalt Plant) (No PSD #) (Shut down)	359.8	3164.9	106.0	19.5	--	Relocated
64	Dris Paving (Asphalt Plant) (No PSD #)	340.6	3119.2	86.4	46.5	Approx 100	Estimated
65	Overstreet Paving (Asphalt) * changed 1/3/92 * changed 1/8/92 (No PSD#)	355.9	3143.7	90.9	27.0	34	
66,67	New Port Richey Hospital Boiler #1 * changed 1/3/92 (No PSD#)	331.2	3124.5	97.2	42.2	0.2	
68,69	Hospital Corporation of America Boiler #1, #2 (No PSD #)	333.4	3141.0	105.0	25.6	Approx. 24	Estimated
70	Couch Construction - Odessa (Asphalt) * changed 1/3/92 (No PSD #)	340.7	3119.5	86.5	46.2	251	
71	Couch Construction - Zephyrhills (Asphalt) * changed 1/3/92 (No PSD #)	390.3	3129.4	60.4	61.8	69.2	
72	Agrico Baseline (Increment Expanding)	407.5	3071.3	7.2	115.9	-102.4	
73	Agrico Proposed (#179)	407.5	3071.3	7.2	115.9	118.2	
74	McCay Bay Refuse to Energy (#086)	360.0	3091.9	57.1	76.4	--	Date <88

TABLE 5.6.1-16
CLASS I PSD SOURCE INVENTORY - SO_2

No.	Name	UTM Coordinates		Distance to Polk Site (km)	Nearest Class I Recept. (km)	Emissions (TPY)
		East	North			
1	FPC/Debary Prop Turbines	467.5	3197.2	134.3	125.2	16199
2	FPC Intercession City Prop. Turbines	446.3	3126.0	61.2	113.2	10798
3	FPC Intercession City Prop. Turbines	446.3	3126.0	61.2	113.2	9589
4	Florida Crushed Stone Kiln 1 * changed 12/26/91	360.0	3162.4	103.8	20.0	3418
5,7	CF Ind. Baseline C, D	388.0	3116.0	49.6	68.9	-3501
6,8	CF Ind. Proposed C, D	388.0	3116.0	49.6	68.9	3793
9	Florida Mining & Materials Kiln 2	356.2	3169.9	112.2	14.6	50
10	TECO Big Bend- Unit 4	361.9	3075.0	52.3	93.2	22739
11	TECO Big Bend- Units 1 & 2 (24-hr) * combined 1/3/92	361.9	3075.0	52.3	93.2	-84605
12	TECO Big Bend- Unit 3 (24-hr)	361.9	3075.0	52.3	93.2	-42303
13	Pasco County Resource Recovery Facility	347.1	3139.2	93.6	27.4	490
14,15	FPC - Crystal River 4, 5	334.2	3204.5	153.2	21.1	70074
16	FPC - Crystal River 1	334.2	3204.5	153.2	21.1	-10906
17	FPC - Crystal River 2	334.2	3204.5	153.2	21.1	-64565
18	Orlando Utility Stanton 1	483.5	3150.6	103.4	142.5	3661
19	Orlando Utility Stanton 2 24 hr	483.5	3150.6	103.4	142.5	8419
20	Kissimmee Utility Existing	460.1	3129.3	71.9	125.2	1115
21	TECO Hardee Station	404.8	3057.4	19.0	126.1	9641
22	Stauffer (Shut Down)	325.6	3116.7	98.4	51.2	-1808
23	City of Lakeland - McIntosh 3	408.5	3105.8	32.4	90.8	17369
24	Hillsborough County Resource Recovery Facility	368.2	3092.7	49.7	78.1	743
25	Pinellas County Resource Recovery Facility	335.3	3084.4	79.6	81.5	2162
26	Evans Packing (Shut Down)	383.3	3135.8	69.2	52.4	0
27	Asphalt Pavers No. 4 * changed 1/3/92 * changed 12/26/91	361.4	3168.4	108.3	20.0	78

TABLE 5.6.1-16
CLASS I PSD SOURCE INVENTORY - SO_2

No.	Name	UTM Coordinates		Distance to Polk Site (km)	Nearest Class I Recept. (km)	Emissions (TPY)
		East	North			
28	Asphalt Pavers No. 3 * changed 1/3/92 * added 12/26/91	359.9	3162.4	103.8	19.9	78
29	City of Lakeland - Combustion Turbines	409.2	3102.8	29.3	93.3	1011
30	IMC - New Wales SAP #1, 2, 3 Baseline	396.6	3078.9	18.3	103.5	-5908
31	IMC - New Wales SAP #1, 2, 3 Projected	396.6	3078.9	18.3	103.5	6351
32	IMC - New Wales SAP #4, 5 Projected	396.6	3078.9	18.3	103.5	4234
33	IMC - New Wales DAP	396.6	3078.9	18.3	103.5	192
34	Proposed Pasco County Cogeneration Facility	385.6	3139.0	71.1	52.6	175
35	Proposed Lake County Cogeneration Facility	434.0	3198.8	126.5	92.6	175
36	CF Bartow Retired SAP	408.5	3083.0	10.7	107.2	-3841
37	CF Bartow DAP	408.5	3083.0	10.7	107.2	149
38	CF Bartow #7 SAP	408.5	3083.0	10.7	107.2	1837
39	CLM Chloride Metals (Shut Down)	361.8	3088.3	54.3	80.3	0
40	Conserve	398.4	3084.2	18.9	100.1	-528
41	Conserve No. 1 SAP	398.4	3084.2	18.9	100.1	1459
42	Farmland SAP 1, 2	409.5	3079.5	7.3	110.5	-1895
43	Farmland SAP 3, 4	409.5	3079.5	7.3	110.5	2333
44	Farmland SAP 5	409.5	3079.5	7.3	110.5	1457
45	IMC - Lonesome Mine Dry 1	389.6	3067.9	25.4	109.5	639
46	IMC - Lonesome Mine Dry 2	389.6	3067.9	25.4	109.5	735
47	Royster #1	406.7	3085.2	13.6	104.4	-8947
48	Royster #2	406.7	3085.2	13.6	104.4	1240
49,50	US Agrichem Fort Meade SAP 1, 2	416.1	3068.6	5.6	123.2	4376
51	US Agrichem Fort Meade SAP X	416.2	3068.7	5.5	123.1	-2737
52	Seminole (WR Grace) Retired SAP	409.7	3086.0	12.9	105.7	-7502

TABLE 5.6.1-16
CLASS I PSD SOURCE INVENTORY - SO_2

No.	Name	UTM Coordinates		Distance to Polk Site (km)	Nearest Class I Recept. (km)	Emissions (TPY)
		East	North			
53	Seminole (WR Grace) 2 46 16	409.7	3086.0	12.9	105.7	2556
54	Seminole (WR Grace) 2 46 17	409.5	3086.5	13.4	105.2	2501
55	Cargill (Gardinier) SAP 4, 5, 6	363.4	3082.4	51.5	86.4	-6818
56,57	Cargill (Gardinier) SAP 7 Existing, Modification	363.4	3082.4	51.5	86.4	-485
58	AMAX (Mobil) Big 4 Mine	394.8	3067.7	20.4	112.1	21
59	AMAX (Mobil) Big 4 Mine	394.9	3069.8	19.8	110.4	568
60	Mobil - Nichols	398.3	3084.3	19.0	7.0	83
61	FDOC Boiler #3 * changed 1/3/92 * changed 1/8/92	382.2	3166.1	97.6	40.4	104
62	ER Jahna (Lime Dryer)	386.7	3155.8	86.4	47.4	28
63	Oman Construction (Asphalt Plant) (Shut down)	359.8	3164.9	106.0	19.5	0
64	Dris Paving (Asphalt Plant)	340.6	3119.2	86.4	46.5	8
65	Overstreet Paving (Asphalt) * changed 1/3/92 * changed 1/8/92	355.9	3143.7	90.9	27.0	127
66,67	New Port Richey Hospital Boiler #1, #2 * changed 1/3/92	331.2	3124.5	97.2	42.2	3
68,69	Hospital Corporation of America Boiler #1	333.4	3141.0	105.0	25.6	6
70	Couch Construction - Odessa (Asphalt) * changed 1/3/92	340.7	3119.5	86.5	46.2	252
71	Couch Construction - Zephyrhills (Asphalt) * changed 1/3/92	390.3	3129.4	60.4	61.8	123
72	Agrico Baseline	407.5	3071.3	7.2	115.9	-2626
73	Agrico Proposed	407.5	3071.3	7.2	115.9	3942
74	McCay Bay Refuse to Energy	360.0	3091.9	57.1	76.4	743

TABLE 5.6.1-17
AAQS SOURCE INVENTORY - NO_x

No.	County	Source Name	UTM Coordinates East (km)	UTM Coordinates North (km)	Distance (km)	Emissions (TPY)	Screen (Q=20*D)	Model? (Yes/No)	Comments
1	Glades	ER Janna Lime Dryer	386.7	3155.9	86.7	0	1730	No	Q<20D
2	Hardee	American Orange Corp. (Permit Expired)	429.8	3047.3	30.8	0	616	No	Q<20D
3	Hardee	TECO Hardee Station	404.8	3057.4	19.0	5039	380	Yes	Q>20D
4	Hardee	Wachula Power	418.4	3047.0	27.2	65	545	No	Q<20D
5	Highlands	FPC - Avon Park	451.4	3050.5	43.9	27	877	No	Q<20D
6	Hillsborough	Alumax Extrusions	385.6	3097.0	36.8	129	737	No	Q<20D
7	Hillsborough	AMAX Mobil Mining - Big Four Mine	394.7	3069.6	20.1	0	401	No	Q<20D
8	Hillsborough	Cargill	362.9	3082.5	52.1	471	1042	No	Q<20D
9	Hillsborough	Cargill (Gardinier)	358.1	3091.7	59.0	0	1179	No	Q<20D
10	Hillsborough	CF Industries	388.0	3116.0	49.6	1116	993	Yes	Q>20D
11	Hillsborough	Hillsborough Co. Resource Recovery	368.2	3092.7	49.8	657	996	No	Q<20D
12	Hillsborough	IMC - Fort Lonesome	389.6	3067.9	25.3	608	506	Yes	Q>20D
13	Hillsborough	International Petroleum Corp. (Nat. Gas Fired)	389.0	3098.0	34.9	0	699	No	Q<20D
14	Hillsborough	John Carlo, Inc.	348.0	3096.4	70.0	0	1400	No	Q<20D
15	Hillsborough	Mckay Bay Refuse-To-Energy	360.0	3091.9	57.2	1310	1144	Yes	Q>20D
16	Hillsborough	TECO - Big Bend Station	361.9	3075.0	52.4	41912	1048	Yes	Q>20D
17	Hillsborough	TECO - Gannon Station	360.0	3087.5	56.0	28083	1120	Yes	Q>20D
18	Hillsborough	TECO - Hookers Station	358.0	3091.0	58.8	3573	1177	Yes	Q>20D
19	Hillsborough	Consolidated Minerals	393.8	3096.3	30.4	148	607.3	No	Q<20D
20	Hillsborough	CLM - Chloride Metals (Shut Down)	361.8	3088.3	54.4	0	1089	No	Q<20D
21	Orange	Orlando Utilities Stanton #1	483.5	3150.6	103.0	10982	2060	No	Too Far
22	Orange	Orlando Utilities Stanton #2	483.5	3150.6	103.0	3188	2060	No	Too Far
23	Osceola	FPC Intercession City	446.3	3126.0	61.2	1748	1224	Yes	Q>20D
24	Osceola	Kissimee Utilities	460.1	3129.3	71.9	1625	1437.6	Yes	Q>20D
25	Pasco	Couch Construction Co. (Zepherhills)	390.3	3129.4	60.5	0	1209	No	Q<20D

TABLE 5.6.1-17
AAQS SOURCE INVENTORY - NO_x

No.	County	Source Name	UTM Coordinates East (km)	UTM Coordinates North (km)	Distance (km)	Emissions (TPY)	Screen (Q=20*D)	Model? (Yes/No)	Comments
26	Pasco	Couch Const. Odessa	340.7	3119.5	86.6	6	1732	No	Q<20D
27	Pasco	Dris Paving	340.6	3119.2	86.4	100	1728	No	Q<20D
28	Pasco	Evans (Shut Down)				0		No	Q<20D
29	Pasco	New Port Richey Community Hospital	333.4	3133.0	100.2	2	2004.0	No	Q<20D
30	Pasco	Overstreet Paving Co.	355.9	3143.7	91.0	5	1820	No	Q<20D
31	Pasco	Pasco Cogen	385.6	3139.0	71.1	405	1422.9	No	Q<20D
32	Pasco	Pasco County Resource Recovery	347.0	3139.0	93.6	1183	1873	No	Q<20D
33	Pinellas	Pinellas Resource Recovery Facility	335.2	3084.1	79.8	947	1595	No	Q<20D
34	Pinellas	Stauffer Chemical Co. (Shut Down)	325.6	3116.7	98.5	0	1970	No	Q<20D
35	Polk	Adams Packing	421.7	3104.2	31.2	16	623	No	Q<20D
36	Polk	Agrico Chemical Co. - Pierce	403.7	3079.0	11.8	81	235	No	Q>20D
37	Polk	Alcoma Packing Co.	451.6	3085.5	39.1	59	781	No	Q<20D
38	Polk	Allsun Products (Shut Down)	413.5	3093.8	19.9	0	398	No	Q<20D
39	Polk	Bordo Citrus Product Co.	427.8	3097.5	27.2	29	544	No	Q<20D
40	Polk	Cargill (Gardinier)	415.3	3063.3	10.7	176	213	No	Q<20D
41	Polk	CF - Bartow	408.5	3083.0	10.8	0	216	No	Q<20D
42	Polk	Citrus Hill Manufacturing Co.	411.6	3081.4	8.0	11	159	No	Q<20D
43	Polk	Citrus Hill Manufacturing Co. (Frost Proof)	447.9	3068.3	34.2	313	684	No	Q<20D
44	Polk	Citrus World	441.0	3087.3	30.0	1303	599	Yes	Q>20D
45	Polk	City of Lakeland CT's	409.2	3102.8	29.2	186	584	No	Q<20D
46	Polk	City of Lakeland - Larsen Station	409.0	3106.2	32.7	92	654	No	Q<29D
47	Polk	City of Lakeland - McIntosh	408.5	3105.8	32.4	1557	648	Yes	Q>20D
48	Polk	Coca Cola	421.6	3103.7	30.7	270	614	No	Q<20D
49	Polk	Conserve (Nichols)	398.7	3084.2	18.7	13	374	No	Q<20D
50	Polk	Dundee Citrus	438.8	3099.9	35.7	17	714	No	Q<20D

TABLE 5.6.1-17
AAQS SOURCE INVENTORY - NO_x

No.	County	Source Name	UTM Coordinates East (km)	UTM Coordinates North (km)	Distance (km)	Emissions (TPY)	Screen (Q=20*D)	Model? (Yes/No)	Comments
51	Polk	Estech-Agricola (Shut Down)						No	Shut Down
52	Polk	Farmland (SAP 5)	409.5	3080.1	7.8	52	156	No	Q<20D
53	Polk	Farmland Industries	409.5	3080.1	7.8	205	156	Yes	Q>20D
54	Polk	Florida Distillers - Lake Alfred	428.0	3108.1	36.8	17	737	No	Q<20D
55	Polk	Florida Distillers Co. (Aubrundale)	421.4	3102.9	29.9	194	597	No	Q<20D
56	Polk	Holly Hill Fruit Products	441.0	3115.4	49.3	15	987	No	Q<20D
57	Polk	IMC - New Wales	396.7	3079.4	18.3	367	367	Yes	Q=20D
58	Polk	IMC Noralyn	414.7	3080.3	6.4	0	128	No	Q<20D
59	Polk	IMC Prairie	402.9	3087.0	17.4	0	348	No	Q<20D
60	Polk	John Carlo Inc.	426.2	3104.1	32.5	12	649	No	Q<20D
61	Polk	Juice Bowl Products	409.4	3099.9	26.5	39	529	No	Q<20D
62	Polk	Kaplan Industries, Inc.	418.3	3079.3	6.7	20	134	No	Q<20D
63	Polk	Laidlaw Env. Services, Inc.	424.0	3091.9	20.4	0	409	No	Q<20D
64	Polk	Mobil - Electrophos Division (Shut Down)							Shut Down
65	Polk	Mobil Mining & Minerals	398.4	3085.3	19.5	125	390	No	Q<20D
66	Polk	Owens Brockway (Illinois)	423.4	3102.3	28.9	393	675	No	Q<20D
67	Polk	Owens-Illinois	406.0	3102.3	29.6	391	591	No	Q<20D
68	Polk	Pavex Corp.	413.0	3086.2	12.4	24	247	No	Q<20D
69	Polk	Royster Mulberry	406.8	3085.1	13.2	20	265	No	Q<20D
70	Polk	Schering Berlin Polymers,Inc.	410.7	3098.9	25.3	530	505	Yes	Q>20D
71	Polk	Seminole Fertilizer Corp. (WR Grace)	409.8	3086.6	13.5	552	269	Yes	Q>20D
72	Polk	US Agrichem - Bartow	413.2	3086.3	12.3	21	247	No	Q<20D
73	Polk	US Agrichem - Fort Meade	416.0	3069.0	5.2	13	104	No	Q<20D
74	Polk	Agrico - S. Pierce	407.5	3071.5	7.2	139	144	No	Q<20D
75	Sumter	FDOC Boiler #3	382.2	3166.1	97.6	100	1952	No	Q<20D

TABLE 5.6.1-18
AAQS SOURCE INVENTORY - SO_2

No.	County	Source Name	UTM Coordinates		Distance (Km)	Emissions (TPY)	Screen (Q=20*D)	Model? (Yes/No)
			East (Km)	North (Km)				
1	Polk	Adams Packing	421.7	3104.2	31.2	94	624	No
2	Polk	Agrico - S. Pierce	407.5	3071.5	7.1	3206	142	Yes
3	Polk	Alcoma Packing	451.6	3085.5	39.2	328	783	No
4	Hardee	American Orange Corp.	429.8	3047.3	30.8	198	617	No
5	Polk	Brewer/Pavex Co.	413.0	3086.2	12.4	75	247	No
6	Polk	CF - Bartow	408.4	3082.4	10.3	3904	206	Yes
7	Polk	Citrus Hill	447.9	3068.3	34.2	410	683	No
8	Polk	Citrus World	441.0	3087.3	30.0	877	599	Yes
9	Polk	Conserve - Nichols	398.7	3084.2	18.6	1582	372	Yes
10	Hillsborough	Consolidated Minerals	393.8	3096.3	30.3	817	606	Yes
11	Polk	Farmland - Green Bay	409.5	3080.1	7.8	3825	156	Yes
12	Highlands	FPC - Avon Park	451.4	3050.5	43.9	58	879	No
13	Polk	Gardinier Mine (Cargil) Ft. Meade	415.3	3063.3	10.7	1173	213	Yes
14	Hardee	TECO - Hardee Station	404.8	3057.4	19.0	16081	380	Yes
15	Polk	Holly Hill Fruit	441.0	3115.4	49.4	398	988	No
16	Hillsborough	IMC - Lonesome Mine	389.6	3067.9	25.3	1547	506	Yes
17	Polk	IMC - New Wales	396.7	3079.4	18.3	10561	367	Yes
18	Polk	IMC - Noralyn	414.7	3080.3	6.4	505	128	Yes
19	Polk	IMC - Prairie	402.9	3087.0	17.3	137	346	No
20	Hillsborough	International Petroleum	389.0	3098.0	34.9	61	697	No
21	Polk	John Carlo Florida	426.2	3104.1	32.5	33	650	No
22	Polk	City of Lakeland - Larsen Station	409.0	3106.2	32.7	3998	654	Yes
23	Polk	City of Lakeland - McIntosh Station	409.2	3106.2	32.7	30176	654	Yes
24	Polk	Mobil - Nichols	398.4	3085.3	19.5	898	390	Yes

TABLE 5.6.1-18
AAQS SOURCE INVENTORY - SO_2

No.	County	Source Name	UTM Coordinates East (Km)	UTM Coordinates North (Km)	Distance (Km)	Emissions (TPY)	Screen (Q=20*D)	Model? (Yes/No)
25	Polk	Owens-Illinois Glass	406.0	3102.3	29.6	21	591	No
26	Polk	Royster - Mulberry	406.8	3085.1	13.4	1265	268	Yes
27	Polk	WR Grace (Seminole)	409.8	3086.6	13.4	8674	269	Yes
28	Hillsborough	TECO - Big Bend	361.9	3075.0	52.3	237646	1046	Yes
29	Hillsborough	TECO - Gannon	360.0	3087.5	55.9	126940	1118	Yes
30	Hillsborough	TECO - Hookers PT	358.0	3091.0	58.7	13522	1175	Yes
31	Polk	Laidlaw Environmental Services	422.7	3091.9	19.9	240	398	No
32	Polk	US Agrichem - Fort Meade	416.0	3069.0	5.2	2710	104	Yes
33	Hardee	Wachula City Power	418.4	3047.0	27.2	180	545	No
34	Hillsborough	CF Industries	388.0	3116.0	49.4	7096	988	Yes
35	Hillsborough	Hillsborough County Resource Recovery Facility	368.2	3092.7	49.7	893	994	No
36	Polk	AMAX (Mobil) Big 4 Mine	394.7	3096.6	20.0	569	399	Yes
37	Polk	US Agrichem - Bartow	413.2	3086.3	12.4	423	249	Yes
38	Polk	Coca Cola	421.6	3103.7	30.7	119	614	No
39	Polk	Agrico - Pierce	403.7	3079.0	11.7	417	233	Yes
40	Polk	Kaplan Industries	418.3	3079.3	6.8	337	136	Yes
41	Polk	Bordo Citrus	427.8	3097.5	27.2	60	545	No

TABLE 5.6.1-19
AAQS SOURCE INVENTORY - PM

No.	County	Source Name	UTM Coordinates East (km)	UTM Coordinates North (km)	Distance (km)	Emissions (TPY)	Screen (Q=20*D)	Model? (Yes/No)	Comments
1	Glades	ER Janna Lime Dryer	386.7	3155.9	86.7	139.0	1730.0	No	Q<20D
2	Hardee	American Orange Corp. (Permit Expired)	429.8	3047.3	30.8	0.0	615.7	No	Q<20D
3	Hardee	TECO Hardee	404.8	3057.4	19.0	131.0	380.0	No	Q<20D
4	Hardee	Wachula Power	418.4	3047.0	27.4	20.0	547.0	No	Q<20D
5	Highlands	FPC - Avon Park	451.4	3050.5	43.9	422.8	877.3	No	Q<20D
6	Hillsborough	Alumax Extrusions	385.6	3097.0	36.8	57.9	736.8	No	Q<20D
7	Hillsborough	AMAX Mobil Mining - Big Four Mine	394.7	3069.6	20.1	50.2	401.3	No	Q<20D
8	Hillsborough	Cargill	362.9	3082.5	52.1	874.7	1042.3	No	Q<20D
9	Hillsborough	Cargill (Gardinier)	358.1	3091.7	59.0	5.8	1179.0	No	Q<20D
10	Hillsborough	CF Industries	388.0	3116.0	49.6	878.5	992.8	No	Q<20D
11	Hillsborough	CLM - Chloride Metals (Shut Down)	361.8	3088.3	54.4	0.0	1089.0	No	Q<20D
12	Hillsborough	Consolidated Minerals	393.8	3096.3	30.4	507.0	607.3	No	Q<20D
13	Hillsborough	Hillsborough Co. Resource Recovery	368.2	3092.7	49.8	174.1	995.7	No	Q<20D
14	Hillsborough	IMC - Fort Lonesome	389.6	3067.9	25.2	634.0	503.0	Yes	Q>20D
15	Hillsborough	International Petroleum Corp. (Nat. Gas Fired)	389.0	3098.0	34.9	0.0	698.8	No	Q<20D
16	Hillsborough	John Carlo, Inc.	348.0	3096.4	70.0	8.0	1400.3	No	Q<20D
17	Hillsborough	Mckay Bay Refuse-To-Energy	360.0	3091.9	57.2	250.9	1144.1	No	Q<20D
18	Hillsborough	TECO-Gannon Sta.	360.0	3087.5	56.0	6305.8	1119.5	Yes	Q>20D
19	Hillsborough	TECO-Hookers Sta.	358.0	3091.0	58.8	1227.4	1176.8	Yes	Q>20D
20	Hillsborough	TECO-Big Bend Sta.	361.9	3075.0	52.4	7869.8	1048.2	Yes	Q>20D
21	Manatee	FPL Manatee	367.3	3054.2	50.7	2965.0	1014.0	Yes	Q>20D
22	Orange	Orlando Utilities Stanton #1	483.5	3150.6	103.0	548.0	2060	No	Too Far
23	Orange	Orlando Utilities Stanton #2	483.5	3150.6	103.0	375.0	2060	No	Too Far
24	Osceola	FPC Intercession City	446.3	3126.0	61.2	108.0	1224.0	No	Q<20D

TABLE 5.6.1-19
AAQS SOURCE INVENTORY - PM

No.	County	Source Name	UTM Coordinates East (km)	UTM Coordinates North (km)	Distance (km)	Emissions (TPY)	Screen (Q=20*D)	Model? (Yes/No)	Comments
25	Osceola	Kissimee Utilities	460.1	3129.3	71.9	102.5	1437.6	No	Q<20D
26	Pasco	Couch Const. Odessa	340.7	3119.5	86.6	2.8	1731.6	No	Q<20D
27	Pasco	Couch Construction - Zepherhills	390.3	3129.4	60.5	15.9	1209.3	No	Q<20D
28	Pasco	Dris Paving	340.6	3119.2	86.4	100.0	1728.0	No	Q<20D
29	Pasco	Evans (Shut Down)				0.0		No	Q<20D
30	Pasco	New Port Richey Community Hospital	333.4	3133.0	100.2	0.2	2004.0	No	Q<20D
31	Pasco	Overstreet Paving Co.	355.9	3143.7	91.0	3.5	1820.2	No	Q<20D
32	Pasco	Pasco Cogen	385.6	3139.0	71.1	27.0	1422.9	No	Q<20D
33	Pasco	Pasco County Resource Recovery	347.0	3139.0	93.6	59.1	1872.7	No	Q<20D
34	Pinellas	Pinellas Resource Recovery Facility	335.2	3084.1	79.8	373.4	1595.1	No	Q<20D
35	Pinellas	Stauffer Chemical Co. (Shut Down)	325.6	3116.7	98.5	0	1969.7	No	Q<20D
36	Polk	Adams Packing	421.7	3104.2	31.2	144.0	623.0	No	Q<20D
37	Polk	Agrico - Pierce	403.7	3079.0	11.8	605.2	229.0	Yes	Q>20D
38	Polk	Agrico - S. Pierce	407.7	3071.5	7.2	232.0	144.0	Yes	Q>20D
39	Polk	Alcoa	416.8	3116.0	42.1	446.0	842.0	No	Q<20D
40	Polk	Alcoma Packing Co.	451.6	3085.5	39.1	59.7	781.2	No	Q<20D
41	Polk	Allsun Products (Shut Down)	413.5	3093.8	19.9	0.0	398.3	No	Q<20D
42	Polk	Bordo Citrus Product Co.	427.8	3097.5	27.2	0.0	543.8	No	Q<20D
43	Polk	Cargill (Gardinier) - Fort Meade	415.3	3063.3	10.8	132.0	216.0	No	Q<20D
44	Polk	CF - Bartow	408.5	3083.0	10.8	805.0	215.8	Yes	Q>20D
45	Polk	Citrus Hill Manufacturing Co.	411.6	3081.4	8.0	0.4	159.4	No	Q<20D
46	Polk	Citrus Hill Manufacturing Co. (Frost Proof)	447.9	3068.3	34.2	50.0	684.0	No	Q<20D
47	Polk	Citrus World	441.0	3087.3	30.1	412.0	602.0	No	Q<20D
48	Polk	Coca Cola	421.6	3103.7	30.7	332.0	613.0	No	Q<20D

TABLE 5.6.1-19
AAQS SOURCE INVENTORY - PM

No.	County	Source Name	UTM Coordinates East (km)	UTM Coordinates North (km)	Distance (km)	Emissions (TPY)	Screen (Q=20*D)	Model? (Yes/No)	Comments
49	Polk	Conserve	398.7	3084.2	18.4	1590.0	368.0	Yes	Q>20D
50	Polk	C&M Products	405.5	3079.1	9.9	37.0	198.0	No	Q<20D
51	Polk	Dundee Citrus	438.8	3099.9	35.7	0.0	714.5	No	Q<20D
52	Polk	Earl Massey	440.4	3103.4	39.5	39.0	790.0	No	Q<20D
53	Polk	Eger Concrete	428.1	3102.0	31.3	34.0	627.0	No	Q<20D
54	Polk	ER Carpenter	397.0	3131.5	60.0	55.0	1199.0	No	Q<20D
55	Polk	Erly Juice	399.0	3101.8	31.6	13.0	632.0	No	Q<20D
56	Polk	Estech-Agricola (Shut Down)							Q<20D
57	Polk	Ewell Industries	406.3	3092.9	20.4	103.0	408.0	No	Q<20D
58	Polk	Farmland - Bartow	409.5	3080.1	7.6	230.0	152.0	Yes	Q>20D
59	Polk	Farmland (SAP 5)	409.5	3080.1	7.8	0.0	156.8	No	Q<20D
60	Polk	Florida Distillers Co. (Aubrundale)	421.4	3102.9	29.9	2.3	597.1	No	Q<20D
61	Polk	Florida Distillers - Lake Alfred	428.0	3108.1	36.8	4.1	736.8	No	Q<20D
62	Polk	Florida Mining & Materials (Eger)	420.8	3103.4	30.2	118.0	604.0	No	Q<20D
63	Polk	Florida Privitization	418.3	3048.0	26.4	279.6	527.0	No	Q<20D
64	Polk	Florida Tile	405.4	3102.4	29.7	73.0	593.0	No	Q<20D
65	Polk	Holly Hill Fruit Products	441.0	3115.4	49.3	94.0	986.9	No	Q<20D
66	Polk	IMC - Kingsford	398.2	3075.7	15.9	162.0	318.0	No	Q<20D
67	Polk	IMC - New Wales	396.7	3079.4	18.1	1322.0	362.0	Yes	Q>20D
68	Polk	IMC - Noralyn	414.7	3080.3	6.3	682.0	127.0	Yes	Q>20D
69	Polk	IMC - Prairie	402.9	3087.0	17.1	5.0	342.0	No	Q<20D
70	Polk	Imperial Phosphates	404.8	3069.5	10.2	39.0	205.0	No	Q<20D
71	Polk	John Carlo (Asphalt Plant)	426.2	3104.1	32.5	12.4	649.0	No	Q<20D
72	Polk	Juice Bowl Products	409.4	3099.9	26.5	0.3	529.2	No	Q<20D
73	Polk	Kaiser Aluminum	408.3	3085.5	12.8	95.5	257.0	No	Q<20D

TABLE 5.6.1-19
AAQS SOURCE INVENTORY - PM

No.	County	Source Name	UTM Coordinates East (km)	UTM Coordinates North (km)	Distance (km)	Emissions (TPY)	Screen (Q=20*D)	Model? (Yes/No)	Comments
74	Polk	Kaplan Industries,Inc.	418.3	3079.3	6.7	12.0	134.4	No	Q<20D
75	Polk	Laidlaw Env. Services,Inc.	424.0	3091.9	20.4	1.3	408.9	No	Q<20D
76	Polk	City of Lakeland CT's	408.5	3105.8	29.2	74.0	584.0	No	Q<20D
77	Polk	City of Lakeland - Larsen Station	409.0	3106.2	32.6	128.0	652.0	No	Q>20D
78	Polk	City Of Lakeland - McIntosh	408.5	3105.8	32.4	2358.0	648.5	Yes	Q>20D
79	Polk	Macasphalt	423.1	3101.5	29.0	49.0	579.0	No	Q<20D
80	Polk	Mobil Electrophos (Shut Down)	405.6	3079.4	10.0	0	200.0	No	Q<20D
81	Polk	Mobil - Nichols	398.4	3085.3	19.3	385.0	385.0	Yes	Q=20D
82	Polk	Orange Company of Florida	418.7	3083.6	10.7	91.0	214.0	No	Q<20D
83	Polk	Owens Brockway (Illinois)	423.4	3102.3	28.9	188.2	596.4	No	Q<20D
84	Polk	Pavers Inc.	414.0	3098.2	24.2	113.0	484.0	No	Q<20D
85	Polk	Pavex Corp.	413.0	3086.2	12.4	12.6	247.4	No	Q<20D
86	Polk	Quikrete	412.8	3099.0	25.0	190.0	501.0	No	Q<20D
87	Polk	Ridge Pallets	418.6	3084.1	11.1	78.0	222.0	No	Q<20D
88	Polk	Rinker Cencon	412.4	3099.0	25.1	159.0	501.0	No	Q<20D
89	Polk	Royster (PSD)	406.8	3085.1	13.2	105.0	265.0	No	Q<20D
90	Polk	Schering Berlin Polymers,Inc.	410.7	3098.9	25.3	27.6	505.2	No	Q<20D
91	Polk	Seminole Fertilizer Corp. (WR Grace)	409.8	3086.6	13.5	948.7	269.5	Yes	Q>20D
92	Polk	Standard Sand & Silica	441.5	3118.2	52.1	286.0	1041.0	No	Q<20D
93	Polk	Sun Pac	422.7	3092.6	20.5	62.0	411.0	No	Q<20D
94	Polk	US Agrichem - Bartow	413.2	3086.3	12.3	268.0	247.0	Yes	Q>20D
95	Polk	US Agrichem - Fort Meade	416.0	3069.0	5.2	691	103.7	Yes	Q>20D
96	Polk	Vigoro	427.9	3097.4	27.2	136.0	544.0	No	Q<20D
97	Sumter	FDOC Boiler #3	382.2	3166.1	97.6	100.0	1952.0	No	Q<20D

TABLE 5.6.1-20
RECEPTOR GRID FOR PSD CLASS I AREA

Point	UTM Coordinates		Distance from Polk County Site *		
	East (km)	North (km)	ΔX (km)	ΔY (km)	Distance (km)
1	340.3	3,165.7	-74.0	91.82	117.9
2	340.3	3,167.7	-74.0	93.82	119.5
3	340.3	3,169.8	-74.0	95.92	121.1
4	340.7	3,171.9	-73.6	98.02	122.6
5	342.0	3,174.0	-72.3	100.12	123.5
6	343.0	3,176.2	-71.3	102.32	124.7
7	343.7	3,178.3	-70.6	104.42	126.0
8	342.4	3,180.6	-71.9	106.72	128.7
9	341.1	3,183.4	-73.2	109.52	131.7
10	339.0	3,183.4	-75.3	109.52	132.9
11	336.5	3,183.4	-77.8	109.52	134.3
12	334.0	3,183.4	-80.3	109.52	135.8
13	331.5	3,183.4	-82.8	109.52	137.3

* Location of "zero point" for Polk County Site is 414.300 km East; 3,073.880 km North

TABLE 5.6.1-21
WORST-CASE LOAD ANALYSIS RESULTS (PC UNITS)

Averaging Time	Year	Maximum SO_2 Concentration ($\mu g/m^3$)		
		50% Load	75% Load	100% Load
3-Hour	1986	64.6	86.2	106.8
24-Hour	1986	15.1	18.3	21.1
Annual	1986	1.48	1.83	2.05

Source: Ebasco Environmental, 1992

TABLE 5.6.1-22
MAXIMUM OFF-SITE IMPACTS
OF AUXILIARY BOILER AND DIESEL GENERATOR

Pollutant	Averaging Period	Maximum[1] Predicted Concentration ($\mu g/m^3$)	Location[2] X (m)	Location[2] Y (m)	Year	PSD Increment ($\mu g/m^3$)	AAQS ($\mu g/m^3$)
Carbon Monoxide	1-Hour	240.4	-104	-591	1985	N/A	40,000
	8-Hour	72.5	-450	-536	1986	N/A	10,000
Nitrogen Dioxide	Annual	0.12	-450	-536	1984	25	100
Sulfur Dioxide	3-Hour	23.2	-450	-536	1983	512	1,300
	24-Hour	7.0	-450	-536	1986	91	260
	Annual	0.007	-450	-536	1984	20	60
Particulate Matter (PM_{10} or TSP)[3]	24-Hour	6.1	-450	-536	1986	37	150
	Annual	0.006	-450	-536	1984	19	50
Beryllium	24-Hour	0.00041	-450	-536	1986	N/A	N/A
Sulfuric Acid Mist	24-Hour	0.28	-450	-536	1986	N/A	N/A
Benzene	24-Hour	0.002	-450	-536	1986	N/A	N/A
Inorganic Arsenic	24-Hour	0.00066	-450	-536	1986	N/A	N/A

(1) Short-term values are highest, second-highest values for this analysis.
(2) With respect to zero point of 414.30 km E; 3,073.88 km N.
(3) The allowable PSD increment is evaluated for TSP whereas the AAQS compliance is evaluated for PM_{10}. As a conservative approach, all project emissions of particulate matter were assumed to be in the form of PM_{10}.

N/A = Not applicable

Source: Ebasco Environmental, 1992

TABLE 5.6.1-23
SUMMARY OF SIGNIFICANT IMPACT AREAS (CASE B)

Pollutant	Averaging Period	Maximum[1] Predicted Concentration ($\mu g/m^3$)	Location[2] X (m)	Location[2] Y (m)	Year	Significance Level ($\mu g/m^3$)	Distance to Significance (km)	Off-site Significant Impact (Yes/No)
Carbon Monoxide	1-Hour	439.3	2,000	-500	1984	2,000	None	No
	8-Hour	114.2	3,000	-500	1986	500	None	No
Nitrogen Dioxide	Annual	4.6	-2,000	1,000	1986	1	33	Yes
Sulfur Dioxide	3-Hour	358.1	1,000	-500	1983	25	>50	Yes
	24-Hour	80.2	1,000	-500	1985	5	>50	Yes
	Annual	4.8	-2,000	1,000	1986	1	40	Yes
Particulate Matter (PM_{10} or TSP)[3]	24-Hour	36.6	-2,320	0	1983	5	12	Yes
	Annual	4.7	-2,000	-500	1982	1	7	Yes
Beryllium	24-Hour	0.0018	1,000	-500	1985	N/A	N/A	N/A
Sulfuric Acid Mist	24-Hour	15.7	1,000	-500	1985	N/A	N/A	N/A
Inorganic Arsenic	24-Hour	0.00679	1,000	-500	1985	N/A	N/A	N/A

(1) Short-term values are highest rather than highest, second-highest values for this analysis.
(2) With respect to zero point of 414.30 km E; 3,073.88 km N.
(3) The allowable PSD increment is evaluated for TSP whereas the AAQS compliance is evaluated for PM_{10}. As a conservative approach, all project emissions of particulate matter were assumed to be in the form of PM_{10}.

N/A = Not applicable

Source: Ebasco Environmental, 1992

TABLE 5.6.1-24
SUMMARY OF MAXIMUM OFF-SITE IMPACTS (CASE B)

Pollutant	Averaging Period	Maximum[1] Predicted Concentration ($\mu g/m^3$)	Location[2] X (m)	Location[2] Y (m)	Year	PSD Increment ($\mu g/m^3$)	AAQS ($\mu g/m^3$)
Carbon Monoxide	1-Hour	414.5	2,000	-500	1984	N/A	40,000
	8-Hour	97.2	2,000	-500	1983	N/A	10,000
Nitrogen Dioxide	Annual	4.6	-2,000	1,000	1986	25	100
Sulfur Dioxide	3-Hour	263.7	1,000	-500	1983	512	1,300
	24-Hour	65.5	1,000	-500	1984	91	260
	Annual	4.8	-2,000	1,000	1986	20	60
Particulate Matter (PM_{10} or TSP)[3]	24-Hour	30.4	-2,000	-500	1986	37	150
	Annual	4.7	-2,000	-500	1982	19	50
Beryllium	24-Hour	0.0018	1,000	-500	1985	N/A	N/A
Sulfuric Acid Mist	24-Hour	15.7	1,000	-500	1985	N/A	N/A
Inorganic Arsenic	24-Hour	0.00679	1,000	-500	1985	N/A	N/A

(1) Short-term values are highest, second-highest values for this analysis, except for beryllium, sulfuric acid mist, and inorganic arsenic.

(2) With respect to zero point of 414.30 km E; 3,073.88 km N.

(3) The allowable PSD increment is evaluated for TSP whereas the AAQS compliance is evaluated for PM_{10}. As a conservative approach, all project emissions of particulate matter were assumed to be in the form of PM_{10}.

N/A = Not applicable

Source: Ebasco Environmental, 1992

TABLE 5.6.1-25
CLASS II PSD INCREMENT ANALYSES RESULTS

Pollutant	Averaging Period	Maximum[1] Concentration ($\mu g/m^3$)	Receptor Location[2]		Period			Allowable Class II Increments ($\mu g/m^3$)
			X (m)	Y (m)	Julian Day	Ending Hour	Year	
Nitrogen Dioxide	Annual	4.7	2,500	-500	N/A	N/A	1986	25
Sulfur Dioxide	3-Hour	271.8	1,000	-500	42	3	1983	512
	24-Hour	67.2	1,000	-500	226	N/A	1984	91
	Annual	3.1	-9,397	-3,420	N/A	N/A	1982	20
Particulate Matter (TSP)	24-Hour	30.4	-2,000	-500	361	N/A	1986	37
	Annual	5.4	-2,000	-500	N/A	N/A	1986	19

(1) Maximum short-term concentrations are highest, second-highest values.
(2) With respect to zero point of 414.30 km E; 3,073.88 km N.

N/A = Not Applicable

Source: Ebasco Environmental, 1992

TABLE 5.6.1-26
MAXIMUM PROJECT IMPACTS PREDICTED USING ISCST VERSUS CLASS I PSD SIGNIFICANCE VALUES

Pollutant	Averaging Period	Maximum[1] Concentration ($\mu g/m^3$)	Receptor Location[2]		Period			PSD Class I Significance Value[3] ($\mu g/m^3$)	Project Impact Significance (Yes/No)
			X (m)	Y (m)	Julian Day	Ending Hour	Year		
Nitrogen Dioxide	Annual	0.176	-73,870	91,820	N/A	N/A	1982	0.1	Yes
Sulfur Dioxide	3-Hour	12.6	-73,870	91,820	75	6	1986	1.23	Yes
	24-Hour	3.57	-73,870	95,920	99	N/A	1983	0.275	Yes
	Annual	0.22	-73,870	91,820	N/A	N/A	1982	0.1	Yes
Particulate Matter (PM_{10} or TSP)	24-Hour	0.441	-73,470	98,020	344	N/A	1986	1.35	No
	Annual	0.025	-73,870	93,820	N/A	N/A	1983	0.27	No

(1) Maximum short-term concentrations are highest rather than highest, second-highest values.
(2) With respect to zero point of 414.30 km E; 3,073.88 km N.
(3) Significance values as recommended by EPA (1991).

N/A = Not applicable

Source: Ebasco Environmental, 1992

TABLE 5.6.1-27
AAQS ANALYSES RESULTS

Pollutant	Averaging Time	Maximum Concentrations[1]				Receptor Location[2]		Period			Federal NAAQS ($\mu g/m^3$)	Florida FAAQS ($\mu g/m^3$)
		FPC ($\mu g/m^3$)	Background Sources ($\mu g/m^3$)	Monitored Background ($\mu g/m^3$)	Total ($\mu g/m^3$)	X (m)	Y (m)	Julian Date	Ending Hour	Year		
Nitrogen Dioxide	Annual	4.0	3.1	25	32.1	2,500	-500	N/A	N/A	1986	100	100
Sulfur Dioxide	3-Hour	0.0	654	78	732	4,000	5,500	299	12	1983	1,300	1,300
	24-Hour	0.0	198.5	34	232.5	4,000	5,500	167	N/A	1983	365	260
	Annual	1.0	45.2	5	51.2	-7,000	12,124	N/A	N/A	1982	80	60
Particulate Matter (PM_{10})	24-Hour	0.0	128.7	13	141.7	-8,660	5,000	241	N/A	1983	150	150
	Annual	0.2	18.3	12	30.5	-13,156	4,788	N/A	N/A	1984	50	50

(1) Maximum short-term concentrations are highest, second-highest values.

(2) With respect to zero point of 414.30 km E; 3,073.88 km N.

N/A = Not applicable

Source: Ebasco Environmental, 1992

TABLE 5.6.1-28
AIR TOXICS ANALYSIS[1]

Pollutant	FDER NTLs ($\mu g/m^3$)			Maximum Predicted Concentration ($\mu g/m^3$)			Below NTL
	8-Hour	24-Hour	Annual	8-Hour	24-Hour	Annual	
Trace Metals[2]							
Antimony	5	1.2	0.3	0.0457	0.0156	0.000172	Yes
Arsenic	2	0.48	0.00023	0.022	0.0077	0.000495	No
Barium	5	1.2	50	0.103	0.0363	0.00228	Yes
Beryllium	0.02	0.0048	0.00042	0.0052	0.00176	0.00003	Yes
Boron	100	24	N/A	0.134	0.0455	0.000124	Yes
Cadmium	0.5	0.12	0.00056	0.0222	0.00766	0.000168	Yes
Calcium	100	24	N/A	1.533	0.522	0.001424	Yes
Chromium	5	1.2	0.002	0.359	0.142	0.0100	No
Cobalt	0.5	0.12	N/A	0.0297	0.0105	0.000729	Yes
Copper	10	2.4	N/A	0.586	0.201	0.00223	Yes
Lead	N/A	N/A	N/A	0.312	0.107	0.00496	Yes
Magnesium	100	24	N/A	0.476	0.1622	0.000442	Yes
Manganese	50	12	0.4	0.0515	0.0207	0.00164	Yes
Mercury	0.5	0.12	0.3	0.0299	0.0109	0.00068	Yes
Nickel	1	0.24	N/A	0.424	0.158	0.0065	Yes
Selenium	2	0.48	N/A	0.0372	0.0129	0.00085	Yes
Vanadium (as V_2O_3)	0.5	0.12	20	0.172	0.0596	0.0016	Yes
Zinc	50	24	N/A	1.526	0.531	0.0202	Yes
Volatile Organic Compounds							
Benzene [3]	30	7.2	0.12	[3]	[3]	[3]	N/A
Formaldehyde	12	2.88	0.077	0.456	0.156	0.000667	Yes

Notes: [1] Analysis is for eight circuits, 2 PC units and 4 TOUs.
[2] Emission estimates based on application of BACT as discussed in Section 3.4.
[3] Benzene emission estimates are not available for CGCC units, PC units or TOUs.

NTL = "No Threat" Level (FDER Draft, Air Toxics Guidelines)

N/A = Not Applicable

Source: Ebasco Environmental, 1992

TABLE 5.6.1-29
OPTIONS SELECTED FOR READ 56 PROGRAM
PROPOSED FPC POLK COUNTY SITE

Variable	Description	Selected Value
1. CARD 1 – STARTING AND ENDING HOURS, UPPER PRESSURE LEVEL		
IBYR, IBDAY, IBHR, IEYR, IEDAY, IEHR	Starting and ending year, day, hour	As needed
PSTOP	Top pressure level for which data are extracted	500 mb
2. CARD 2 – MISSING DATA CONTROL VARIABLES		
LHT	Height field control variable	True (1)
LTEMP	Height field control variable	True (1)
LWD	Wind direction field control variable	True (1)
LWS	Wind speed field control variable	True (1)

(1) Program run a second time with value set to false in order provide a missing value indicator for mandatory levels of 850, 700, and 500 mb. Data for these levels are input by user.

TABLE 5.6.1-30
OPTIONS SELECTED FOR MESOPAC II PROGRAM
PROPOSED FPC POLK COUNTY SITE

Variable	Description	Selected Value
1. CARD GROUP 1 – TITLE		
TITLE	Title of run	As needed
2. CARD GROUP 2 – GENERAL RUN INFORMATION		
NYR, IDYSTR, IHRMAX	Year, start day, and number	As needed
NSSTA, NUSTA	Number of surface and rawinsonde stations	As needed
3. CARD GROUP 3 – GRID DATA		
IMAX, JMAX	Number of grid points in the X and Y directions	15, 15
DGRID	Grid spacing	20 km
4. CARD GROUP 4 – OUTPUT OPTIONS		
Various	Disk and printer control variables for writing data to disk	As needed
5. CARD GROUP 5 – LAND USE CATEGORIES AT EACH GRID POINT		
ILANDU	Land use categories at each grid point	15 by 15 array
6. CARD GROUP 6 – DEFAULT OVERRIDE OPTIONS		
IOPTS(1)	Surface wind speed measurement heights control variable	0 (Default– 10 m)
IOPTS(2)	von Karman constant control variable	0 (Default)
IOPTS(3)	Friction velocity constants control variable	0 (Default)
IOPTS(4)	Mixing height constants control variable	0 (Default)

TABLE 5.6.1-30
OPTIONS SELECTED FOR MESOPAC II PROGRAM
PROPOSED FPC POLK COUNTY SITE

Variable	Description	Selected Value
IOPTS(5)	Wind speed control variable	0 (Default – RADIUS = 99 km, ILWF = 2, IUWF = 4)
IOPTS(6)	Surface roughness lengths control variable	0 (Default)
IOPTS(7)	Option to adjust heat flux estimate	0 (Default)
IOPTS(8)	Radiation reduction factors control variable	0 (Default)
IOPTS(9)	Heat flux constant control variable	0 (Default)
IOPTS(10)	Option to begin run at date other than at start of meteorological data files	0 or 1, as needed
7.– 14. CARD GROUPS 7 TO 14		
Various	Options input to override default values	Not used
15. CARD GROUP 15 – SURFACE STATION DATA		
Various	Surface meteorological station information	As needed
16. CARD GROUP 16 – RAWINSONDE STATION DATA		
Various	Rawinsonde meteorological station information	As needed

Note: Precipitation data were available and were used in the enhanced operation mode of the MESOPUFF II modeling.

TABLE 5.6.1-31
OPTIONS SELECTED FOR MESOPUFF II PROGRAM
PROPOSED FPC POLK COUNTY SITE

Variable	Description	Selected Value
1. CARD GROUP 1 – TITLE		
TITLE	Title of run	As needed
2. CARD GROUP 2 – GENERAL RUN INFORMATION		
NSYR, NSDAY, NSHR	Year, start day and hour	As needed
NADVTS	Number of hours in run	As needed
NPTS	Number of point sources	As needed
NAREAS	Number of area sources	Not used
NREC	Number of non–gridded receptors	13 (Class I area)
NSPEC	Number of chemical species to model	1 (SO2)
3. CARD GROUP 3 – COMPUTATIONAL VARIABLES		
IAVG	Concentration averaging time	24 hours
NPUF	Puff release rate for each source	1 puff/hour
NSAMAD	Minimum sampling rate	2 samples/hour
LVSAMP	Variable sampling rate option	True (increase rate with higher wind speeds)
WSAMP	Reference wind speed used in variable sampling rate option (used if LVSAMP is true)	2 m/s
LSGRID	Control variable for concentration computations at sampling grid points	False (sampling at non–gridded points only)
AGEMIN	Minimum age of puffs to be sampled	900 seconds (should not be larger than 3600 seconds)

TABLE 5.6.1-31
OPTIONS SELECTED FOR MESOPUFF II PROGRAM
PROPOSED FPC POLK COUNTY SITE

Variable	Description	Selected Value
1. CARD GROUP 1 – TITLE		
TITLE	Title of run	As needed
2. CARD GROUP 2 – GENERAL RUN INFORMATION		
NSYR, NSDAY, NSHR	Year, start day and hour	As needed
NADVTS	Number of hours in run	As needed
NPTS	Number of point sources	As needed
NAREAS	Number of area sources	Not used
NREC	Number of non–gridded receptors	13 (Class I area)
NSPEC	Number of chemical species to model	1 (SO2)
3. CARD GROUP 3 – COMPUTATIONAL VARIABLES		
IAVG	Concentration averaging time	24 hours
NPUF	Puff release rate for each source	1 puff/hour
NSAMAD	Minimum sampling rate	2 samples/hour
LVSAMP	Variable sampling rate option	True (increase rate with higher wind speeds)
WSAMP	Reference wind speed used in variable sampling rate option (used if LVSAMP is true)	2 m/s
LSGRID	Control variable for concentration computations at sampling grid points	False (sampling at non–gridded points only)
AGEMIN	Minimum age of puffs to be sampled	900 seconds (should not be larger than 3600 seconds)

TABLE 5.6.1-31
OPTIONS SELECTED FOR MESOPUFF II PROGRAM
PROPOSED FPC POLK COUNTY SITE

Variable	Description	Selected Value
1. CARD GROUP 1 – TITLE		
TITLE	Title of run	As needed
2. CARD GROUP 2 – GENERAL RUN INFORMATION		
NSYR, NSDAY, NSHR	Year, start day and hour	As needed
NADVTS	Number of hours in run	As needed
NPTS	Number of point sources	As needed
NAREAS	Number of area sources	Not used
NREC	Number of non–gridded receptors	13 (Class I area)
NSPEC	Number of chemical species to model	1 (SO2)
3. CARD GROUP 3 – COMPUTATIONAL VARIABLES		
IAVG	Concentration averaging time	24 hours
NPUF	Puff release rate for each source	1 puff/hour
NSAMAD	Minimum sampling rate	2 samples/hour
LVSAMP	Variable sampling rate option	True (increase rate with higher wind speeds)
WSAMP	Reference wind speed used in variable sampling rate option (used if LVSAMP is true)	2 m/s
LSGRID	Control variable for concentration computations at sampling grid points	False (sampling at non–gridded points only)
AGEMIN	Minimum age of puffs to be sampled	900 seconds (should not be larger than 3600 seconds)

TABLE 5.6.1-31
OPTIONS SELECTED FOR MESOPUFF II PROGRAM
PROPOSED FPC POLK COUNTY SITE

Variable	Description	Selected Value
16. CARD GROUP 16 – NON–GRIDDED RECEPTOR COORDINATES		
XREC, YREC	X– and Y–coordinates of non–gridded receptors	Used

(1) This option was not used when the MESOPUFF II model was run in the inert mode. In the enhanced mode, this option was considered.

TABLE 5.6.1-32
SUMMARY OF 1982 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT
USING THE ISCST AND MESOPUFF II MODELS
(Based on the FPC Facility's Impacts
Predicted to be Greater than the Significant Impact Levels (SIL) Using the ISCST Model)

Time Period			Receptor	ISCST Concentrations ($\mu g/m^3$)		MESOPUFF Step 1 (1)			MESOPUFF Step 2			
						Concentration ($\mu g/m^3$)		Is Increment Exceeded and FPC's Impact Above SIL?	Concentration ($\mu g/m^3$)			Is Increment Exceeded and FPC's Impact Above SIL?
Julian Day	Hour Ending	Calendar Date Month/Day	Receptor Number	All Sources (A)	Proposed FPC Sources (B)	MESOPUFF II FPC Only (C)	Adjusted Total (A−B+C)		ISCST for Sources <=50 km of Class I Area (D)	MESOPUFF for Non-FPC Sources >50 km of Class I Area (E)	Adjusted Total (C+D+E)	
24-Hour Concentration Analysis												
22	24	1/22	1	5.66	0.58	0.14	5.22	No				
30	24	1/30	1	6.15	0.41	1.10	6.84	Yes	0.56	2.50	4.16	No
30	24	1/30	2	6.17	0.41	1.10	6.87	Yes	0.48	2.45	4.03	No
30	24	1/30	3	6.82	0.40	1.08	7.50	Yes	1.44	2.37	4.89	No
30	24	1/30	4	5.53	0.38	1.03	6.18	Yes	0.87	2.33	4.23	No
106	24	4/16	12	5.01	0.77	0.96	5.20	Yes	1.42	−20.00	−17.62	No
106	24	4/16	13	5.18	0.74	0.83	5.27	Yes	1.72	−19.30	−16.75	No
154	24	6/03	2	5.62	0.44	0.13	5.30	No				
154	24	6/03	3	5.74	0.36	0.12	5.50	No				
154	24	6/03	4	6.04	0.30	0.11	5.85	No				
154	24	6/03	13	5.80	0.27	0.11	5.63	No				
155	24	6/04	5	5.83	0.42	0.00	5.41	No				
155	24	6/04	11	5.38	0.29	0.00	5.09	No				
155	24	6/04	12	5.06	0.49	0.00	4.57	No				
177	24	6/26	5	5.02	0.36	0.02	4.69	No				
187	24	7/06	4	5.04	1.20	0.61	4.45	No				
188	24	7/07	1	5.36	0.68	2.01	6.69	Yes	0.93	−3.81	−0.87	No
205	24	7/24	4	6.02	0.60	0.0007	5.42	No				
205	24	7/24	5	5.41	0.77	0.0010	4.65	No				
205	24	7/24	7	5.16	0.83	0.0014	4.36	No				
205	24	7/24	8	5.15	0.81	0.0014	4.34	No				
205	24	7/24	9	5.51	0.79	0.0015	4.73	No				
205	24	7/24	12	5.15	0.64	0.0009	4.51	No				
205	24	7/24	13	5.35	0.51	0.0007	4.84	No				
230	24	8/18	4	5.72	0.58	0.85	6.00	Yes	1.15	−3.49	−1.49	No
230	24	8/18	5	5.21	0.59	0.88	5.50	Yes	0.51	−3.13	−1.75	No
230	24	8/18	13	5.42	0.50	1.05	5.96	Yes	0.37	−4.56	−3.14	No

TABLE 5.6.1-32
SUMMARY OF 1982 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT
USING THE ISCST AND MESOPUFF II MODELS
(Based on the FPC Facility's Impacts
Predicted to be Greater than the Significant Impact Levels (SIL) Using the ISCST Model)

Time Period			Receptor	ISCST Concentrations ($\mu g/m^3$)		MESOPUFF Step 1 (1)			MESOPUFF Step 2			
						Concentration ($\mu g/m^3$)		Is Increment Exceeded and FPC's Impact Above SIL?	Concentration ($\mu g/m^3$)			Is Increment Exceeded and FPC's Impact Above SIL?
Julian Day	Hour Ending	Calendar Date Month/Day	Receptor Number	All Sources (A)	Proposed FPC Sources (B)	MESOPUFF II FPC Only (C)	Adjusted Total (A−B+C)		ISCST for Sources <=50 km of Class I Area (D)	MESOPUFF for Non−FPC Sources >50 km of Class I Area (E)	Adjusted Total (C+D+E)	
336	24	12/02	1	5.50	0.40	0.00	5.09	No				
336	24	12/02	2	6.06	0.36	0.00	5.69	No				
336	24	12/02	3	6.17	0.31	0.00	5.86	No				
356	24	12/22	4	5.31	0.52	0.02	4.80	No				
357	24	12/23	1	5.10	1.46	0.84	4.49	No				
358	24	12/24	1	5.42	0.29	1.92	7.05	Yes	0.09	−0.55	1.46	No
358	24	12/24	2	5.91	0.30	1.66	7.27	Yes	0.34	0.37	2.38	No
356	24	12/24	3	6.54	0.30	1.40	7.64	Yes	1.09	1.40	3.89	No
358	24	12/24	4	6.54	0.29	1.11	7.36	Yes	1.40	2.47	4.98	No
361	24	12/27	1	6.90	1.05	1.20	7.05	Yes	1.09	2.29	4.58	No

Note: MESOPUFF II modeling is performed in the inert mode (i.e., without chemical transformation or wet/dry deposition).

(1) No additional analysis is needed if no exceedance of the increment is predicted or the proposed FPC facility's impacts are less than the significant impact levels.

TABLE 5.6.1-33
SUMMARY OF 1983 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT USING THE ISCST AND MESOPUFF II MODELS
(Based on the FPC Facility's Impacts Predicted to be Greater than the Significant Impact Levels (SIL) Using the ISCST Model)

Time Period			Receptor	ISCST Concentrations ($\mu g/m^3$)		MESOPUFF Step 1 (1)			MESOPUFF Step 2			
						Concentration ($\mu g/m^3$)		Is Increment Exceeded and FPC's Impact Above SIL?	Concentration ($\mu g/m^3$)			Is Increment Exceeded and FPC's Impact Above SIL?
Julian Day	Hour Ending	Calendar Date Month/Day	Receptor Number	All Sources (A)	Proposed FPC Sources (B)	MESOPUFF II FPC Only (C)	Adjusted Total (A−B+C)		ISCST for Sources <=50 km of Class I Area (D)	MESOPUFF for Non−FPC Sources >50 km of Class I Area (E)	Adjusted Total (C+D+E)	
24−Hour Concentration Analysis												
26	24	1/26	1	5.15	0.96	0.00126	4.20	No				
26	24	1/26	7	5.14	0.61	0.00101	4.53	No				
26	24	1/26	8	5.09	0.59	0.00067	4.50	No				
26	24	1/26	9	5.26	0.57	0.00037	4.71	No				
26	24	1/26	10	5.12	0.61	0.00022	4.50	No				
32	24	2/01	4	5.22	1.70	1.35	4.87	No				
32	24	2/01	5	5.12	1.62	1.36	4.86	No				
32	24	2/01	6	5.48	1.49	1.44	5.43	Yes	0.78	−1.10	1.12	No
32	24	2/01	7	5.68	1.38	1.53	5.81	Yes	1.41	−0.93	2.01	No
32	24	2/01	8	5.39	1.33	1.55	5.61	Yes	1.23	−1.49	1.29	No
32	24	2/01	10	5.57	1.34	1.53	5.76	Yes	0.96	−3.05	−0.56	No
32	24	2/01	11	6.15	1.43	1.48	6.20	Yes	0.66	−3.79	−1.66	No
32	24	2/01	12	6.73	1.49	1.44	6.68	Yes	0.69	−3.97	−1.84	No
32	24	2/01	13	6.87	1.49	1.39	6.77	Yes	0.70	−3.66	−1.59	No
63	24	3/04	7	6.64	0.42	2.54	6.76	Yes	1.72	−4.65	−0.39	No
63	24	3/04	8	6.48	0.39	2.50	6.59	Yes	0.92	−4.62	−1.20	No
63	24	3/04	9	6.51	0.35	2.48	6.62	Yes	0.98	−4.51	−1.07	No
63	24	3/04	10	6.32	0.49	2.37	6.19	Yes	0.86	−4.93	−1.70	No
63	24	3/04	11	5.97	0.72	2.19	7.45	Yes	0.89	−5.12	−2.04	No
63	24	3/04	12	5.85	0.92	1.91	6.84	Yes	1.29	−4.99	−1.79	No
63	24	3/04	13	5.18	1.00	1.56	5.73	Yes	1.16	−4.75	−2.04	No
64	24	3/05	6	6.22	1.27	0.76	5.71	Yes	3.08	1.19	5.03	Yes
64	24	3/05	12	5.58	1.38	0.24	4.44	No				
64	24	3/05	13	5.03	1.32	0.11	3.82	No				
104	24	4/14	4	5.35	0.46	0.21	5.08	No				
104	24	4/14	5	5.21	0.35	0.078	4.93	No				
104	24	4/14	11	5.62	0.28	0.0067	5.34	No				
104	24	4/14	12	6.03	0.36	0.038	5.71	No				
104	24	4/14	13	5.80	0.45	0.12	5.48	No				
121	24	5/01	1	8.55	0.42	0.025	8.18	No				
121	24	5/01	2	7.82	0.42	0.022	7.42	No				
121	24	5/01	3	6.70	0.43	0.019	6.29	No				
121	24	5/01	4	6.40	0.44	0.018	5.97	No				
121	24	5/01	5	5.65	0.45	0.014	5.21	No				
121	24	5/01	6	5.08	0.46	0.012	4.63	No				

TABLE 5.6.1-33
SUMMARY OF 1983 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT
USING THE ISCST AND MESOPUFF II MODELS
(Based on the FPC Facility's Impacts
Predicted to be Greater than the Significant Impact Levels (SIL) Using the ISCST Model)

Time Period			Receptor	ISCST Concentrations (µg/m³)		MESOPUFF Step 1 (1)			MESOPUFF Step 2			
						Concentration (µg/m³)		Is Increment Exceeded and FPC's Impact Above SIL?	Concentration (µg/m³)			Is Increment Exceeded and FPC's Impact Above SIL?
Julian Day	Hour Ending	Calendar Date Month/Day	Receptor Number	All Sources (A)	Proposed FPC Sources (B)	MESOPUFF II FPC Only (C)	Adjusted Total (A−B+C)		ISCST for Sources <=50 km of Class I Area (D)	MESOPUFF for Non−FPC Sources >50 km of Class I Area (E)	Adjusted Total (C+D+E)	
122	24	5/02	3	5.32	0.40	0.58	5.51	Yes	0.19	5.42	6.19	Yes
122	24	5/02	4	6.82	0.52	0.54	6.84	Yes	0.90	5.35	6.79	Yes
122	24	5/02	13	5.43	0.43	0.41	5.41	Yes	0.66	4.14	5.21	Yes
127	24	5/07	1	5.06	0.37	0.34	5.04	Yes	0.019	3.35	3.71	No
127	24	5/07	5	6.27	0.37	0.36	6.26	Yes	2.41	4.11	6.86	Yes
127	24	5/07	6	7.02	0.33	0.34	7.03	Yes	2.11	4.02	6.47	Yes
127	24	5/07	7	6.58	0.29	0.30	6.59	Yes	1.35	4.05	5.70	Yes
127	24	5/07	8	6.12	0.28	0.30	6.14	Yes	1.19	4.14	5.63	Yes
127	24	5/07	10	5.57	0.30	0.34	5.61	Yes	1.01	4.21	5.56	Yes
127	24	5/07	11	6.32	0.33	0.35	6.33	Yes	1.41	4.34	6.10	Yes
127	24	5/07	12	6.46	0.35	0.35	6.47	Yes	1.38	4.50	6.23	Yes
127	24	5/07	13	6.54	0.35	0.38	6.57	Yes	1.44	4.65	6.47	Yes
130	24	5/10	4	6.81	0.27	0.20	6.54	No				
130	24	5/10	5	7.32	0.27	0.20	7.25	No				
135	24	5/15	9	5.31	0.90	1.45	5.86	Yes	0.78	1.41	3.64	No
139	24	5/19	1	5.06	0.72	0.075	4.41	No				
216	24	8/04	3	5.26	0.29	0.082	5.06	No				
247	24	9/04	6	5.01	0.68	0.21	4.53	No				
263	24	9/20	1	5.21	0.32	1.24	6.14	Yes	1.27	1.97	4.48	No
316	24	11/14	6	6.11	0.30	1.50	7.31	Yes	1.58	−5.44	−2.36	No
316	24	11/14	10	5.44	0.29	1.31	6.46	Yes	1.26	−6.34	−3.77	No

Note: MESOPUFF II modeling is performed in the inert mode (i.e., without chemical transformation or wet/dry deposition).

(1) No additional analysis is needed if no exceedance of the increment is predicted or the proposed FPC facility's impacts are less than the significant impact levels.

TABLE 5.6.1-34
SUMMARY OF 1984 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT
USING THE ISCST AND MESOPUFF II MODELS
(Based on the FPC Facility's Impacts
Predicted to be Greater than the Significant Impact Levels (SIL) Using the ISCST Model)

Time Period			Receptor	ISCST Concentrations ($\mu g/m^3$)		MESOPUFF Step 1 (1)			MESOPUFF Step 2			
						Concentration ($\mu g/m^3$)		Is Increment Exceeded and FPC's Impact Above SIL?	Concentration ($\mu g/m^3$)			Is Increment Exceeded and FPC's Impact Above SIL?
Julian Day	Hour Ending	Calendar Date Month/Day	Receptor Number	All Sources (A)	Proposed FPC Sources (B)	MESOPUFF II FPC Only (C)	Adjusted Total (A−B+C)		ISCST for Sources <=50 km of Class I Area (D)	MESOPUFF for Non−FPC Sources >50 km of Class I Area (E)	Adjusted Total (C+D+E)	
24−Hour Concentration Analysis												
64	24	3/04	1	6.49	0.45	0.34	6.38	Yes	0.60	4.20	5.14	Yes
64	24	3/04	2	5.55	0.49	0.32	5.38	Yes	0.80	4.15	5.27	Yes
64	24	3/04	3	6.00	0.51	0.31	5.80	Yes	2.26	4.03	6.80	Yes
144	24	5/23	1	5.14	0.54	0.026	4.63	No				
144	24	5/23	2	5.36	0.50	0.028	4.89	No				
144	24	5/23	3	5.85	0.44	0.030	5.44	No				
149	24	5/28	1	5.09	0.52	0.61	5.18	Yes	1.01	1.31	2.83	No
158	24	6/06	1	5.08	0.87	0.15	4.36	No				
158	24	6/06	2	5.40	0.91	0.11	4.60	No				
158	24	6/06	3	5.65	0.94	0.076	4.79	No				
158	24	6/06	4	5.16	0.95	0.051	4.26	No				
158	24	6/06	9	5.44	0.69	0.0043	4.75	No				
158	24	6/06	10	5.21	0.77	0.0070	4.45	No				
166	24	6/14	4	5.63	0.31	1.04	6.36	Yes	0.26	0.85	2.15	No
166	24	6/14	5	6.53	0.41	1.08	7.20	Yes	0.75	0.48	2.31	No
166	24	6/14	6	6.17	0.50	1.12	6.79	Yes	0.91	0.10	2.13	No
166	24	6/14	7	5.50	0.59	1.16	6.07	Yes	1.00	−0.15	2.01	No
166	24	6/14	8	5.11	0.59	1.14	5.66	Yes	1.14	−0.19	2.09	No
170	24	6/18	5	5.19	1.18	1.35	5.36	Yes	1.38	2.14	4.87	No
199	24	7/17	3	5.79	0.81	0.00013	4.98	No				
205	24	7/23	1	5.74	0.54	1.52	6.72	Yes	1.00	−3.81	−1.29	No
205	24	7/23	2	5.02	0.54	1.65	6.13	Yes	1.78	−3.71	−0.28	No
210	24	7/28	3	5.41	0.55	0.42	5.29	Yes	1.44	−8.74	−4.88	No
210	24	7/28	8	5.45	0.70	0.49	5.24	Yes	1.42	−5.25	−3.34	No
214	24	8/01	4	6.04	0.32	0.84	6.56	Yes	0.99	−0.28	1.55	No
214	24	8/01	5	5.25	0.40	0.94	5.80	Yes	1.13	−0.12	1.95	No
215	24	8/02	1	6.37	0.45	1.55	7.47	Yes	1.34	−0.80	2.09	No
215	24	8/02	2	5.06	0.45	1.70	6.31	Yes	0.73	−0.58	1.85	No

TABLE 5.6.1-34
SUMMARY OF 1984 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT
USING THE ISCST AND MESOPUFF II MODELS
(Based on the FPC Facility's Impacts
Predicted to be Greater than the Significant Impact Levels (SIL) Using the ISCST Model)

Time Period			Receptor	ISCST Concentrations ($\mu g/m^3$)		MESOPUFF Step 1 (1)			MESOPUFF Step 2			
						Concentration ($\mu g/m^3$)		Is Increment Exceeded and FPC's Impact Above SIL?	Concentration ($\mu g/m^3$)			Is Increment Exceeded and FPC's Impact Above SIL?
Julian Day	Hour Ending	Calendar Date Month/Day	Receptor Number	All Sources (A)	Proposed FPC Sources (B)	MESOPUFF II FPC Only (C)	Adjusted Total (A−B+C)		ISCST for Sources <=50 km of Class I Area (D)	MESOPUFF for Non−FPC Sources >50 km of Class I Area (E)	Adjusted Total (C+D+E)	
365	24	12/30	1	5.29	0.57	1.71	6.44	Yes	0.37	−4.88	−2.80	No
365	24	12/30	2	7.04	0.59	1.76	8.21	Yes	0.44	−4.55	−2.35	No
365	24	12/30	3	9.20	0.61	1.80	10.40	Yes	1.05	−4.24	−1.39	No
365	24	12/30	4	9.82	0.61	1.87	11.08	Yes	0.89	−3.74	−0.88	No
365	24	12/30	5	7.77	0.60	1.99	9.17	Yes	0.65	−2.88	−0.24	No
365	24	12/30	6	5.72	0.55	2.08	7.25	Yes	1.45	−2.27	1.26	No
365	24	12/30	10	5.13	0.51	2.06	6.69	Yes	1.44	−3.30	0.20	No
365	24	12/30	11	5.14	0.54	1.96	6.56	Yes	0.84	−4.45	−1.65	No
365	24	12/30	12	5.19	0.55	1.85	6.49	Yes	0.43	−5.77	−3.49	No
365	24	12/30	13	5.44	0.55	1.74	6.63	Yes	0.36	−7.19	−5.09	No

Note: MESOPUFF II modeling is performed in the inert mode (i.e., without chemical transformation or wet/dry deposition).

(1) No additional analysis is needed if no exceedance of the increment is predicted or the proposed FPC facility's impacts are less than the significant impact levels.

TABLE 5.6.1-35
SUMMARY OF 1985 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT
USING THE ISCST AND MESOPUFF II MODELS
(Based on the FPC Facility's Impacts
Predicted to be Greater than the Significant Impact Levels (SIL) Using the ISCST Model)

Time Period			Receptor	ISCST Concentrations ($\mu g/m^3$)		MESOPUFF Step 1 (1)			MESOPUFF Step 2			
						Concentration ($\mu g/m^3$)		Is Increment Exceeded and FPC's Impact Above SIL?	Concentration ($\mu g/m^3$)			Is Increment Exceeded and FPC's Impact Above SIL?
Julian Day	Hour Ending	Calendar Date Month/Day	Receptor Number	All Sources (A)	Proposed FPC Sources (B)	MESOPUFF II FPC Only (C)	Adjusted Total (A−B+C)		ISCST for Sources <=50 km of Class I Area (D)	MESOPUFF for Non−FPC Sources >50 km of Class I Area (E)	Adjusted Total (C+D+E)	
3−Hour Concentration Analysis												
302	3	10/29	9	25.7	1.36	0.06	24.42	No				
24−Hour Concentration Analysis												
54	24	2/23	3	5.21	0.34	0.90	5.77	Yes	0.64	1.64	3.18	No
157	24	6/6	9	5.16	0.69	0.007	4.48	No				
176	24	6/25	12	5.98	0.30	0.00	5.69	No				
212	24	7/31	2	5.29	0.68	0.39	5.00	Yes	0.49	0.94	1.82	No
212	24	7/31	3	6.06	0.67	0.38	5.77	Yes	0.67	0.95	2.00	No
212	24	7/31	4	5.09	0.66	0.37	4.80	No				
232	24	8/20	13	5.31	0.29	0.0091	5.03	No				
242	24	8/30	1	5.77	1.32	1.80	6.25	Yes	0.18	−2.68	−0.70	No
242	24	8/30	2	5.04	1.23	1.88	5.70	Yes	0.22	−2.28	−0.18	No
242	24	8/30	6	6.82	0.89	2.26	8.19	Yes	2.46 (2)	2.27	6.99	Yes
242	24	8/30	7	5.16	0.87	2.21	6.50	Yes	1.82	2.57	6.60	Yes
242	24	8/30	10	5.12	0.83	2.21	6.50	Yes	1.49	1.87	5.57	Yes
242	24	8/30	11	5.78	0.84	2.11	7.05	Yes	1.83	1.31	5.25	Yes
242	24	8/30	12	6.36	0.88	1.94	7.42	Yes	2.45	0.69	5.08	Yes
242	24	8/30	13	5.48	0.94	1.83	6.37	Yes	1.89	0.033	3.75	No
302	24	10/29	9	5.05	0.67	0.21	4.59	No				
334	24	11/30	5	7.30	0.32	0.07	7.04	No				
334	24	11/30	6	5.68	0.42	0.12	5.38	No				
334	24	11/30	7	5.52	0.48	0.17	5.22	No				
334	24	11/30	8	5.02	0.47	0.15	4.69	No				
334	24	11/30	10	5.23	0.42	0.08	4.89	No				

TABLE 5.6.1-35
SUMMARY OF 1985 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT
USING THE ISCST AND MESOPUFF II MODELS
(Based on the FPC Facility's Impacts
Predicted to be Greater than the Significant Impact Levels (SIL) Using the ISCST Model)

Time Period			Receptor	ISCST Concentrations (µg/m³)		MESOPUFF Step 1 (1)			MESOPUFF Step 2			
						Concentration (µg/m³)		Is	Concentration (µg/m³)			Is
Julian Day	Hour Ending	Calendar Date Month/Day	Receptor Number	All Sources (A)	Proposed FPC Sources (B)	MESOPUFF II FPC Only (C)	Adjusted Total (A−B+C)	Increment Exceeded and FPC's Impact Above SIL?	ISCST for Sources <=50 km of Class I Area (D)	MESOPUFF for Non−FPC Sources >50 km of Class I Area (E)	Adjusted Total (C+D+E)	Increment Exceeded and FPC's Impact Above SIL?
345	24	12/11	5	5.01	0.46	0.31	4.86	No				

Note: MESOPUFF II modeling is performed in the inert mode (i.e., without chemical transformation or wet/dry deposition).

(1) No additional analysis is needed if no exceedance of the increment is predicted or the proposed FPC facility's impacts are less than the significant impact levels.
(2) Based on revised exit velocity and temperature for Florida Crushed Stone emission source and elimination of Oman Construction source.

TABLE 5.6.1-36
SUMMARY OF 1986 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT
USING THE ISCST AND MESOPUFF II MODELS
(Based on the FPC Facility's Impacts
Predicted to be Greater than the Significant Impact Levels (SIL) Using the ISCST Model)

Time Period			Receptor	ISCST Concentrations ($\mu g/m^3$)		MESOPUFF Step 1 (1)			MESOPUFF Step 2			
						Concentration ($\mu g/m^3$)		Is Increment Exceeded and FPC's Impact Above SIL?	Concentration ($\mu g/m^3$)			Is Increment Exceeded and FPC's Impact Above SIL?
Julian Day	Hour Ending	Calendar Date Month/Day	Receptor Number	All Sources (A)	Proposed FPC Sources (B)	MESOPUFF II FPC Only (C)	Adjusted Total (A−B+C)		ISCST for Sources <=50 km of Class I Area (D)	MESOPUFF for Non−FPC Sources >50 km of Class I Area (E)	Adjusted Total (C+D+E)	
3−Hour Concentration Analysis												
205	3	7/24	4	25.4	1.01	0.0	24.39	No				
205	3	7/24	13	36.5	0.67	0.0	35.83	No				
24−Hour Concentration Analysis												
41	24	2/10	11	5.72	1.52	0.014	4.21	No				
41	24	2/10	12	5.81	0.99	0.013	4.83	No				
48	24	2/17	6	5.64	0.49	0.30	5.45	Yes	2.12	−3.93	−1.51	No
166	24	6/15	1	8.07	0.44	1.02	8.65	Yes	0.73	−20.95	−19.2	No
166	24	6/15	2	6.64	0.38	1.03	7.29	Yes	0.92	−20.83	−18.88	No
166	24	6/15	3	6.93	0.32	1.04	7.65	Yes	1.91	−20.62	−17.67	No
167	24	6/16	1	5.45	0.98	0.29	4.76	No				
167	24	6/18	2	5.57	0.99	0.29	4.87	No				
167	24	6/16	5	5.57	1.24	0.32	4.65	No				
167	24	6/18	6	6.23	1.39	0.33	5.17	Yes	0.77	−3.41	−2.31	No
167	24	6/16	7	6.42	1.56	0.34	5.20	Yes	2.29	−3.48	−0.85	No
167	24	6/16	8	6.01	1.55	0.32	4.78	No				
167	24	6/16	9	5.97	1.56	0.30	4.71	No				
167	24	6/16	10	8.83	1.39	0.28	5.72	Yes	1.26	−3.24	−1.7	No
167	24	6/18	11	7.50	1.21	0.24	6.53	No				
167	24	6/16	12	6.65	1.09	0.21	5.77	No				
205	24	7/24	3	6.37	0.36	0.0025	6.01	No				
205	24	7/24	12	5.14	0.78	0.0026	4.36	No				
205	24	7/24	13	7.21	0.46	0.0022	6.75	No				
215	24	8/3	4	5.37	0.82	0.14	4.69	No				
215	24	8/3	5	5.58	0.59	0.15	5.14	No				
215	24	8/3	6	7.03	0.46	0.15	6.72	No				
215	24	8/3	7	8.78	0.43	0.16	8.51	No				
215	24	8/3	8	8.79	0.42	0.16	8.53	No				
215	24	8/3	9	9.35	0.43	0.16	9.08	No				
215	24	8/3	10	8.09	0.41	0.16	7.84	No				
215	24	8/3	11	7.55	0.48	0.15	7.22	No				
215	24	8/3	12	7.33	0.61	0.14	6.86	No				
215	24	8/3	13	6.12	0.79	0.13	5.46	No				

TABLE 5.6.1-36
SUMMARY OF 1986 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT USING THE ISCST AND MESOPUFF II MODELS
(Based on the FPC Facility's Impacts Predicted to be Greater than the Significant Impact Levels (SIL) Using the ISCST Model)

Time Period			Receptor	ISCST Concentrations ($\mu g/m^3$)		MESOPUFF Step 1 (1)			MESOPUFF Step 2			
						Concentration ($\mu g/m^3$)		Is Increment Exceeded and FPC's Impact Above SIL?	Concentration ($\mu g/m^3$)			Is Increment Exceeded and FPC's Impact Above SIL?
Julian Day	Hour Ending	Calendar Date Month/Day	Receptor Number	All Sources (A)	Proposed FPC Sources (B)	MESOPUFF II FPC Only (C)	Adjusted Total (A−B+C)		ISCST for Sources <=50 km of Class I Area (D)	MESOPUFF for Non-FPC Sources >50 km of Class I Area (E)	Adjusted Total (C+D+E)	
218	24	8/6	5	5.25	0.38	1.82	6.69	Yes	1.82	−3.67	−0.03	No
218	24	8/6	6	5.04	0.35	1.93	6.62	Yes	1.35	−3.43	−0.15	No
218	24	8/6	7	5.23	0.32	2.01	6.92	Yes	1.18	−3.20	−0.01	No
218	24	8/6	8	5.31	0.31	1.87	6.87	Yes	0.91	−3.35	−0.57	No
218	24	8/6	10	5.18	0.32	1.51	6.37	Yes	0.76	−3.88	−1.61	No
218	24	8/6	11	5.19	0.34	1.28	6.13	Yes	0.66	−4.29	−2.35	No
218	24	8/6	12	5.19	0.35	1.07	5.91	Yes	0.90	−4.68	−2.71	No
218	24	8/6	13	5.03	0.36	0.89	5.56	Yes	1.07	−5.08	−3.12	No
222	24	8/10	4	5.62	0.32	0.23	5.53	No				
224	24	8/12	6	5.31	0.55	0.84	5.60	Yes	1.00	2.72	4.56	No
224	24	8/12	7	5.31	0.39	0.81	5.73	Yes	0.95	2.45	4.21	No
242	24	8/30	1	6.61	0.83	0.20	5.98	No				
242	24	8/30	2	7.76	0.85	0.21	7.12	No				
242	24	8/30	3	8.79	0.86	0.22	8.15	No				
242	24	8/30	4	8.74	0.85	0.24	8.13	No				
242	24	8/30	5	5.86	0.80	0.26	5.32	No				
253	24	9/10	4	5.43	0.45	1.37	6.35	Yes	0.67	−10.68	−8.64	No
253	24	9/10	5	5.41	0.54	1.37	6.24	Yes	0.76	−10.17	−8.04	No
256	24	9/13	7	5.20	0.49	0.18	4.89	No				
256	24	9/13	8	5.01	0.46	0.18	4.73	No				
256	24	9/13	10	5.54	0.55	0.16	5.15	No				
256	24	9/13	11	6.99	0.69	0.15	6.45	No				
256	24	9/13	12	8.21	0.76	0.15	7.60	No				
256	24	9/13	13	8.76	0.76	0.14	8.14	No				
267	24	9/24	1	5.38	0.58	1.71	6.51	Yes	0.18	−14.95	−13.06	No
270	24	9/27	1	6.00	0.36	0.10	5.74	No				
270	24	9/27	2	7.64	0.28	0.10	7.46	No				
272	24	9/29	2	5.41	0.40	0.00	5.01	No				
272	24	9/29	5	5.75	0.39	0.00	5.36	No				
298	24	10/25	11	5.28	0.30	1.57	6.55	Yes	0.89	−1.55	0.91	No

TABLE 5.6.1-36
SUMMARY OF 1986 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT
USING THE ISCST AND MESOPUFF II MODELS
(Based on the FPC Facility's Impacts
Predicted to be Greater than the Significant Impact Levels (SIL) Using the ISCST Model)

Time Period			Receptor	ISCST Concentrations ($\mu g/m^3$)		MESOPUFF Step 1 (1)			MESOPUFF Step 2			
						Concentration ($\mu g/m^3$)		Is	Concentration ($\mu g/m^3$)			Is
Julian Day	Hour Ending	Calendar Date Month/Day	Receptor Number	All Sources	Proposed FPC Sources	MESOPUFF II FPC Only	Adjusted Total	Increment Exceeded and FPC's Impact Above SIL?	ISCST for Sources <=50 km of Class I Area	MESOPUFF for Non-FPC Sources >50 km of Class I Area	Adjusted Total	Increment Exceeded and FPC's Impact Above SIL?
				(A)	(B)	(C)	(A-B+C)		(D)	(E)	(C+D+E)	
299	24	10/26	8	5.01	0.57	0.00	4.44	No				
299	24	10/26	9	5.77	0.58	0.00	5.19	No				
329	24	11/25	1	6.51	0.79	1.08	6.80	Yes	0.10	5.23	6.41	Yes
329	24	11/25	2	5.23	0.87	0.86	5.22	Yes	0.13	5.36	6.35	Yes
329	24	11/25	3	5.12	0.93	0.67	4.86	No				
329	24	11/25	4	6.08	1.01	0.50	5.57	Yes	0.96	4.99	6.45	Yes
329	24	11/25	5	5.77	1.10	0.31	4.98	No				
329	24	11/25	6	5.20	1.18	0.19	4.21	No				
329	24	11/25	12	5.76	0.96	0.37	5.17	Yes	1.23	3.83	5.43	Yes
329	24	11/25	13	6.65	0.88	0.53	6.30	Yes	0.90	4.03	5.46	Yes
332	24	11/28	3	5.76	0.30	1.80	7.26	Yes	1.72	-0.59	2.93	No
344	24	12/10	13	5.47	2.64	0.17	3.00	No				

Note: MESOPUFF II modeling is performed in the inert mode (i.e., without chemical transformation or wet/dry deposition).

(1) No additional analysis is needed if no exceedance of the increment is predicted or the proposed FPC facility's impacts

TABLE 5.6.1-37
SUMMARY OF 1983 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT REMAINING AFTER MESOPUFF II MODEL, STEPS 3 AND 4
(Based on the FPC Facility's Impacts Predicted to be Greater than the Significant Impact Levels (SIL) Using the MESOPUFF II Model Through Step 2)

Time Period			Rec.	Concentration (μg/m³)		MESOPUFF Step 3 Concentration (μg/m³)						MESOPUFF Step 4 Concentration (μg/m³)					
						Case 1 (1)		Case 2 (2)		Case 3 (3)		Case 1 (1)		Case 2 (2)		Case 3 (3)	
Julian Day	Hour End	Month/ Day	Rec. No.	ISCST for Sources <=50 km of Class I Area (A)	MESOPUFF Step 2 for Non-FPC Sources >50 km of Class I Area (B)	MESOPUFF FPC Only (C)	Adj. Total (A+B+C)	MESOPUFF FPC Only (D)	Adj. Total (A+B+D)	MESOPUFF FPC Only (E)	Adj. Total (A+B+E)	Non-FPC Src. >50 km of Class I Area (F)	Adj. Total (A+C+F)	Non-FPC Src. >50 km of Class I Area (G)	Adj. Total (A+D+G)	Non-FPC Src. >50 km of Class I Area (H)	Adj. Total (A+E+H)
24-Hour Concentration Analysis																	
84	24	3/05	6	3.08	1.19	0.71	4.98	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
122	24	5/02	3	0.19	5.42	0.30	5.91	0.30	5.91	0.30	5.91	3.02	3.51	NA	NA	NA	NA
122	24	5/02	4	0.80	5.35	0.28	6.53	0.28	6.53	0.28	6.53	2.86	4.14	NA	NA	NA	NA
122	24	5/02	13	0.66	4.14	0.22	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
127	24	5/07	5	2.41	4.11	0.32	6.84	0.32	6.84	0.32	6.84	3.34	6.07	3.34	6.07	3.32	6.05
127	24	5/07	6	2.11	4.02	0.31	6.44	0.31	6.44	0.31	6.44	3.20	5.62	3.20	5.62	3.17	5.59
127	24	5/07	7	1.35	4.05	0.268	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
127	24	5/07	8	1.19	4.14	0.268	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
127	24	5/07	10	1.01	4.21	0.30	5.52	0.30	5.52	0.30	5.52	3.26	4.57	NA	NA	NA	NA
127	24	5/07	11	1.41	4.34	0.31	6.06	0.31	6.06	0.31	6.06	3.40	5.12	3.40	5.12	3.35	5.07
127	24	5/07	12	1.38	4.50	0.32	6.20	0.32	6.20	0.32	6.20	3.54	5.24	3.54	5.24	3.51	5.21
127	24	5/07	13	1.44	4.65	0.35	6.44	0.35	6.44	0.35	6.44	3.68	5.47	3.68	5.47	3.64	5.43

Note: NA is not applicable because the proposed FPC's impacts are less than the SIL or the predicted total concentration is less than the PSD Class I increment.

(1) Case 1 includes chemical transformation, dry deposition, Gaussian vertical concentration distribution.
(2) Case 2 includes options in Case 1 plus wet deposition.
(3) Case 3 includes options in Case 2 plus option for 3 vertical layers used for deposition.

TABLE 5.6.1-38

SUMMARY OF 1983 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT REMAINING AFTER MESOPUFF II MODEL, STEPS 3 AND 4, CASE 4 (1)

(Based on the FPC Facility's Impacts Predicted to be Greater than the Significant Impact Levels (SIL) Using the MESOPUFF II Model Through Step 4, Case 3)

Time Period			Receptor	Concentration (µg/m³)		MESOPUFF Step 3 Concentration (µg/m³)		MESOPUFF Step 4 Concentration (µg/m³)	
				ISCST for Sources <=50 km of Class I Area	MESOPUFF Step 4, Case 3 Non-FPC Sources >50 km of Class I Area	Case 4		Case 4	
Julian Day	Hour Ending	Month/ Day	Receptor Number	(A)	(B)	MESOPUFF FPC Only (C)	Adjusted Total (A+B+C)	Non-FPC Src. >50 km of Class I Area (D)	Adjusted Total (A+C+D)
24-Hour Concentration Analysis									
127	24	5/07	5	2.41	3.32	0.044	5.77	1.32	3.77
127	24	5/07	6	2.11	3.17	0.034	5.31	1.28	3.42
127	24	5/07	11	1.41	3.35	0.035	4.80	1.49	2.94
127	24	5/07	12	1.38	3.51	0.042	4.93	1.53	2.95
127	24	5/07	13	1.44	3.64	0.055	5.14	1.61	3.11

(1) Case 1 includes chemical transformation, dry deposition, Gaussian vertical concentration distribution.
Case 2 includes options in Case 1 plus wet deposition.
Case 3 includes options in Case 2 plus option for 3 vertical layers used for deposition.
Case 4 includes options in Case 3 plus option for uniform vertical concentration distribution instead of Gaussian.

TABLE 5.6.1-39

SUMMARY OF 1984 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT REMAINING AFTER MESOPUFF II MODEL, STEPS 3 AND 4

(Based on the FPC Facility's Impacts Predicted to be Greater than the Significant Impact Levels (SIL) Using the MESOPUFF II Model Through Step 2)

Time Period			Rec.	Concentration (μg/m³)		MESOPUFF Step 3 Concentration (μg/m³)						MESOPUFF Step 4 Concentration (μg/m³)					
						Case 1 (1)		Case 2 (2)		Case 3 (3)		Case 1 (1)		Case 2 (2)		Case 3 (3)	
Julian Day	Hour End	Month/ Day	Rec. No.	ISCST for Sources <=50 km of Class I Area (A)	MESOPUFF Step 2 for Non-FPC Sources >50 km of Class I Area (B)	MESOPUFF FPC Only (C)	Adj. Total (A+B+C)	MESOPUFF FPC Only (D)	Adj. Total (A+B+D)	MESOPUFF FPC Only (E)	Adj. Total (A+B+E)	Non-FPC Src. >50 km of Class I Area (F)	Adj. Total (A+C+F)	Non-FPC Src. >50 km of Class I Area (G)	Adj. Total (A+D+G)	Non-FPC Src. >50 km of Class I Area (H)	Adj. Total (A+E+H)
24-Hour Concentration Analysis																	
84	24	3/04	1	0.60	4.20	0.254	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
84	24	3/04	2	0.60	4.15	0.243	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
84	24	3/04	3	2.26	4.03	0.236	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Note: NA is not applicable because the proposed FPC's impacts are less than the SIL or the predicted total concentration is less than the PSD Class I increment.

(1) Case 1 includes chemical transformation, dry deposition, Gaussian vertical concentration distribution.
(2) Case 2 includes options in Case 1 plus wet deposition.
(3) Case 3 includes options in Case 2 plus option for 3 vertical layers used for deposition.

TABLE 5.6.1-40
SUMMARY OF 1985 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT REMAINING AFTER MESOPUFF II MODEL, STEPS 3 AND 4
(Based on the FPC Facility's Impacts Predicted to be Greater than the Significant Impact Levels (SIL) Using the MESOPUFF II Model Through Step 2)

Time Period			Rec.	Concentration ($\mu g/m^3$)		MESOPUFF Step 3 Concentration ($\mu g/m^3$)						MESOPUFF Step 4 Concentration ($\mu g/m^3$)					
						Case 1 (1)		Case 2 (2)		Case 3 (3)		Case 1 (1)		Case 2 (2)		Case 3 (3)	
Julian Day	Hour End	Month/ Day	Rec. No.	ISCST for Sources <=50 km of Class I Area (A)	MESOPUFF Step 2 for Non-FPC Sources >50 km of Class I Area (B)	MESOPUFF FPC Only (C)	Adj. Total (A+B+C)	MESOPUFF FPC Only (D)	Adj. Total (A+B+D)	MESOPUFF FPC Only (E)	Adj. Total (A+B+E)	Non-FPC Src. >50 km of Class I Area (F)	Adj. Total (A+C+F)	Non-FPC Src. >50 km of Class I Area (G)	Adj. Total (A+D+G)	Non-FPC Src. >50 km of Class I Area (H)	Adj. Total (A+E+H)
24-Hour Concentration Analysis																	
242	24	8/30	6	2.46 (4)	2.27	2.10	6.83	1.95	6.68	1.95	6.68	2.13	6.69	2.10	6.51	2.10	6.51
242	24	8/30	7	1.82	2.57	2.04	6.43	1.90	6.29	1.90	6.29	2.40	6.26	2.39	6.11	2.39	6.11
242	24	8/30	10	1.49	1.87	2.03	5.39	1.91	5.27	1.91	5.27	1.69	5.21	1.64	5.04	1.64	5.04
242	24	8/30	11	1.83	1.31	1.94	5.08	1.85	4.99	NA	NA	NA	NA	NA	NA	NA	NA
242	24	8/30	12	2.45	0.89	1.80	4.94	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Note: NA is not applicable because the proposed FPC's impacts are less than the SIL or the predicted total concentration is less than the PSD Class I increment.

(1) Case 1 includes chemical transformation, dry deposition, Gaussian vertical concentration distribution.
(2) Case 2 includes options in Case 1 plus wet deposition.
(3) Case 3 includes options in Case 2 plus option for 3 vertical layers used for deposition.
(4) Based on revised exit velocity and temperature for Florida Crushed Stone emission source and elimination of Oman Construction source.

TABLE 5.6.1-41

SUMMARY OF 1985 PREDICTED CONCENTRATIONS COMPARED TO THE SO_2 PSD CLASS I INCREMENT AFTER MESOPUFF II MODEL, STEPS 3 AND 4, CASE 4 (1)

(Based on the FPC Facility's Impacts Predicted to be Greater than the Significant Impact Levels (SIL) Using the MESOPUFF II Model Through Step 4, Case 3)

Time Period			Receptor	Concentration (µg/m³)		MESOPUFF Step 3 Concentration (µg/m³)		MESOPUFF Step 4 Concentration (µg/m³)	
				ISCST for Sources <=50 km of Class I Area	MESOPUFF Step 4, Case 3 Non-FPC Sources >50 km of Class I Area	Case 4		Case 4	
Julian Day	Hour Ending	Month/ Day	Receptor Number			MESOPUFF FPC Only	Adjusted Total	Non-FPC Src. >50 km of Class I Area	Adjusted Total
				(A)	(B)	(C)	(A+B+C)	(D)	(A+C+D)
24-Hour Concentration Analysis									
242	24	8/30	6	2.46 (2)	2.10	1.17	5.73	1.10	4.73
242	24	8/30	7	1.82	2.39	1.14	5.35	1.29	4.25
242	24	8/30	10	1.49	1.64	1.20	4.33	1.02	3.71

(1) Case 1 includes chemical transformation, dry deposition, Gaussian vertical concentration distribution.
Case 2 includes options in Case 1 plus wet deposition.
Case 3 includes options in Case 2 plus option for 3 vertical layers used for deposition.
Case 4 includes options in Case 3 plus option for uniform vertical concentration distribution instead of Gaussian.

(2) Based on revised exit velocity and temperature for Florida Crushed Stone emission source and elimination of Oman Construction source.

TABLE 5.6.1-42

SUMMARY OF 1986 PREDICTED VIOLATIONS OF THE SO_2 PSD CLASS I INCREMENT REMAINING AFTER MESOPUFF II MODEL, STEPS 3 AND 4

(Based on the FPC Facility's Impacts Predicted to be Greater than the Significant Impact Levels (SIL) Using the MESOPUFF II Model Through Step 2)

Time Period			Rec.	Concentration (μg/m³)		MESOPUFF Step 3 Concentration (μg/m³)						MESOPUFF Step 4 Concentration (μg/m³)					
						Case 1 (1)		Case 2 (2)		Case 3 (3)		Case 1 (1)		Case 2 (2)		Case 3 (3)	
Julian Day	Hour End	Month/ Day	Rec. No.	ISCST for Sources <=50 km of Class I Area (A)	MESOPUFF Step 2 for Non-FPC Sources >50 km of Class I Area (B)	MESOPUFF FPC Only (C)	Adj. Total (A+B+C)	MESOPUFF FPC Only (D)	Adj. Total (A+B+D)	MESOPUFF FPC Only (E)	Adj. Total (A+B+E)	Non-FPC Src. >50 km of Class I Area (F)	Adj. Total (A+C+F)	Non-FPC Src. >50 km of Class I Area (G)	Adj. Total (A+D+G)	Non-FPC Src. >50 km of Class I Area (H)	Adj. Total (A+E+H)
24-Hour Concentration Analysis																	
329	24	11/25	1	0.10	5.23	0.71	6.04	0.71	6.04	0.71	6.04	4.53	5.34	4.53	5.34	4.53	5.34
329	24	11/25	2	0.13	5.36	0.55	6.04	0.55	6.04	0.55	6.04	4.43	5.11	4.43	5.11	4.43	5.11
329	24	11/25	4	0.96	4.99	0.41	6.36	0.41	6.36	0.41	6.36	3.85	5.22	3.85	5.22	3.85	5.22
329	24	11/25	13	0.90	4.03	0.40	5.33	0.40	5.33	0.40	5.33	2.82	4.12	NA	NA	NA	NA

Note: NA is not applicable because the proposed FPC's impacts are less than the SIL or the predicted total concentration is less than the PSD Class I increment.

(1) Case 1 includes chemical transformation, dry deposition, Gaussian vertical concentration distribution.
(2) Case 2 includes options in Case 1 plus wet deposition.
(3) Case 3 includes options in Case 2 plus option for 3 vertical layers used for deposition.

TABLE 5.6.1-43

SUMMARY OF 1986 PREDICTED CONCENTRATIONS COMPARED TO THE SO, PSD CLASS I INCREMENT AFTER MESOPUFF II MODEL, STEPS 3 AND 4, CASE 4 (1)

(Based on the FPC Facility's Impacts Predicted to be Greater than the Significant Impact Levels (SIL) Using the MESOPUFF II Model Through Step 4, Case 3)

Time Period			Receptor	Concentration (μg/m³)		MESOPUFF Step 3 Concentration (μg/m³)		MESOPUFF Step 4 Concentration (μg/m³)	
				ISCST for Sources <=50 km of Class I Area	MESOPUFF Step 4, Case 3 Non-FPC Sources >50 km of Class I Area	Case 4		Case 4	
Julian Day	Hour Ending	Month/ Day	Receptor Number			MESOPUFF FPC Only	Adjusted Total	Non-FPC Src. >50 km of Class I Area	Adjusted Total
				(A)	(B)	(C)	(A+B+C)	(D)	(A+C+D)
24-Hour Concentration Analysis									
329	24	11/25	1	0.10	4.53	0.44	5.07	1.82	2.36
329	24	11/25	2	0.13	4.43	0.34	4.90	1.76	2.23
329	24	11/25	4	0.96	3.85	0.19	5.00	1.63	2.78

(1) Case 1 includes chemical transformation, dry deposition, Gaussian vertical concentration distribution.
Case 2 includes options in Case 1 plus wet deposition.
Case 3 includes options in Case 2 plus option for 3 vertical layers used for deposition.
Case 4 includes options in Case 3 plus option for uniform vertical concentration distribution instead of Gaussian.

TABLE 5.6.1-44
ESTIMATED PROJECT IMPACTS AND BACKGROUND CONCENTRATIONS IN CLASS I AREA

Pollutant	Maximum Predicted Concentrations ($\mu g/m^3$)					Estimated Background ($\mu g/m^3$)
	1-Hour	3-Hour	8-Hour	24-Hour	Annual	
CO	1.49E+01	6.44E+00	3.04E+00	1.23E+00	1.14E-01	1700
NO_2	3.34E+01	1.62E+01	7.52E+00	2.86E+00	1.76E-01	10
SO_2	2.95E+01	1.27E+01	6.02E+00	2.42E+00	2.25E-01	3
PM	3.64E+00	1.76E+00	8.20E-01	3.11E-01	2.82E-02	29
VOC (O_3)	1.62E+00	7.14E-01	3.36E-01	1.34E-01	1.24E-02	55
Lead	2.02E-02	1.09E-02	5.00E-03	1.79E-03	1.59E-04	0.1
Beryllium	3.28E-04	1.79E-04	8.19E-05	2.92E-05	9.30E-07	N/A
Mercury	2.29E-03	1.12E-03	5.21E-04	1.97E-04	1.77E-05	N/A
Fluorides	3.91E-03	1.26E-03	6.23E-04	2.94E-04	2.89E-05	N/A
H_2SO_4	2.45E+00	1.14E+00	5.34E-01	2.06E-01	1.89E-02	N/A
Arsenic	2.05E-03	9.22E-04	4.33E-04	1.71E-04	1.55E-05	N/A
Antimony	2.91E-03	1.58E-03	7.27E-04	2.59E-04	5.22E-06	N/A
Barium	1.28E-02	5.14E-03	2.45E-03	1.03E-03	9.70E-05	N/A
Boron	8.35E-03	4.59E-03	2.10E-03	7.47E-04	3.78E-06	N/A
Cadmium	1.46E-03	7.80E-04	3.58E-04	1.29E-04	4.80E-06	N/A
Calcium	9.58E-02	5.27E-02	2.41E-02	8.57E-03	4.34E-05	N/A
Chromium	2.51E-02	1.27E-02	5.86E-03	2.19E-03	1.93E-04	N/A
Cobalt	3.95E-03	1.54E-03	7.39E-04	3.14E-04	2.57E-05	N/A
Copper	3.77E-02	2.04E-02	9.35E-03	3.35E-03	6.17E-05	N/A
Formaldehyde	2.95E-02	1.59E-02	7.32E-03	2.62E-03	2.23E-05	N/A
Magnesium	2.98E-02	1.64E-02	7.50E-03	2.66E-03	1.35E-05	N/A
Manganese	5.27E-03	2.23E-03	1.06E-03	4.33E-04	3.64E-05	N/A
Nickel	3.03E-02	1.53E-02	7.08E-03	2.64E-03	1.27E-04	N/A
Selenium	3.79E-03	1.64E-03	7.76E-04	3.11E-04	2.90E-05	N/A
Vanadium	1.64E-02	7.32E-03	3.44E-03	1.36E-03	5.92E-05	N/A
Zinc	1.12E-01	5.65E-02	2.62E-02	9.72E-03	5.92E-04	N/A

Notes: Short-term values are highest, second-highest concentrations. See text for sources of estimated background concentrations.
N/A: Not Available
Source: Ebasco Environmental, 1992

TABLE 5.6.1-45
ESTIMATED PROJECT IMPACTS AND BACKGROUND CONCENTRATIONS IN THE GENERAL VICINITY OF THE PROPOSED PROJECT

Pollutant	Maximum Predicted Concentrations ($\mu g/m^3$)					Estimated Background ($\mu g/m^3$)
	1-Hour	3-Hour	8-Hour	24-Hour	Annual	
CO	4.14E+02	2.35E+02	9.70E+01	3.70E+01	3.44E+00	1700
NO_2	1.52E+03	6.67E+02	3.15E+02	1.12E+02	4.60E+00	25
SO_2	1.04E+03	2.63E+02	2.19E+02	6.55E+01	4.80E+00	5
PM	1.65E+02	7.20E+01	3.40E+01	1.15E+01	9.05E-01	12
VOC (O_3)	6.03E+01	2.67E+01	1.25E+01	4.15E+00	3.68E-01	55
Lead	1.13E+00	4.84E-01	2.30E-01	7.75E-02	5.23E-03	N/A
Beryllium	1.88E-02	8.00E-03	3.80E-03	1.28E-03	3.09E-05	N/A
Mercury	1.07E-01	4.72E-02	2.23E-02	8.22E-03	6.61E-04	N/A
Fluorides	5.42E-02	2.84E-02	1.27E-02	3.94E-03	7.50E-04	N/A
H_2SO_4	1.03E+02	4.50E+01	2.12E+01	7.11E+00	5.69E-01	N/A
Arsenic	7.95E-02	3.52E-02	1.65E-02	5.64E-03	4.95E-04	N/A
Antimony	1.66E-01	7.08E-02	3.36E-02	1.13E-02	1.72E-04	N/A
Barium	3.75E-01	1.71E-01	7.96E-02	2.63E-02	2.80E-03	N/A
Boron	4.86E-01	2.07E-01	9.81E-02	3.31E-02	1.24E-04	N/A
Cadmium	8.06E-02	3.45E-02	1.64E-02	5.60E-03	1.68E-04	N/A
Calcium	5.57E+00	2.37E+00	1.13E+00	3.80E-01	1.42E-03	N/A
Chromium	1.25E+00	5.69E-01	2.68E-01	1.14E-01	1.00E-02	N/A
Cobalt	1.07E-01	4.96E-02	2.30E-02	7.65E-03	7.29E-04	N/A
Copper	2.13E+00	9.09E-01	4.31E-01	1.47E-01	2.23E-03	N/A
Formaldehyde	1.66E+00	7.08E-01	3.36E-01	1.13E-01	6.67E-04	N/A
Magnesium	1.73E+00	7.36E-01	3.50E-01	1.18E-01	4.42E-04	N/A
Manganese	1.79E-01	8.46E-02	3.95E-02	1.66E-02	1.64E-03	N/A
Nickel	1.50E+00	6.68E-01	3.16E-01	1.22E-01	6.50E-03	N/A
Selenium	1.35E-01	6.01E-02	2.81E-02	9.32E-03	8.54E-04	N/A
Vanadium	6.25E-01	2.76E-01	1.30E-01	4.32E-02	1.60E-03	N/A
Zinc	5.52E+00	2.39E+00	1.13E+00	3.91E-01	2.02E-02	N/A

Notes: Short-term values are highest, second-highest concentrations. See text for sources of estimated background concentrations.
N/A: Not Available
Source: Ebasco Environmental, 1992

TABLE 5.6.1-46
THRESHOLD NO_2 CONCENTRATIONS
FOR VISIBLE INJURY TO PLANT SPECIES

Exposure Period (Hour)	Threshold Concentration[a] ($\mu g/m^3$)	
	U.S. EPA (1976)	Thompson et al. (1974)
1	68,620	1,880-28,200
2	37,600	--
3	22,560	--
4	16,920	--
8	9,024	4,324-6,580[b]
24	4,324	1,880

[a] Extrapolated values
[b] Values reported for 8-21 hours

TABLE 5.6.1-47
RESPONSE OR SENSITIVITY RATING OF
VEGETATION TYPICAL OF THE PROPOSED PROJECT TO NO_2

Vegetation	NO_2 Concentration ($\mu g/m^3$)	Exposure Period	Rating or Response	Reference
Citrus sinensis	470	8 months	Intermediate sensitivity leaf abscission and reduced yield	Taylor and MacLean (1970) Thompson et al. (1970)
Melaleuca leucadendra	--	--	Moderately sensitive	MacLean et al. (1968)
Citrus sinensis (Marsh seedless grapefruit Valencia orange Tangelo orange Hamlin orange Temple orange)	376,000	4-8 hours	Necrotic areas along succulent young shoots	MacLean et al. (1968)
	470,000	1 hour	Necrotic areas along succulent young shoots	MacLean et al. (1968)

TABLE 5.6.1-48
THRESHOLD SO_2 CONCENTRATIONS FOR
VISIBLE INJURY TO SENSITIVE VEGETATION

Exposure Period (hour)	Threshold Concentration ($\mu g/m^3$)			
	Jacobsen (1977)	Jones et al. (1974)	Linzon (1973)	USEPA (1973)
1	2,000	1,300-2,620	1,834	1,300-7,860
2	1,050	--	1,048	655-5,240
3	850	786-1,572	785[a]	400-3,750[a]
4	750	--	681	262-2,620
8	500	--	472	131-1,310

[a] Interpolated value

TABLE 5.6.1-49

RESPONSE OR SENSITIVITY RATING OF

VEGETATION TYPICAL OF THE PROPOSED PROJECT TO SO_2 PAGE 1 OF 2

Vegetation	SO_2 Concentration ($\mu g/m^3$)	Exposure Period	Rating or Response	Reference
Acer sp.	118	Growing season	No leaf injury	Fed Am Soc Exp Bio (1973)
(maples)	--	--	Resistant	Sucoff and Bailey (1971)
	2,620-5,240	1 hour	Threshold level	Jones et al. (1974)
	1,572-2,096	3 hours	Threshold level	Jones et al. (1974)
Acer rubrum	--	--	Tolerant	USDA (1972)
(red maple)	786	5 hours	11% Leaf injury[a]	Davis and Shelly (1992)
Citrus sp.	--	--	Tolerant	USEPA (1976)
Citrus surantium	2,620	2 hours/day 40 days	No leaf injury, decrease in total linear growth	Fed Am Soc Exp Bio (1973)
Citrus mobillis var. unshiu	2,620	2 hours/day 40 days	No leaf injury	Fed Am Soc Exp Bio (1973)
Citrus sinensis (Koethon orange)	2,096	10 days	No visible injury Decreased growth	Mat Sushima and Brewer (1972)
Fragaria ananassa	2,620	6 hours/day 4 days	No leaf injury	Rajput et al. (1977)
Pinus sp.	3,930-5,240	Peak	Sensitive	Jones et al. (1974)
(southern pines)	2,620-5,240	1 hour	Sensitive	Jones et al. (1974)
	1,572-2,096	3 hours	Sensitive	Jones et al. (1974)
Pteridium aquilium (brackenfern)	--	--	Sensitive	USEPA (1976)
Quercus virginiana (live oak)	--	--	Tolerant	Loomis and Padgett (1973)

TABLE 5.6.1-49
RESPONSE OR SENSITIVITY RATING OF
VEGETATION TYPICAL OF THE PROPOSED PROJECT TO SO_2 PAGE 2 OF 2

Vegetation	SO_2 Concentration ($\mu g/m^3$)	Exposure Period	Rating or Response	Reference
Rhus spp.	2,620-3,920	Peak	Sensitive	Jones et al. (1974)
(summacs)	1,310-2,620	1 hour	Sensitive	Jones et al. (1974)
Rubus spp.	2,620-3,930	Peak	Sensitive	Jones et al. (1974)
	1,310-2,620	1 hour	Sensitive	Jones et al. (1974)
	786-1,572	3 hours	Sensitive	Jones et al. (1974)
Taxodium distichum (bald cypress)	2,620	48 hours	Reduced growth	Shanklin and Kozlowski (1985)

[a] Exposed to O_3 and acid precipitation as well as SO_2

TABLE 5.6.1-50
THRESHOLD O_3 CONCENTRATIONS FOR
VISIBLE INJURY TO PLANT SPECIES[a]

Exposure Period (hour)	Ozone Concentration ($\mu g/m^3$)		
	Sensitive	Intermediate	Tolerant
0.5	294-588	490-1,176	980
1.0	196-490	392-784	686
2.0	137-392	294-588	490
4.0	98-294	196-490	392
8.0	59-196	157-392	294

[a] Heggestad and Heck (1971)

TABLE 5.6.1-51
RESPONSE OR SENSITIVITY RATING OF VEGETATION TYPICAL OF THE PROJECT AREA TO OZONE

Vegetation	O_3 Concentration ($\mu g/m^3$)	Exposure Period	Impact Area Rating or Response	Reference
Acer rubrum (Red maple)	--	--	Tolerant	USDA (1972)
Acer rubrum	178	7 hours/day 8-12 weeks	Leaf injury	Davis and Shelly (1992)
	156	7 hours/day 8-12 weeks	11% leaf injury Less growth/biomass	
Citrus sp.	--	--	Sensitive	USEPA (1976)
Cornus sp.	--	--	Tolerant	USEPA (1976)
Liquidembar stryacilflua (sweetgum)	52	8 hours/day 3 days/week 16 weeks	Sensitive Growth reduction	Jensen and Dochinger, (1989)
Nyssa sylvatica (Blackgum)	--	--	Tolerant	USEPA (1976)
Parthenocissus quinquefolia (Virginia creeper)	784	4 hours/day 14 days	Leaf injury	Treshow (1970)
Pinus elliottii (Slash pine)	149-203 (Seasonal mean)	112 days	Increased reduction in growth with increasing O_3 concentrations	Hogsett et al. (1985)
Quercus rubra (Red Oak)	78	7 hours/day 8-12 weeks	Leaf injury	Davis and Shelly (1992)
	156	7 hours/day 8-12 weeks	5% leaf injury Less growth/biomass	

TABLE 5.6.1-52
RESPONSE OR SENSITIVITY RATING OF
VEGETATION TO MIXTURES OF SO_2 AND NO_2

Vegetation	SO_2 Concentration ($\mu g/m^3$)	NO_2 Concentration ($\mu g/m^3$)	Exposure Period	Rating or Response	Reference
Glycine max (Soybean)	131	94	4 hours	Slight leaf discoloration	Fed. Am. Soc. Exp. Bio. (1973)
	131-655	94-470	4 hours	Greater than additive effort	USEPA (1976)
	262	188	4 hours	Leaf injury (35%)	Tingey et al. (1971)
	262	282	4 hours	Leaf injury (20%)	Tingey et al. (1971)
	524	376	4 hours	Leaf injury (9%)	Tingey et al. (1971)
	262	94	4 hours	No leaf injury	Tingey et al. (1971)
Medicago sativa	655	470	1 hour	9% inhibition of CO_2 uptake	White et al. (1974)
	655	470	2 hours	15% inhibition of CO_2 uptake	White et al. (1974)
Nicotiana tabacum (Tobacco)	262	188	4 hours	Leaf injury (11%)	Tingey et al. (1971)
	262	282	4 hours	Leaf injury (18%)	Tingey et al. (1971)
Lycopersicon esculentum (Tomato)	262	188	4 hours	Leaf injury (1%)	Tingey et al. (1971)
	262	282	4 hours	Leaf injury (17%)	Tingey et al. (1971)

TABLE 5.6.1-53
RESPONSE OR SENSITIVITY RATING OF VEGETATION TO MIXTURES OF SO_2 AND O_3

Vegetation	SO_2 Concentration ($\mu g/m^3$)	O_3 Concentration ($\mu g/m^3$)	Exposure Period	Rating or Response	Reference
Acer rubrum	52	137	5 hours/day	Sensitive	Jensen and Dochinger
(red maple)			3 days/week, 16 weeks	Growth reduction	(1989)
			8 hours/day	Sensitive	
	52	294	3 days/week, 16 weeks	Growth reduction	Jensen and Dochinger (1989)
Brassica oleracea	1,310	98	4 hours	Leaf injury (4%)	Tingey et al. (1973b)
capitata	262	196	4 hours	Leaf injury (22%)	Tingey et al. (1973b)
(Cabbage)	655	196	4 hours	Leaf injury (14%)	Tingey et al. (1973b)
	1,310	98	4 hours	Leaf injury (54%)	Tingey et al. (1973b)
Fragaria ananassa	2,620	980	6 hours/day	Leaf injury	Rajput et al. (1977)
(strawberry)			4 days		
Fraxinus pennsylvanica	209	196	4 hours/day	Reduced growth[a]	Chappelka et al. (1988)
(green ash)			5 days/week, 6 weeks		
Glycine max	2,620	196	4 hours	Additive effect	USEPA (1976)
(soybean)	131	98	6 hours	Leaf injury and decreased growth	Tingey et al. (1973b)
	98	98	6 hours	Leaf injury and decreased growth	Heagle et al. (1974)
	196	196	6 hours	Leaf injury and decreased growth	Heagle et al. (1974)
	655	98	4 hours	No leaf injury	Tingey et al. (1973a)
	2,620	196	4 hours	Leaf injury (1%)	Tingey et al. (1973a)
Gossypium sp.	734-838	176-216	10 weeks	Leaf injury and chlorosis	Fed Am Soc E Bio (1975)
(cotton)					

TABLE 5.6.1-53
RESPONSE OR SENSITIVITY RATING OF VEGETATION TO MIXTURES OF SO_2 AND O_3

Vegetation	SO_2 Concentration ($\mu g/m^3$)	O_3 Concentration ($\mu g/m^3$)	Exposure Period	Rating or Response	Reference
Liquidambar styraciflua (sweetgum)	52	137	8 hours/day 3 days/week, 16 weeks	Sensitive Growth reduction	Jensen and Dochinger (1989)
	52	294	8 hours/day 3 days/week, 16 weeks	Sensitive Growth reduction	Jensen and Dochinger (1989)
Lycopersicon esculentum (tomato)	1,310	98	4 hours	Leaf injury (1%)	Tingey et al. (1973b)
	262	196	4 hours	Leaf injury (50%)	Tingey et al. (1973b)
	655	196	4 hours	Leaf injury (10%)	Tingey et al. (1973b)
	1,310	196	4 hours	Leaf injury (13%)	Tingey et al. (1973b)
Medicago sativa (alfalfa)	1,310	98	4 hours	Leaf injury (2%)	Tingey et al. (1973b)
	262	196	4 hours	Leaf injury (24%)	Tingey et al. (1973b)
	655	196	4 hours	Leaf injury (21%)	Tingey et al. (1973b)
	1,310	196	4 hours	Leaf injury (60%)	Tingey et al. (1973b)
Nicotiana tabacum	1,310	98	4 hours	Leaf injury (60%)	Tingey et al. (1973b)
	262	196	4 hours	Leaf injury (95%)	Tingey et al. (1973b)
	655	196	4 hours	Leaf injury (88%)	Tingey et al. (1973b)
	1,310	196	4 hours	Leaf injury (96%)	Tingey et al. (1973b)

[a] In combination with simulated acid rain

TABLE 5.6.1-54
SUMMARY OF ESTIMATED TRACE ELEMENT SOIL CONCENTRATIONS IN THE CLASS I AREA

Trace Elements	Maximum Predicted Trace Element Concentration ($\mu g/m^3$)	Deposition Flux ($g/m^2/yr$)	Estimated Soil Concentration Increase (mg/kg/yr)	Average Background Soil Concentration	Percent Increase Due to Emissions From the Proposed Project	
					Per Annum	30 Year Plant Life
Lead	1.59E-04	3.31E-05	1.41E-04	14.00	1.01E-03	3.02E-02
Beryllium	9.30E-07	1.94E-07	8.24E-07	0.55	1.50E-04	4.49E-03
Mercury	1.77E-05	3.68E-06	1.57E-05	0.08	1.94E-02	5.81E-01
Arsenic	1.55E-05	3.23E-06	1.37E-05	4.80	2.86E-04	8.58E-03
Antimony	5.22E-06	1.09E-06	4.62E-06	0.52	8.89E-04	2.67E-02
Barium	9.70E-05	2.02E-05	8.59E-05	290.00	2.96E-05	8.89E-04
Boron	3.78E-06	7.87E-07	3.35E-06	31.00	1.08E-05	3.24E-04
Cadmium	4.80E-06	9.99E-07	4.25E-06	0.06	7.09E-03	2.13E-01
Calcium	4.33E-05	9.01E-06	3.84E-05	24,000.00	1.60E-07	4.79E-06
Chromium	1.93E-04	4.02E-05	1.71E-04	33.00	5.18E-04	1.55E-02
Cobalt	2.57E-05	5.35E-06	2.28E-05	5.90	3.86E-04	1.16E-02
Copper	6.17E-05	1.28E-05	5.46E-05	13.00	4.20E-04	1.26E-02
Manganese	3.64E-05	7.58E-06	3.22E-05	260.00	1.24E-05	3.72E-04
Nickel	1.27E-04	2.64E-05	1.12E-04	11.00	1.02E-03	3.07E-02
Selenium	2.90E-05	6.04E-06	2.57E-05	0.30	8.56E-03	2.57E-01
Vanadium	5.92E-05	1.23E-05	5.24E-05	43.00	1.22E-04	3.66E-03
Zinc	5.92E-04	1.23E-04	5.24E-04	40.00	1.31E-03	3.93E-02

Source: Ebasco Environmental, 1992

TABLE 5.6.1-55
SUMMARY OF ESTIMATED TRACE ELEMENT SOIL CONCENTRATIONS IN THE GENERAL VICINITY OF THE PROPOSED PROJECT

Trace Elements	Maximum Predicted Trace Element Concentration ($\mu g/m^3$)	Deposition Flux ($g/m^2/yr$)	Estimated Soil Concentration Increase (mg/kg/yr)	Average Background Soil Concentration	Percent Increase Due to Emissions From the Proposed Project	
					Per Annum	30 Year Plant Life
Lead	5.23E-03	1.09E-03	4.63E-03	14.00	3.31E-02	9.92E-01
Beryllium	3.09E-05	6.43E-06	2.74E-05	0.55	4.48E-03	1.49E-01
Mercury	6.61E-04	1.38E-04	5.85E-04	0.08	7.18E-01	2.15E+01
Arsenic	4.95E-04	1.03E-04	4.38E-04	4.80	9.13E-03	2.74E-01
Antimony	1.72E-04	3.58E-05	1.52E-04	0.52	2.93E-02	8.79E-01
Barium	2.80E-03	5.83E-04	2.48E-03	290.00	8.55E-04	2.57E-02
Boron	1.24E-04	2.58E-05	1.10E-04	31.00	3.54E-04	1.06E-02
Cadmium	1.68E-04	3.50E-05	1.49E-04	0.06	2.47E-01	7.42E+00
Calcium	1.42E-03	2.96E-04	1.26E-03	24,000.00	5.26E-06	1.58E-04
Chromium	1.00E-02	2.08E-03	8.86E-03	33.00	2.68E-02	8.05E-01
Cobalt	7.29E-04	1.52E-04	6.46E-04	5.90	1.09E-02	3.28E-01
Copper	2.23E-03	4.64E-04	1.97E-03	13.00	1.52E-02	4.56E-01
Manganese	1.64E-03	3.41E-04	1.45E-03	260.00	5.59E-04	1.68E-02
Nickel	6.50E-03	1.35E-03	5.76E-03	11.00	5.23E-02	1.57E+00
Selenium	8.54E-04	1.78E-04	7.56E-04	0.30	2.51E-01	7.54E+00
Vanadium	1.60E-03	3.33E-04	1.42E-03	43.00	3.29E-03	9.88E-02
Zinc	2.02E-02	4.20E-03	1.79E-02	40.00	4.46E-02	1.34E+00

Source: Ebasco Environmental, 1992

TABLE 5.6.1-56

REPORTED EFFECTS IN WILDLIFE OF SELECTED AIR CONTAMINANTS

Pollutant	Concentration ($\mu g/m^3$)	Exposure	Reported Effect	Reference
Sulfur Dioxide	427-854	1 hour	Respiratory stress in guinea pigs	Newman and Schreiber (1988)
	267	7 hours/day 5 days/week, 10 weeks	Respiratory stress in rats	Newman and Schreiber (1988)
	13-157	Continually for 5 months	Decreased abundance of deer mice	Newman and Schreiber (1988)
Nitrogen Dioxide	1,917	3 hours	Respiratory stress in mice	Trzeciak et al. (1977)
	96-958	8 hours/day, 122 days	Respiratory stress in guinea pigs	Gardner and Graham (1976)
Ozone	160?-200	3 hours	Respiratory stress; increased susceptibility to respiratory infection in mice rats and rabbits	Newman and Schreiber (1988)
Particulates	120 (PbO_3)	Continually for 2 months	Respiratory stress, reduced respiratory disease defenses	Newman and Schreiber (1988)
	100 ($NiCl_2$)	2 hours	Decreased respiratory disease defenses in rats and hamsters	Newman and Schreiber (1988)

TABLE 5.6.1-57
VISIBILITY ANALYSIS

Visual Effects Screening Analysis for
Source: FPC POLK COUNTY SITE
Class I Area: CHASSAHOWITZKA WILDERNESS

*** LEVEL-1 SCREENING ***

Input Emissions for

Particulates	67.06	
NOx (as NO2)	457.02	
Primary NO2	.00	G /S
Soot	.00	G /S
Primary SO4		

**** Default particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	.04 ppm
Background Visual Range:	25.00 km
Source-Observer Distance:	117.90 km
Min. Source-Class I Distance:	117.90 km
Max. Source-Class I Distance:	137.30 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

RESULTS

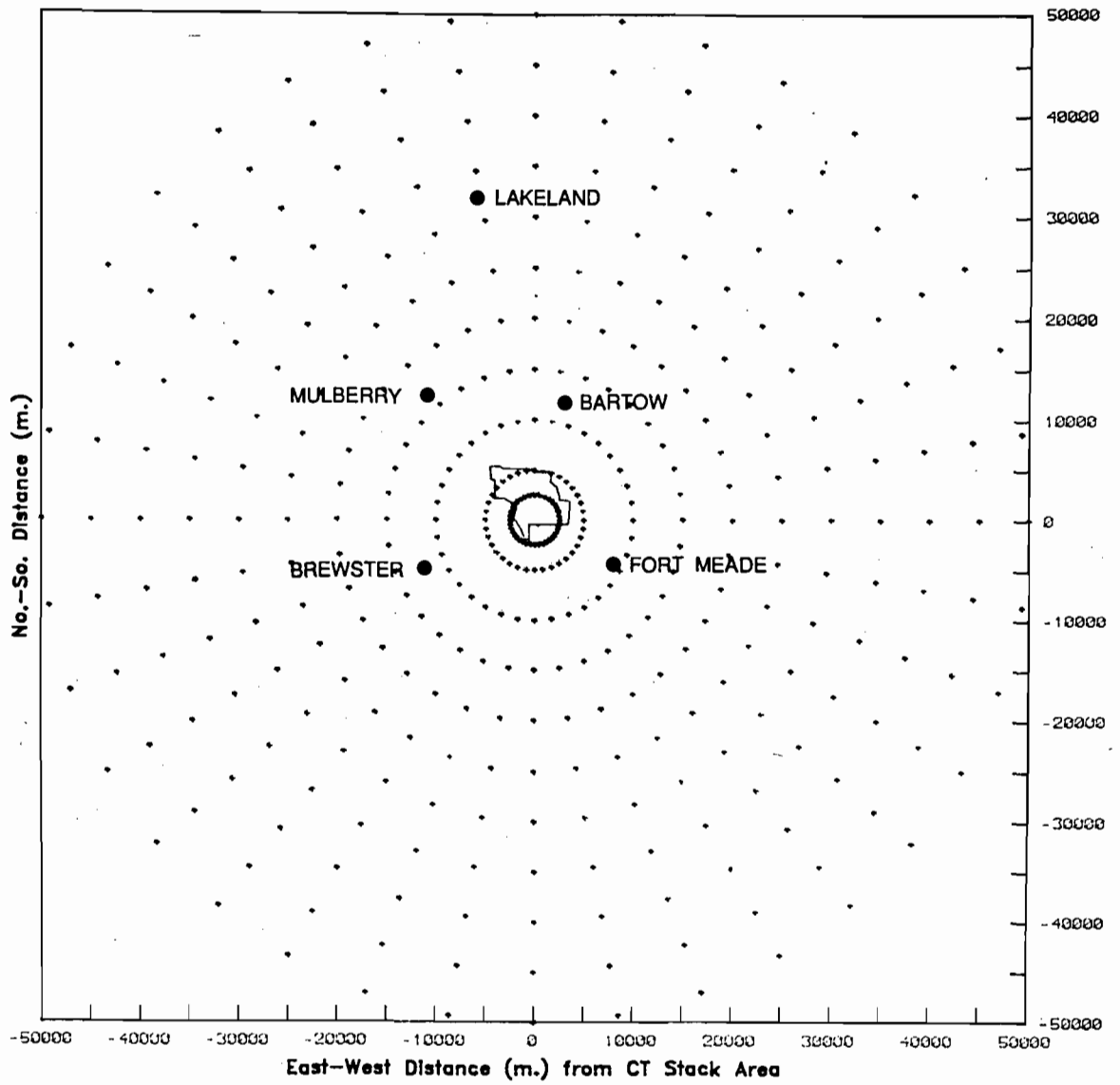
Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screen Criteria ARE NOT Exceeded

					Delta E		Contrast	
Background	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	117.9	84.	2.00	.242	.05	-.000
SKY	140.	84.	117.9	84.	2.00	.063	.05	-.003
TERRAIN	10.	84.	117.9	84.	2.00	.013	.05	.000
TERRAIN	140.	84.	117.9	84.	2.00	.004	.05	.000

Maximum Visual Impacts OUTSIDE Class I Area
Screening Crieria ARE NOT Exceeded

					Delta E		Contrast	
Background	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	75.	114.1	94.	2.00	.252	.05	-.000
SKY	140.	75.	114.1	94.	2.00	.066	.05	-.003
TERRAIN	10.	65.	110.0	104.	2.00	.019	.05	.000
TERRAIN	140.	65.	110.0	104.	2.00	.005	.05	.000

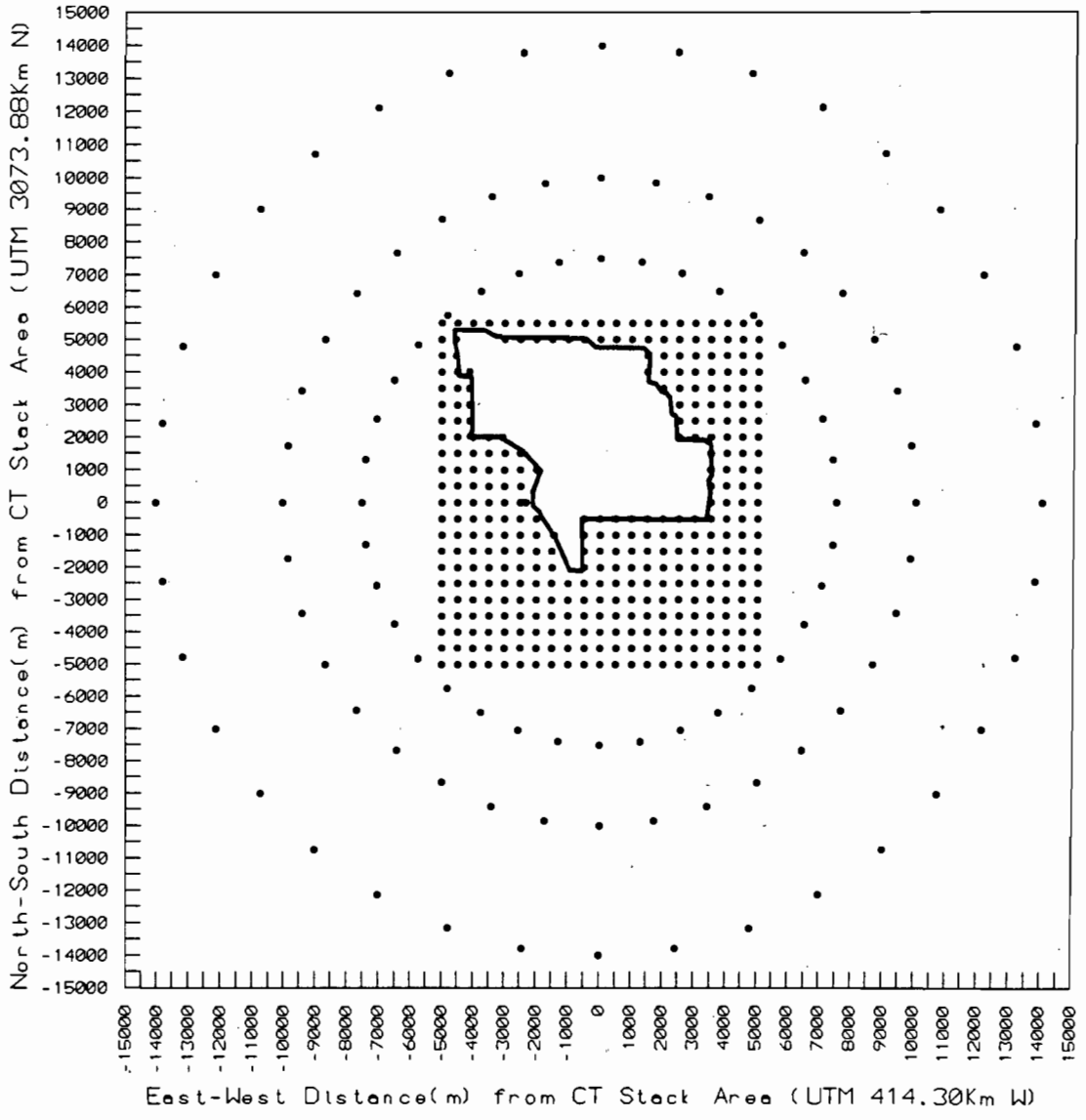


Source: Ebasco Environmental, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 5.6.1-1
RECEPTOR GRID FOR SIGNIFICANT IMPACT AREA ANALYSES

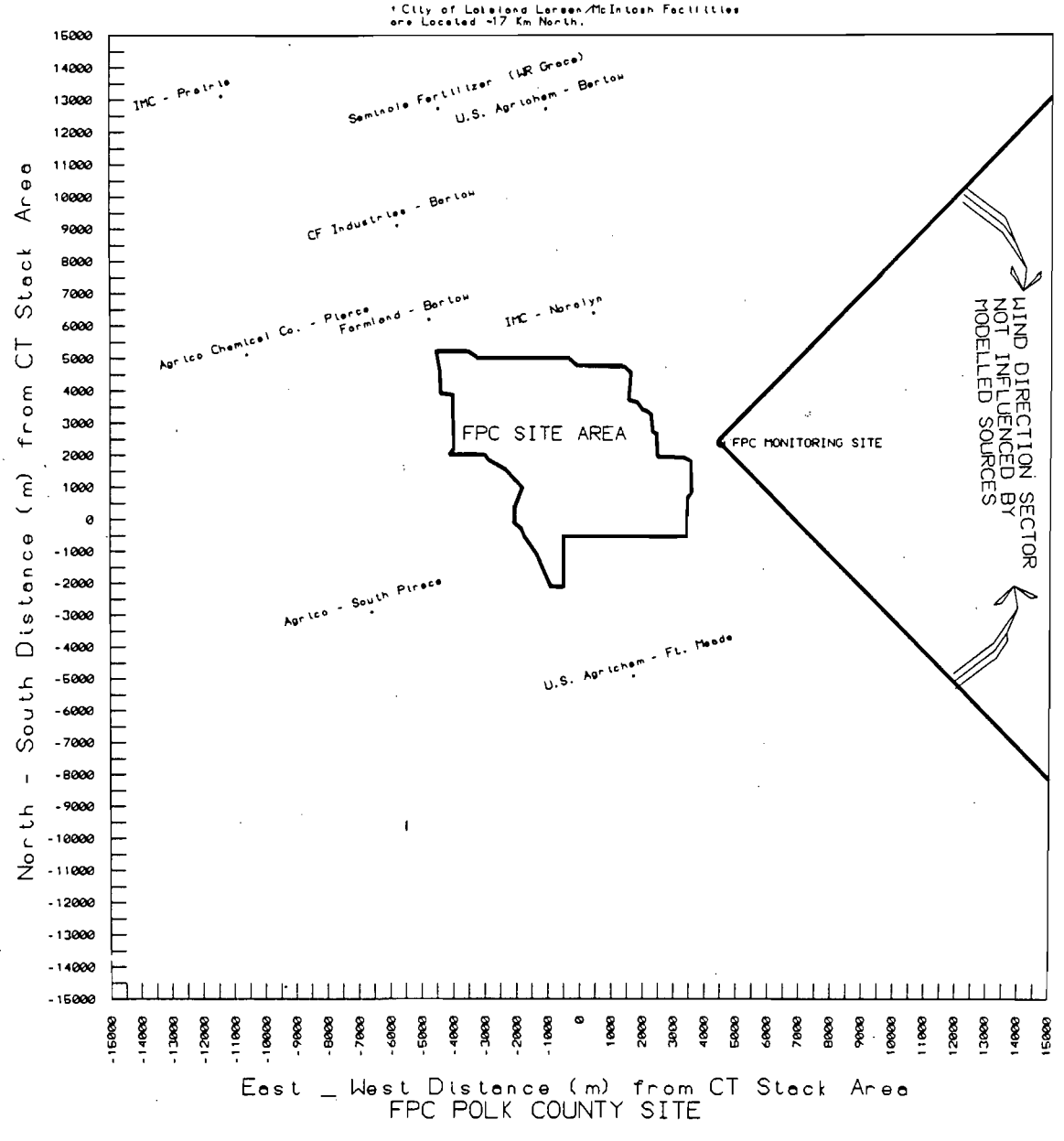


Source: Ebasco Environmental, 1992

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FIGURE 5.6.1-2
COARSE RECEPTOR GRID FOR CLASS II PSD AND AAQS ANALYSES

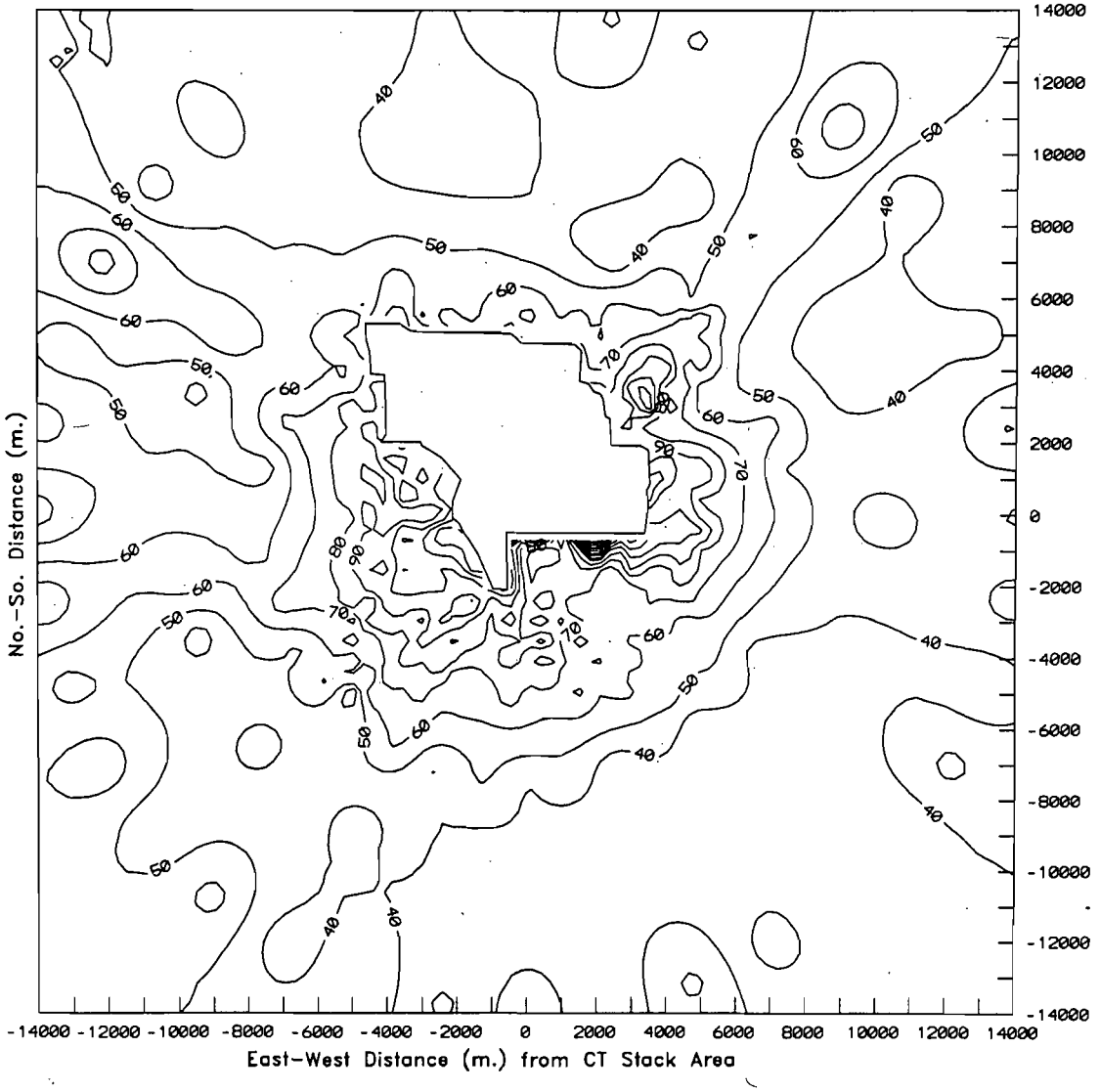


Source: Ebasco Environmental, 1992

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FIGURE 5.6.1-3
LOCATIONS OF SELECTED NEAR-SITE MODELLED PM SOURCES AND WIND DIRECTION SECTOR CONSIDERED FOR BACKGROUND PM CONCENTRATIONS

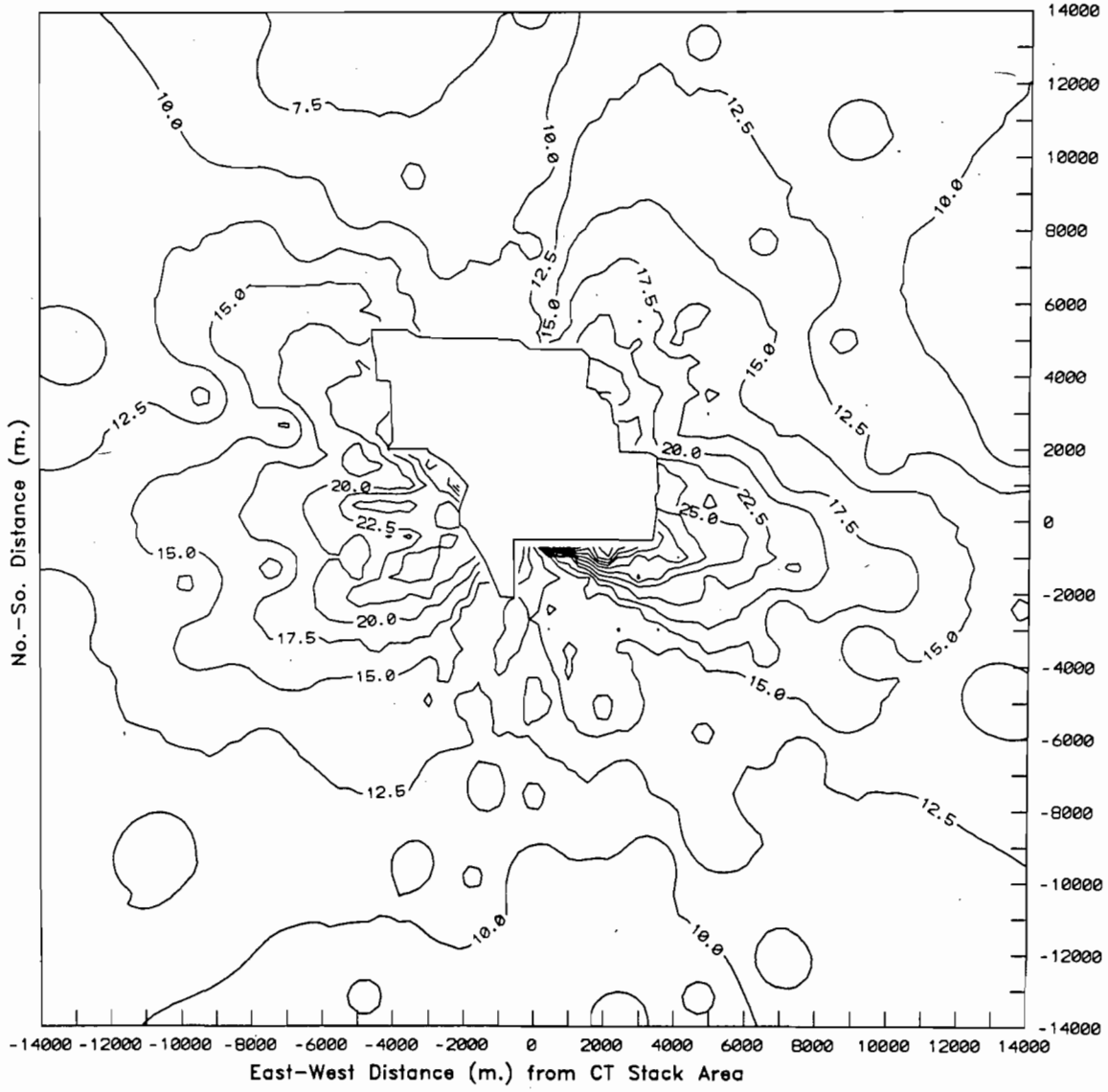


Source: Ebasco Environmental, 1992

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Polk County Site

FIGURE 5.6.1-4
MAXIMUM PREDICTED OFF-SITE 3-HOUR AVERAGE SO_2 PROJECT IMPACTS ($\mu g/m^3$)

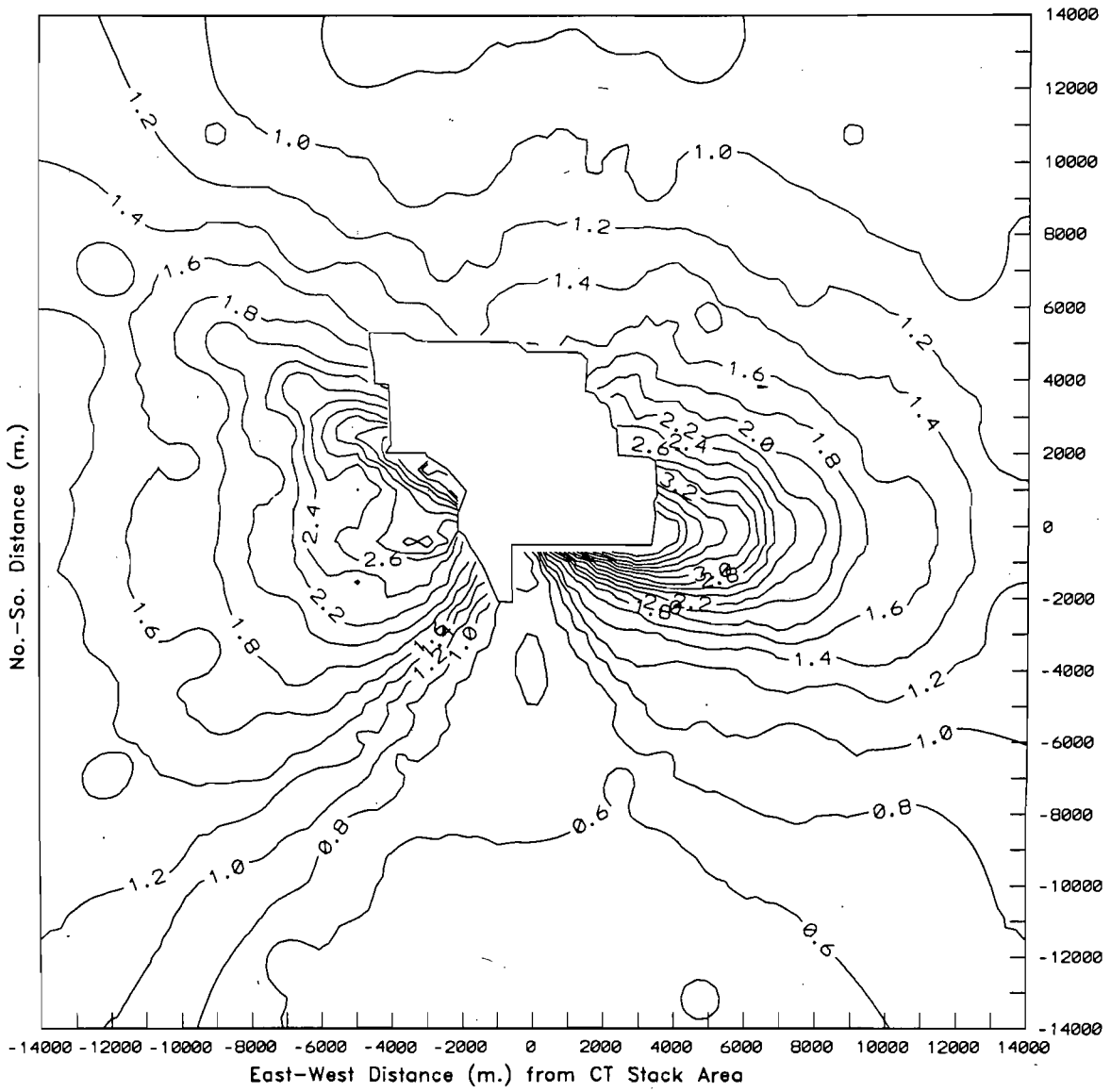


Source: Ebasco Environmental, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 5.6.1-5
MAXIMUM PREDICTED OFF-SITE 24-HOUR AVERAGE SO_2 PROJECT IMPACTS ($\mu g/m^3$)



Source: Ebasco Environmental, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 5.6.1-6
MAXIMUM PREDICTED OFF-SITE ANNUAL AVERAGE SO_2 PROJECT IMPACTS ($\mu g/m^3$)

5.7 NOISE

Potential noise impacts have been assessed for the four closest groups of residential receptors and two small churches around the project site. Both continuous and intermittent sources of noise resulting from operation of the full 3,200 MW development, with coal gasification, have been assessed for two possible site configurations. The first configuration, or option, includes twelve CTs with six coal gasification plants. The second option replaces four of the twelve CTs and two of the six coal gasification plants with two 600 MW PC steam turbine generating units. The NOISECALC noise model developed by the New York State Department of Public Service (Driscoll, 1984) was the primary analytical tool employed in the assessment (see Appendix 10.5.7 for a description of the model).

Since specific equipment has not been selected, this noise assessment was performed using similar equipment, scaled up on a megawatt basis, from the recently certified FPL Martin CGCC Project. Using equipment similar to that used in the FPL Martin CGCC Project and increasing, or scaling up, the effects of this equipment based on the increase in wattage of the FPC Polk County Site, introduces a measure of conservatism in all calculations derived from the use of such equipment. Noise level input data for the Martin Project were obtained from a variety of sources. Power block data were provided by vendors; gasifier plant noise levels were based on actual measurements performed at the Shell Oil Company demonstration plant in Texas; and train and coal handling equipment noise levels were obtained from literature values.

Predicted noise levels are compared with the EPA guideline day/night noise level (L_{dn}) of 55 dBA (EPA, 1974). This level does not represent a noise standard but is a guideline level which was developed without regard to cost or feasibility of compliance. The EPA document points out that a large portion of the population currently lives in much higher level noise environments, particularly in urban areas. Even in rural areas, residences located adjacent to railroads and highways typically experience L_{dn} levels well above 55 dBA. The predicted levels are also combined with the existing L_{dn} levels to determine the expected net increase in noise levels at the receptor locations. Increases of less than 5 dBA are considered to be insignificant.

5.7.1 Receptors and Barriers

Figure 5.7.1-1 is a map of the area which shows the locations of residential receptors and the two churches used in the noise model. Table 5.7.1-1 provides the distances in miles between

each receptor and the plant acoustic center located in the proposed power block area. Locations 1, 3 and 4 will be shielded, to some extent, from lower elevation noise sources by existing earth berms or dams used in the previous mining operations. The dams will be retained as a part of the proposed project. However, locations 2, 5 and 6, all south of the project site, will receive no shielding from dams or other features.

5.7.2 Noise Sources

The noise sources were grouped into five different acoustic centers, based upon the elevation of the source above the ground, to permit the noise model to correctly calculate shielding due to the dams. The combustion turbines and associated auxiliary equipment were assigned an average elevation of 50 feet. The coal gasification plants were split into two centers with most of the equipment at an elevation of 20 feet and the gas vents at 175 feet above the ground. Three elevations were used in the coal yard with the unloader at 50 feet, the stacker/reclaimer at 30 feet and the locomotives at 15 feet. Table 5.7.2-1 provides a complete listing of plant equipment and associated sound levels at a reference distance of 50 feet. The equipment listing is from the FPL Martin CGCC Site Certification Application, but the quantities and total sound levels have been adjusted to reflect the maximum proposed configuration at the Polk County Site for each of the two potential configurations.

5.7.3 Noise Modeling Results

The results of the noise modeling at each of the six receptor locations are presented in Table 5.7.3-1 for both the 12 CT option and the PC option. The highest level of 48 dBA occurs with the 12 CT option at Trinity Church on CR 555 about 1.9 miles south of the plant site. The lowest levels, ranging from 29 to 33 dBA, occur in Fort Meade, Homeland and the single mobile home residence north of the plant site with the PC option. The PC option is 2 dBA quieter at all locations because 2 of the 6 gasifier units are eliminated. The gasifier units would be the loudest source of continuous noise at the site. The noise levels assigned to the gasifier units are also the most uncertain since they are based on measured noise levels at a small demonstration plant with only a 30 MW capacity, which was then scaled up to a 500 MW plant capacity. No actual data are available on a full-size plant and it is believed that the scaled up values are higher than the levels which will actually be produced by the plants.

Infrequent operation of the flare stack or emergency pressure relief valves will temporarily increase noise levels to about 64 dBA at the nearest residence, which is 2.8 miles south of the site, and to 69 dBA at the nearest church 1.9 miles south of the site.

5.7.4 Impact Assessment

Day/night noise levels (L_{dn}) have been computed for the plant and associated coal handling activities based on the predicted levels presented in Section 5.7.3. It was conservatively assumed that all plant activities, including coal handling, will take place at any time of the day or night. Calculation of the L_{dn} level requires that a 10 dBA penalty be added to predicted noise levels between the hours of 10 p.m. and 7 a.m. to account for the increased awareness of people to nighttime noise. Thus, the L_{dn} level is always higher than the 24-hour average level.

The L_{dn} levels associated with plant operations were then combined with the existing L_{dn} levels at the modeled receptor locations to show the total L_{dn} level with the plant at full capacity for both options. Table 5.7.4-1 presents the results of these calculations. Existing noise levels were not measured at the three houses 2.8 miles south of the plant site on CR 630 nor at Watson Church at the intersection of CR 630 and CR 555, also 2.8 miles south of the plant site. For impact assessment purposes, ambient levels were assumed to be 3 dBA less than levels measured near the mobile home north of the site. Traffic is the primary noise source at all three locations, but traffic appeared to be less on CR 630 than on CR 640, thus the 3 dBA reduction in levels.

The predicted L_{dn} levels due to the plant are below the existing L_{dn} levels at all locations by a significant amount. When the predicted plant levels are combined with the existing L_{dn} levels, the increase is less than one decibel, ranging from zero at the mobile home north of the site and in the Town of Fort Meade to 0.6 decibels at Trinity Church south of the site. The greatest increase at any residential receptor will be only 0.2 decibels at Homeland and at the three houses south of the site on CR 630. The differences in the combined L_{dn} levels between the 12 CT option and the PC option ranges from zero to 0.2 decibels.

Increases in noise levels below 5 dBA are generally not significant and increases in levels of less than 3 dBA are generally not noticeable. Therefore, the fractional increases described above will not be noticeable nor significant. None of the predicted levels due to the plant alone, without the existing background levels, exceed the EPA L_{dn} guideline level of 55 dBA. The

isolated location and very large buffer area around the plant site are the primary factors in achieving this lack of noise impacts.

5.7.5 References

Adams, T.S. 1989. Noise Measurements at Shell Oil Company's Coal Gasification Demonstration Project in Deer Park, Texas. Unpublished. July. Norcross, Georgia.

Adams, T.S. and M.A. Bilello. 1991. Measurements of Noise from Rotary Coal Unloading Operations. Technical paper presented at NOISE-CON 91 in Tarrytown, New York. Sponsored by the Institute of Noise Control Engineering, Poughkeepsie, New York.

API (American Petroleum Institute). 1982. Manual 512, September, 1982.

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Driscoll, D.A. 1984. NOISECALC (A Computer Program for Sound Propagation Calculations). State of New York Department of Public Service. Albany, New York.

EPA (U.S. Environmental Protection Agency). 1971. Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances. NTID300.1. Office of Noise Abatement and Control. Washington, D.C.

EPA (U.S. Environmental Protection Agency). 1974. Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety. EPA 550/9-74-004. Office of Noise Abatement and Control. Washington, D.C.

Swing, J.W. and D.B. Pies. 1973. Assessment of Noise Environments Around Railroad Operations. Report WCR 73-5. Wyle Laboratories. El Segundo, California.

TABLE 5.7.1-1
NOISE RECEPTOR LOCATIONS

Receptor	Distance from Plant Acoustic Center (Miles)
1 - Single mobile home to north at CR640/CR555	3.1
2 - 3 to 4 houses south of CR630, east of CR555	2.8
3 - Community of Homeland	3.4
4 - Town of Fort Meade	4.7
5 - Trinity Church on CR555	1.9
6 - Watson Church at CR555/CR630	2.9

Source: Ebasco Environmental, 1992

TABLE 5.7.2-1
PROJECT EQUIPMENT SOUND LEVELS

Description	Individual Sound Level (dBA)	Maximum Quantity in Operation Simultaneously	
		12 CT Option	Pulverized Coal Option
POWER BLOCK[1]:			
Combustion turbine (CT)	76	12	8
CT inlet silencer	64	12	8
CT exhaust duct to HRSG	79	12	8
HRSG (Heat Recovery Steam Generator)	69	12	8
CT exhaust stack	64	12	8
HP feedwater pump	69	12	8
LP feedwater pump	67	12	8
Lube oil pump/motor	64	18	12
Fuel oil pump	64	12	8
Circulating water pump	68	12	8
Instrument air compressor	62	6	4
Steam turbine/generator	69	6	4
Auxiliary boiler	65	3	2
Auxiliary boiler stack	64	3	2
Auxiliary boiler FD fan	79	3	2
Auxiliary boiler feedwater pump	65	6	4
Auxiliary boiler deaerator vent	70	3	2
Service water pump motor	60	3	2
Condenser vacuum pump	65	6	4
Main transformer	65	18	12
Start-up transformer	65	6	4
Auxiliary transformer	65	12	8
Coal crusher	66	6	4
Pulverized coal 500 MW unit	86	0	2
GASIFIER EQUIPMENT[2]	95	6	4
GASIFIER VENTS[2]	84	6	4
COAL UNLOADER[3]	71	1	1
STACKER/RECLAIMER[4]	75	1	1
LOCOMOTIVE[5]	71	5	5
FLARE STACK[6]	129	6	4
DOZERS[7]	80	3	3
COMPACTORS[7]	74	2	2

Note: Sound levels measured 50 feet from acoustic center.

Sources:
[1] Vendors
[2] Adams, 1989
[3] Adams and Bilello, 1991
[4] BBN, 1978
[5] Swing and Pies, 1973
[6] API Manual 512
[7] U.S. EPA, 1971

TABLE 5.7.3-1
NOISE MODELING RESULTS

Receptor	Sound Level (dBA)		
	Normal Maximum Plant Operations		Flare Stack or Emergency Pressure Relief Valves
	12 CT Option	Pulverized Coal Option	
Mobile Home	34	32	55
South Houses	43	41	64
Homeland	35	33	56
Fort Meade	31	29	52
Trinity Church	48	46	69
Watson Church	43	41	64

Source: Ebasco Environmental, 1992

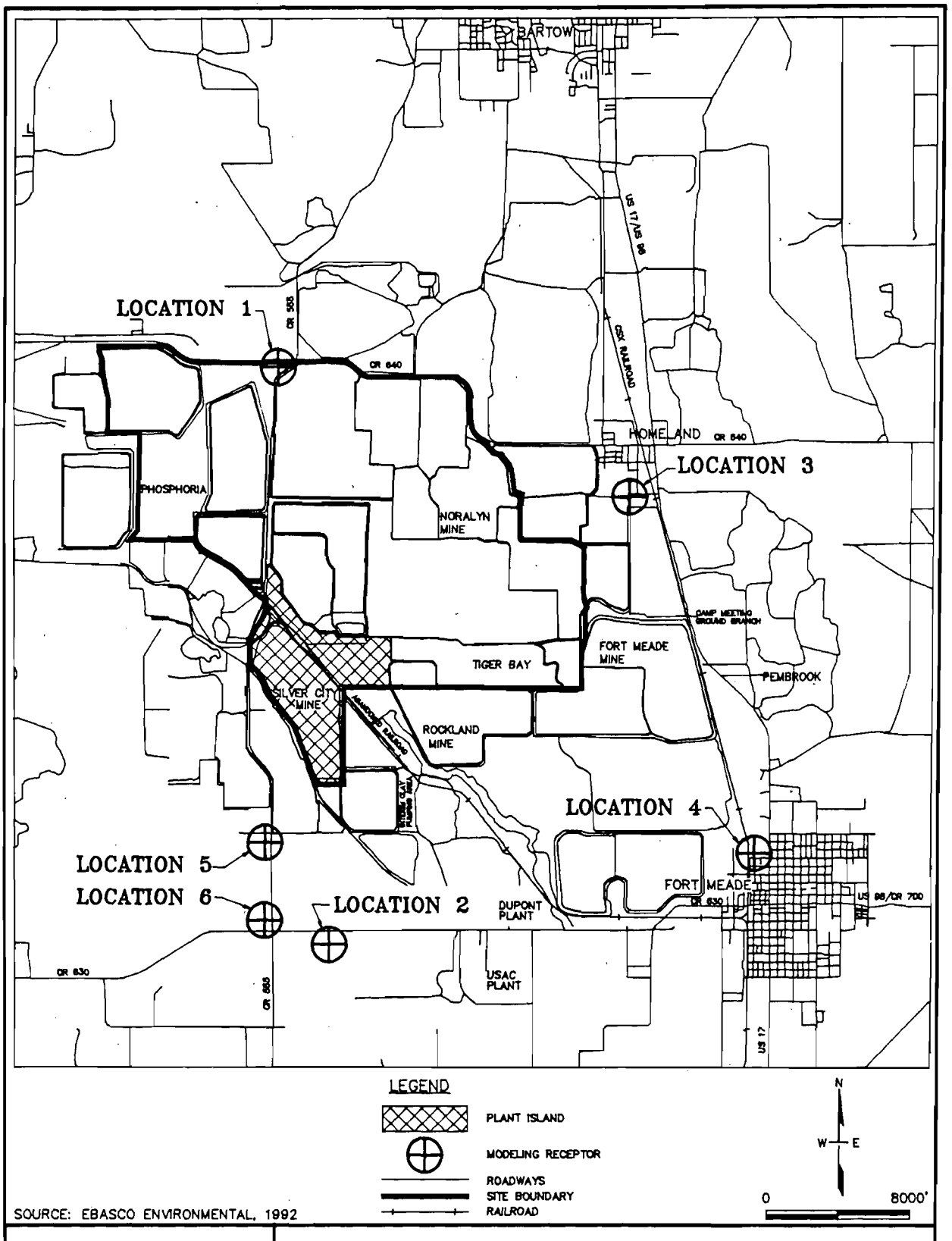
TABLE 5.7.4-1
DAY/NIGHT (LDN) NOISE LEVELS

Receptor	Existing LDN	LDN Levels Due to Plant		Combined Plant and Existing LDN Levels	
		12 CT Option	Pulverized Coal Option	12 CT Option	Pulverized Coal Option
Mobile Home	64.5	40.4	38.4	64.5	64.5
South Houses	61.5*	49.4	47.4	61.7	61.6
Homeland	53.2	41.4	39.4	53.5	53.4
Fort Meade	57.5	37.4	35.4	57.5	57.5
Trinity Church	62.7	54.4	52.4	63.3	63.1
Watson Church	61.5*	49.4	47.4	61.7	61.6

*Estimated based on levels measured near the mobile home location.

Note: Noise levels measured in dBA

Source: Ebasco Environmental, 1992



Florida Power CORPORATION

Polk County Site

FIGURE 5.7.1-1
NOISE MODELING RECEPTOR LOCATIONS

5.8 CHANGES IN NONAQUATIC SPECIES POPULATIONS

5.8.1 Impacts

Long-term changes in populations of important wetland and upland species as the result of power plant operation could result from three factors: air quality effects, groundwater drawdown, and implementation of the enhancement program described in Section 4.4. The following analysis focuses on the effects of these factors on the on-site buffer area and off-site areas which might be impacted.

The effects of long-term (chronic) exposure of plants and wildlife to predicted ambient concentrations of SO_2, NO_2, O_3, a mixture of SO_2 and NO_2, a mixture of SO_2 and O_2, fugitive dust, and other pollutants can only be generally estimated. The effects of long-term exposures to concentrations of these air contaminants, below those concentrations that result in acute injury symptoms, is not thoroughly documented in the literature. It is reported in the literature that chronic injury symptoms do occur when plants are exposed to concentrations below injury threshold levels. Even if chronic injury symptoms were to be manifested by vegetation and wildlife, it is not anticipated that the injury will be severe enough to result in changes in species diversity and composition (see Section 5.6.1.11). Other factors, such as water availability, light, and soil nutrients, would tend to have more of an effect on species diversity and composition than exposure to low levels of air contaminants.

Long-term groundwater withdrawals are likewise not expected to result in significant changes to nonaquatic and wetland vegetation communities. Lands surrounding the site have for the most part been reclaimed or will be reclaimed from mining operations and are to be primarily uplands. Section 2.3.2-1 presents a description of the modified ground water characteristics in the site area. The Peace River flood plain and Hookers Prairie areas are remote to the effects of site groundwater withdrawals. Ground water will not be withdrawn from the Surficial Aquifer. Consequently, wetlands and uplands will not be affected by this mode of withdrawal.

The upland and wetland enhancement program, on the other hand, will significantly improve habitat quality and species composition and diversity in and adjacent to that part of the site (see Section 4.4). Cooling pond seepage into Tiger Bay will enhance vegetation communities there and in Camp Meeting Ground Branch. McCullough Creek ecological systems will not be affected because of supplemental surface water input from USAC parcels. Each of the

enhancement measures is designed to increase vegetation and wildlife species diversity over that associated with the existing deteriorating condition of Tiger Bay and with implementation of projected reclamation for nonmandatory areas. Cattle grazing, a reduced hydroperiod, presence of exotic vegetation, and feral hog activities, for example, would have resulted in disturbed land with lower vegetation and wildlife productivity and diversity. The increased wildlife usage of the buffer area will extend into adjacent undeveloped lands.

5.8.2 Monitoring

Monitoring of off-site nonaquatic species is not proposed. Section 4.4.2 includes a discussion of the proposed on-site monitoring program for Tiger Bay and the buffer area. Monitoring the success of the enhancement program will extend well into the operational phase of the project. A detailed ecological resources management plan will be developed to address the control of exotic species and documentation of the restoration and expansion of wetlands following certification. The plan will be based upon the conceptual plan presented in Section 4.4.2.

5.9 OTHER PLANT OPERATION EFFECTS

Traffic impacts associated with plant operation are discussed below. All other effects of plant operation are discussed in the appropriate sections of the Site Certification Application (SCA). No additional discussion is needed to describe environmental effects of plant operation.

5.9.1 Highway Traffic

Traffic associated with the operation of the power plant represents a long term impact to Polk County roadways. While these impacts are much less than those of the peak construction activity, they are more significant since they will be recurring from buildout into the future. Traffic impacts will be directly related to the number of employees, since materials for plant operations will arrive primarily by rail and/or pipeline. A total of 554 operations workers will be needed for ultimate site development. This employment projection was the basis of the traffic analysis.

This traffic impact analysis was prepared based on two different scenarios, one that assumes buildout in 2008 and another that assumes buildout in 2018. The Polk County Conditional Use Permit (CUP) application included a traffic impact analysis based on the first scenario. Although that is one possible scenario, Section 3.1 of this SCA presents the now anticipated buildout schedule, i.e., the second scenario, reflecting a longer buildout period than that assumed for the Polk County CUP traffic analysis. For purposes of continuity, this section addresses the traffic impacts of both the original, shorter, buildout schedule and the currently proposed, longer, buildout schedule.

The CUP traffic impact analysis was reviewed by both Polk County and the Florida Department of Transportation (FDOT). Recommendations for improvements were developed with input from both agencies. These improvements became the subject of conditions of the Polk County CUP, approved by the Polk County Board of County Commissioners on June 2,, 1992. A copy of the CUP is included in Appendix 10.2.4, and the traffic condition relevant to project operation is also reiterated in Section 5.9.1.7. In recognition of the fact that the buildout schedule was subject to change, the CUP condition relates the need for roadway or intersection improvements to a level of employment rather than a specific year and provide for monitoring of employment and traffic conditions to determine the appropriate

timing of the improvements. Thus, the Polk County CUP condition effectively addresses the need for improvements regardless of changes in the buildout schedule.

5.9.1.1 Study Area

The study area for this analysis was determined to be roadways on which the project contributes 5 percent or more of Level of Service (LOS) C. The determination of significant impact is based on peak-hour peak-direction traffic volumes generated from plant operations compared to the generalized LOS C volumes adopted by Polk County and FDOT. The roadway capacities were shown in Tables 2.2.7-3 and 2.2.7-4 in Section 2.2.7.2. Table 5.9.1-1 summarizes the impact on the area roadways.

Based on this analysis, the following roadways were included as study links:

- CR 555: SR 60 to CR 630, and
- CR 630: CR 555 to U.S. 17/98.

The following intersections were also included in the study:

- CR 555 and SR 60,
- CR 555 and CR 640 (unsignalized),
- CR 555 and CR 630 (unsignalized), and
- U.S. 17/98 and CR 630.

Since all of the study roadways are Polk County roadways, no FDOT generalized LOS volumes are applicable for the analysis of operations traffic.

5.9.1.2 Year 2008 Non-Project Traffic

A projection of future traffic not associated with the FPC site has been made based on existing volumes increased with an annual growth rate of 2.1 percent, compounded annually, to the year 2008. Roadway volumes were increased to 2008 levels as shown in Figures 5.9.1-1 and 5.9.1-2. These volumes were analyzed with generalized roadway LOS volume

tables. Table 5.9.1-2 shows the volumes and their corresponding LOS. All of the roadway segments are anticipated to operate acceptably.

Intersection volumes were similarly derived for 2008 conditions. Two of the study intersections are currently unsignalized. All of the intersections are expected to operate acceptably in 2008 without the addition of project volumes. All of the study intersections were analyzed using the Highway Capacity Manual (HCM) signalized intersection methodology. Table 5.9.1-3 summarizes the results of the analysis. The worksheets are included in Appendix 10.5.2.

5.9.1.3 Year 2018 Non-Project Traffic

The longer buildout scenario provides for an additional 10 years before the buildout of the power plant. During this additional 10 years, it is assumed that non-project volumes will continue to increase at 2.1 percent per year, compounded annually. As shown in Table 5.9.1-4 and on Figures 5.9.1-3 and 5.9.1-4, non-project volumes were increased to 2018 levels.

The roadway volumes were analyzed using the Polk County adopted generalized roadway service volumes as shown in Table 2.2.7-3. The roadways, as shown in Table 5.9.1-4, are all expected to operate acceptably.

Intersections were evaluated using HCM signalized intersection methodology. The analysis indicated that three of the four intersections are expected to operate acceptably. Without improvements, the CR 555 and SR 60 intersection will operate at LOS F. Improvements to alleviate this deficiency are recommended as a part of the total traffic analysis. Table 5.9.1-5 summarizes the intersection conditions. This unsignalized intersection is not expected to warrant the installation of a traffic signal without the addition of project traffic.

5.9.1.4 Plant Operations Traffic

Trips associated with the operation of the power plant were estimated through a trip generation analysis and then a distribution and assignment process. The plant operations are anticipated to be conducted with three shifts. It is planned to operate the plant with 65 percent of the employees working during the day shift. The remaining 35 percent of the

employees will work during the two other shifts. The following is the projected employment by shift:

Day Shift	360 employees
Evening Shift	97 employees
Night Shift	97 employees

TRIP GENERATION

Trip generation expected from a power plant has been related to the number of employees. A trip generation study of a similar type of power plant was conducted by Kimley-Horn in 1990. The study was conducted at the Florida Power & Light Company Martin Plant in Martin County. At the time of the study, the operating plant had 204 employees. The trip generation rates found in the study are shown in Table 5.9.1-6. The rates and equations in the Institute of Transportation Engineers (ITE) Trip Generation were also reviewed as a comparison. Land Use Code 130: Heavy Industrial is the category which most closely approximates a power plant. Using Heavy Industrial trip generation, rates similar to those observed at the Martin plant were found. In 1974, FDOT conducted a study of a FPC power plant in Pinellas County. Though peak hour information was not available from the FDOT study, the daily rate corresponded well with the Martin Plant data.

Table 5.9.1-6 summarizes the trip generation rates per employee as obtained from the data sources consulted. The data from the Martin Plant were used in trip generation for this analysis because they are the most recent data available and are project specific. Table 5.9.1-7 presents anticipated generation of new trips.

DISTRIBUTION AND ASSIGNMENT

Trips were distributed and assigned to the roadway network using the FSUTMS assignment discussed in conjunction with construction traffic (Section 4.6.1.4). Using the percentage assignment derived from FSUTMS, the expected project trips were assigned to the roadway network. From this assignment, the study area was defined, as shown previously in Table 5.9.1-1. At study intersections, peak hour project traffic turning movements were determined. Figures 5.9.1-5 and 5.9.1-6 illustrate the operations traffic volumes on the study

roadways during the a.m. and p.m. peak hours. The volumes are also included in Tables 5.9.1-8, 5.9.1-9, 5.9.1-11, and 5.9.1-12.

5.9.1.5 2008 Total Traffic Capacity Analysis

The 2008 non-project volumes and operations traffic volumes were combined to provide a projection of 2008 total traffic. The total traffic volumes on study roadways and intersections were analyzed to determine the anticipated operating conditions. Figures 5.9.1-7 and 5.9.1-8 illustrate the 2008 a.m. and p.m. peak hour roadway volumes respectively.

The roadways were evaluated using the Polk County generalized LOS volumes. Tables 5.9.1-8 and 5.9.1-9 summarize the volumes and generalized LOS. All of the roadways are anticipated to operate acceptably at project buildout.

The study intersections were analyzed for buildout traffic conditions. Neither of the two unsignalized intersections is expected to warrant the installation of a traffic signal at project buildout. The study intersections were analyzed using HCM signalized intersection methodology. Table 5.9.1-10 indicates the operational conditions of the intersections with project traffic. The SR 60 and CR 555 intersection is projected to operate unacceptably in 2008. The improvement recommended in conjunction with 2002 construction traffic will alleviate the capacity deficiency. This improvement is to add a westbound left-turn phase to the signal operations. The other intersections are anticipated to operate acceptably without any improvements.

5.9.1-6 2018 Total Traffic Capacity Analysis

The buildout year volumes for the longer scenario were derived and analyzed. Traffic from plant operations was combined with 2018 non-project traffic. Figures 5.9.1-9 and 5.9.1-10 illustrate the 2018 peak season a.m. and p.m. peak hour total traffic volumes, respectively.

The roadways were evaluated using the Polk County generalized service volumes. As Tables 5.9.1-11 and 5.9.1-12 indicate, all of the study roadways are expected to operate acceptably.

The study intersections were analyzed for the 2018 buildout scenario. Intersections were analyzed using 1985 HCM signalized intersection methodology. As Table 5.9.1-13 indicates,

three of the four study intersections are anticipated to operate acceptably without any improvements.

The CR 555 and SR 60 intersection is expected to operate unacceptably in 2018 without improvements. The improvement recommended in conjunction with the 2010 construction traffic will alleviate the capacity deficiency. This improvement is the addition of a westbound left-turn phase to the signal operations.

Neither of the two unsignalized intersections is expected to meet minimum traffic signal volume warrants at project buildout.

5.9.1.7 Recommendations

The traffic conditions associated with power plant operations were determined using the maximum projected operations employment of 554 people. The improvement necessary to accommodate operations traffic is also recommended as a part of the construction traffic analysis (Section 4.6.1.8). No other improvements are required to accommodate the traffic impacts from operation traffic at the FPC power plant site at buildout.

Using the number of employees rather than a specific year is the most appropriate measure of the need for improvement. Following is a plan, already incorporated into the Polk County CUP conditions, which bases the improvements and monitoring conditions at the intersection on the number of employees. The number of employees described below reflects the number of employees reporting to the site for the same shift starting time (i.e., starting times within 1 hour).

CR 555 and SR 60

Prior to the time that the number of employees reporting to the site at the same shift time exceeds 150, FPC shall add a signal phase for westbound left-turns which operates as protected/permissive at the intersection of CR 555 and SR 60. Modifications to the transportation system must conform to the requirements of the FDOT.

5.9.2 Rail Traffic

5.9.2.1 Introduction

FPC anticipates using coal as a fuel source for generating capacity at the Polk County Site. It is probable that coal will be delivered directly from mines to the plant by railroad. The following traffic impact analysis is based on trains transporting coal to the Polk County Site for an overland route from the Appalachia coal region.

For purposes of this investigation, it was necessary to make a number of assumptions. Because no agreements have been reached for coal purchase or coal transportation, the route, coal sources, and mode of transportation will be subject to future contract negotiations.

Figure 5.9.2-1 depicts the Florida portion of the most probable railway route for transport of coal from Appalachia. The overland CSX route was chosen as the most probable route on the basis of economies of scale, labor economics in terms of crew schedules, and density of traffic on the lines. Table 5.9.2-1 presents an inventory, by county, of the number of at-grade crossings and presents the average rail-highway crossing per mile on each segment. The number of at-grade rail-highway crossings were identified using the latest available railroad crossing locator maps obtained from the FDOT district offices. The at-grade rail-highway crossings were also divided into urban (incorporated) crossings and rural (unincorporated) crossings.

5.9.2.2 Methodology

Two criteria were used to evaluate the traffic impact of railroad transportation:

- Magnitude of existing and proposed train traffic
- Additional traffic delay caused by coal trains at railroad grade crossings.

TRAIN VOLUME INCREASE

It is anticipated that at full operation of the FPC Polk County Site, an average of three to four 100-car trains daily would bring coal to the plant. Information available from railroad companies indicates that existing train lengths generally range from 25 to 150 cars. The

existing daily train volume on the probable railroad line and the projected train volume based on eight coal train trips per day are included in Table 5.9.2-2.

TRAFFIC DELAY INCREASE

The following calculation for delay was performed for the probable coal transportation scenario with existing train volumes and proposed train volumes. This information was used to estimate the magnitude of the increase in delay caused by the proposed project:

$$D = NC * ANT * ACT * AWT$$

where

D = Total delay for the railroad line in vehicle-hour per day

NC = Total number of at-grade crossings on the railroad line

ANT = Average daily train volume

ACT = Average traffic on crossing roadways per crossing event

AWT = Average waiting time for the traffic stopped by the train

The components of the equation are described as follows:

- Total number of at-grade crossings (NC) - Latest available railroad crossing locator maps were obtained from the FDOT district offices to identify the number of at-grade crossings along the probable railroad line. Table 5.9.2-1 shows the summary of crossing numbers. Only those active crossings with crossing numbers were counted.

- Average daily train volume (ANT) - The average daily train volume as reflected in Table 5.9.2-2 was used for the analysis.

- Average traffic on crossing roadways per crossing event (ACT) - For each railroad line, 20 sample crossings were selected from both an urban (incorporated) area and a rural (unincorporated) area. The samples for urban area crossings were selected from Polk County and Orange County. The samples for rural area crossings were selected from Polk County and Volusia County. Average daily traffic for selected samples was obtained from the Rail-Highway Crossing Inventory by Transportation Statistics Office of the FDOT. For the

purpose of choosing our samples, urban and rural area designations were consistent with those classified on the FDOT railroad crossing locator maps. The average daily traffic on crossing roadways is divided by the average waiting periods available during one day to obtain the traffic for an average crossing event. Delay was calculated separately for urban areas and rural areas, using the average daily traffic from selected samples.

- Average waiting time for the traffic stopped by the train (AWT) - Due to the limited information available at the time this study was undertaken, the average waiting time was defined as half of the average gate-closing time. This assumes a uniform distribution of the vehicles arriving during a train crossing event. The average gate-closing time is calculated as follows:

  Average Gate-Closing Time = Advanced warning time (30 seconds) plus average train crossing time plus a lag time (10 seconds)

  Average Train-Crossing Time = (number of cars x length of each car) divided by average running speed.

For the purpose of calculating average train-crossing time, a review of all travel speed information was made. Based on available data, average travel speeds of 35 mph in urban areas and 45 mph for rural areas were chosen.

The existing and proposed highway traffic delays caused by train crossing events were calculated in the following forms:

- Projected total highway traffic delayed at crossings throughout the overland railway route
- Projected average highway vehicle delay at each crossing
- Projected total highway vehicle delay at crossings throughout the overland railway route
- Projected average highway traffic delay at each crossing per vehicle

The resultant highway traffic delays for the existing and proposed rail traffic conditions are also summarized in Table 5.9.2-2.

Trains in urban areas typically travel at an average speed of 35 mph while trains in rural areas average 45 mph. At these speeds and allowing time for advance gate closures plus opening of gates when the train has passed, an urban crossing will typically be closed for 2.5 minutes and a rural crossing for 2.0 minutes for one of FPC's 100-car coal delivery trains. Since traffic usually arrives at the crossing in random fashion, vehicles will wait from 0 to 2.5 or 2.0 minutes for urban and rural crossings, respectively. Therefore, the average vehicle waiting time at an urban crossing will be 1.25 minutes and 1.0 minute at a rural crossing.

As shown in Table 5.9.2-2, the additional eight train trips per day incurred by the FPC coal transportation will increase the average highway vehicle delay by 1.1 seconds per vehicle at each crossing in urban areas and 0.65 second per vehicle at each crossing in rural areas, based on total daily traffic volumes at the railroad crossings. Additionally, 25,520 vehicles per day are projected to be delayed throughout the probable railroad route in urban areas which is equivalent to a total daily vehicle delay of 532 vehicle-hours. In rural areas, the additional delay projected throughout the probable railroad route is 3,200 vehicles per day or 53 vehicle-hours per day. In other words, the projected additional delay is 119 vehicle-minutes (1.98 vehicle-hours) per crossing per day in urban areas and 15 vehicle-minutes (0.25 vehicle-hours) per crossing per day in rural areas.

The signalized intersection LOS analysis methodology published in the 1985 Highway Capacity Manual, which is commonly used in LOS analysis for highway systems, was used to determine the project impact on the LOS at the railroad crossings.

At a signalized intersection, the traffic on crossing streets shares the right-of-way of the intersection through green time allocations. A railroad crossing operates similarly to an actuated signalized intersection since the highway traffic shares the right-of-way of the railroad crossings with the trains and the trains have the privilege to use the right-of-way over the highway traffic. In the 1985 HCM, LOS for signalized intersections is defined in terms of delay. Delay is a measure of driver discomfort, frustration, fuel consumption, and lost travel time. Specifically, LOS criteria are stated in terms of average stopped delay per vehicle. The criteria are given in Table 5.9.2-3. A signalized intersection is considered operating at LOS A when the average stopped delay per vehicle at the intersection is 5 seconds or less. Using this criteria, and the average highway vehicle delay at crossings shown in Table 5.9.2-2, it was found that the overall railroad crossings through the overland CSX route operate at LOS A without the project impact and will still operate at LOS A with the project impact.

5.9.3 Benefits to On-Site Wetlands

Section 4.4 presents a discussion of the enhancement plan and associated benefits for Tiger Bay wetlands. This enhancement will progress from the construction period through the operation of the power plant.

5.9.4 References

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TABLE 5.9.1-1
OPERATIONS STUDY AREA

Roadway	Polk LOS C	FDOT LOS C	Project Traffic	Polk Impact	FDOT Impact
CR 555					
SR 60 to CR 640	540	--	81	15.0%	--
CR 640 to Plant Entrance	540	--	133	24.6%	--
Plant Entrance to CR 630	540	--	57	10.6%	--
U.S. 17					
CR 630 to S. 9th St	1090	1540	22	2.0%	1.4%
SR 60					
SR 37 to CR 555	2,280	2190	2	0.1%	0.1%
CR 555 to SR 60A	2,280	1540	61	2.7%	4.0%
CR 640					
SR 37 to CR 555	540	--	26	4.8%	--
CR 555 to U.S. 17/98	540	--	12	2.2%	--
CR 630					
SR 37 to CR 555	540	--	6	1.1%	--
CR 555 to U.S. 17/98	540	--	48	8.9%	--

Source: Kimley-Horn, 1992

TABLE 5.9.1-2
PEAK SEASON PEAK HOUR PEAK DIRECTION
2008 NON-PROJECT ROADWAY CONDITIONS

Roadway	LOS Standard	A.M. Volume		LOS	P.M. Volume		LOS
		Northbound/ Eastbound	Southbound/ Westbound		Northbound/ Eastbound	Southbound/ Westbound	
CR 555							
SR 60 to CR 640	D	199	439	C	409	128	C
CR 640 to Agricola Rd	D	60	290	B	241	45	B
Agricola Rd to CR 630	D	66	210	B	171	56	B
CR 630							
CR 555 to U.S. 17/98	D	178	299	B	342	231	C

Source: Kimley-Horn, 1992

TABLE 5.9.1-3
2008 NON-PROJECT PEAK HOUR
INTERSECTION CONDITIONS

Intersection	A.M. LOS	P.M. LOS
CR 555 and SR 60	B	B
CR 555 and CR 640	A	B
CR 555 and CR 630	A	A
U.S. 17/98 and CR 630	C	C

Source: Kimley-Horn, 1992

TABLE 5.9.1-4
PEAK SEASON PEAK HOUR PEAK DIRECTION
2018 NON-PROJECT ROADWAY CONDITIONS

Roadway	LOS Standard	A.M. Volume		LOS	P.M. Volume		LOS
		Northbound/ Eastbound	Southbound/ Westbound		Northbound/ Eastbound	Southbound/ Westbound	
CR 555							
SR 60 to CR 640	D	245	541	D	504	158	C
CR 640 to Agricola Rd	D	74	358	C	299	55	B
Agricola Rd to CR 630	D	81	258	B	209	70	B
CR 630							
CR 555 to U.S. 17/98	D	220	368	C	421	285	C

Source: Kimley-Horn, 1992

TABLE 5.9.1-5
2018 NON-PROJECT PEAK HOUR
INTERSECTION CONDITIONS

Intersection	Existing Geometry		With Improvements	
	A.M. LOS	P.M. LOS	A.M. LOS	P.M. LOS
CR 555 and SR 60	F	F	C	B
CR 555 and CR 640	B	B	N/A	N/A
CR 555 and CR 630	B	A	N/A	N/A
U.S. 17/98 and CR 630	C	C	N/A	N/A

N/A = Not Applicable
Source: Kimley-Horn, 1992

TABLE 5.9.1-6
COMPARISON OF POWER PLANT TRIP GENERATION RATES PER EMPLOYEE

Time	FPL Martin Plant	ITE: Heavy Industrial	FDOT 1974 Power Plant
Daily	2.35	2.05	2.2
A.M. Peak	0.62	0.51	N/A
P.M. Peak	0.41	0.88	N/A

N/A = Not Available.
Source: Kimley-Horn, 1992

TABLE 5.9.1-7
OPERATIONS TRIP GENERATION

Time	Rate x Employees	Trip Ends
Daily	2.35 T.E./EMPL. x 554 EMPL.	1,302
A.M. Peak		
Enter		202
Exit		61
Total	0.62 T.E./EMPL. x 360 EMPL. 0.41 T.E./EMPL. x 97 EMPL.	263
P.M. Peak		
Enter		95
Exit		113
Total	0.41 T.E./EMPL. x 360 EMPL. 0.62 T.E./EMPL. x 97 EMPL.	208

Note: Rate = T.E./EMPL. x EMPL.
where T.E. = trip ends
EMPL. = employees

Source: Kimley-Horn, 1992

TABLE 5.9.1-8
PEAK SEASON A.M. PEAK HOUR
2008 TOTAL ROADWAY CONDITIONS

Roadway	LOS Standard	Operations Volume		Total Volume		Polk LOS
		Northbound/ Eastbound	Southbound/ Westbound	Northbound/ Eastbound	Southbound/ Westbound	
CR 555						
SR 60 to CR 640	D	25	81	224	520	C
CR 640 to Plant Entrance	D	40	133	100	423	C
Plant Entrance to CR 630	D	56	18	122	228	B
CR 630						
CR 555 to U.S. 17/98	D	15	47	193	346	C

Source: Kimley-Horn, 1992

TABLE 5.9.1-9
PEAK SEASON P.M. PEAK HOUR
2008 TOTAL ROADWAY CONDITIONS

Roadway	LOS Standard	Operations Volume		Total Volume		Polk LOS
		Northbound/ Eastbound	Southbound/ Westbound	Northbound/ Eastbound	Southbound/ Westbound	
CR 555						
SR 60 to CR 640	D	45	38	454	166	C
CR 640 to Plant Entrance	D	75	63	316	108	B
Plant Entrance to CR 630	D	27	31	198	87	B
CR 630						
CR 555 to U.S. 17/98	D	26	22	368	253	C

Source: Kimley-Horn, 1992

TABLE 5.9.1-10
2008 TOTAL PEAK HOUR TRAFFIC
INTERSECTION CONDITIONS

Intersection	Existing Geometry A.M. LOS	Existing Geometry P.M. LOS	With Improvements A.M. LOS	With Improvements P.M. LOS
CR 555 and SR 60	F	B	B	B
CR 555 and CR 640	A	B	N/A	N/A
CR 555 and CR 630	B	A	N/A	N/A
U.S. 17/98 and CR 630	C	C	N/A	N/A

Note: N/A - Not applicable
Source: Kimley-Horn, 1992

TABLE 5.9.1-11
PEAK SEASON A.M. PEAK HOUR
2018 TOTAL ROADWAY CONDITIONS

Roadway	LOS Standard	Operations Volume		Total Volume		Polk LOS
		Northbound/ Eastbound	Southbound/ Westbound	Northbound/ Eastbound	Southbound/ Westbound	
CR 555						
SR 60 to CR 640	D	25	81	270	622	D
CR 640 to Plant Entrance	D	40	133	114	491	C
Plant Entrance to CR 630	D	56	18	137	276	B
CR 630						
CR 555 to U.S. 17/98	D	15	47	235	415	C

Source: Kimley-Horn, 1992

TABLE 5.9.1-12
PEAK SEASON P.M. PEAK HOUR
2018 TOTAL ROADWAY CONDITIONS

Roadway	LOS Standard	Operations Volume		Total Volume		Polk LOS
		Northbound/ Eastbound	Southbound/ Westbound	Northbound/ Eastbound	Southbound/ Westbound	
CR 555						
SR 60 to CR 640	D	45	38	549	196	D
CR 640 to Plant Entrance	D	75	63	374	118	C
Plant Entrance to CR 630	D	27	31	236	101	B
CR 630						
CR 555 to U.S. 17/98	D	26	22	447	307	C

Source: Kimley-Horn, 1992

TABLE 5.9.1-13
2018 TOTAL PEAK HOUR TRAFFIC
INTERSECTION CONDITIONS

Intersection	Existing Geometry A.M. LOS	Existing Geometry P.M. LOS	With Improvements A.M. LOS	With Improvements P.M. LOS
CR 555 and SR 60	F	F	C	C
CR 555 and CR 640	B	B	N/A	N/A
CR 555 and CR 630	B	A	N/A	N/A
U.S. 17/98 and CR 630	C	C	N/A	N/A

Note: N/A - No improvement recommended
Source: Kimley-Horn, 1992

TABLE 5.9.2-1
INVENTORY OF AT-GRADE RAIL-HIGHWAY CROSSINGS

County	Total Number of Crossings	Number of Rural Crossings	Number of Urban Crossings	Average Number of Crossings Per Mile
Polk	86	18	68	1.43
Osceola	33	13	20	2.36
Orange	87	4	83	3.95
Seminole	21	15	6	1.31
Volusia	51	45	6	1.28
Putnam	57	45	12	1.46
Clay	38	38	0	1.36
Duval	82	9	73	2.73
Nassau	36	36	0	2.77
Total	491	223	268	1.87

Note: Crossing inventory based on Florida portion of most probable railway route, using overland CSX route from the Appalachia coal region.

Source: Kimley-Horn, 1992
Florida Department of Transportation

TABLE 5.9.2-2
SUMMARY OF TRAIN TRAFFIC IMPACT AT RAIL-HIGHWAY CROSSINGS

Scenario	Existing Conditions		Existing & Proposed Conditions		Project Impact	
	Urban	Rural	Urban	Rural	Urban	Rural
Total Number of At-Grade Railroad-Highway Crossings	268	223	268	223	0	0
Daily Train Traffic (Trains Per Day)	24*	13*	32	21	8	8
Average Daily Highway Traffic at each Crossing (Vehicles per Day)	6,855	1,292	6,855	1,292	0	0
Total Daily Highway Traffic Delayed at Crossings (Vehicles per Day)	76,550	5,210	102,070	8,410	25,520	3,200
Average Daily Highway Vehicle Delay per Crossing (Vehicle-Minutes)	357	23	476	38	119	15
Total Daily Highway Vehicle Delay at Crossings (Vehicle-Hours)	1,595	87	2,127	140	532	53
Average Highway Vehicle Delay at Crossings (Seconds per Vehicle)	3.1	1.1	4.2	1.75	1.1	0.65

*Provided for portion of track with highest train traffic.

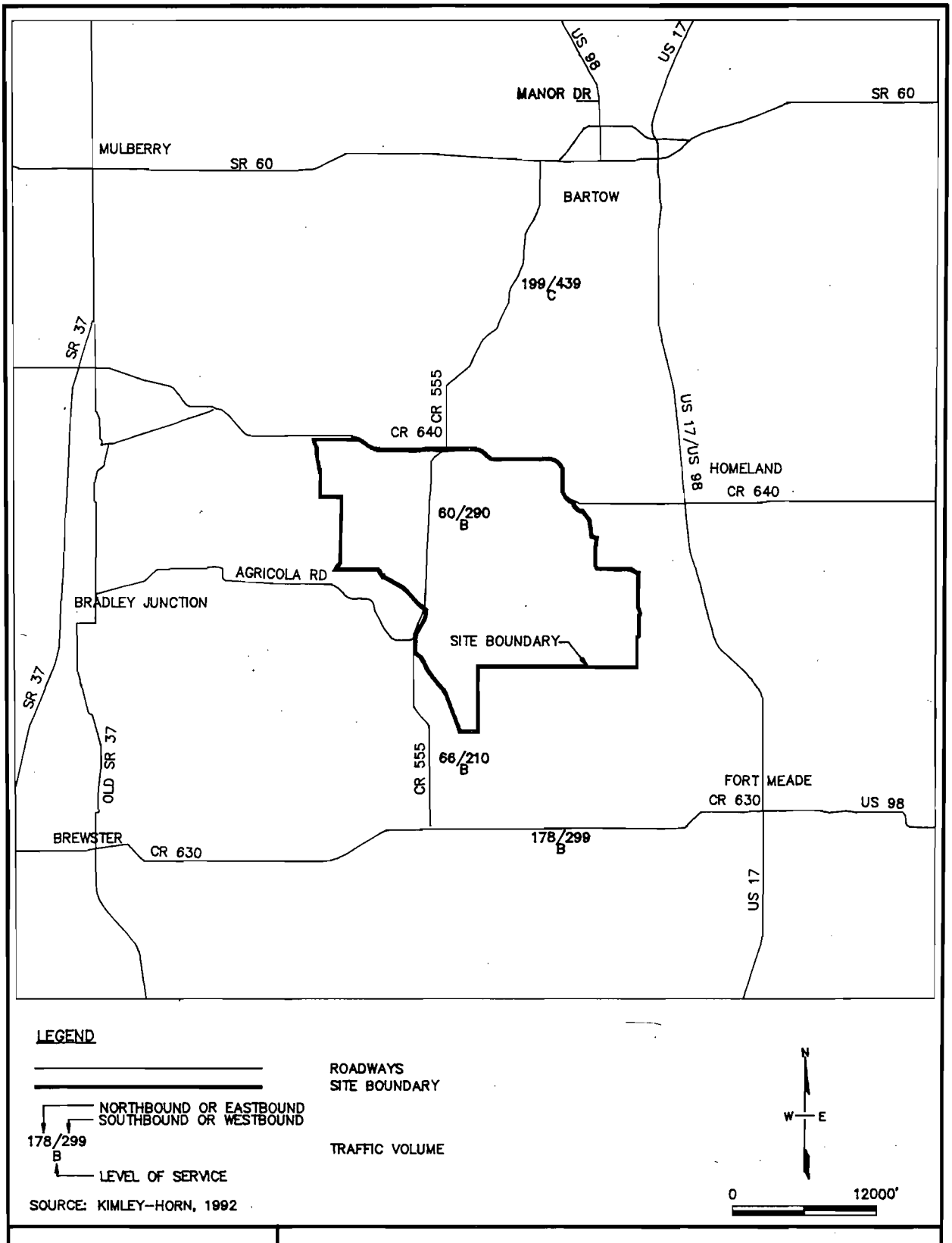
Note: Impacts based on use of overland CSX route.

Source: Kimley-Horn, 1992
Florida Department of Transportation

TABLE 5.9.2-3
LEVEL-OF-SERVICE CRITERIA
FOR SIGNALIZED INTERSECTIONS

Level of Service	Stopped Delay Per Vehicle (Sec.)
A	5
B	5.1 to 15.0
C	15.1 to 25.0
D	25.1 to 40.1
E	40.1 to 60.0
F	>60.0

Source: Transportation Research Board, 1985
Kimley-Horn, 1992

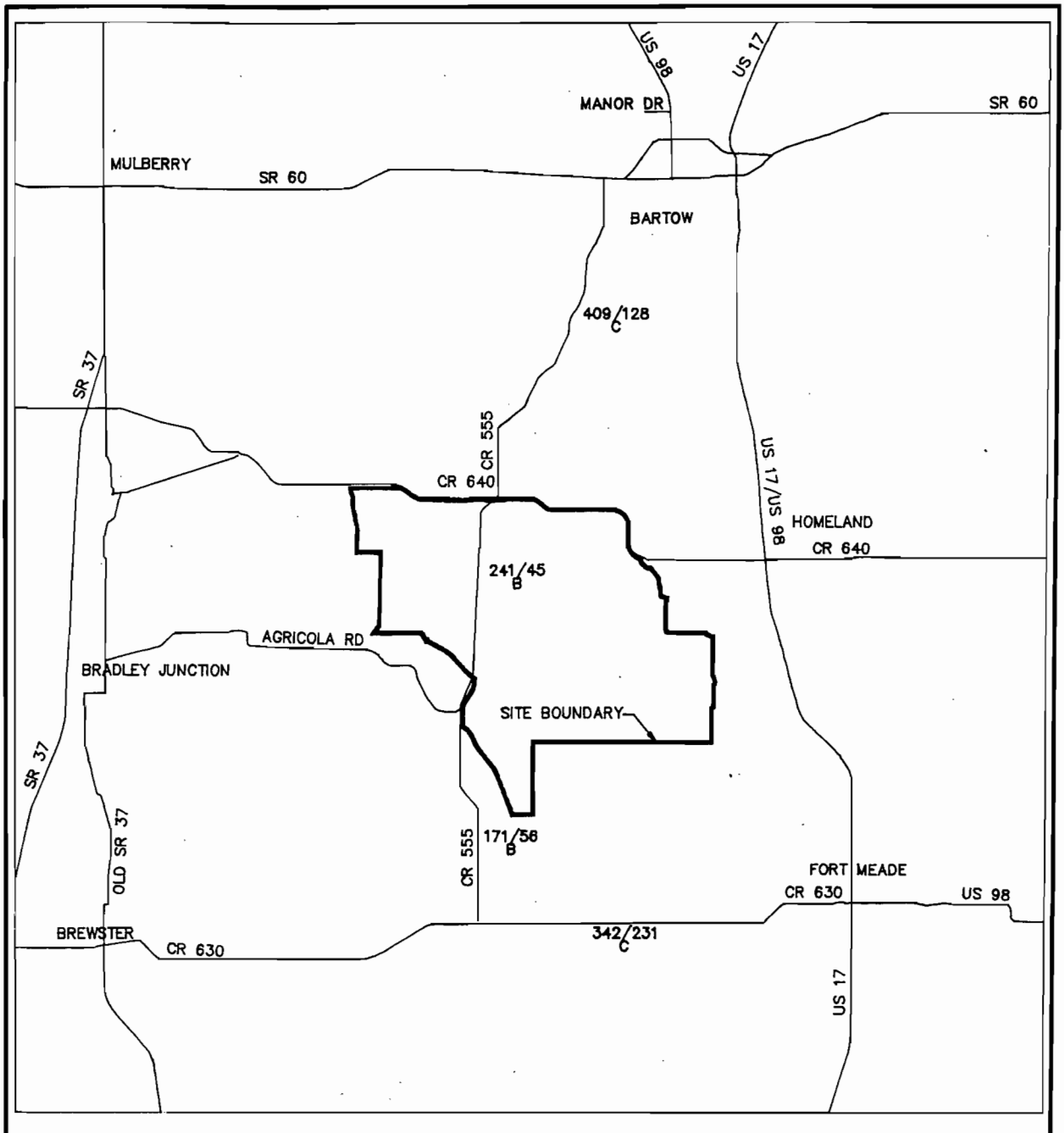


Florida Power CORPORATION

Polk County Site

FIGURE 5.9.1-1

2008 PEAK SEASON
A.M. PEAK HOUR NON-PROJECT TRAFFIC

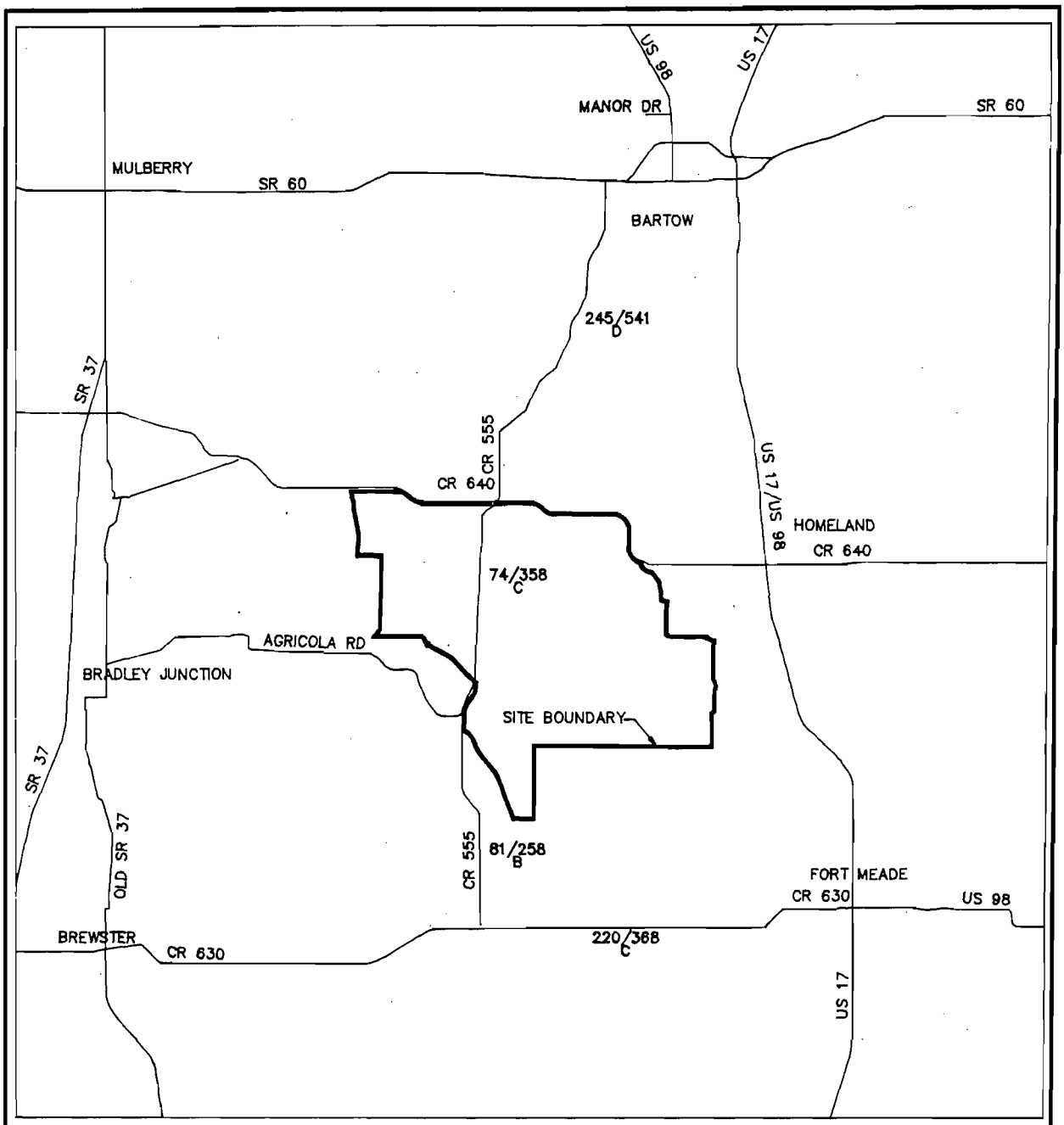


Florida Power CORPORATION

Polk County Site

FIGURE 5.9.1-2

2008 PEAK SEASON P.M. PEAK HOUR NON-PROJECT TRAFFIC



LEGEND

ROADWAYS
SITE BOUNDARY

NORTHBOUND OR EASTBOUND
SOUTHBOUND OR WESTBOUND
220/368
C
LEVEL OF SERVICE

TRAFFIC VOLUME

SOURCE: KIMLEY-HORN, 1992

N
W E

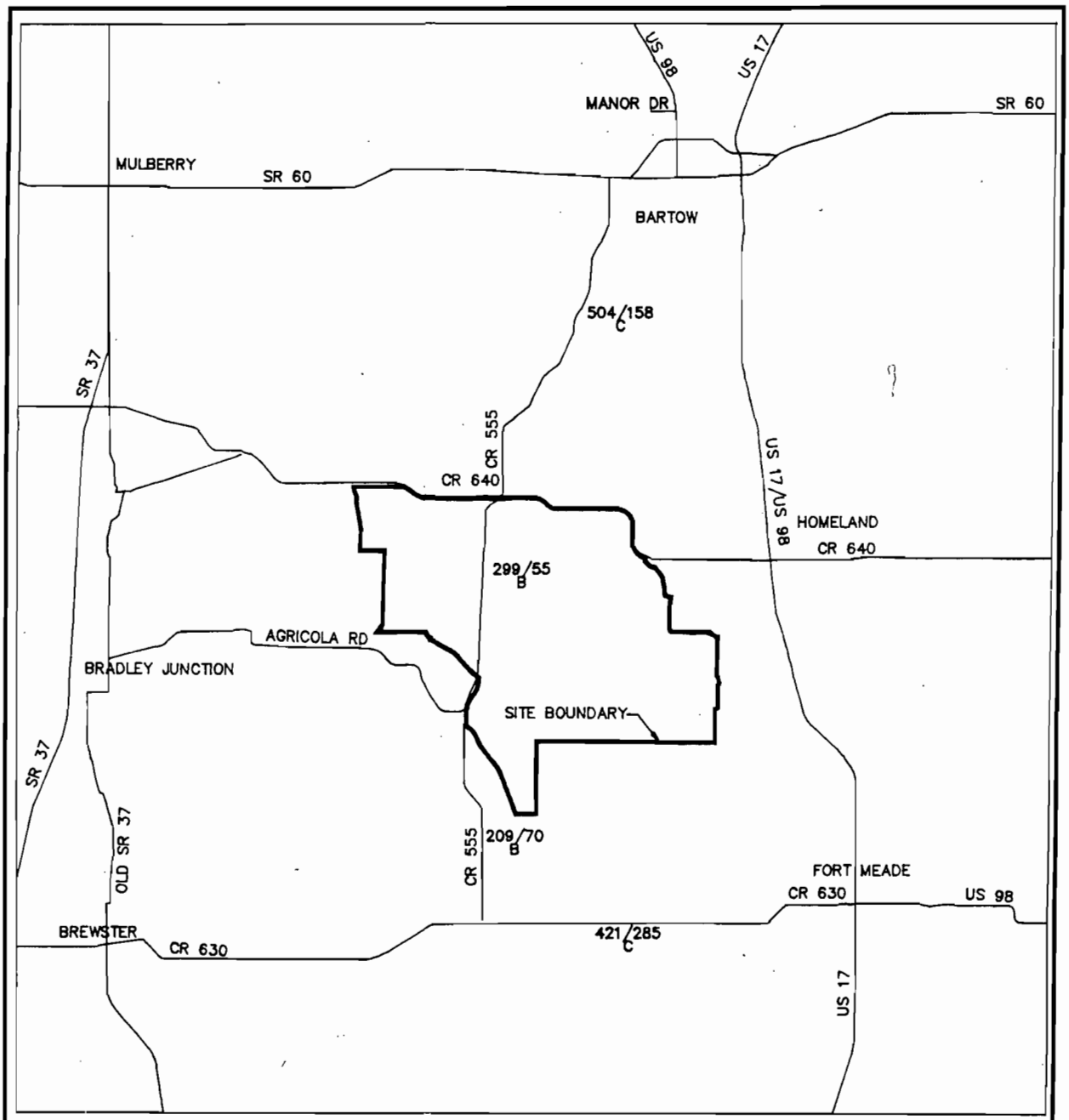
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Florida Power CORPORATION

Polk County Site

FIGURE 5.9.1-3

2018 PEAK SEASON
A.M. PEAK HOUR NON-PROJECT TRAFFIC

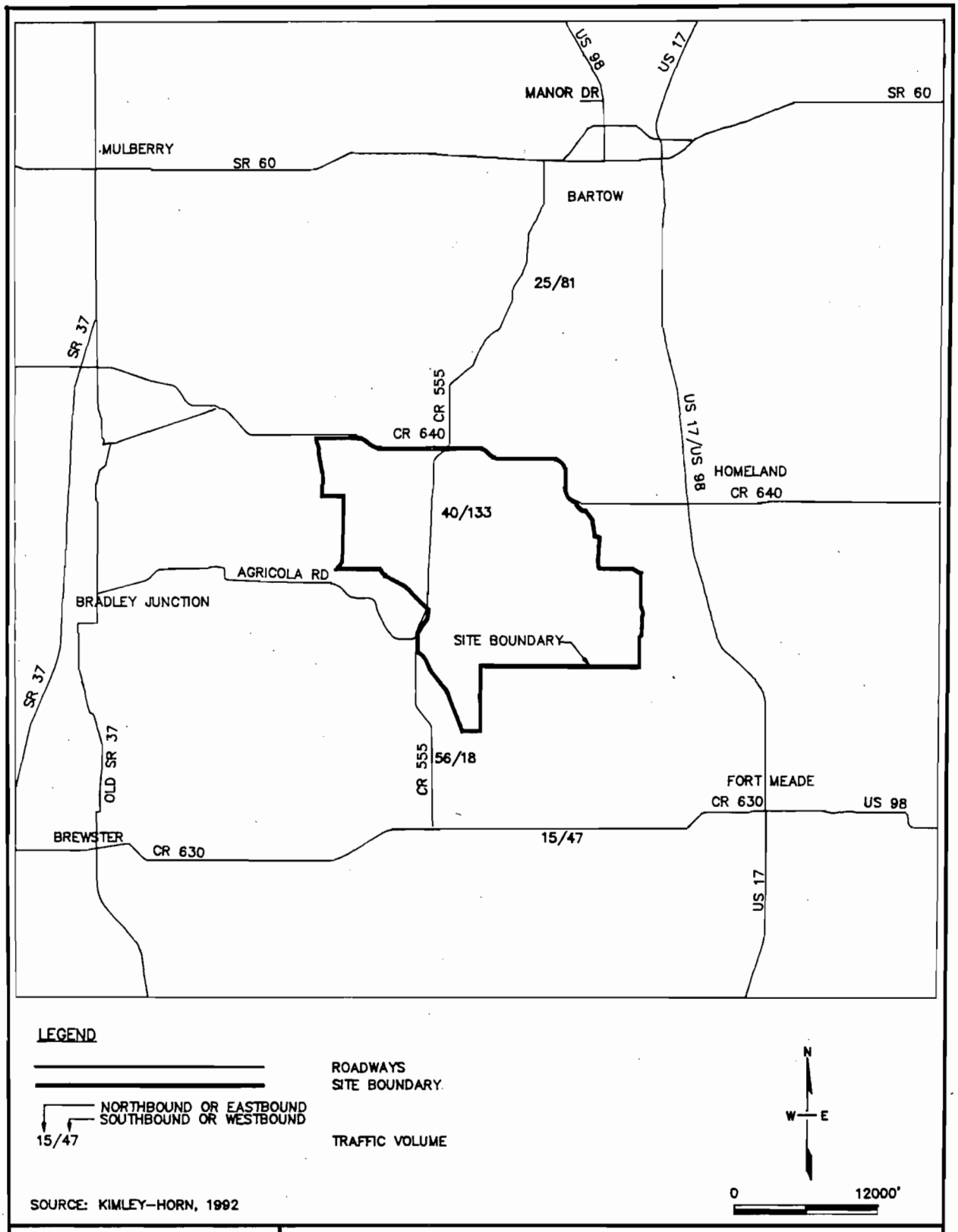


Florida Power CORPORATION

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FIGURE 5.9.1-4

2018 PEAK SEASON
P.M. PEAK HOUR NON-PROJECT TRAFFIC

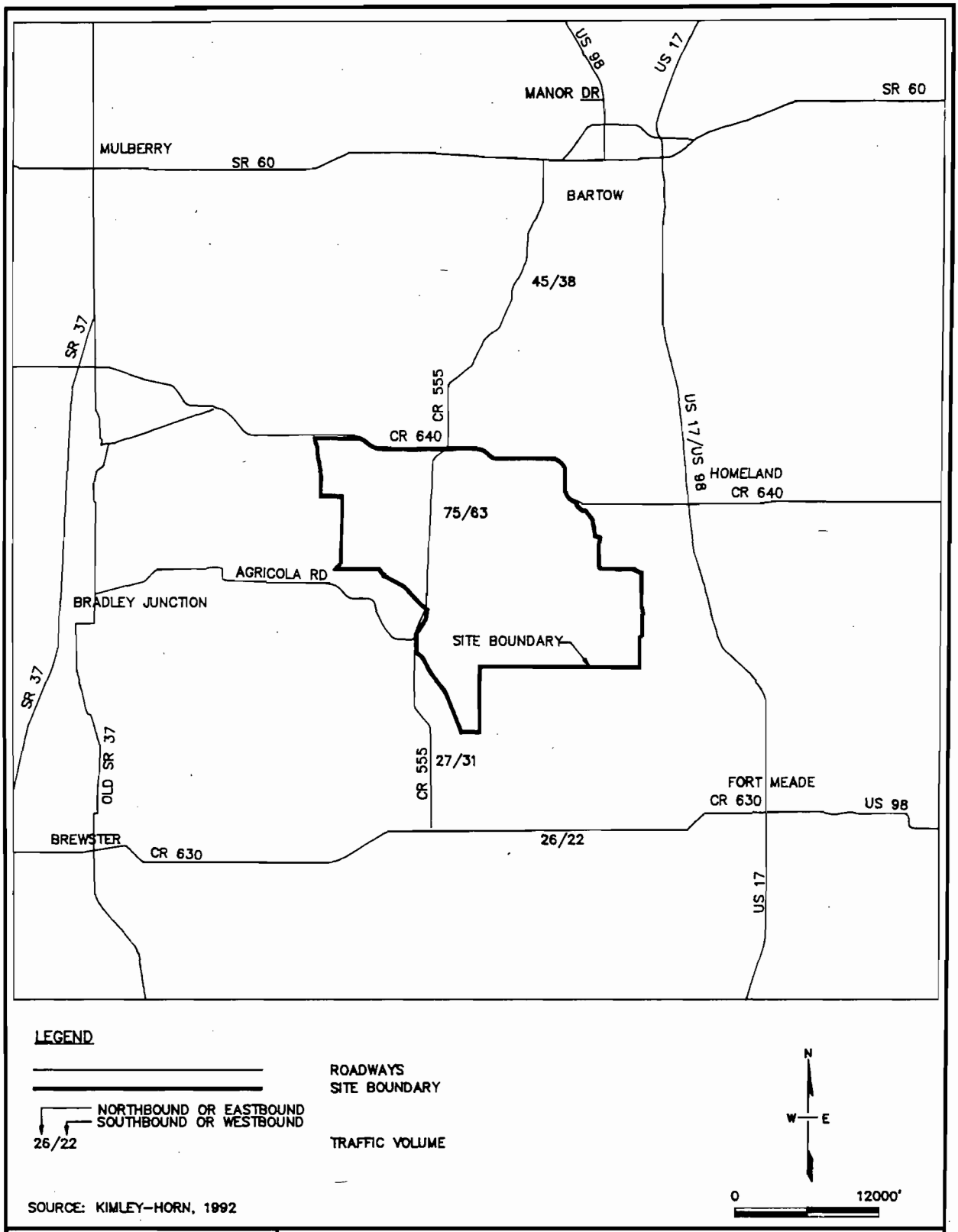


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Polk County Site

FIGURE 5.9.1-5

OPERATION PROJECT TRIPS
A.M. PEAK HOUR

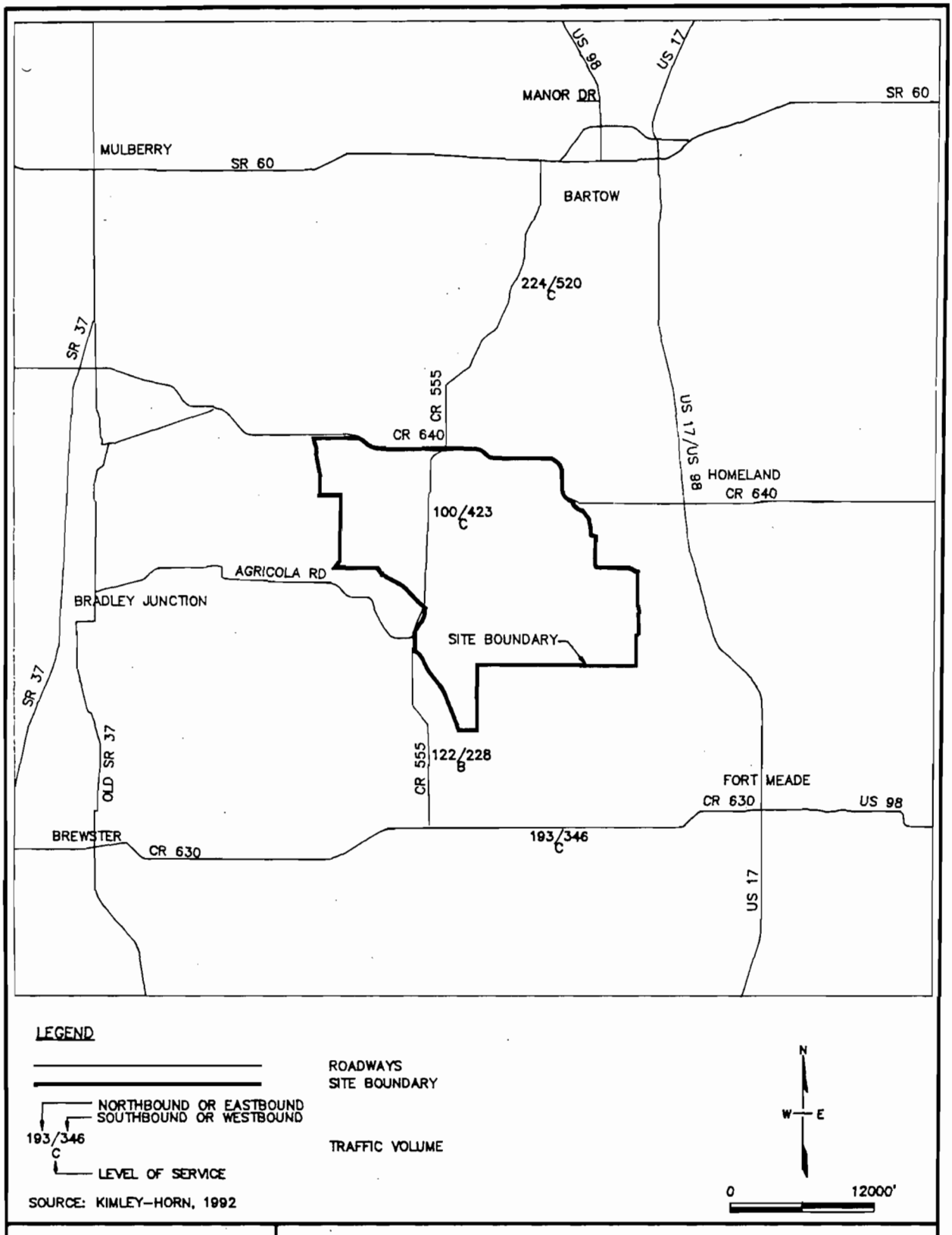


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Polk County Site

FIGURE 5.9.1-6

OPERATION PROJECT TRIPS P.M. PEAK HOUR

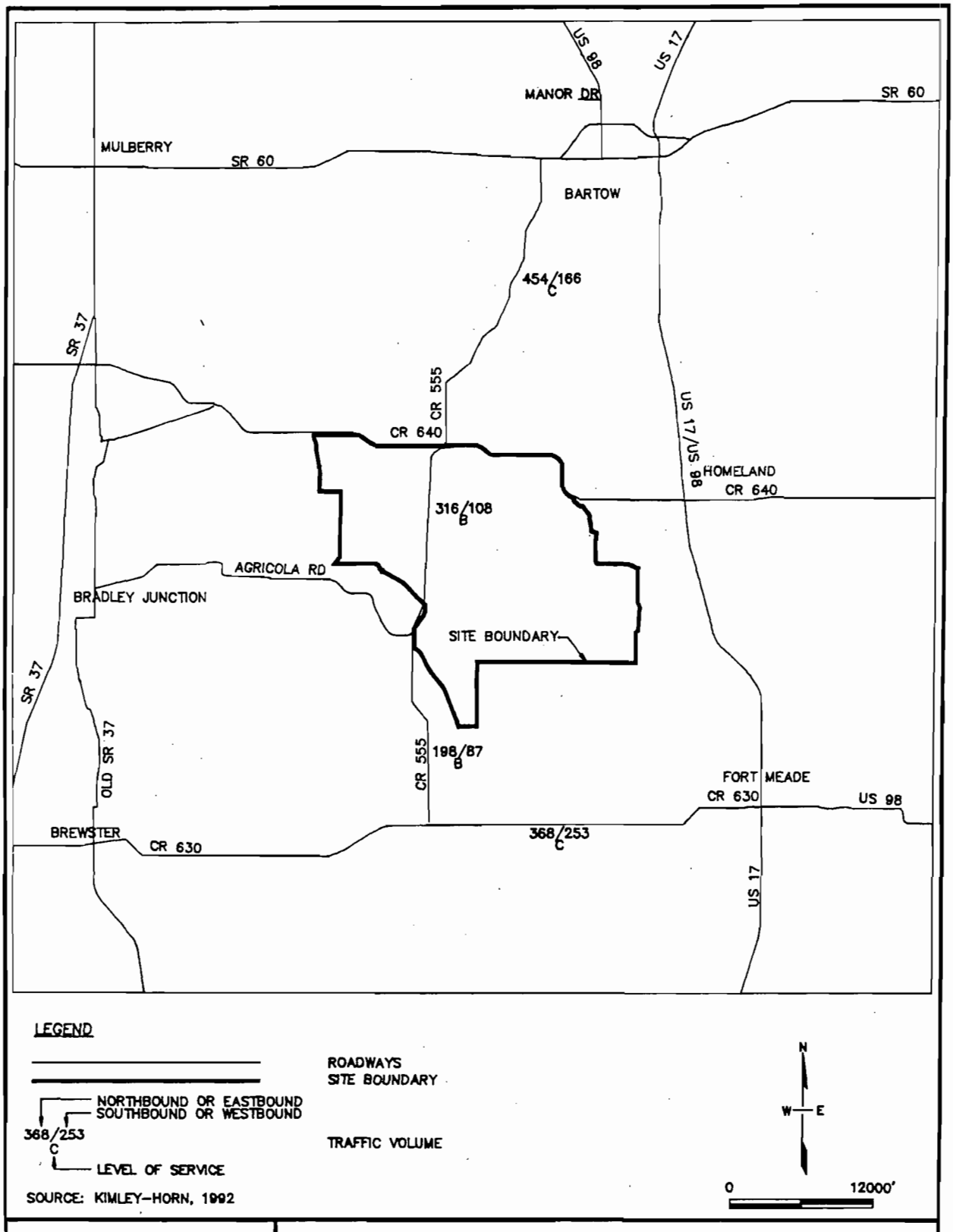


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Polk County Site

FIGURE 5.9.1-7

2008 PEAK SEASON
A.M. PEAK HOUR TOTAL TRAFFIC

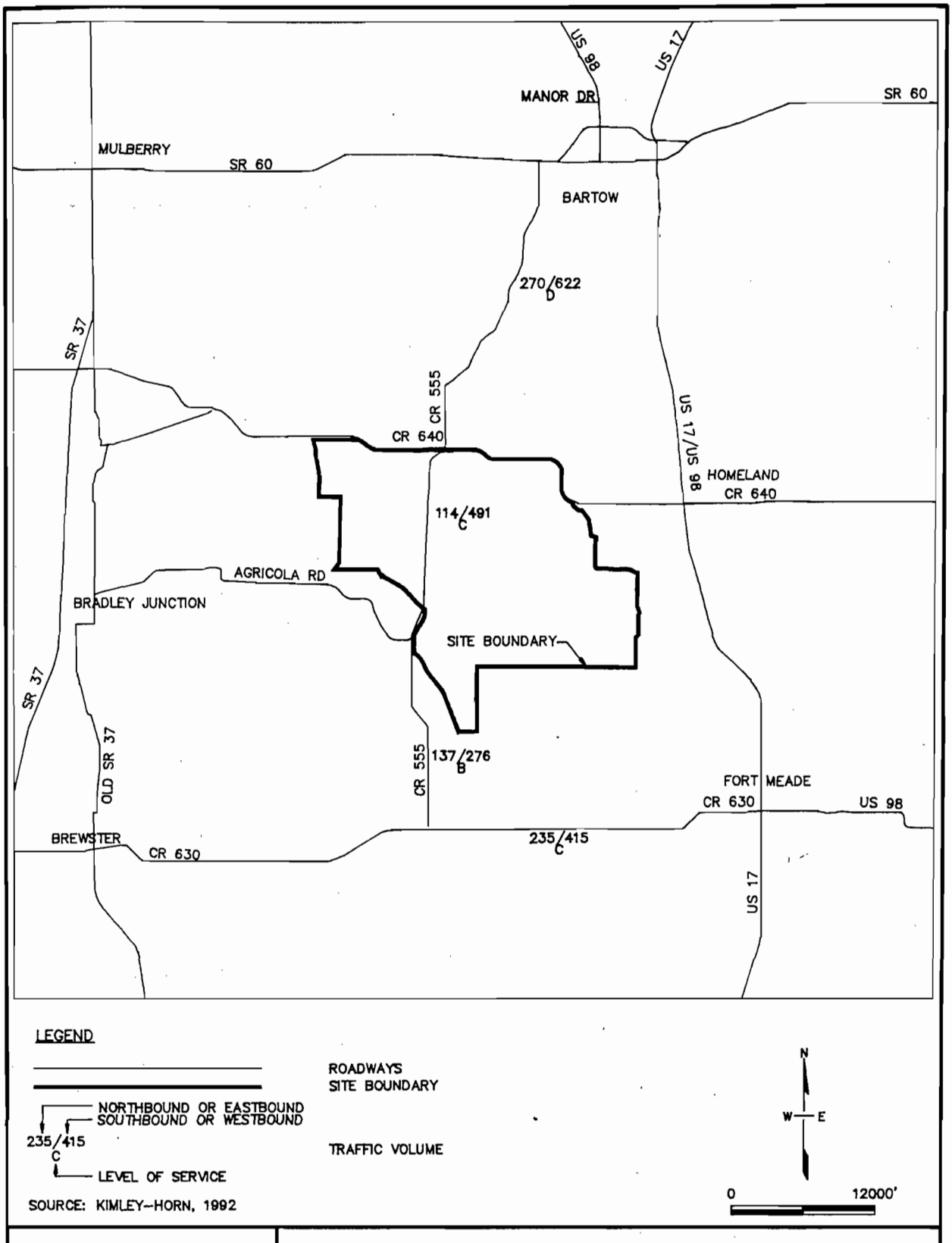


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Polk County Site

FIGURE 5.9.1-8

2008 PEAK SEASON P.M. PEAK HOUR TOTAL TRAFFIC

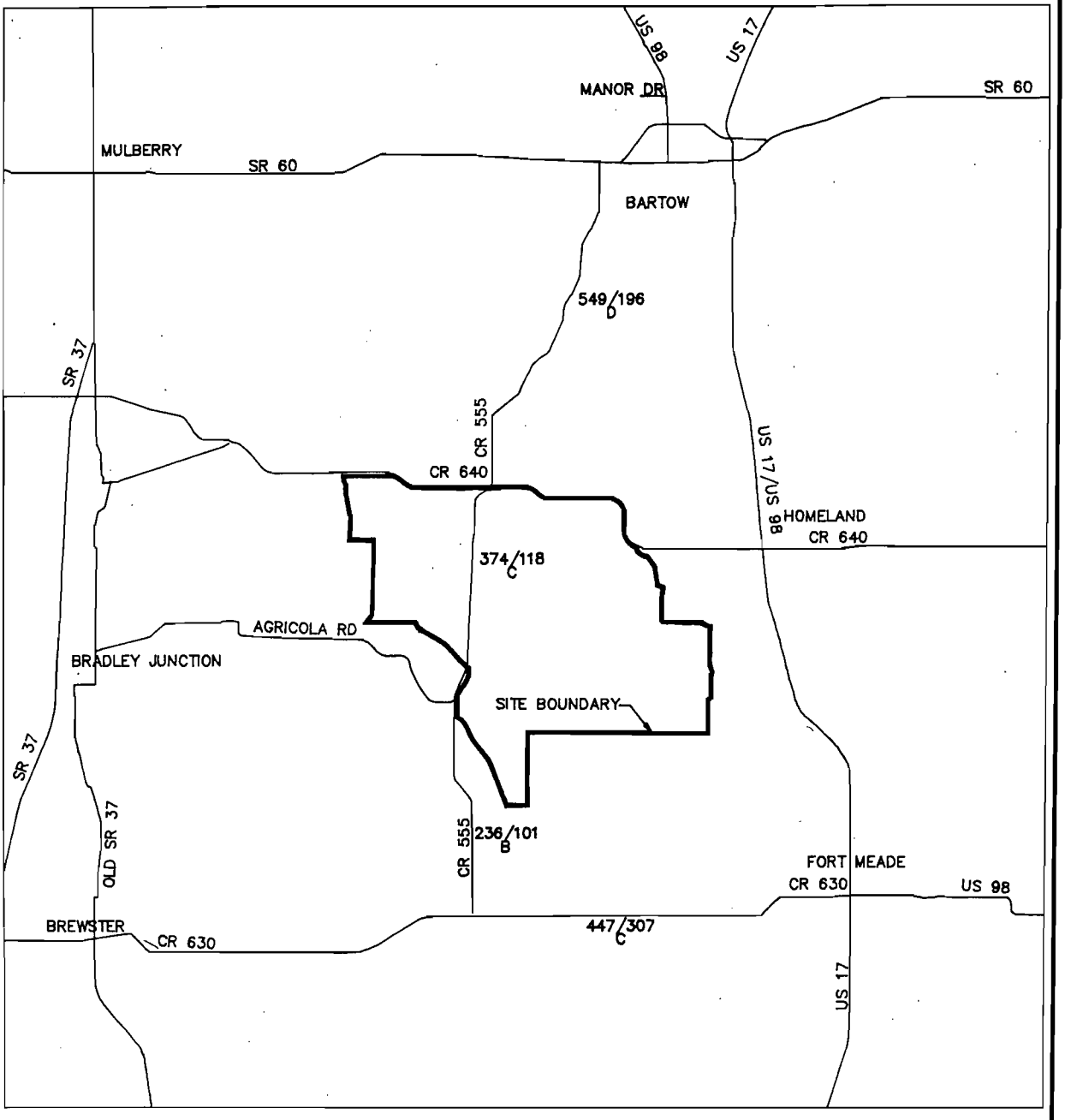


Florida Power CORPORATION

Polk County Site

FIGURE 5.9.1-9

2018 PEAK SEASON
A.M. PEAK HOUR TOTAL TRAFFIC

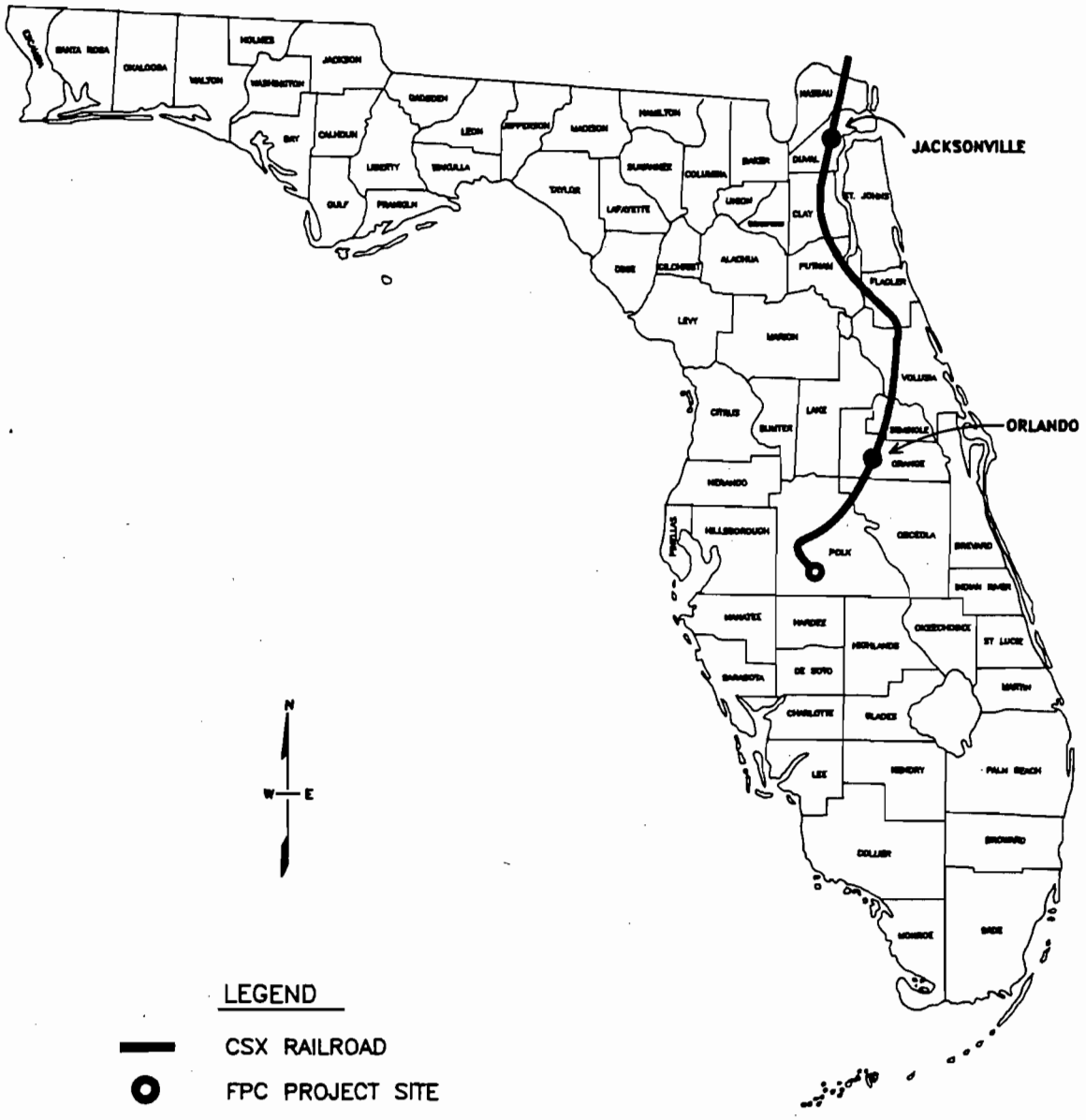


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Polk County Site

FIGURE 5.9.1-10

2018 PEAK SEASON P.M. PEAK HOUR TOTAL TRAFFIC



SOURCE: KIMLEY – HORN, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 5.9.2–1
PROBABLE RAILWAY TRANSPORTATION ROUTES

5.10 ARCHAEOLOGICAL SITES

As a result of the highly disturbed nature of the site, no significant archaeological sites are expected to be encountered.

5.11 RESOURCES COMMITTED

Irreversible and irretrievable commitments of state or local resources due to plant operation include the use of physical resources (e.g. limestone, surface water, and ground water) and the potential displacement of biological resources and their habitat. Project operation will also require the commitment of certain human and financial resources.

5.11.1 Physical Resources

Some physical resources to be used by the plant, such as natural gas, coal and fuel oil, are not found locally and are therefore not classified as state resources committed to the project. The physical state resources committed to plant operation therefore include only surface water, ground water, air, and possibly a limited amount of limestone. Limestone might be used as a fluxing agent to maintain fluidity of molten slag in the gasifer when utilizing certain types of coal with high temperature ash melting points or as a desulfurizing agent for flue gas from the PC units.

Consumptive use of water will be limited to makeup water to the cooling pond. The volume of water to be water cropped will average about 9,250 ac-ft/yr to help compensate for evaporative losses from the cooling pond. It is estimated that a maximum of 31.6 MGD of water will be withdrawn from the Upper Floridan Aquifer for cooling pond supplemental makeup.

No irreversible or irretrievable commitment of air resources is anticipated as a result of project operation. The site is located in an attainment area for all criteria pollutants, and the distribution of other air pollutant sources around the site is sparse. Analysis of likely air quality impacts of the project (Section 5.6) indicates that applicable ambient air quality standards would not be approached by operation of the plant. The site is located more than 100 km (62 mi) from the nearest Class I PSD area, and therefore the plant should have no significant impact on that Class I area.

5.11.2 Biological Resources

As discussed in Section 5.2.1, aquatic communities in the vicinity of the proposed plant will not experience adverse effects from operation of the plant. Discharges of cooling pond water will

not be made. There will be no construction or operation of makeup water intake systems in any waters of the state.

Construction and operation of the plant will not require the commitment of additional wildlife habitat or other terrestrial vegetation, and will have no measurable effect on wildlife species populations. Plant air emissions are not expected to have a measurable effect on the growth and productivity of surrounding vegetation, including agricultural crops.

5.11.3 Economic and Cultural Resources

Economic resources committed to the project will include human labor, financial commitments, and the displacement of other potential economic uses of the site. A maximum operational work force of approximately 554 persons will be dedicated to the project as long as it is in operation. While individual employees will come and go in the lifetime of the project, at any given time after ultimate buildout there will be approximately 554 persons employed at the plant and therefore not available for employment elsewhere. Similarly, financial resources that FPC commits to operation of the plant will not be available for alternative uses as long as the plant is in operation. Because no expansion of government-supplied services will be required by the plant, no commitment of state or local government financial resources is anticipated.

New employees and their families, like any growing population, will place additional demands on the local infrastructure (see Section 7.2). Effects on schools, utilities, highways, and other public facilities are expected to be more than offset by taxes paid in Polk County.

The displacement of other economic uses of the site will be limited because the site is presently an active phosphate mining area. After reclamation, use of the site would have been extremely limited because such a large portion of it would consist of reclaimed above-grade waste clay settling areas. As a result of the project, approximately 6,700 acres would not be reclaimed for agricultural (pasture) use.

No cultural resources are known to exist on-site, therefore no commitment of cultural resources is anticipated.

5.12 VARIANCES

No variances from applicable federal or state standards appear to be required.

TABLE OF CONTENTS

CHAPTER 6

TRANSMISSION LINE AND OTHER LINEAR FACILITIES

Section/Title			Page
6.1	TRANSMISSION LINE		6.1-1
6.1.1	Project Introduction		6.1-1
6.1.2	Corridor Location and Layout		6.1-1
6.1.3	Transmission Line and Road Design Characteristics		6.1-2
6.1.4	Cost Projections		6.1-3
6.1.5	Corridor Selection		6.1-3
6.1.6	Socio-Political Environment of the Corridor Area		6.1-3
	6.1.6.1	Governmental Jurisdictions	6.1-3
	6.1.6.2	Zoning and Land Use Plans	6.1-3
	6.1.6.3	Easements, Title, Agency Works	6.1-4
	6.1.6.4	Vicinity Scenic, Cultural, and Natural Landmarks	6.1-5
	6.1.6.5	Archaeological and Historic Sites	6.1-5
6.1.7	Bio-Physical Environment of the Corridor Area		6.1-5
	6.1.7.1	Land Use/Vegetation	6.1-5
	6.1.7.2	Affected Waters and Wetlands	6.1-6
	6.1.7.3	Ecology	6.1-6
	6.1.7.4	Other Environmental Features	6.1-6
6.1.8	Effects of Right-of-Way Preparation and Transmission Line Construction		6.1-7
	6.1.8.1	Right-of-Way Clearing and Access	6.1-7
	6.1.8.2	Impact on Water Bodies and Uses	6.1-9

TABLE OF CONTENTS (Continued)

Section/Title		Page
6.1.8.3	Solid Wastes	6.1-10
6.1.8.4	Changes to Vegetation, Wildlife and Aquatic Life	6.1-10
6.1.8.5	Impact on Human Populations	6.1-11
6.1.8.6	Impact on Regional Scenic, Cultural, and Natural Landmarks	6.1-11
6.1.8.7	Impact on Archaeological and Historic Sites	6.1-11
6.1.9	Post-Construction Impacts and Effects of Maintenance	6.1-11
6.1.9.1	Maintenance Techniques	6.1-11
6.1.9.2	Multiple Uses	6.1-12
6.1.9.3	Changes in Species Populations	6.1-12
6.1.9.4	Effects of Public Access	6.1-12
6.1.10	Electric and Magnetic Effects	6.1-12
6.1.11	References	6.1-15
6.2	GAS PIPELINE	6.2-1
6.2.1	Project Introduction	6.2-1
6.2.2	Corridor Location and Layout	6.2-2
6.2.3	Gas Pipeline and Road Design Characteristics	6.2-2
6.2.4	Cost Projections	6.2-3
6.2.5	Corridor Selection Process	6.2-3
6.2.5.1	Identification of a Study Area and Corridor Selection Criteria	6.2-4
6.2.5.2	Evaluation of Candidate Corridors	6.2-5
6.2.6	Socio-Political Environment of the Corridor Area	6.2-6

TABLE OF CONTENTS (Continued)

Section/Title		Page
6.2.6.1	Governmental Jurisdictions	6.2-6
6.2.6.2	Zoning and Land Use Plans	6.2-7
6.2.6.3	Easements, Title, Agency Works	6.2-10
6.2.6.4	Vicinity Scenic, Cultural, and Natural Landmarks	6.2-11
6.2.6.5	Archaeological and Historic Sites	6.2-11
6.2.7	Bio-Physical Environment of the Corridor Area	6.2-11
6.2.7.1	Land Use/Vegetation	6.2-11
6.2.7.2	Affected Waters and Wetlands	6.2-12
6.2.7.3	Ecology	6.2-12
6.2.7.4	Other Environmental Features	6.2-13
6.2.8	Effects of Right-of-Way Preparation and Pipeline Construction	6.2-13
6.2.8.1	Construction Techniques	6.2-13
6.2.8.2	Impact on Water Bodies and Uses	6.2-17
6.2.8.3	Solid Wastes	6.2-17
6.2.8.4	Changes to Vegetation, Wildlife and Aquatic Life	6.2-18
6.2.8.5	Impact on Human Populations	6.2-18
6.2.8.6	Impact on Regional Scenic, Cultural and Natural Landmarks	6.2-18
6.2.8.7	Impact on Archaeological and Historic Sites	6.2-18
6.2.9	Post-Construction Impacts and Effects of Maintenance	6.2-19
6.2.9.1	Maintenance Techniques	6.2-19
6.2.9.2	Right-of-Way Uses	6.2-19
6.2.9.3	Operational Safety Provisions	6.2-20
6.2.9.4	Changes in Species Populations	6.2-21
6.2.9.5	Effects of Public Access	6.2-21

TABLE OF CONTENTS (Continued)

Section/Title		Page
6.2.10	References	6.2-21
6.3	OTHER LINEAR FACILITIES	6.3-1
6.3.1	Project Introduction	6.3-1
6.3.2	Corridor Location and Layout	6.3-2
6.3.3	Reclaimed Water Pipeline and Road Design Characteristics	6.3-2
6.3.4	Cost Projections	6.3-2
6.3.5	Corridor Selection	6.3-2
6.3.6	Socio-Political Environment of the Corridor Area	6.3-3
6.3.6.1	Governmental Jurisdictions	6.3-3
6.3.6.2	Zoning and Land Use Plans	6.3-3
6.3.6.3	Easements, Title, Agency Works	6.3-6
6.3.6.4	Vicinity Scenic, Cultural and Natural Landmarks	6.3-6
6.3.6.5	Archaeological and Historic Sites	6.3-6
6.3.7	Bio-Physical Environment of the Corridor Area	6.3-7
6.3.7.1	Land Use/Vegetation	6.3-7
6.3.7.2	Affected Waters and Wetlands	6.3-7
6.3.7.3	Ecology	6.3-7
6.3.7.4	Other Environmental Features	6.3-8
6.3.8	Effects of Right-of-Way Preparation and Pipeline Construction	6.3-8
6.3.8.1	Construction Techniques	6.3-8
6.3.8.2	Impact on Water Bodies and Uses	6.3-11
6.3.8.3	Solid Wastes	6.3-11
6.3.8.4	Changes to Vegetation, Wildlife, and Aquatic Life	6.3-12
6.3.8.5	Impact on Human Populations	6.3-12

TABLE OF CONTENTS (Continued)

Section/Title — Page

6.3.8.6 Impact on Regional Scenic, Cultural and Natural Landmarks 6.3-12
6.3.8.7 Impact on Archaeological and Historic Sites 6.3-12

6.3.9 Post-Construction Impacts and Effects of Maintenance 6.3-13

6.3.9.1 Maintenance Techniques 6.3-13
6.3.9.2 Right-of-Way Uses 6.3-13
6.3.9.3 Changes in Species Populations 6.3-13
6.3.9.4 Effects of Public Access 6.3-14

6.3.10 Other Post-Construction Effects 6.3-14
6.3.11 References 6.3-14

LIST OF TABLES

Table/Title		Page
6.1.1-1	ESTIMATED PER-MILE TRANSMISSION LINE COSTS	6.1-16
6.2.4-1	COST PER MILE FOR GAS PIPELINE CONSTRUCTION	6.2-23
6.2.5-1	CORRIDOR SELECTION CRITERIA	6.2-24

LIST OF FIGURES

Figure/Title		Page
6.1.1-1	TRANSMISSION LINE CORRIDOR LOCATION MAP	6.1-17
6.1.1-2A	BARCOLA SUBSTATION TO FORT MEADE SUBSTATION TRANSMISSION LINE CORRIDOR - SHEET A	6.1-18
6.1.1-2B	BARCOLA SUBSTATION TO FORT MEADE SUBSTATION TRANSMISSION LINE CORRIDOR - SHEET B	6.1-19
6.1.1-2C	BARCOLA SUBSTATION TO FORT MEADE SUBSTATION TRANSMISSION LINE CORRIDOR - SHEET C	6.1-20
6.1.1-2D	BARCOLA SUBSTATION TO FORT MEADE SUBSTATION TRANSMISSION LINE CORRIDOR - SHEET D	6.1-21
6.1.1-3	TYPICAL "VEE" STRING DOUBLE-CIRCUIT TANGENT STRUCTURE	6.1-22
6.1.1-4	TYPICAL 230 KV DOUBLE CIRCUIT SMALL ANGLE SUSPENSION SELF-SUPPORTING STEEL STRUCTURE	6.1-23
6.1.1-5	TYPICAL DOUBLE CIRCUIT VERTICAL TANGENT HORIZONTAL "VEE" STRUCTURE	6.1-24
6.1.1-6	TYPICAL INSULATORS AND HARDWARE	6.1-25
6.1.1-7	TYPICAL ACCESS ROAD AND STRUCTURE PAD PLAN AND CROSS SECTION	6.1-26
6.1.6-1A	LOCAL GOVERNMENT JURISDICTIONS WITHIN 1/2 MILE OF TRANSMISSION LINE CORRIDOR - SHEET A	6.1-27

LIST OF FIGURES (Continued)

Figure/Title		Page
6.1.6-1B	LOCAL GOVERNMENT JURISDICTIONS WITHIN 1/2 MILE OF TRANSMISSION LINE CORRIDOR - SHEET B	6.1-28
6.1.6-2	FUTURE LAND USE DESIGNATIONS WITHIN THE TRANSMISSION LINE CORRIDOR	6.1-29
6.1.6-3A	ZONING DESIGNATIONS WITHIN THE TRANSMISSION LINE CORRIDOR - SHEET A	6.1-30
6.1.6-3B	ZONING DESIGNATIONS WITHIN THE TRANSMISSION LINE CORRIDOR - SHEET B	6.1-31
6.1.7-1A	LAND USE AND VEGETATION OF TRANSMISSION LINE CORRIDOR AREA - SHEET A	6.1-32
6.1.7-1B	LAND USE AND VEGETATION OF TRANSMISSION LINE CORRIDOR AREA - SHEET B	6.1-33
6.2.1-1	NATURAL GAS PIPELINE PREFERRED CORRIDOR LAYOUT	6.2-25
6.2.2-1	PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR - KEY	6.2-26
6.2.2-1A	PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR - SHEET A	6.2-27
6.2.2-1B	PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR - SHEET B	6.2-28
6.2.2-1C	PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR - SHEET C	6.2-29

LIST OF FIGURES (Continued)

Figure/Title		Page
6.2.2-1D	PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR - SHEET D	6.2-30
6.2.2-1E	PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR - SHEET E	6.2-31
6.2.2-1F	PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR - SHEET F	6.2-32
6.2.2-1G	PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR - SHEET G	6.2-33
6.2.2-1H	PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR - SHEET H	6.2-34
6.2.5-1	CANDIDATE CORRIDOR ROUTES	6.2-35
6.2.6-1	LOCAL GOVERNMENT JURISDICTIONS WITHIN ONE-HALF MILE OF THE CORRIDOR	6.2-36
6.2.6-2	FUTURE LAND USE DESIGNATIONS, HILLSBOROUGH COUNTY, FLORIDA	6.2-37
6.2.6-3	FUTURE LAND USE DESIGNATIONS, POLK COUNTY, FLORIDA	6.2-38
6.2.6-4A	ZONING DESIGNATIONS IN THE PIPELINE CORRIDOR, SHEET A	6.2-39
6.2.6-4B	ZONING DESIGNATIONS IN THE PIPELINE CORRIDOR, SHEET B	6.2-40

LIST OF FIGURES (Continued)

Figure/Title		Page
6.2.6-4C	ZONING DESIGNATIONS IN THE PIPELINE CORRIDOR, SHEET C	6.2-41
6.2.6-4D	ZONING DESIGNATIONS IN THE PIPELINE CORRIDOR, SHEET D	6.2-42
6.2.7-1A	LAND USE AND VEGETATION IN PREFERRED CORRIDOR, SHEET A	6.2-43
6.2.7-1B	LAND USE AND VEGETATION IN PREFERRED CORRIDOR, SHEET B	6.2-44
6.2.7-1C	LAND USE AND VEGETATION IN PREFERRED CORRIDOR, SHEET C	6.2-45
6.2.7-1D	LAND USE AND VEGETATION IN PREFERRED CORRIDOR, SHEET D	6.2-46
6.2.8-1	TYPICAL CROSS SECTION, NATURAL GAS PIPELINE DURING CONSTRUCTION	6.2-47
6.3.0-1	RECLAIMED WATER PIPELINE CORRIDOR CENTERLINE LOCATION MAP	6.3-16
6.3.2-1A	BARTOW SEWAGE TREATMENT PLANT RECLAIMED WATER PIPELINE CORRIDOR - SHEET A	6.3-17
6.3.2-1B	BARTOW SEWAGE TREATMENT PLANT RECLAIMED WATER PIPELINE CORRIDOR - SHEET B	6.3-18

LIST OF FIGURES (Continued)

Figure/Title		Page
6.3.2-1C	BARTOW SEWAGE TREATMENT PLANT RECLAIMED WATER PIPELINE CORRIDOR - SHEET C	6.3-19
6.3.6-1A	LOCAL GOVERNMENT JURISDICTIONS WITHIN 1/2 MILE OF THE RECLAIMED WATER PIPELINE CORRIDOR - SHEET A	6.3-20
6.3.6-1B	LOCAL GOVERNMENT JURISDICTIONS WITHIN 1/2 MILE OF THE RECLAIMED WATER PIPELINE CORRIDOR - SHEET B	6.3-21
6.3.6-2	POLK COUNTY FUTURE LAND USE DESIGNATIONS WITHIN THE RECLAIMED WATER PIPELINE CORRIDOR	6.3-22
6.3.6-3A	POLK COUNTY ZONING DESIGNATIONS WITHIN THE RECLAIMED WATER PIPELINE CORRIDOR - SHEET A	6.3-23
6.3.6-3B	POLK COUNTY ZONING DESIGNATIONS WITHIN THE RECLAIMED WATER PIPELINE CORRIDOR - SHEET B	6.3-24
6.3.7-1A	LAND USE AND VEGETATION OF THE PREFERRED RECLAIMED WATER PIPELINE CORRIDOR AND AREA ONE QUARTER MILE BEYOND EACH EDGE OF CORRIDOR, SHEET A	6.3-25
6.3.7-1B	LAND USE AND VEGETATION OF THE PREFERRED RECLAIMED WATER PIPELINE CORRIDOR AND AREA ONE QUARTER MILE BEYOND EACH EDGE OF CORRIDOR, SHEET B	6.3-26

6.1 TRANSMISSION LINE

6.1.1 Project Introduction

Construction of the first phase Polk County units during 1998 - 2000 will require rebuilding the existing FPC Barcola-Fort Meade 230 kV transmission line and connecting it to a new 230 kV switchyard at the FPC Polk County Site. The existing 230 kV line presently passes through the site (Figure 6.1.1-1). It will be necessary to rebuild the existing line from the Barcola Substation to the plant site and from the plant site to the Fort Meade Substation with double circuit structures to support a second 230 kV circuit. Construction of the new facilities will require a slight expansion of the existing right-of-way encompassed in the corridor proposed for certification. It will also be necessary to relocate about 2.7 miles of the existing Fort Meade-Rockland 115 kV circuit parallel to SR 630, west of the Fort Meade Substation (PSC, 1992). No physical expansion of either the Barcola or Fort Meade Substations is proposed.

The most significant advantage of connecting this new generation capacity to the Barcola and Fort Meade 230 kV substations and integrating the Polk County Site into FPC's Ridge Division 230 kV transmission system is that it improves system capacity and reliability. The PSC Need Determination Order, found in Appendix 10.7 of this SCA, contains discussions of the transmission line proposed for this project.

In the future, an additional 230 kV transmission line will be established to the West Lake Wales Substation, and four or five additional 230 kV connections will be constructed to FPC's proposed 500 kV substation as the site is progressively developed. Certification of these additional associated transmission line facilities will be sought in future supplemental applications.

6.1.2 Corridor Location and Layout

The proposed corridor for the initial connection of the Polk County Site into the electric grid begins at the Barcola Substation near the intersection of CR 640 and CR 555. It travels southward adjacent to mined lands along CR 555 until it reaches the power block, where it travels in a southeasterly direction through mined lands until it nears CR 630. At this point, it travels eastward while north of, and parallel to, CR 630 to the Fort Meade Substation. The corridor, when parallel to CR 630, includes mined lands, industrial facilities and citrus groves.

With the exception of the crossing of CR 555, the 5.6 mile segment of the line from the Barcola Substation to the plant will be within the Polk County Site boundary. The line will be off-site for about 4.4. miles from the southern site boundary to the Fort Meade Substation.

The corridor proposed for certification includes the existing right-of-way plus additional areas for expansion. Figure 6.1.1-1 depicts the layout of the corridor. The corridor width is 1,000 feet in the on-site sections from the Barcola Substation to the power block area and 500 feet in the off-site sections from the power block to the Fort Meade Substation. The corridor widths will allow room for realignment of the existing right-of-way. Figures 6.1.1-2A through 6.1.1-2D present a 1:12,000 aerial photographic display of the Barcola-Fort Meade transmission line corridor. The date of the aerial photography is March 17, 1992, and shows the current land use and land cover conditions in the corridor. The corridor segment between the Barcola Substation and the plant includes a 69 kV transmission line. A 115 kV transmission line occurs in the corridor segment between the plant and Fort Meade Substation.

6.1.3 Transmission Line and Road Design Characteristics

Typical structures and insulators and hardware which would be used for the upgrade of the Barcola-Fort Meade 230 kV line to a double circuit are shown on Figures 6.1.1-3 through 6.1.1-6. Other specialized structures may be needed at angles.

The line nominal operating voltage is to be 230 kV; the maximum current rating (MCR) is 1980 amperes. Span lengths between structures typically will be approximately 700 feet, but could range from 500 to 900 feet depending on final line design.

Transmission line conductor clearances above ground will vary along the length of the line. In all cases, the clearances will comply with the National Electrical Safety Code (IEEE, 1990) and will be a minimum of 28 feet above ground.

Upgrading of existing access roads will take place. Where required, a structure pad, generally 100 feet by 100 feet, will be prepared at the structure location (Figure 6.1.1-7).

Short unpaved finger roads for construction and maintenance may be required in wetland areas to access the structures from the existing mine roads near to CR 630. Local fill material, if suitable, will be used for these roads. These roads will be 25 feet in width generally. However,

the length will vary depending on the structure distance from the access road. As part of road construction, culverts will be installed where necessary to maintain existing drainage.

6.1.4 Cost Projections

Table 6.1.1-1 provides the estimated per-mile costs of the proposed 230 kV transmission line rebuild.

6.1.5 Corridor Selection

No corridor selection process was undertaken because of the use of an existing right-of-way and because much of the transmission line (Barcola Substation to the plant) will be within the site boundary. Inspection of the existing right-of-way and adjacent land uses resulted in a determination that minimal additional impacts would occur as a result of upgrading the existing transmission line. The proposed corridor follows existing linear features (CR 555, CR 630, dams, railroads, existing transmission lines) for its entire length.

6.1.6 Socio-Political Environment of the Corridor Area

6.1.6.1 Governmental Jurisdictions

The proposed transmission corridor is within the unincorporated area of Polk County. Figures 6.1.6-1A and 6.1.6-1B show the transmission line corridor in relation to the local government jurisdictions within one-half mile of the corridor.

6.1.6.2 Zoning and Land Use Plans

POLK COUNTY FUTURE LAND USE

Polk County adopted a comprehensive plan pursuant to Chapter 163, F.S. and Rule 9J-5 F.A.C. in April 1991 (Polk County BOCC, 1991). The transmission line corridor crosses two land use categories, Phosphate Mining (PM) and Agricultural/Residential-Rural (A/RR), on the County's 2010 Future Land Use map, as illustrated on Figure 6.1.6-2.

The Polk County Comprehensive Plan describes PM areas as those areas with existing or proposed phosphate mining operations, and non-reclaimed mine lands. The corridor mainly crosses phosphate lands which have been mined. The Plan states that construction, operation and maintenance of uses ancillary to electric power generation facilities are permitted within this land use category. The A/RR land use category is intended to encourage productive agricultural uses and to provide for low-density residential development in rural areas. Allowable uses include farm labor residential uses, utility structures associated with farm operations, and low-density residential uses. The Plan also states that utilities, including electrical transmission lines and substations, are allowed in all land use classifications, subject to County approval.

The transmission line upgrade between the Barcola Substation and the Fort Meade Substation was addressed in the CUP for the Polk County Site. The CUP was approved by the Board of County Commissioners on June 2, 1992.

POLK COUNTY ZONING

The Polk County Zoning Ordinance was adopted on March 1, 1983. The County is currently drafting new land development regulations (LDRs) which are scheduled to be adopted in 1993. Until the new LDRs are adopted, the 1983 zoning ordinance is in effect. The zoning designations included in the corridor are shown on Figures 6.1.6-3A and 6.1.6-3B. The majority of the corridor in Polk County is designated Rural Conservation (RC) with two areas zoned General Industrial (GI), and one area near the Fort Meade Substation zoned Commercial District-Heavy Commercial (C-4) (Polk County BOCC, 1983).

Electric transmission lines are defined as Class I Essential Services in the Polk County Zoning Ordinance and, as such, are allowed as permitted uses in all zoning districts.

6.1.6.3 Easements, Title, Agency Works

CR 555 and CR 630 are the only county-maintained roads which must be crossed. Polk County requires a use permit for any facilities crossing county roads. Approval for crossing CR 555 and CR 630 will be obtained through the site certification process.

6.1.6.4 Vicinity Scenic, Cultural, and Natural Landmarks

The transmission line corridor passes primarily through lands which have been disturbed by phosphate mining. No scenic, cultural, or natural landmarks are found within one-half mile of the transmission line corridor.

6.1.6.5 Archaeological and Historic Sites

As stated above, the transmission line corridor is located in an area which has been disturbed by phosphate mining and the corridor follows existing linear facilities. Due to the corridor's location, it is unlikely that any archaeological or historic sites would be found within one-half mile of the corridor. A letter from DHR dated June 30, 1992 (DHR, 1992) states that due to the location and the nature of this project, it is not likely that any significant archaeological or historical sites would be impacted (Appendix 10.5.2).

6.1.7 Bio-Physical Environment of the Corridor Area

6.1.7.1 Land Use/Vegetation

Land use and vegetation of the preferred corridor and its vicinity are presented on Figures 6.1.7-1A and 6.1.7-1B. Mapped information is labeled using the Florida Land Use and Land Cover Classification System. Aerial photographs (scale 1:12,000) showing the preferred corridor and the area extending one-half mile from each corridor edge are presented on Figures 6.1.1-2A through 6.1.1-2D.

The corridor is located on, or adjacent to, lands that are, or have been, mined for phosphate ore. Other existing land uses within one-half mile of the corridor include CR 555 a single residence at the intersection of CR 555 and CR 640, citrus grove, and industrial facilities. Less than ten residences occur along the CR 630 portion of the corridor. These residences are not adjacent to the proposed right-of-way. Vegetation communities found in the corridor are similar to those which are described in Section 2.3.5.

6.1.7.2 Affected Waters and Wetlands

The transmission line corridor includes minimal wetland acreage which could be affected by the project. Wetlands along CR 555 within the corridor to the power plant include only small wetlands associated with ditches along the road. Similarly, the corridor includes some wetland ditches associated with CR 630 and phosphate mining. The corridor crosses no major canals or wetland areas. The corridor includes a crossing of McCullough Creek near CR 630. The Creek will be spanned by the transmission line with no structures placed in its floodplain. Access to this area will be by existing road systems.

6.1.7.3 Ecology

This section presents a discussion of the corridor status of species identified as threatened or endangered or species of special concern by the U.S. Fish and Wildlife Service, Florida Game and Fresh Water Fish Commission, and Florida Department of Agriculture and Consumer Services. Section 2.3.6 includes a discussion of those species afforded special protection which have the potential to occur in Polk County and surrounding counties and which can occur in the project area. Plant and animal species status listed in that section also apply to the transmission line corridor. Vegetation community types occurring in the corridor are similar to those occurring at the Polk County Site or which would occur at the site with existing reclamation plans implemented.

The probability of occurrence of threatened and endangered species in the preferred corridor is based on discussions with agency personnel and observations by project ecologists. There are no records of nesting or breeding occurrences in the corridor or its vicinity for any threatened or endangered animals. Because vertebrates are mobile, their movements and activity patterns may take them into appropriate habitats within the corridor. Woodstork, and a variety of wading birds, for example, have been observed feeding in the corridor. However, the corridor is not known to include habitats required by a population of threatened or endangered species or species of special concern.

6.1.7.4 Other Environmental Features

No other environmental features associated with the transmission line warrant discussion.

6.1.8 Effects of Right-of-Way Preparation and Transmission Line Construction

6.1.8.1 Right-of-Way Clearing and Access

It will be necessary to clear the right-of-way for the upgrade of the 230 kV transmission line in order to provide access to both the existing and new structure locations, as well as to provide proper clearances for the safe and efficient operation of the transmission line. Access roads may be needed between the structures, or from other linear facilities in the area, as warranted, for construction and maintenance of the line.

The clearing in upland areas will be accomplished using rotary mowers, shear machines, and conventional landclearing equipment, such as bulldozers and root rakes. The right-of-way will be cleared from the transmission line centerline to 15 feet on each side of the outer conductor positions for the length of the conductor; removing all trees or vegetation to ground level, with the stumps removed or ground to 6 inches below the groundline. The remaining width of right-of-way will only be cleared of vegetation that reaches a mature height that extends above an imaginary 45 degree line from the clear cut area as defined above to the edge of the right-of-way. Additionally, an area 100 feet by 100 feet will be cleared and de-stumped around each new structure location.

The wetland clearing will have the same configuration as the upland clearing, however the clearing will be accomplished by hand using chain saws or by rotary machines (off of matting or on low ground pressure tracks), and no stumps or low growing vegetation will be removed with the following exceptions: 1) a 25 feet wide area between the structures or off an existing linear facility will need to be de-stumped to provide for access by low ground pressure equipment, the placement of temporary matting, or the placement of fill, should an access road be necessary; 2) and an area around each structure to avoid conflict with the foundation installation.

The remainder of the right-of-way in wetland areas, beyond 15 feet on either side of the outer conductor positions for the length of the conductors, will not be cleared; however, selective trimming or removal of vegetation which can attain a mature height greater than 15 feet will be employed.

Access roads are required to provide efficient and safe ingress and egress to the transmission line structures for construction and maintenance. To the extent possible, existing upgraded access roads will be used for the majority of construction and maintenance activities associated with the proposed transmission line. In wetland areas, removable construction matting or low-ground-pressure equipment may be utilized in place of fill where practicable; however, fill may be necessary in some wetland areas. These methods may be used alone or in combination as conditions (i.e., soft ground, deep muck, etc.) warrant.

Where upgrading of roads is required in upland areas, soil from both sides of the road surface may be used for fill. Bulldozers and/or motor graders will be used. In cases where hauled fill is required, the fill will be spread, compacted, and shaped to the design width and elevation.

LINE CONSTRUCTION

Existing 230 kV transmission structures will be removed between the Barcola and Fort Meade Substations. Generally, for structure removal, a rubber-tired crane or crawler crane will be used. After structure removal, holes will be filled with clean suitable fill. Salvageable material including insulators, line and line hardware will be returned to FPC material warehouses for reuse, recycling, or sold for scrap by contractors. Other material and debris will be disposed of in a licensed landfill.

It is expected that single-shaft steel poles will be the typical structure type used on this project. Line construction activities will include the placement of foundations, assembly and erection of structures, and installation of conductors. Steel embedded sections will be the typical foundation in most areas of the line.

In most situations where the steel embedded sections are used, a hole will be excavated using an auguring machine and the steel will be placed into the hole and backfilled with concrete or rock. Minimal dewatering is expected to be required. In special cases where foundation conditions permit, vibrating structures in place may be used.

Structures will be erected using cranes and support vehicles. Insulators and roller blocks will be installed following completion of structure erection. Standard wire-pulling equipment will be used to install the conductors and overhead ground wires.

EROSION CONTROL

To reduce erosion potential during construction, disturbance of the natural ground cover will be kept to a minimum. The use of construction matting and low-ground-pressure equipment will reduce disturbance to wetland areas, thus minimizing the potential for erosion. Turbidity screens and other erosion control devices including temporary culverts and/or staked hay bales will be used during construction. As part of the line construction process, disturbed areas will be restored by contour grading. With the exception of the required access roads and structure pads, low-lying vegetation will be allowed to remain. Disturbed ground cover is known to reestablish quickly, thereby reducing the erosion potential.

If road construction occurs which would impact a wetland area, hay bales or turbidity screens will be staked in place approximately 15 to 25 feet from the wetland area to avoid potential impacts to water quality and the vegetative community. Construction within wetlands will be reviewed on an individual basis to determine appropriate environmental protection measures. This may include silt screens, temporary matting across wetlands, or other measures as appropriate.

6.1.8.2 Impacts on Water Bodies and Uses

The corridor crosses several ditches associated with CR 555 between the existing Barcola Substation and the Polk County Site. From the Polk County Site to the Fort Meade Substation the corridor crosses additional ditches associated with mining areas and along CR 630. The corridor also crosses McCullough Creek north of CR 630.

Dredging and filling in wetlands may be required for construction in ditches along CR 555 and in ditches adjacent to mine areas. The crossing of McCullough Creek will require review by the FDER and Corps of Engineers. If necessary, culverts will be installed under access road fill sections to allow equalization of water levels. The need for fill will be minimized by using existing roads for access.

FPC will comply with all applicable FDER water quality standards. Water quality will be maintained through the use of erosion control methods, as required, such as staked hay bales and fabric fences. Seeding and mulching will be used, if required, to control erosion on steep slopes.

The construction of the transmission line should not require ground water withdrawals or relocation of any water bodies. Minimal dewatering is expected. In addition, the construction will not create any new connections to waters-of-the-state. No navigable waterways will be crossed. Consequently, no effects to navigation should occur from this transmission line upgrade. Construction activities will not affect stability or integrity of existing dams.

In conclusion, the resulting impacts on the existing water bodies and wetlands will be minimal. Natural drainage patterns will be maintained by adequate placement of culverts. Water quality will be maintained by appropriate clearing practices and the use of erosion and sediment controls, as required, during construction. No state owned lands under waters, including those under the control of the Board of Trustees of the Internal Improvement Trust Fund, are crossed by the line.

6.1.8.3 Solid Wastes

Solid waste generated from right-of-way clearing and line construction typically consists of cleared vegetation and construction debris. Cleared vegetation and combustible debris may be burned on-site in upland areas. Applicable state and local fire-related regulations will be followed. All noncombustible solid waste will be collected and removed for recycling or off-site disposal in compliance with all applicable regulations. The quantity of solid waste generated will depend upon site-specific characteristics of the area being cleared. Since it is anticipated that the majority of the transmission line will be within an existing right-of-way, relatively small amounts of solid waste should be generated, except that generated by the removal of old structures. Materials available for recycling will be transported for sale as salvage.

6.1.8.4 Changes to Vegetation, Wildlife, and Aquatic Life

No significant permanent changes to animal and plant populations are expected. Most of the corridor is currently in mining, industry, pasture and other agricultural landcovers. Some vegetation will be disturbed by the construction of the transmission line. Disturbed areas will be allowed to revegetate as each section of the transmission line is completed. Less than 10 total acres of wetlands are expected to be disturbed by transmission line construction.

6.1.8.5 Impact on Human Populations

All facilities of the transmission line installed in state or county road right-of-ways are to be designed and constructed in accordance with specifications outlined in FDOT's Utility Accommodation Guide (FDOT, 1990).

The transmission line corridor includes an existing right-of-way through sparsely populated areas that are dominated by the phosphate industry. The corridor disturbances to this area are expected to be minimal. The use of existing rights-of-way and the short duration of construction activities in any given location should minimize any inconvenience which might occur.

6.1.8.6 Impact on Regional Scenic, Cultural, and Natural Landmarks

There were no regional scenic, cultural, or natural landmarks identified within one half-mile of the transmission line corridor.

6.1.8.7 Impact on Archaeological and Historic Sites

Due to the highly disturbed nature of the corridor, no significant archaeological or historic sites are expected within the right-of-way. DHR has stated that it is not likely that any significant sites would be impacted by the project.

6.1.9 Post-Construction Impacts and Effects of Maintenance

6.1.9.1 Maintenance Techniques

Maintenance activities for the transmission line will consist of preventative and corrective measures. Although transmission lines normally require minimal maintenance, FPC will conduct annual inspections to ensure the safe operation of the line. During these annual inspections, both right-of-way clearing and access will be inspected. Transmission line conductors, insulators, etc., will be inspected also. Inspections will be conducted using both ground and aerial means.

Maintenance of the right-of-way will be consistent with the clearing practices described in Section 6.1.8.1. This will allow the performance of right-of-way maintenance, while encouraging the growth of low-growing woody and herbaceous vegetation. Any vegetation that

may be cut during clearing of the right-of-way (Section 6.1.8.1) may be girdled or selectively treated with herbicides during line maintenance. Herbicides will include only those registered by the EPA and which have state approval. Herbicide application rates and concentrations will be in accordance with label directions and will be carried out by a licensed applicator, meeting all applicable federal, state, and local regulations. During maintenance clearing, vegetation will be allowed to remain on-site.

6.1.9.2 Multiple Uses

Multiple uses within a transmission line right-of-way typically can include agricultural operations (e.g., grazing, orange groves, and row crops), and other activities that do not interfere with FPC's use of the right-of-way for the operation and maintenance of the proposed transmission line. FPC maintains a Right-of-Way Utilization Committee that will consider future requests for multiple uses of the transmission line right-of-way. This committee reviews requests for multiple uses to assure that the proposed use of the right-of-way is compatible with safe line operation and maintenance. However, since FPC will have an easement for this right-of-way rather than owning it fee simple, the opportunities for multiple use will be limited.

6.1.9.3 Changes in Species Populations

No measurable changes in previously defined important species populations (Section 2.3.6), will take place because of the use of an existing maintained right-of-way and the associated lack of habitat.

6.1.9.4 Effects of Public Access

Generally, existing access roads will be used. No new road construction will increase exposure of previously undisturbed areas to the public. The entire corridor exists in lands greatly disturbed by mining, industry, and citrus groves. Therefore, no new roads or road improvements will change public access to undisturbed areas.

6.1.10 Electric and Magnetic Effects

Transmission lines designed to operate at 230 kV and higher have been in service in Florida and other areas of the United States for many years. Currently, there are over 4,586 circuit miles

of 230 kV lines in operation in Florida. In the United States, there are over 70,511 circuit miles of 230 kV and greater voltage transmission lines in operation. These lines are operated in all types of land uses, including urban, suburban, agricultural, wetlands, and open country areas.

The electric field under a transmission line is primarily a function of the voltage impressed on the line and conductor height above ground. The strength of the magnetic field is primarily a function of the amount of current carried by the line and the height of the conductors above ground. Consequently, electric and magnetic fields vary along the right-of-way since the conductor height above ground varies.

The electric and magnetic field values for the Polk County Site 230 kV line upgrade were calculated in accordance with FDER Rule 17-274, F.A.C., Electric and Magnetic Fields. The fields were calculated for the maximum current rating (MCR) load condition. The voltage was assumed to be the maximum operating voltage of 242 kV for the double circuit 230 kV lines and 73 kV for the existing wood pole 69 kV lines. The calculation point was at the midspan of a typical 700 ft span where the conductor sag is at its maximum during high load and ambient temperature conditions. This calculation method produces the maximum electric and magnetic fields under the conductors for the particular load condition. Normal day-to-day operation of the line will result in lower values than the ones shown in any of these calculations because of the conservative assumptions used as the basis for calculations.

Appendix 10.10 contains seven calculation cases performed for the Polk County Site 230 kV line upgrade. The cases represent typical cross-sections of the right-of-way from the Barcola Substation to the Fort Meade Substation. The results shown in Appendix 10.10 indicate that the electric and magnetic field strengths are typical of those found for other 230 kV transmission lines, and, in all cases, are below the State of Florida limits of: 2 kiloVolts/meter (kV/m) electric field at the edge of the transmission line right-of-way and the property boundary of a new substation, 8 kV/m electric field on the right-of-way, and 150 milliGauss (mG) magnetic field at the edge of a transmission line right-of-way or property boundary of a new substation, as found in Rule 17-274.450(3), F.A.C.

While the calculations make use of the typical structure type shown on Figure 6.1.1-3, other configurations may be developed during detailed design such as those shown on Figures 6.1.1-4 through 6.1.1-6. While use of these alternative structure types may slightly change the associated electric and magnetic field strengths, the field values will still be below the state of

Florida limits. FPC will submit a finalized electric and magnetic field package based on the actual design structures prior to the start of construction.

AUDIBLE NOISE

High voltage transmission lines generate some audible noise due to corona around the conductors. This noise should be noticeable only during rainy and humid weather because water droplets increase the amount of corona. However, the sound of falling rain on buildings and vegetation often partially masks transmission line noise. During wet conditions, the median (L50) A-weighted sound pressure level of the transmission line noise will be 39.1 dBA at the edge of the right-of-way. The noise levels produced by the transmission lines fall well below guidelines recommended by EPA to "protect public health and welfare with an adequate margin of safety" (see Section 2.3.8).

During fair weather conditions, when the conductors are dry, audible noise levels produced by the 230 kV transmission lines will be less than normal outdoor ambient noise levels and, therefore, not noticeable.

RADIO AND TELEVISION INTERFERENCE

The rebuilt transmission line will not travel close to sensitive receptors. Minimal housing occurs near the corridor and no housing is adjacent to the right-of-way. Most of the housing, which is present, is adjacent to CR 630 and is well removed from the transmission line. Radio and television receptors are at a distance from the right-of-way, which should preclude significant interference. If any problem should occur, it can be pinpointed readily on an individual basis and corrected. Cable television, satellite television, and telephone reception are unaffected by transmission line noise.

6.1.11 References

DHR (Division of Historic Resources). 1992. Letter from George W. Percy, Director, Tallahassee, to M. Tuttell, Moore/Bowers, Tampa. June 30, 1992.

EPRI (Electric Power Research Institute). 1987. Transmission Line Reference Book, 345 kV and Above. Second Edition

FDOT (Florida Department of Transportation). 1990. Utility Accommodation Guide. Tallahassee, Florida.

IEEE (Institute of Electrical and Electronics Engineers, Inc.). 1990. National Electrical Safety Code: 1990 Edition. ANSI CS2-1990. New York, New York.

PSC (Florida Public Service Commission). 1992. Order Determining the Need for a Proposed Power Plant. Order No. 25805

Polk County BOCC (Board of County Commissioners). 1983. Polk County Zoning Ordinance. Bartow, Florida. 1983.

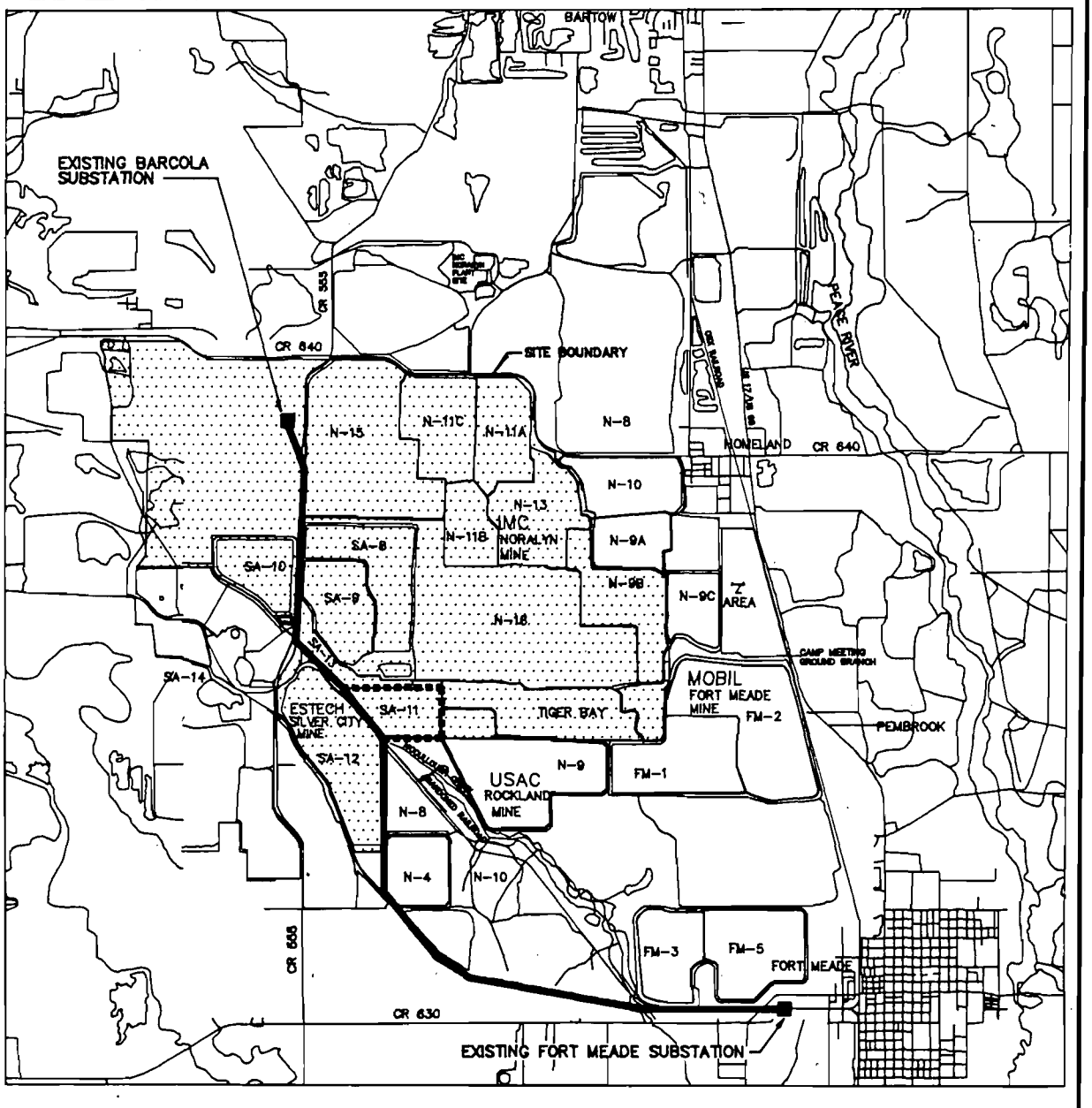
Polk County BOCC. 1991. Polk County Comprehensive Plan. Bartow, Florida. April 19, 1991.

TABLE 6.1.1-1
ESTIMATED PER-MILE TRANSMISSION LINE COSTS

Transmission Line Component	Estimated Cost Per Mile (1997 $)
Line Construction (materials, labor, land rights, structures, insulators, wire, etc.)	$ 530,000
Removal of Existing Structures[1]	$ 53,000
Access Road Construction and Right-of-Way Clearing	$ 20,000
Total	$ 603,000

[1] If removal of existing foundations is necessary, $12,500 per mile must be added to estimate.

Source: FPC, 1992.

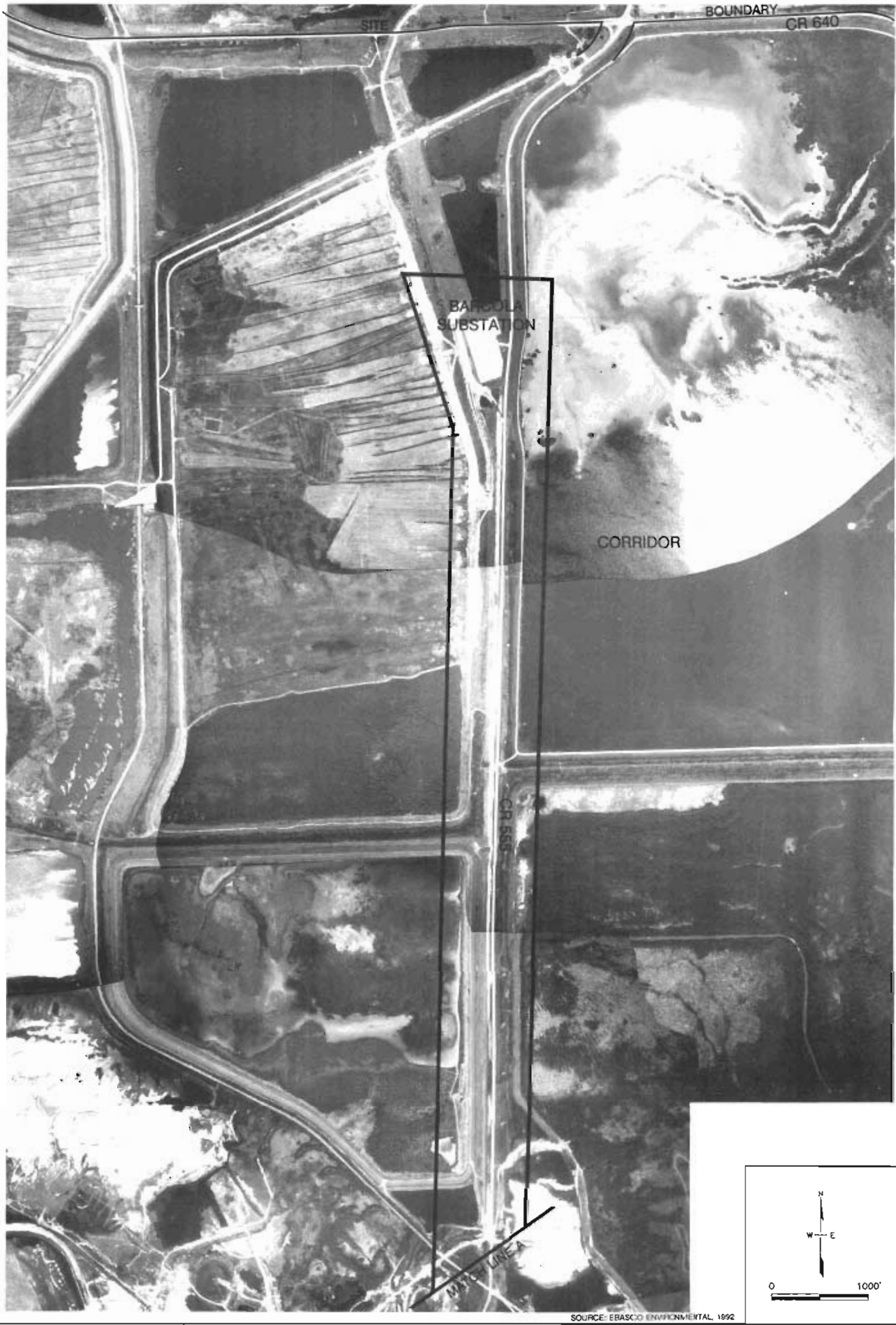


SOURCE: EBASCO ENVIRONMENTAL, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 6.1.1-1
TRANSMISSION LINE CORRIDOR LOCATION MAP



SOURCE: EBASCO ENVIRONMENTAL, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 6.1.1-2A
BARCOLA SUBSTATION TO FORT MEADE SUBSTATION
TRANSMISSION LINE CORRIDOR
SHEET A



Florida Power CORPORATION

Polk County Site

FIGURE 6.1.1-2B
BARCOLA SUBSTATION TO FORT MEADE SUBSTATION
TRANSMISSION LINE CORRIDOR
SHEET B



SOURCE: EBASCO ENVIRONMENTAL, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 6.1.1-2D
BARCOLA SUBSTATION TO FORT MEADE SUBSTATION
TRANSMISSION LINE CORRIDOR
SHEET D

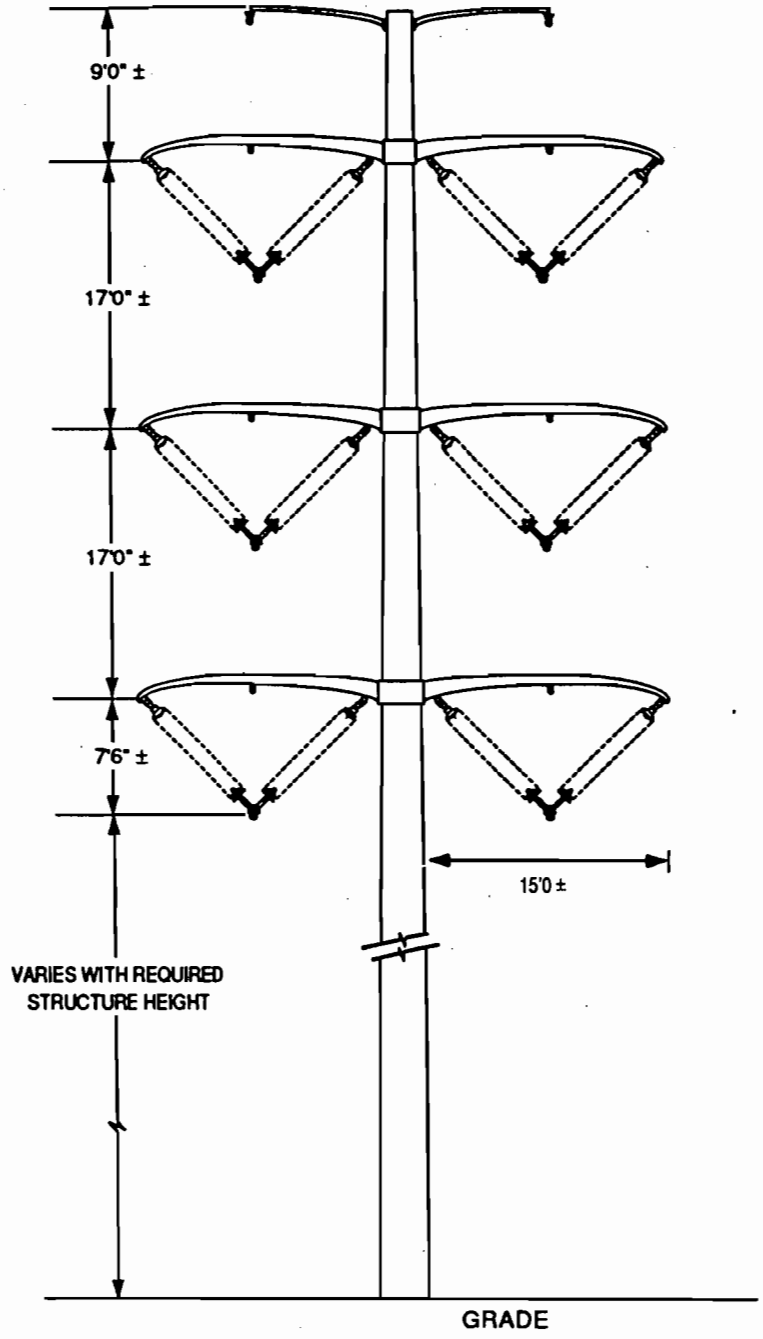


SOURCE: ERASCO ENVIRONMENTAL, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 6.1.1-2D
BARCOLA SUBSTATION TO FORT MEADE SUBSTATION
TRANSMISSION LINE CORRIDOR
SHEET D



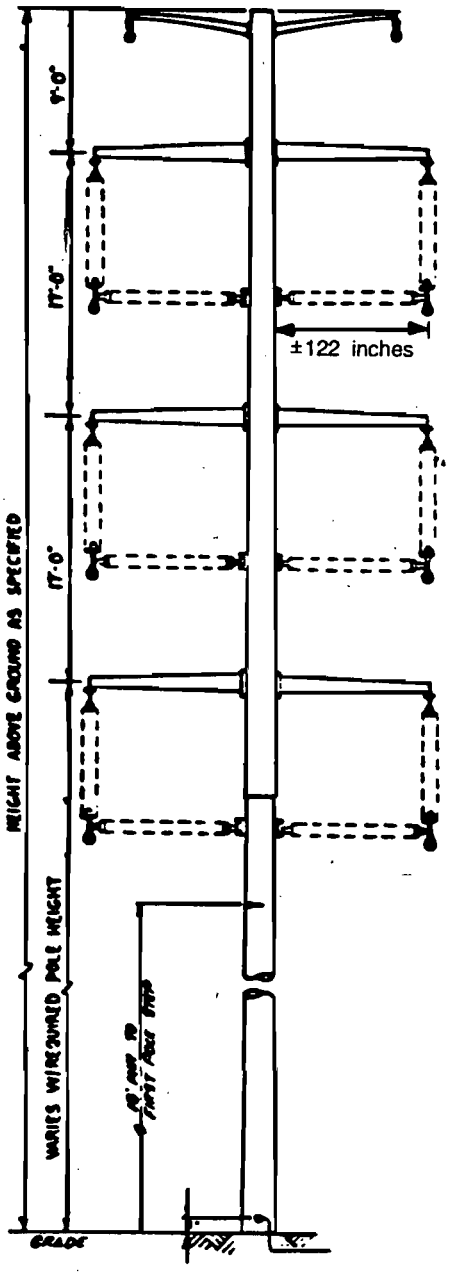
NOTES: TYPICAL DIMENSIONS SHOWN
TYPICAL STRUCTURE HEIGHT WILL RANGE FROM APPROXIMATELY 110 TO 125 FEET ABOVE GRADE.
DOUBLE-CIRCUIT STRUCTURE SHOWN.

Source: Florida Power Corporation, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 6.1.1-3
TYPICAL "VEE" STRING DOUBLE-CIRCUIT TANGENT STRUCTURE

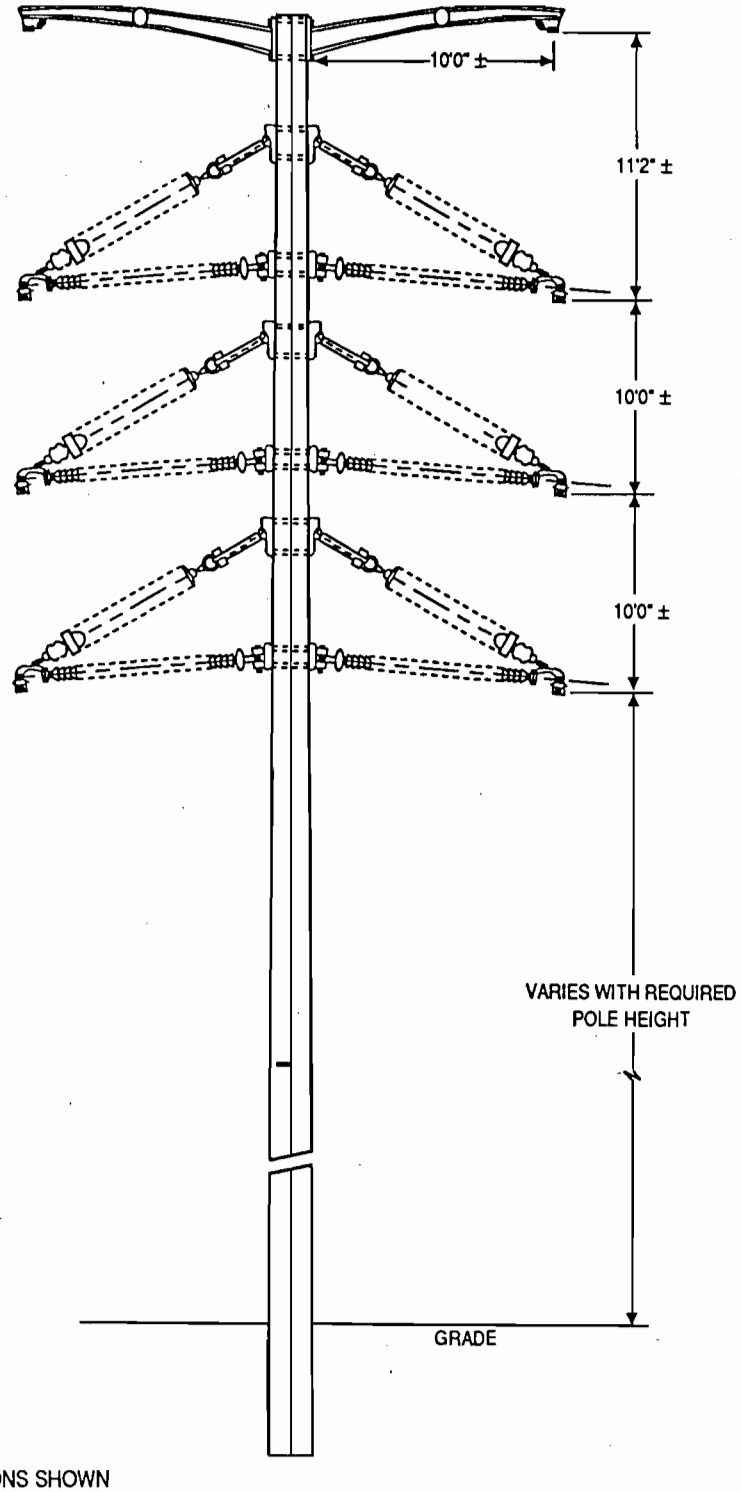


Source: Florida Power Corporation, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 6.1.1-4
TYPICAL 230 KV DOUBLE CIRCUIT SMALL ANGLE SUSPENSION SELF-SUPPORTING STEEL STRUCTURE



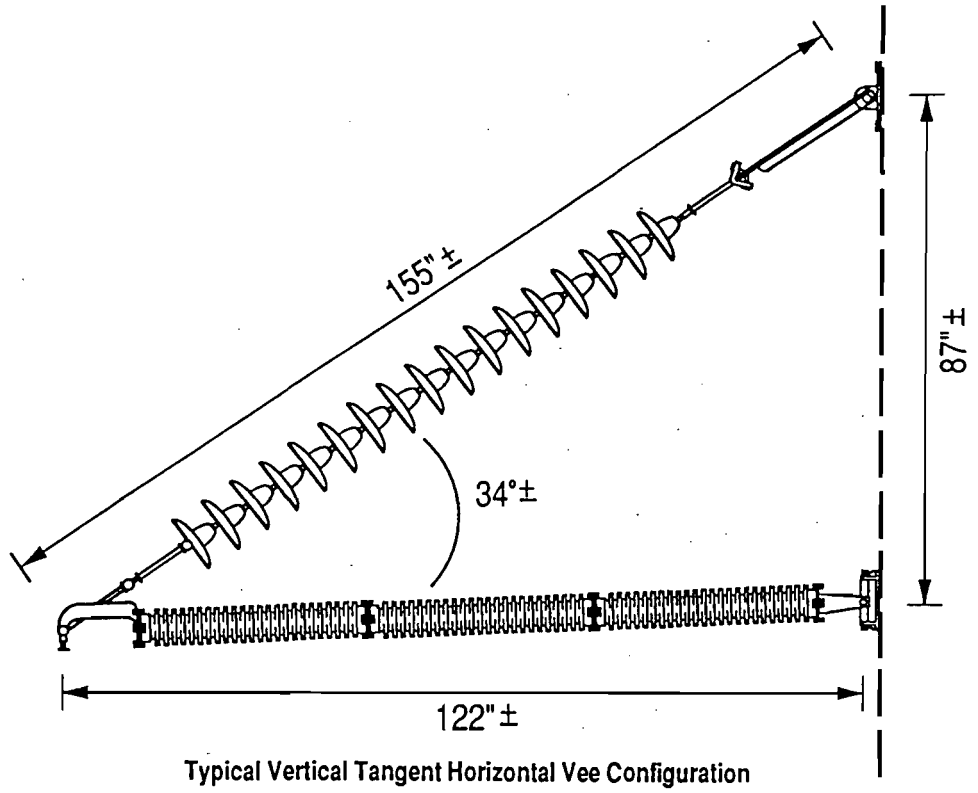
NOTE: NOMINAL DIMENSIONS SHOWN

Source: Florida Power Corporation, 1992

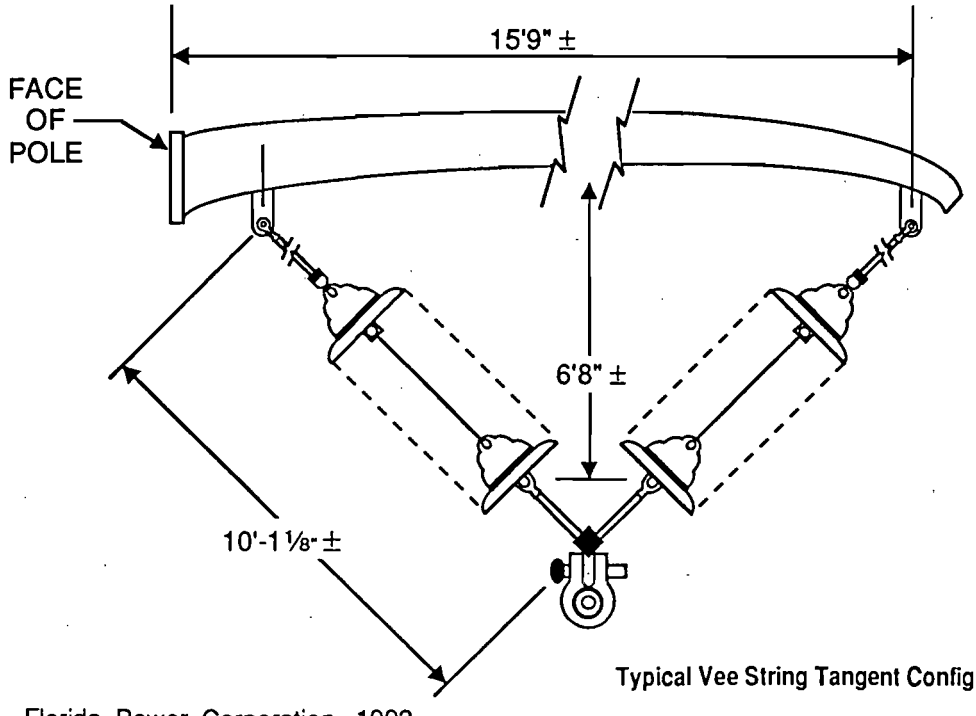
Florida Power CORPORATION

Polk County Site

FIGURE 6.1.1-5
TYPICAL DOUBLE CIRCUIT VERTICAL TANGENT HORIZONTAL "VEE" STRUCTURE



Typical Vertical Tangent Horizontal Vee Configuration



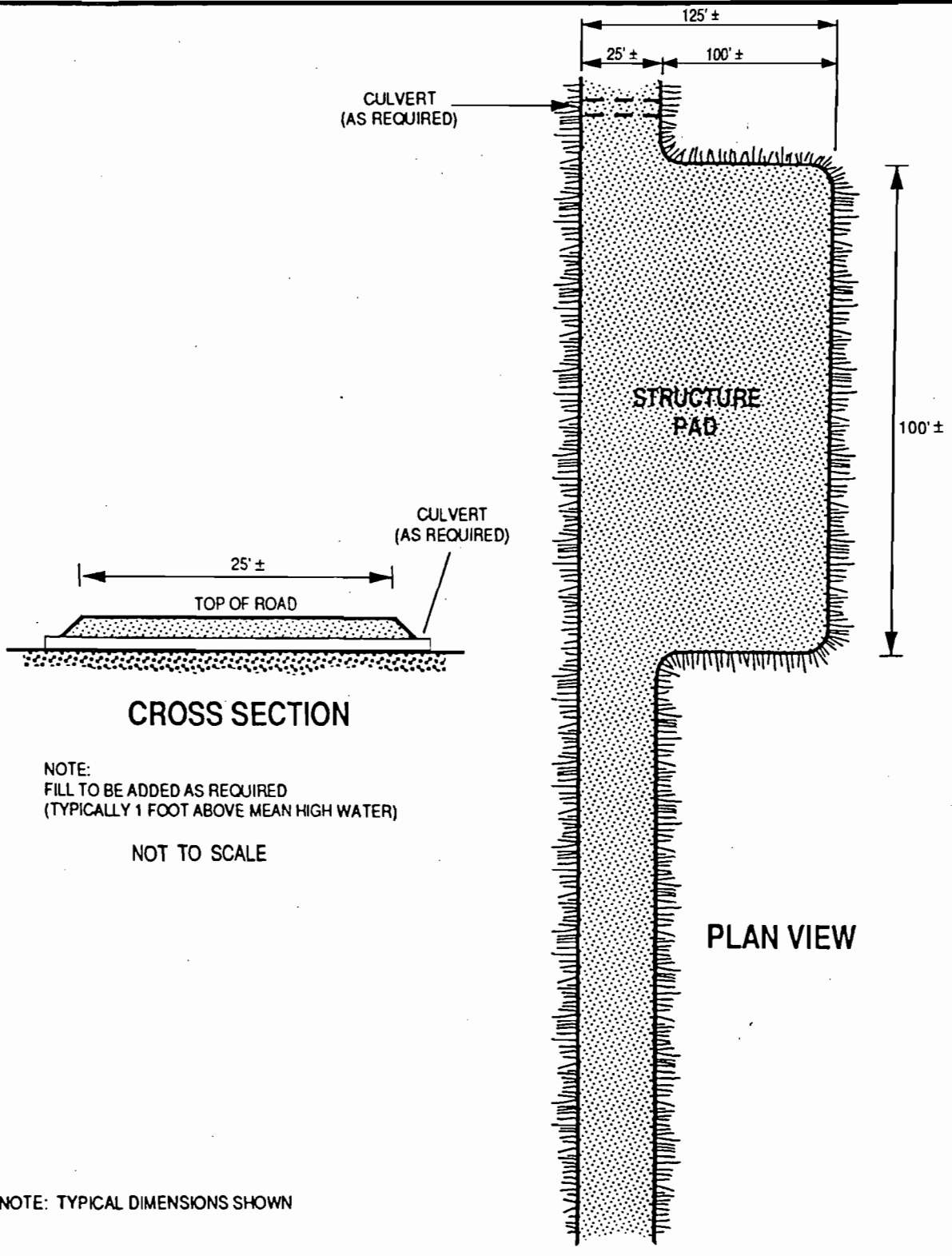
Typical Vee String Tangent Configuration

Source: Florida Power Corporation, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 6.1.1-6
TYPICAL INSULATORS AND HARDWARE

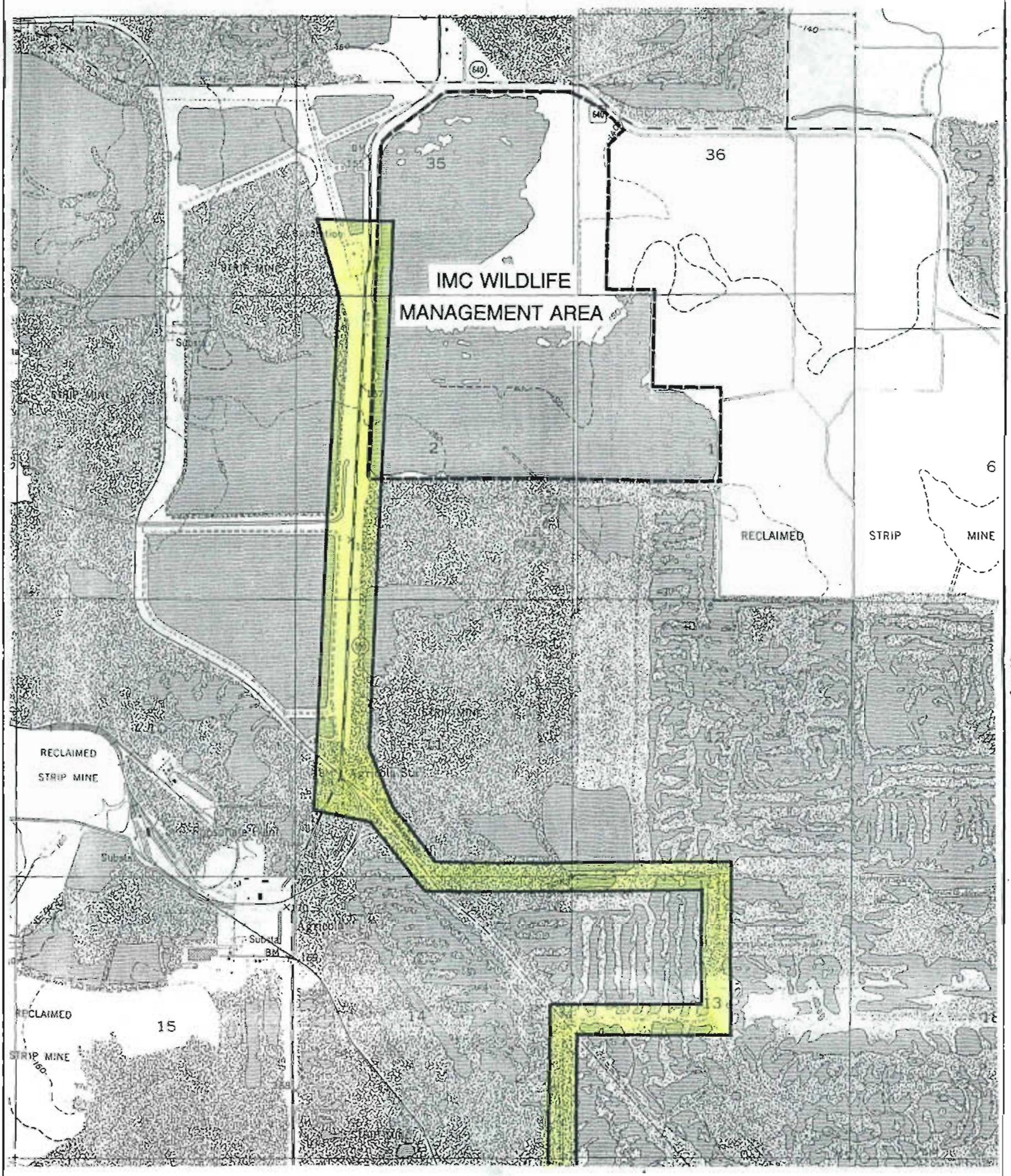


Source: Florida Power Corporation, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 6.1.1-7
TYPICAL ACCESS ROAD AND STRUCTURE PAD PLAN AND CROSS SECTION



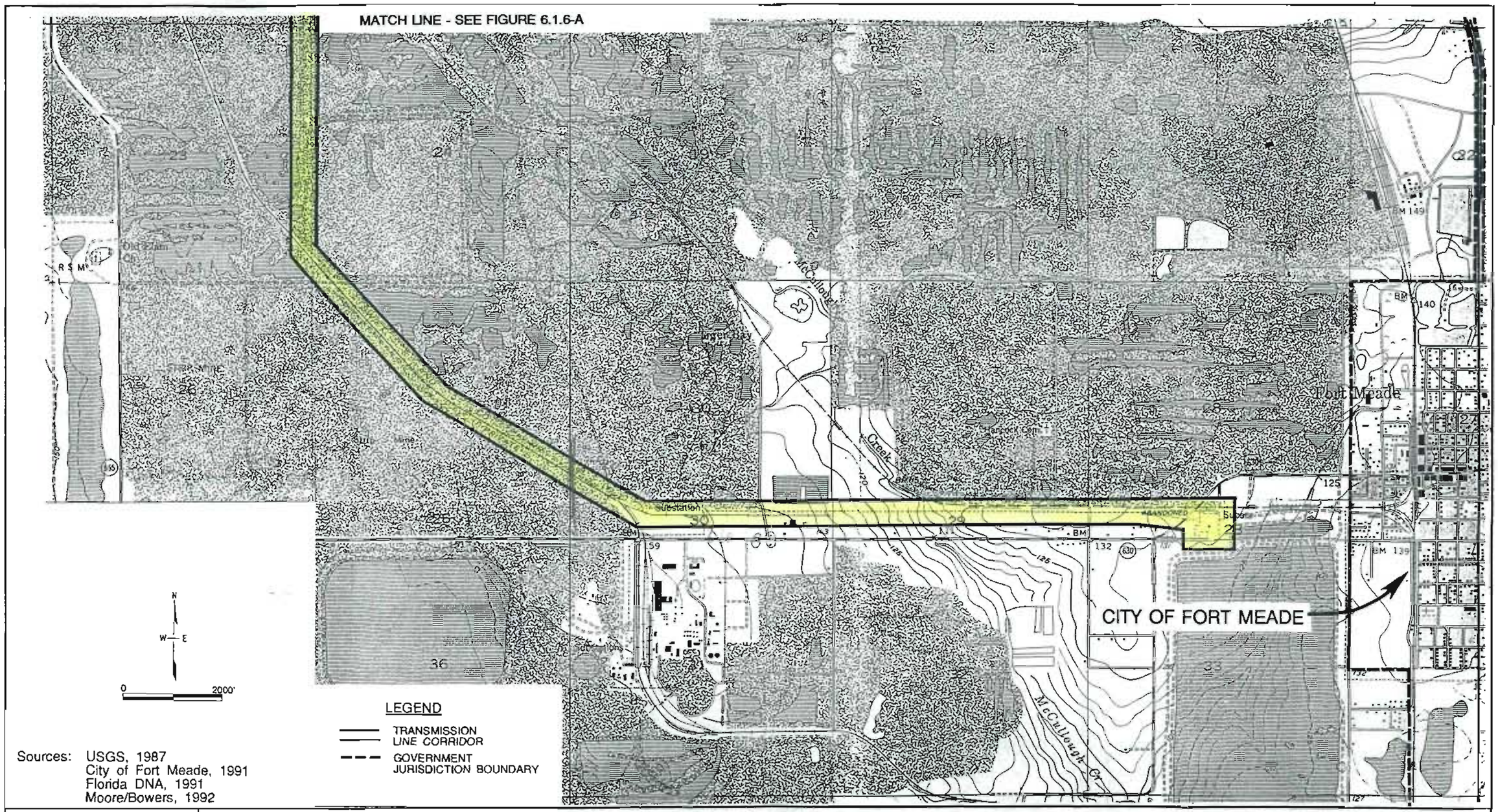
Sources: USGS, 1987
City of Fort Meade, 1991
Florida DNA, 1991
Moore/Bowers, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 6.1.6-1A
LOCAL GOVERNMENT JURISDICTIONS WITHIN 1/2 MILE OF TRANSMISSION LINE CORRIDOR
SHEET A

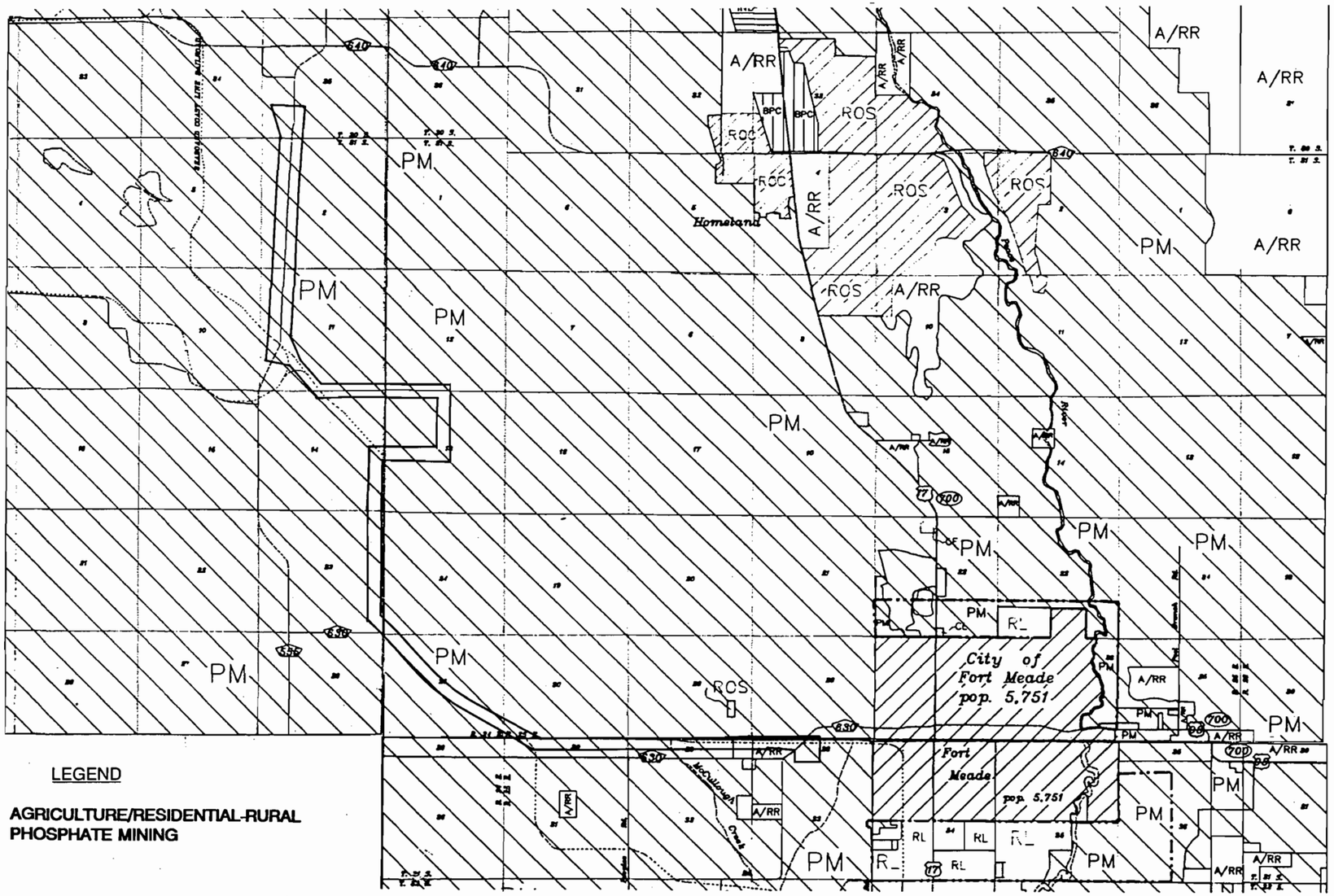
< POLK Co.



Florida Power CORPORATION

Polk County Site

FIGURE 6.1.6-1B
LOCAL GOVERNMENT JURISDICTIONS
WITHIN 1/2 MILE OF TRANSMISSION LINE CORRIDOR
SHEET B



LEGEND

A/RR	AGRICULTURE/RESIDENTIAL-RURAL
PM	PHOSPHATE MINING

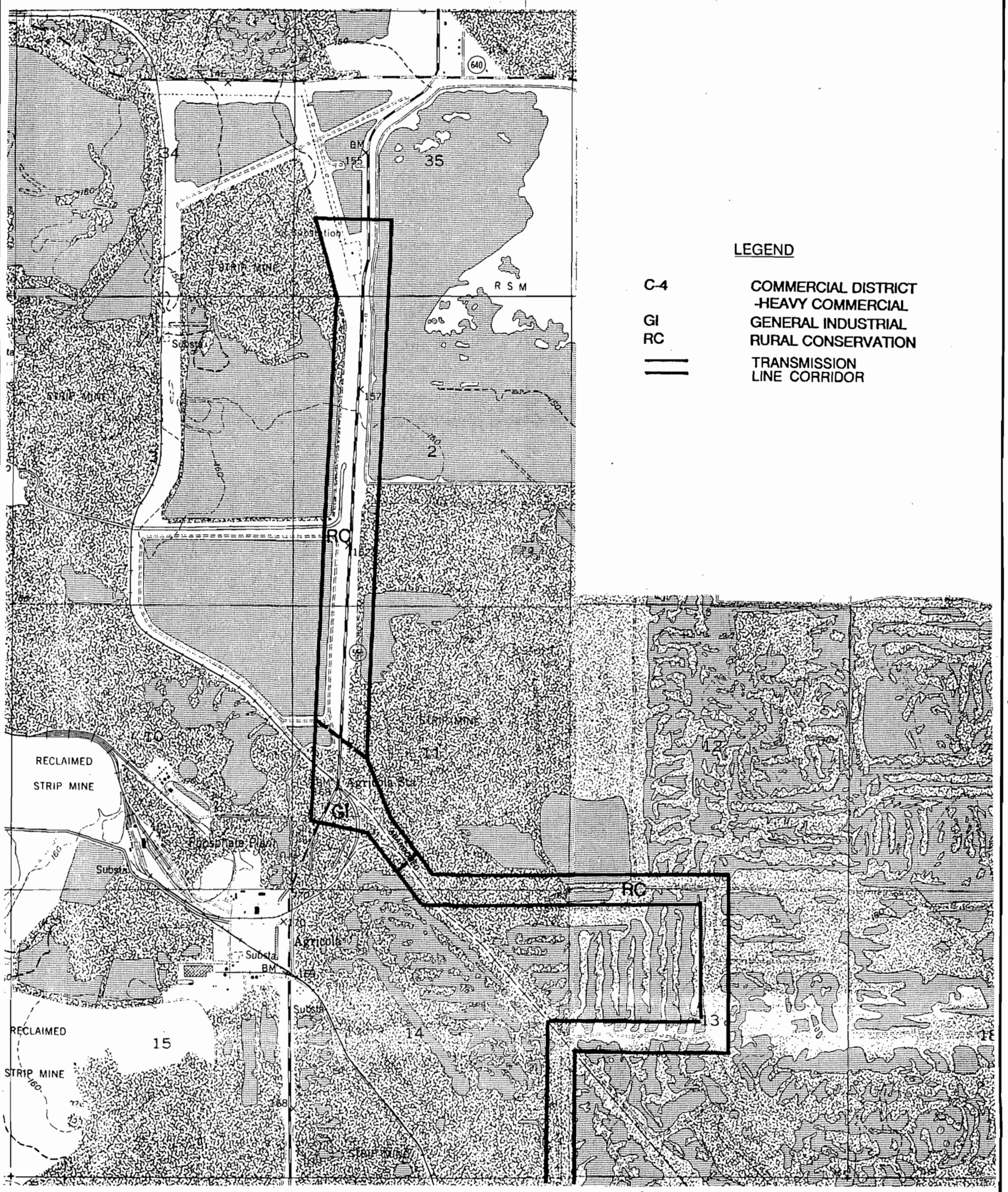
Sources: Polk County BOCC, 1991
Moore/Bowers, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 6.1.6-2

FUTURE LAND USE DESIGNATIONS WITHIN THE TRANSMISSION LINE CORRIDOR



Sources: USGS, 1986 & 1987
Polk County Zoning Dept., 1992
Moore/Bowers, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 6.1.6-3A
ZONING DESIGNATIONS WITHIN THE TRANSMISSION LINE CORRIDOR
SHEET A

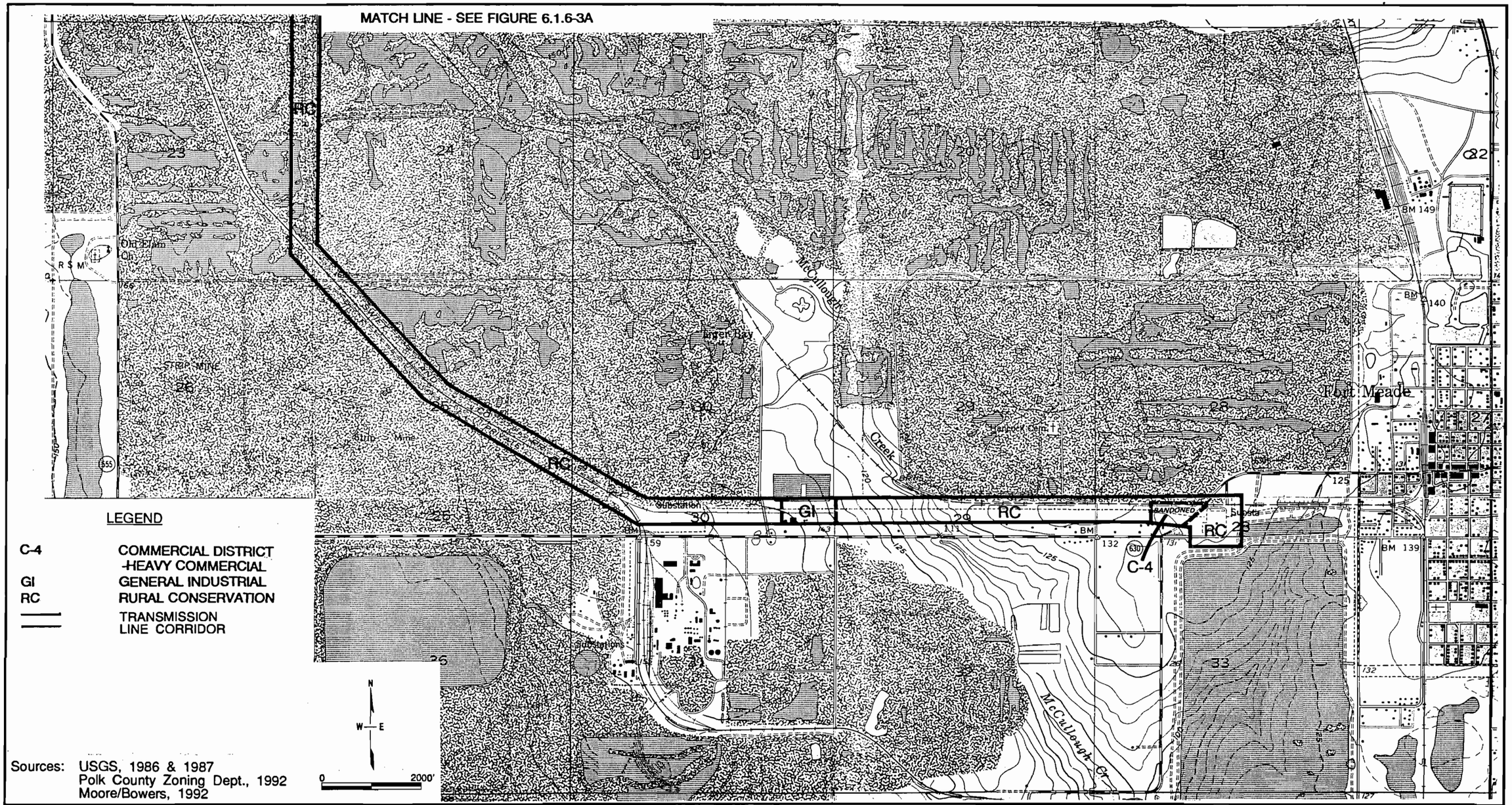
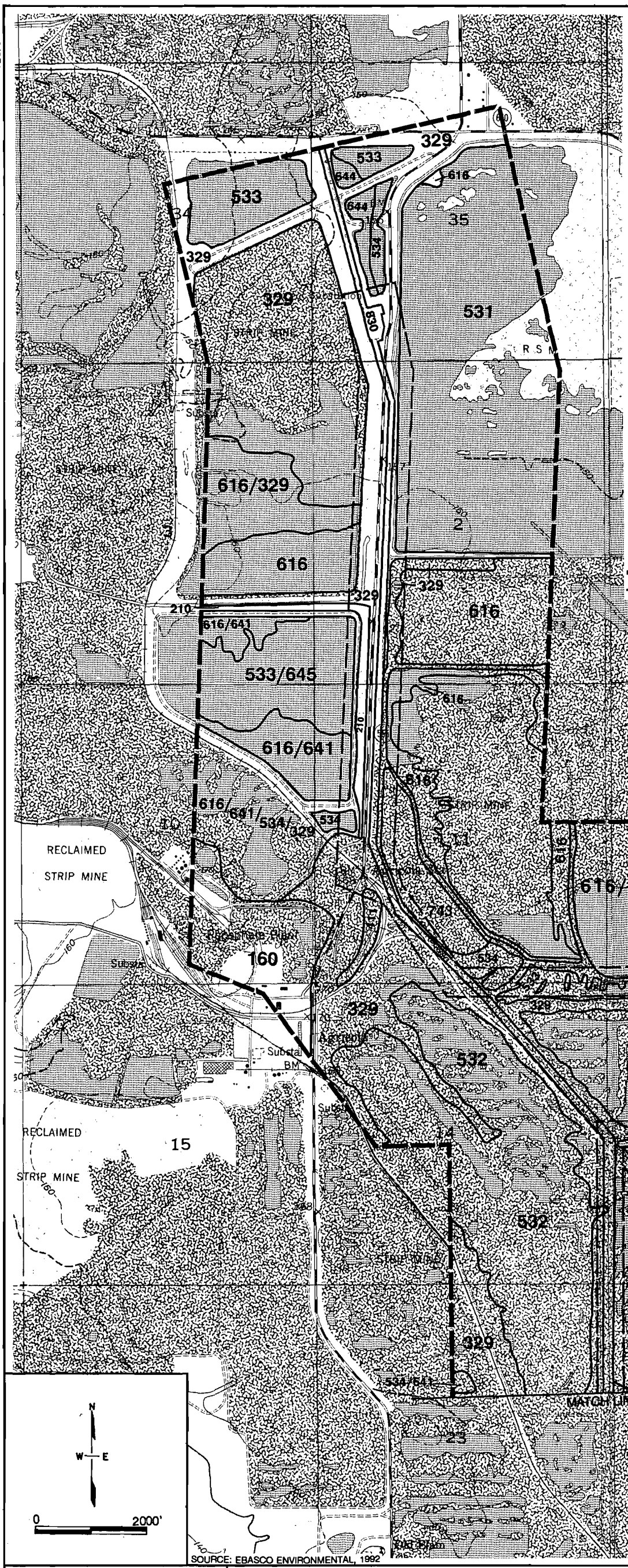


FIGURE 6.1.6-3B
ZONING DESIGNATIONS
WITHIN THE TRANSMISSION LINE CORRIDOR
SHEET B

Florida Power CORPORATION

Polk County Site



LEGEND

LEVEL II FLUCCS CODES
- 110 RESIDENTIAL LOW DENSITY
- 140 COMMERCIAL AND SERVICES
- 150 INDUSTRIAL
- 160 EXTRACTIVE (PROCESSING FACILITIES ONLY)
- 210 CROPLAND AND PASTURELAND
- 220 TREE CROPS
- 830 UTILITIES

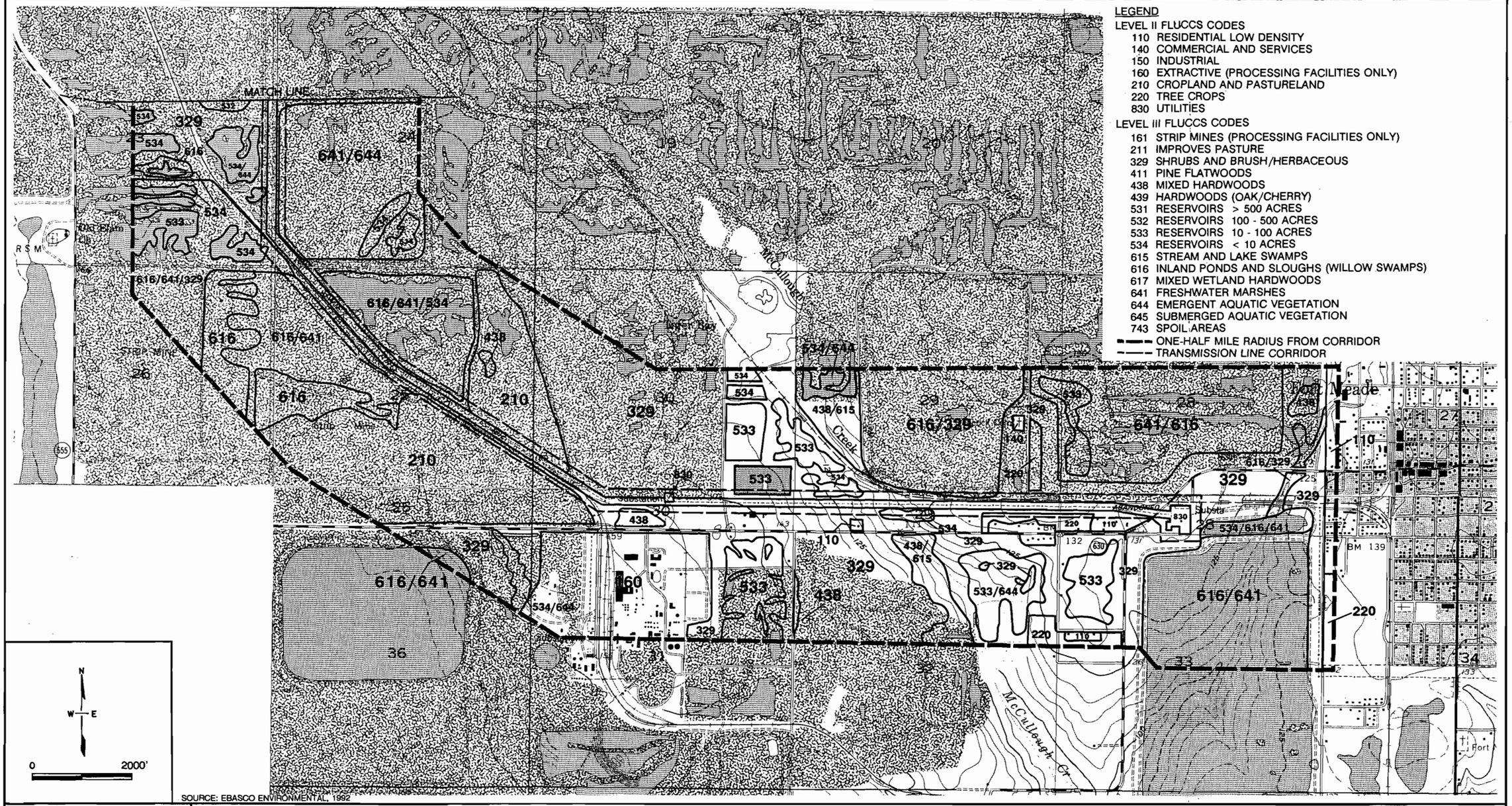
LEVEL III FLUCCS CODES
- 161 STRIP MINES (PROCESSING FACILITIES ONLY)
- 211 IMPROVED PASTURE
- 329 SHRUBS AND BRUSH/HERBACEOUS
- 411 PINE FLATWOODS
- 438 MIXED HARDWOODS
- 439 HARDWOODS (OAK/CHERRY)
- 531 RESERVOIRS > 500 ACRES
- 532 RESERVOIRS 100 - 500 ACRES
- 533 RESERVOIRS 10 - 100 ACRES
- 534 RESERVOIRS < 10 ACRES
- 615 STREAM AND LAKE SWAMPS
- 616 INLAND PONDS AND SLOUGHS (WILLOW SWAMPS)
- 617 MIXED WETLAND HARDWOODS
- 641 FRESHWATER MARSHES
- 644 EMERGENT AQUATIC VEGETATION
- 645 SUBMERGED AQUATIC VEGETATION
- 743 SPOIL AREAS

- ONE-HALF MILE RADIUS FROM CORRIDOR
- TRANSMISSION LINE CORRIDOR

Florida Power CORPORATION

Polk County Site

FIGURE 6.1.7-1A
LAND USE AND VEGETATION OF TRANSMISSION LINE CORRIDOR AREA
SHEET A



Florida Power CORPORATION

Polk County Site

FIGURE 6.1.7-1B
LAND USE AND VEGETATION OF TRANSMISSION LINE CORRIDOR AREA
SHEET B

6.2 GAS PIPELINE

6.2.1 Project Introduction

Natural gas for the project will be delivered to the Polk County Site in one of two ways. The preferred way involves delivery from a proposed, but yet unrouted, main trunk line operated by the SunCoast Pipeline Company. SunCoast Pipeline Company is a partnership of United Gas Pipeline Company, ANR Pipeline Co. and Florida Power Corporation (FPC). The SunCoast Pipeline is a planned intrastate natural gas pipeline which will be permitted in accordance with the recently passed Natural Gas Transmission Pipeline Siting Act. The trunk line will be routed directly to the site.

The backup alternative fuel supply would be an approximately 18 mile long lateral to a Florida Gas Transmission (FGT) line in Hillsborough County. The FGT line in Hillsborough County has not been constructed but has been approved by the Federal Energy Regulatory Commission (FERC, 1991).

This backup alternative pipeline lateral will originate from the approved FGT gas supply line, which runs parallel to State Road (SR) 39 in Hillsborough County, and will terminate at the Polk County Site. The pipeline lateral will originate at a point along SR 39 in Hillsborough County about 2.7 miles south of the intersection of CR 640 with SR 39 (Figure 6.2.1-1). The lateral corridor is 1,000 feet wide. However, the actual right-of-way width needed for the pipeline is a maximum of 75 feet for construction, of which up to 50 feet will be permanently maintained.

Only one other gas pipeline is located within 5 miles of the backup corridor. This FGT pipeline travels south along CR 555, near the site, and then west, past Bradley Junction, and terminates in Polk County about a mile from the Hillsborough County line.

Starting from the connection to the future FGT pipeline, the major components of the backup lateral will be:

- A gas metering assembly at SR 39 (Hillsborough County)
- A scraper trap (a piping component located at either end of a pipeline to allow launching or receiving of internal cleaning or inspection devices into/from the main line)

- A buried 30-inch maximum diameter gas transmission pipeline manufactured of high strength steel with sectionalizing block valves
- A pressure regulating station and a gas metering assembly at the Polk County Site

A Supervisory Control and Data Acquisition (SCADA) system will be used to monitor and operate the system and a cathodic protection system will be installed to protect the buried line against corrosion. The anticipated in-service date is 1998.

6.2.2 Corridor Location and Layout

Figures 6.2.2.-1 and 6.2.2-1A through 6.2.2-1H display the backup pipeline corridor. From the origin of the pipeline adjacent to SR 39 in Hillsborough County, the corridor proceeds east/southeast along Jameson Road for about 3 miles to the Tampa Electric Company (TECO) transmission line, then follows the transmission line north and east for a distance of approximately 3 miles, and continues south to follow along Durrance Road for about 3.5 miles. The corridor heads north from just west of SR 37 in Bradley Junction, and follows a TECO transmission line north for approximately 1 mile and then east for approximately 2.5 miles. The corridor then heads south to follow Agricola Road east, then across CR 555 to the Polk County Site. Total length of the gas pipeline corridor is about 18.2 miles.

6.2.3 Gas Pipeline and Road Design Characteristics

The pipe will be manufactured of carbon-steel according to American Petroleum Institute standards. It will have a diameter of up to 30 inches and will be longitudinally welded at the mill. All facilities will be built in accordance with the requirements of the U.S. Department of Transportation (USDOT) (49 CFR, Part 192) as amended by the Materials Transportation Bureau, Office of Pipeline Safety Operations. Pursuant to Chapter 368, F.S., the Florida Public Service Commission (PSC) has authority to regulate safety considerations for intrastate gas transmission and distribution pipelines that operate exclusively within Florida. Under that authority the PSC has adopted administrative rules, Chapter 25-12, Florida Administrative Code (F.A.C.), for gas pipeline safety, design, construction and operation. These PSC regulations adopt and expand the federal safety regulations particularly in the areas of pipeline welding and inspection and of drug testing of critical employees. The gas lateral pipeline connecting the project to a gas transmission pipeline will be subject to these PSC regulations.

The pipe will have a protective external coating. Such coating will be checked electrically for voids in the coating prior to shipping and prior to installation in the ground. The pipe will be installed to a depth of at least 30 inches below the surface. Burial will be deeper where required to pass beneath ditches, canals and roads. Concrete coated pipe, concrete weights, and screw anchors will be used as necessary to locally control buoyancy.

A cathodic protection system will be installed to prevent corrosion. This system will be activated within 1 year following construction. The cathodic system will be monitored to insure continued protection.

A metering station will be located at the gas pipeline origin at SR 39 and at the pipeline termination point at the Polk County Site. No other non-pipe facilities will be used between these points.

No access roads for construction and maintenance will be needed for this facility.

6.2.4 Cost Projections

Cost projections for the pipeline on an average per mile basis are provided in Table 6.2.4-1.

6.2.5 Corridor Selection Process

The preferred corridor for the backup gas pipeline from SR 39 to the Polk County Site was selected and evaluated by the following:

- Consultants with expertise in power plant engineering, routing of linear facilities, land use planning, environmental permitting
- Representatives of FPC Environmental Services Department

The corridor selection process incorporated land use, environmental, engineering, and cost considerations. The selection methodology employed was designed to be:

- Sensitive to land use and environmental conditions
- Objective in decision making

- Responsive to regulatory requirements
- Documented on a verifiable basis

The corridor selection process consisted of three stages: Identification of a Study Area, Identification of Corridor Selection Criteria, and Evaluation of Candidate Corridors.

6.2.5.1 Identification of a Study Area and Corridor Selection Criteria

A corridor study area was selected which was bounded on the west by the SR 39 right-of-way (where the gas line tie-in will occur), on the south by latitude 27° 43' 6", on the east by the Polk County Site and on the north by latitude 27° 51' 40". This study area encompassed the origin and termination points and provided a broad enough area within which a reasonable number of alternatives could be identified for evaluation. The study area covered about 162 square miles.

Eleven criteria were identified as being the most relevant for selection and evaluation of routes for underground pipeline facilities in the study area. These criteria were applied in various levels of emphasis to the corridor selection process as noted below.

The corridor selection criteria employed are defined in Table 6.2.5-1. The exclusion criteria (presence of clay settling ponds) preclude routing of the corridor through portions of this study area. Minimization and avoidance criteria represent those routing parameters where their presence or occurrence in the corridor is considered negative from an environmental, engineering or licensing standpoint. Favorable criteria refer to locations where corridor alignments are generally preferred.

EXCLUSION

- Presence of clay settling ponds
- Cemeteries
- Lakes and ponds

AVOIDANCE OR MINIMIZATION WHERE APPROPRIATE

- Wetlands
- Forested habitats
- Number of landowners
- Length of corridor
- Potential mining areas
- Populated areas

FAVORABLE

- Common corridor utilization
- Corridor along thoroughfares

6.2.5.2 Evaluation of Candidate Corridors

Three general candidate corridor routes with small variations within each were identified (Figure 6.2.5-1). These corridor routes were selected based primarily upon the presence of existing east-west linear facilities (i.e. roads, transmission lines, gas pipelines, etc.), rights-of-way were considered to be conducive to the collocation of, or adjacent positioning of, a natural gas pipeline.

All alternative corridors share an existing linear facility such as a railroad, road, or transmission line. All three alternate corridors cross a portion of the Alafia River. Distinctive features of each alternative corridor are as follows:

NORTHERN CORRIDOR

The amount of wetlands crossed is least along the north corridor. However, the number of landowners and residents is greatest along this corridor. The northern corridor crosses the Alafia River at a narrow point; however, forested vegetation would be impacted.

SOUTHERN CORRIDOR

The southern corridor crosses the river and its floodplain at a wide point. Floodplain and forest vegetation encroaches upon the rail line and road which cross the river. The southern corridor impacts the fewest landowners and is located in the least populated area, but there are also few residents in or near the middle corridor.

MIDDLE CORRIDOR

The least amount of forested wetlands crossed by a corridor occurs along the middle corridor. The middle corridor crosses the Alafia River at probably its best location. The river passes through this area in an open pasture and lacks a significant floodplain. Jack and bore techniques can easily be applied to this area with minimal impact to ecological resources.

CONCLUSION

After a review of these corridors using the criteria listed in Table 6.2.5-1, the middle corridor was selected. This corridor is clearly superior to either of the other corridors from an ecological resources perspective. The northern corridor is considered a poor choice from a human resources evaluation. The southern corridor was not selected because of its likely impact on ecological resources. The middle corridor was selected based on the balancing of all considerations, including engineering, cost, ecological resources, and land use.

6.2.6 Socio-Political Environment of the Corridor Area

6.2.6.1 Governmental Jurisdictions

The proposed backup pipeline lateral lies in unincorporated Polk County and unincorporated Hillsborough County. There are no municipalities located within 0.5 mile of the pipeline lateral at any point. The pipeline does pass to the north and west of Bradley Junction, a small unincorporated community located approximately 5 miles west of the proposed plant site.

The proposed corridor follows existing linear facilities (road, railroad or transmission line) for its entire length. Much of the area crossed has been disturbed by phosphate mining. Polk County operates a 1.5-acre neighborhood ball park located within 0.5 mile of the proposed

corridor on Pine Street in Bradley Junction (Figure 6.2.6-1). There are no state parks or other special features located within 0.5 mile of the corridor.

6.2.6.2 Zoning and Land Use Plans

HILLSBOROUGH COUNTY FUTURE LAND USE

Hillsborough County's Comprehensive Plan, entitled Future of Hillsborough, was adopted in July 1989 and amended through May, 1992. The future land use categories crossed by the selected backup pipeline corridor in Hillsborough County include Agriculture/Mining (A/M), Agricultural/Rural (A/R), and Environmentally Sensitive Area (E) as shown on Figure 6.2.6-2. The corridor originates just west of SR 39, which is designated as a scenic highway in the County's Comprehensive Plan. The Future Land Use Element of the plan states that the location and construction of public facilities may be considered in any land use plan designation (Hillsborough County BOCC, 1989).

Hillsborough County's Comprehensive Plan describes the A/M classification as areas of long term agricultural character, or areas currently involved in agricultural or other rural uses. The category also specifically permits residential, rural scale neighborhood commercial, office, and industrial uses subject to locational criteria. Mining activities and commercial and industrial uses directly related to mining are also permitted in appropriate locations. Residential densities in the A/M classification are limited to 0.05 dwelling unit per gross acre (1 unit per 20 acres), while commercial, office and industrial uses are limited to 40,000 square feet or a floor area ratio (FAR) of 0.25, whichever is less intense.

The A/R land use classification also includes lands of long term agricultural character, or areas currently involved in agricultural or other rural uses. The classification permits residential, rural scale neighborhood commercial, office, and industrial uses subject to locational criteria. Mining and related uses are also permitted. Residential densities in the A/R classification are limited to 0.2 dwelling unit per gross acre (1 unit per 5 acres), while non-residential uses have the same limitations as in the A/M classification.

Areas designated E are environmentally sensitive privately-owned lands. Development in these areas may be restricted by federal, state, and/or local environmental regulations. Development in these areas is subject to compliance with the County's Conservation and Aquifer Recharge

and Coastal Management Elements. The plan states that the E designations on the Land Use Plan Map are very generalized and that on-site evaluations are necessary for specific projects. Environmentally sensitive areas crossed by the corridor correspond to the Alafia River, its tributaries, and its floodplain as shown on Figure 6.2.6-2.

SR 39 is designated as a scenic corridor in Hillsborough County's Comprehensive Plan. This designation is given to corridors which are determined to have scenic qualities of local or county wide significance. The designation is intended to preserve and enhance the function and aesthetic appearance of the corridor with concern for open space, appropriate landscaping, scenic easements, constrained access, and the limitation of non-residential uses. The County's new Land Development Code, adopted March 4, 1992, contains provisions for landscaping and scenic easements along SR 39 and any development which occurs along SR 39 must meet these requirements. The metering station is proposed to be located on SR 39 and will comply with these requirements.

The Hillsborough County Comprehensive Plan identifies the Alafia River as a special resource protection area. The river corridor is defined as the lands within 500 feet of the mean annual high water mark of the river. The Comprehensive Plan states that draining, clearing, or filling of wetlands, including hydric hammocks, is prohibited within this corridor. The river area policies prohibit additional heavy industrial land use designations within 500 feet of the river and call for the County to develop criteria to protect the river corridor from visual intrusion. Policies in the Coastal Management Element and the Conservation and Aquifer Recharge Elements of the plan require development to minimize its impacts on wetlands, riverine floodplains, and other environmentally sensitive areas. The pipeline will meet these requirements of the plan.

POLK COUNTY FUTURE LAND USE

Polk County adopted a Comprehensive Plan pursuant to Chapter 163, F.S. and Rule 9J-5 F.A.C. in April 1991. Future land use categories crossed by the pipeline are illustrated on Figure 6.2.6-3. The gas pipeline lateral crosses two future land use categories on the County's 2010 Future Land Use map. The Polk County Comprehensive Plan states that utilities, including natural gas pipelines, are allowed in all land use classifications, subject to County approval.

The majority of the corridor in Polk County is designated as Phosphate Mining, while a portion of the corridor near Bradley Junction is designated as a Rural Cluster Center (Polk County BOCC, 1991). The Polk County Comprehensive Plan describes Phosphate Mining areas as those areas with existing or proposed phosphate mining operations, and non-reclaimed mined lands. The corridor mainly crosses phosphate lands which have been mined. The plan states that construction, operation and maintenance of uses ancillary to electric power generation facilities are permitted within this land use category. Rural-Cluster Centers are designed to allow for retail and service establishments to serve the needs of surrounding rural residents.

HILLSBOROUGH COUNTY ZONING

The zoning categories crossed in Hillsborough County are Agriculture (A) and Acreage Agricultural (AA) (Figure 6.2.6-4A through 4D). Hillsborough County adopted a new Land Development Code (LDC) on March 4, 1992. The LDC became effective as of May 1, 1992. According to the Hillsborough County City/County Planning Commission's Office on Zoning Conformance, zoning conformance is scheduled to occur by August 6, 1992, in the corridor area. Lands which are currently zoned A or AA and are classified as A/M on the future land use map will be converted to Agricultural Mining (AM), while lands which are zoned A and AA and are classified as A/R on the future land use map will be converted to Agricultural Rural (AR) during zoning conformance (Hillsborough County BOCC, 1992).

Although zoning conformance in the corridor area had not been completed at the time of preparation of this SCA, it is anticipated that it will be complete by the time of filing and therefore this discussion of applicable zoning district regulations assumes that the new LDC has been completely implemented. Therefore, the pipeline is assumed to cross areas which are zoned AM and AR, and the metering station is anticipated to be located in an area zoned AR.

The pipeline itself is not regulated by the LDC. However, it is subject to Hillsborough County's review under the County's land alteration regulations. Also, the pipeline would be subject to the County's wetland protection rule (Hillsborough County Environmental Protection Commission Chapter 1-11). This rule states that development affecting wetlands may only be authorized if reasonable use of the land cannot be accomplished without affecting the wetland, and only if the environmental benefits provided by the wetlands are sufficiently protected by the conditions imposed upon the development. Adequate protection of the environmental benefits is assumed if the adverse impact is of a temporary nature and there is an acceptable mitigation

plan; if the adverse impact is to previously altered wetlands; where the adverse impact is confined to a small area; where the adverse impact is in the public interest (construction of public works); and in other specified instances.

The pipeline metering station is considered to be included in the "Public Facilities, other" classification of the LDC. Public facilities are allowed as a limited use in the AR district and are subject to administrative review. The metering station would be required to comply with buffering and screening regulations listed in the LDC.

POLK COUNTY ZONING

The Polk County Zoning Ordinance was adopted on March 1, 1983. The County is currently drafting new land development regulations (LDRs) which are scheduled to be adopted in 1993. Until the new LDRs are adopted, the 1983 zoning ordinance is in effect (Polk County BOCC, 1983). The zoning designations included in the pipeline corridor are shown in Figures 6.2.6-4A through 6.2.6-4D. The majority of the corridor in Polk County is designated Rural Conservation (RC) with areas near major phosphate processing facilities zoned General Industrial (GI).

Gas transmission lines are defined as Class I Essential Services in the Polk County Zoning Ordinance. Class I Essential Services are allowed as permitted uses in all zoning districts. The gas pipeline lateral was addressed in the Polk County CUP, which was approved by the Polk County Board of County Commissioners (BOCC) on June 2, 1992.

6.2.6.3 Easements, Title, Agency Works

When crossings of state roads are made, they must conform to the specifications outlined in the Florida Department of Transportation's (FDOT) "Utility Accommodation Guide" (FDOT, 1990). Approvals for crossing of CR 555, SR 37, and SR 39 and any other county-maintained roads will be obtained through the site certification process. The Tampa Port Authority (TPA) has jurisdiction over all navigable fresh and salt waters in Hillsborough County, including the Alafia River. The TPA's Rules For Sovereignty Lands Management require an easement be acquired for all utility crossings and rights-of-way. Such an easement will be obtained through the site certification process.

6.2.6.4 Vicinity Scenic, Cultural, and Natural Landmarks

The pipeline corridor passes primarily through lands which have been disturbed by phosphate mining. No scenic, cultural, or natural landmarks are found in the vicinity of the gas pipeline corridor in Polk or Hillsborough County.

6.2.6.5 Archaeological and Historic Sites

The corridor crosses primarily through lands that have been disturbed by phosphate mining, both in Hillsborough County and Polk County. In addition, the corridor follows existing linear facilities, such as other pipelines, transmission lines, roads and railroads, throughout its entire length. The Florida Department of State, Division of Historical Resources (DHR) has stated that it is their opinion that the pipeline corridor would not impact any significant archeological or historic sites (DHR, 1992). A copy of this letter is located in Appendix 10.5.2.

6.2.7 Bio-Physical Environment of the Corridor Area

6.2.7.1 Land Use/Vegetation

Land use and vegetation of the preferred corridor and its vicinity are presented on Figures 6.2.7-1A through 6.2.7-1D. Mapped information is labeled using the Florida Land Use and Cover Classification System (FLUCCS) (FDOT, 1985). Aerial photographs (scale 1:12,000) showing the preferred corridor and the area extending 0.5 mile from each corridor edge are presented on Figure 6.2.1-1.

The corridor in Hillsborough County is located primarily in phosphate lands. Other land uses found within 0.5 mile of the corridor in Hillsborough County include agricultural uses (pasture, citrus groves) and low density residential uses along Jameson Road near SR 39.

In Polk County, the corridor also is located primarily in lands that are, or have been, used for phosphate mining. Other existing land uses within 0.5 mile of the corridor include vacant, undeveloped lands and some low density residential uses in the area just west of SR 37 in Bradley Junction.

Vegetation communities found in the corridor are similar to those which are described in Section 2.3.5 and shown on Figures 6.2.7-1A through 6.2.7-1D.

6.2.7.2 Affected Waters and Wetlands

The preferred corridor alignment was selected, in part, to minimize impacts to water bodies and wetlands. The corridor will cross an isolated portion of Hookers Prairie east of Bradley Junction, and a series of small wetlands disturbed by mining operations and roadside ditches. The corridor crosses the South Prong Alafia River near SR 39. This crossing is at a point where there is no forested floodplain and the terrain is primarily open pasture. The pipeline will be installed beneath the river with jack and bore techniques, or other techniques that minimize impacts to the river.

6.2.7.3 Ecology

This section presents a discussion of the corridor status of species identified as threatened or endangered, or species of special concern by the U.S. Fish and Wildlife Service (FWS), Florida Game and Fresh Water Fish Commission (FGFWFC) and Florida Department of Agriculture and Consumer Services (DACS). Section 2.3.6 includes a discussion of those species afforded special protection which potentially occur in Polk County and surrounding counties and which can occur at the project site. Plant and animal species status listed in that section (Tables 2.3.6-9 and 2.3.6-10) also apply to the gas pipeline corridor. Vegetation community types occurring in the corridor are similar to those occurring at the Polk County Site or which would occur at the site with existing reclamation plans implemented.

The probability of occurrence of threatened and endangered species in the preferred corridor is based on discussions with agency personnel and observations by project ecologists. There are no records of nesting or breeding occurrences in the corridor or its vicinity for any threatened or endangered animals. Because vertebrates are mobile, their movements and activity patterns may take them into appropriate habitats within the corridor. Woodstorks, and a variety of wading birds, for example, have been observed feeding in the corridor. The corridor is not known to include habitats critical for the support of a population of threatened or endangered species, or species of special concern.

6.2.7.4 Other Environmental Features

No other biophysical features have been identified for discussion in the SCA.

6.2.8 Effects of Right-of-Way Preparation and Pipeline Construction

6.2.8.1 Construction Techniques

Pipeline construction activities differ slightly from pipeline to pipeline but generally include the following which are described in more detail below:

- Surveying and right-of-way preparation
- Ditching/trenching
- Installation
- Testing
- Right-of-way restoration

Other specialized activities may take place such as:

- Boring and installation of road, railroad and stream crossings
- Installation of mainline block valve assemblies

APPLICABLE CODES

The key regulatory document for the design and construction of the pipeline will be Minimum Federal Safety Standards for Gas Lines, Part 192, Title 49, CFR, implemented by the USDOT and referred to as 49 CFR, Part 192 hereafter. The PSC has adopted the USDOT standards.

SURVEYING AND RIGHT-OF-WAY PREPARATION

Following right-of-way selection and acquisition, the entire route will be surveyed. The centerline of the pipeline right-of-way will be marked at about 200-foot intervals. Within the

right-of-way staked by the surveying crew, the contractor personnel will clear the terrain to provide a work platform or working strip allowing unimpeded progress of the construction activities.

The 75-foot right-of-way will first be cleared of brush and timber in accordance with the contract specifications and permit or regulatory limitations. The stumps will be grubbed and all materials cleared will be disposed of in a manner consistent with the construction permits and applicable state and local requirements. This may include upland burial on-site, burning or hauling off-site. Generally, machetes, chain saws, bulldozers, backhoes and trucks are the tools and equipment used during that operation.

Next, the top soil layer within the right-of-way will be stripped where excavation will occur with a dozer or grader and bermed to one side of the working strip. In both uplands and wetlands, the top soil or upper 6 inches of soil will be saved to be spread back over the stripped area during restoration of the right-of-way.

The work platform is then graded to provide smooth access to all equipment used in the following phases of construction.

The pipeline occupies only a small portion of the right-of-way necessary for construction and possible future maintenance (Figure 6.2.8-1). Only 10 to 15 feet of the right-of-way width are needed to store the spoil excavated from the trench. For the maximum 30-inch pipeline, the ditch bottom will be approximately 4 feet wide. Depending on the type of soil being excavated and the type of ditching equipment used, the width of the trench at grade level may be only slightly wider than at the bottom, e.g. 6 feet, or it may be wider if unstable trench slopes are encountered.

The space adjacent to the trench is used to string the pipe joints on skids until they are ready for the welding operation. Working room is required on both sides of the pipe such that 10 to 12 feet must be reserved between the edge of the trench and the sideboom track. The width of the sideboom (also called pipelayer) for a 30-inch line is approximately 12 feet with counterweight retracted and 16 feet or more when extended. Additional space is needed to the outside of the equipment for pick-up trucks, lube truck, other sidebooms and similar equipment to pass the stationary equipment.

TRENCH CONSTRUCTION

This operation is called ditching and can be performed in a number of ways, based on the local conditions of the area crossed by the line. Wheel ditchers are the most convenient and effective way of opening the ditch.

For this backup pipeline, except in rocky areas if any are crossed along the route, the total depth of the trench will be about 5 to 5.5 feet.

Ditching for conventional drainage ditch crossings can be accomplished with backhoes or draglines. The choice of equipment will depend on the size of the ditch, water depth and current velocity, make-up of the channel bed and required trench depth. To control the water turbidity or to limit its increase as a result of construction activities, various methods are available as a function of site-specific conditions. For small waterways, siltation barriers can be installed immediately downstream of the crossing. These siltation barriers consist of suspended fabric and/or hay bales. Jack and bore or directional drilling techniques will be used for larger waterways such as the crossing of the South Prong of the Alafia River.

To eliminate the disturbance to traffic or river systems brought on by using the open cut method of trenching across a roadway, boring techniques have been developed. The operation consists of drilling a hole horizontally under the road or river bed while inserting a pipe in that hole. The minimum depth of cover between the top of the pipe and either the road surface or the river bottom of the adjacent ditches is regulated by the U.S. DOT and counties.

A boring machine is generally a motor driven auger equipped with a control panel and is mounted on a frame designed to straddle a pipe. A winch or hydraulic jacks provide the force applied to the auger and the pipe for their horizontal progress.

In normal soils, boring for the 30-inch maximum pipeline could extend up to 300 feet in length, which is sufficient to cross an area as wide as an interstate highway, and will be adequate to cross the Alafia River at the proposed location.

PIPE INSTALLATION

Pipe installation, known as stringing pipe, can be accomplished just after the ditch has been opened or in other ways which also minimize the amount of time a trench is open. It essentially sets up the work for the actual assembly of the pipeline.

Since the welding operation is all-important in ensuring the structural integrity of the pipeline, it is performed by highly skilled personnel. All welding personnel will be certified in the welding process associated with gas pipelines. The validity of the welding method (called the weld procedure) is verified and qualified following the requirements of API Standard 1104 for Welding Pipe Lines and Related Facilities.

HYDROSTATIC TESTING

The entire pipeline and its associated facilities will be pressure tested to prove their integrity. No evidence of leakage is allowed before the pipeline is authorized for operation. The records of all tests must be properly filed and maintained by the pipeline operator. Upon completion of all tests, the pipeline is ready for commissioning.

Part 192 of 49 CFR and project specifications establish stringent limits and requirements for the hydrotest. Both maximum and minimum levels are prescribed for test pressures as a function of the pipe physical characteristics (diameter, wall thickness and steel grade), the class location and the expected operating pressure. To satisfy all of these requirements, the range of required test pressures must be computed for each segment of the line. In any case, the minimum test pressure equals 110 percent of the maximum pressure at which the pipeline will be allowed to operate. A hydrostatic test program will be devised when the final design of the pipeline is completed. The water to be used for hydrostatic testing will be obtained from impounded water on the site and returned to this source following testing. No off-site surface or ground water sources will be used for hydrostatic testing.

RIGHT-OF-WAY RESTORATION

During construction, topsoil will be saved to be spread back over the stripped area during right-of-way restoration following pipe installation. Once the pipeline is buried in place, the stripped

topsoil will be spread back in place to its original location and topography. Hydroseeding will be undertaken as necessary to quickly stabilize soils with a vegetation cover.

6.2.8.2 Impact on Water Bodies and Uses

Detailed information on dredging and filling (locations and volumes) will be provided to Florida Department of Environmental Regulation (FDER) and other jurisdictional agencies pursuant to a condition of certification, when the right-of-way location is determined and engineering is completed, as provided by Section 6.1.8.7 of the FDER SCA Guidelines. Permanent access roads will not be needed. Temporary culverts may be needed when crossing the man-made ditches and drainages along the right-of-way. This will be done to equalize water levels. Following construction, the culverts will be removed and the drainages restored to pre-construction configurations. The need for culverts will be minimized by using existing roads for access, where possible.

Locally, vegetation will be disturbed by the construction of the gas line. Disturbed areas will be allowed to revegetate naturally. Water quality will be maintained through use of erosion control and filtration devices, such as staked hay bales and fabric fences. All applicable FDER water quality standards will be met. Seeding and mulching will be used, as required, to control erosion on steep slopes, for example, along ditch banks. Construction will not create any new connections to waters-of-the-state.

Gas line impacts of the preferred corridor on water bodies and wetlands will be minimal. Construction will not require groundwater withdrawals or relocation of any water bodies. Existing runoff and drainage patterns will be maintained by construction techniques, culvert placement, and maximized use of existing access roads. Water quality will be maintained by appropriate clearing procedures and use of sediment and erosion control measures.

6.2.8.3 Solid Wastes

Cleared vegetation and combustible debris may be burned on-site in upland areas. Applicable state and local fire related regulations will be followed. All non-combustible construction solid wastes will be collected and removed for recycling or off-site disposal in compliance with all applicable regulations.

6.2.8.4 Changes to Vegetation, Wildlife, and Aquatic Life

No significant permanent changes to animal and plant populations are expected. Most of the corridor is currently in pasture and other early successional landcovers. Following construction, vegetation in these open areas, including wetlands, will be allowed to return to its original condition and maintained in an early successional state.

6.2.8.5 Impact on Human Populations

All facilities of the natural gas pipeline installed in a state or county road right-of-way are to be designed and constructed in accordance with specifications outlined in FDOT's Utility Accommodation Guide. Construction would begin in 1997 if this backup alternative is implemented, and would be expected to take approximately 4 to 6 months to complete.

The pipeline corridor parallels existing linear facilities through sparsely populated areas that are dominated by the phosphate industry. The only concentration of population is located in Bradley Junction, a small unincorporated community in southwestern Polk County. The corridor follows an existing transmission line right-of-way along the northern and western edge of Bradley Junction, and disturbances to this area are expected to be minimal. The use of existing rights-of-way and the short duration of construction activities in any given location should minimize any inconvenience which might occur.

6.2.8.6 Impact on Regional Scenic, Cultural, and Natural Landmarks

No regional scenic, cultural, or natural landmarks have been identified within 0.5 mile of the pipeline corridor.

6.2.8.7 Impact on Archeological and Historic Sites

A map of the proposed pipeline corridor was submitted to the DHR for review. DHR (1992) has stated that no significant archaeological or historical sites are recorded in the area and none are likely to be present in the area of the pipeline (Appendix 10.5.2).

6.2.9 Post-Construction Impacts and Effects of Maintenance

6.2.9.1 Maintenance Techniques

The primary regular maintenance activity will consist of a visual inspection of the right-of-way. These patrols can be carried out on foot, by vehicle, where possible, or from the air. These inspections will ensure that no activity detrimental to the safety of the pipeline is taking place within, or in the vicinity of, the right-of-way. The pipeline operator also will verify that no encroachment of the right-of-way occurs and that land development along the route does not affect the class location for any section of the line.

The 50-foot permanent right-of-way will be mowed or selectively controlled with herbicides periodically to provide good visibility to patrols. Generally, no heavy vegetation will be allowed to reestablish along the route because of root damage to the pipe.

During the life of a pipeline, repairs that would involve heavy equipment and materials to be mobilized should not be necessary. If such repairs do become necessary, they would take place on an emergency basis and be of very short duration.

Inspection crews will monitor regularly the efficiency of the cathodic protection system along the entire line. Electrical measurements performed will be at test stations permanently installed along the pipeline. Test stations are usually located at roads and railroad crossings or approximately every 1 to 2 miles.

6.2.9.2 Right-of-Way Uses

Indiscriminate movement of heavy equipment over the pipeline will not be allowed. Only machinery that will not be hazardous to the integrity of the pipeline will be allowed to operate within the right-of-way. Surface usage of the land for establishing lawns or grazing of animals is acceptable. Warning markers will identify the pipeline at regular intervals and remind owners along the right-of-way of its presence underground. Access to the right-of-way will be limited by fences and gates on privately owned lands.

6.2.9.3 Operational Safety Provisions

The natural gas pipeline supplying the FPC Polk County Site from the FGT main line will be protected against large pressure fluctuations and overpressure. To further protect the backup pipeline lateral against excessive internal pressure, several means of protection will be implemented. They are:

- Safety relief valves and stacks will be designed and installed at the inlet to the pipeline in accordance with API-521. The capacity of the valve(s) will be designed to maintain the internal pipeline pressure below the Maximum Allowable Operating Pressure.

- A computer based SCADA system will be placed in service to monitor and control the pipeline operation. The system will include a real time leak detection software package that will receive input from measuring instruments mounted on the pipeline at both ends and at intermediate isolation valves. The SCADA system will model accurately the operation of the pipeline and account for normal transient phenomenons. It will generate an alarm to warn the operators of a possible leak. The operators can then take appropriate action.

- At least two intermediate mainline isolation valves will be provided. These valves, as well as the block valves at each end of the line, will be equipped with the necessary actuators and instrumentation to allow remote operation (closure and opening). This will permit quick isolation of the pipeline in sections from the control room thus limiting the amount of gas released in case of a leak.

- In addition to these features, 49 CFR Part 192 requires the pipeline operator to have written procedures for continuing surveillance, damage prevention program and emergency plans. Part 192 of 49 CFR also requires the pipeline operator to conduct patrols of the line and leakage surveys. The periodic leak surveys allow detection of small gas leaks which could go undetected by the computer based leak detection program.

Past experience in the natural gas transmission industry proves that all these types and levels of protection provide for a very good safety record.

6.2.9.4 Changes in Species Populations

The maximum 50 feet operations right-of-way will include no above ground structures except for the metering station and occasional warning signs. In a short time, ground cover over most of the land will be reestablished.

No threatened or endangered animals or species of special concern are known to require land occupied in the corridor. Locally, cattle grazing, mining activities, transmission line right-of-way maintenance, human activity, and traffic render gas pipeline and surrounding habitat types poorly suited for habitation by such species. No known endangered plant populations occur in the corridor. Consequently, no measurable changes to populations of important species are expected as the result of right-of-way maintenance.

6.2.9.5 Effects of Public Access

The gas pipeline corridor parallels existing linear facilities for its entire length and, except for publicly owned right-of-ways included in the corridor, is entirely located on privately owned lands. No new access roads are to be constructed and public access to previously inaccessible areas will be limited.

6.2.10 References

American Petroleum Institute. n.d. API, Specification 5L for Line Pipe.

DHR (Florida Division of Historical Resources). 1992. Letter from D. Breit, DHR, Tallahassee, to M. Tuttell, Moore/Bowers, Tampa, Florida. May 4, 1992.

FERC (Federal Energy Regulatory Commission). 1991. Florida Gas Transmission Company, St. Petersburg/Sarasota Connector Project Environmental Assessment. Washington D.C.

FDOT (Florida Department of Transportation). 1990. Utility Accommodation Guide. Tallahassee, Florida.

FDOT. 1985. Florida Land Use, Cover and Forms Classification System. Tallahassee, Florida.

Hillsborough County BOCC (Board of County Commissioners). 1989. Future of Hillsborough. As amended through May 1992. Tampa, Florida.

Hillsborough County BOCC. 1992. Land Development Code. Ordinance 92-05. Adopted March 4, 1992. Municipal Code Corporation. Tallahassee, Florida.

Polk County BOCC. 1983. Polk County Zoning Ordinance. Bartow, Florida.

Polk County BOCC. 1991. Polk County Comprehensive Plan. Bartow, Florida. April 19, 1992.

USDOT (U.S. Department of Transportation). 49 CFR, Part 192, Minimum Federal Safety Standards for Gas Lines. USDOT, Materials Transport Bureau, Office of Pipeline Safety Operations.

TABLE 6.2.4-1
COST PER MILE FOR GAS PIPELINE CONSTRUCTION

Gas Pipeline Construction Task	Cost Per Mile (1998)
Land Acquisition	$ 16,600
Right-of-Way Preparation	$ 10,000
Pipeline Installation	$584,500
Total	$611,100

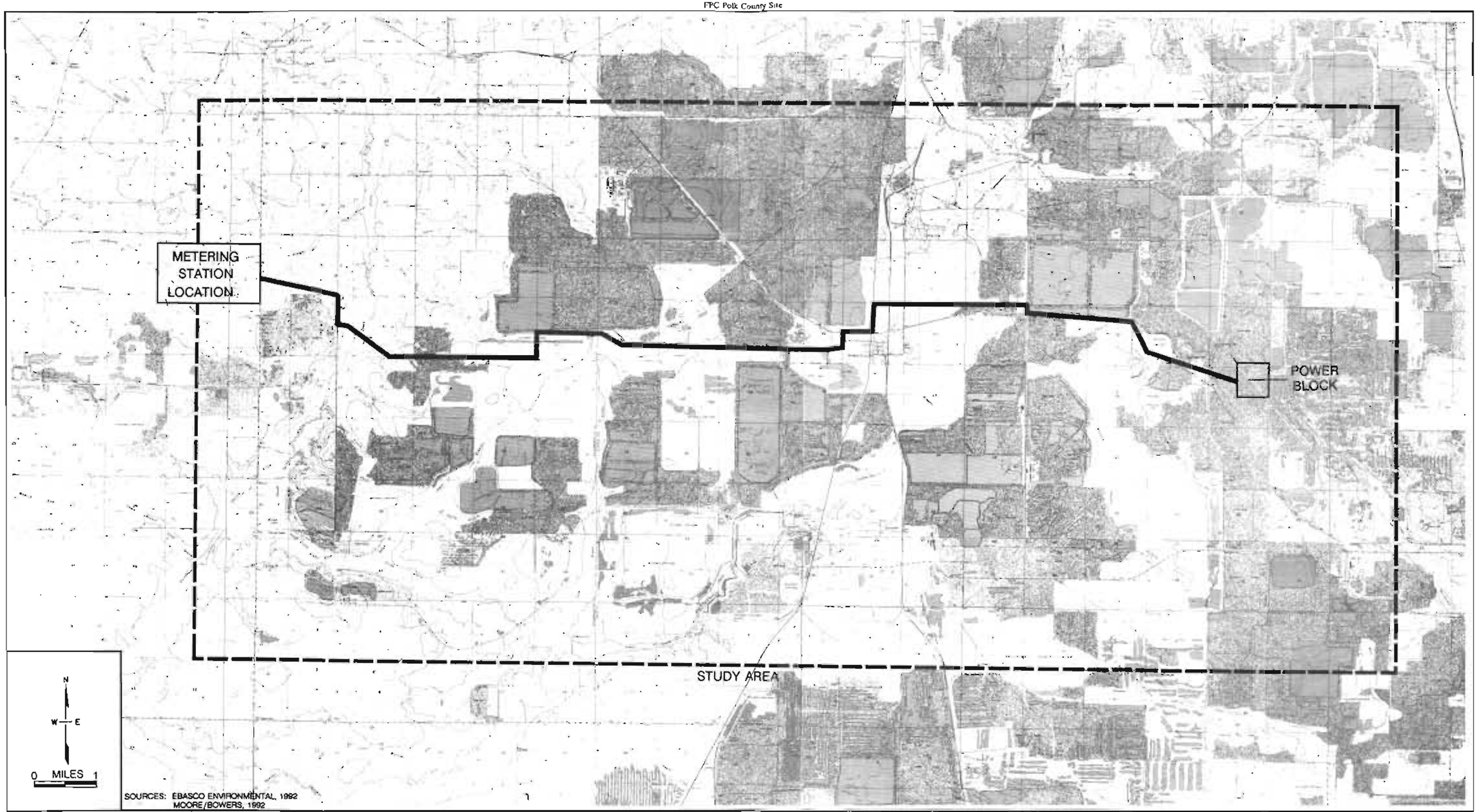
Note: Cost based on 18.2 mile pipeline length and 20 inch pipeline diameter.

Source: Ebasco Environmental, 1992.

TABLE 6.2.5-1
CORRIDOR SELECTION CRITERIA

Criteria	Measure	Definition/Methodology
EXCLUSION		
Presence of clay settling ponds created from mining activities	Excluded from consideration	Unstable ground unsuitable for pipeline installation; mine company plans; DNR reports.
Potential impacts to lakes or ponds	Excluded from consideration	Identify from aerial photographs
Potential impacts to cemeteries	Excluded from consideration	Cemeteries in maps and aerial photographs and field verified
AVOIDANCE		
Potential impacts to wetlands	Length of corridor centerline through wetlands in miles	Length of wetlands as measured from aerial photography
Potential impacts to forested uplands	Length of corridor centerline through forested uplands	Length of forest types as defined by the FLUCCS and measured on the aerial photography
MINIMIZE		
Number of land owners affected	Total number of land parcels included in corridor	Number of parcels from Polk and Hillsborough Counties' plat maps
Cost	Overall corridor length in miles	Multiply cost per mile times corridor length
Corridor through potential phosphate mining areas	Total length of corridor through potential phosphate mining area in miles	Length of corridor along potential phosphate mining areas; identified from aerials and DNR reports
Corridor through populated areas	Number of houses	Houses counted from aerial photographs
Future Land Use	Total length of corridor through residential land use categories	Length measured on future land use maps
FAVORABLE		
Common corridor utilization	Length of corridor parallel or adjacent to existing right-of-way in miles	Aerial photographs or quad sheets
Corridor along major thoroughfares	Total length of corridor adjacent to major roads in miles	Measure from aerials or quad sheets

Source: Ebasco Environmental, 1992.

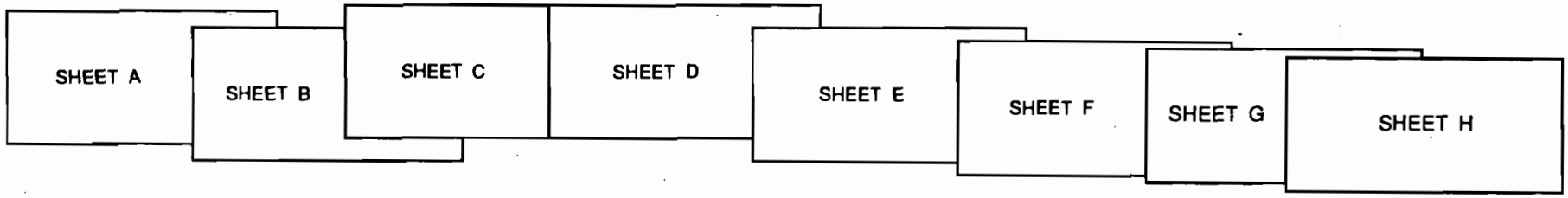


Florida Power CORPORATION

Polk County Site

FIGURE 6.2.1-1

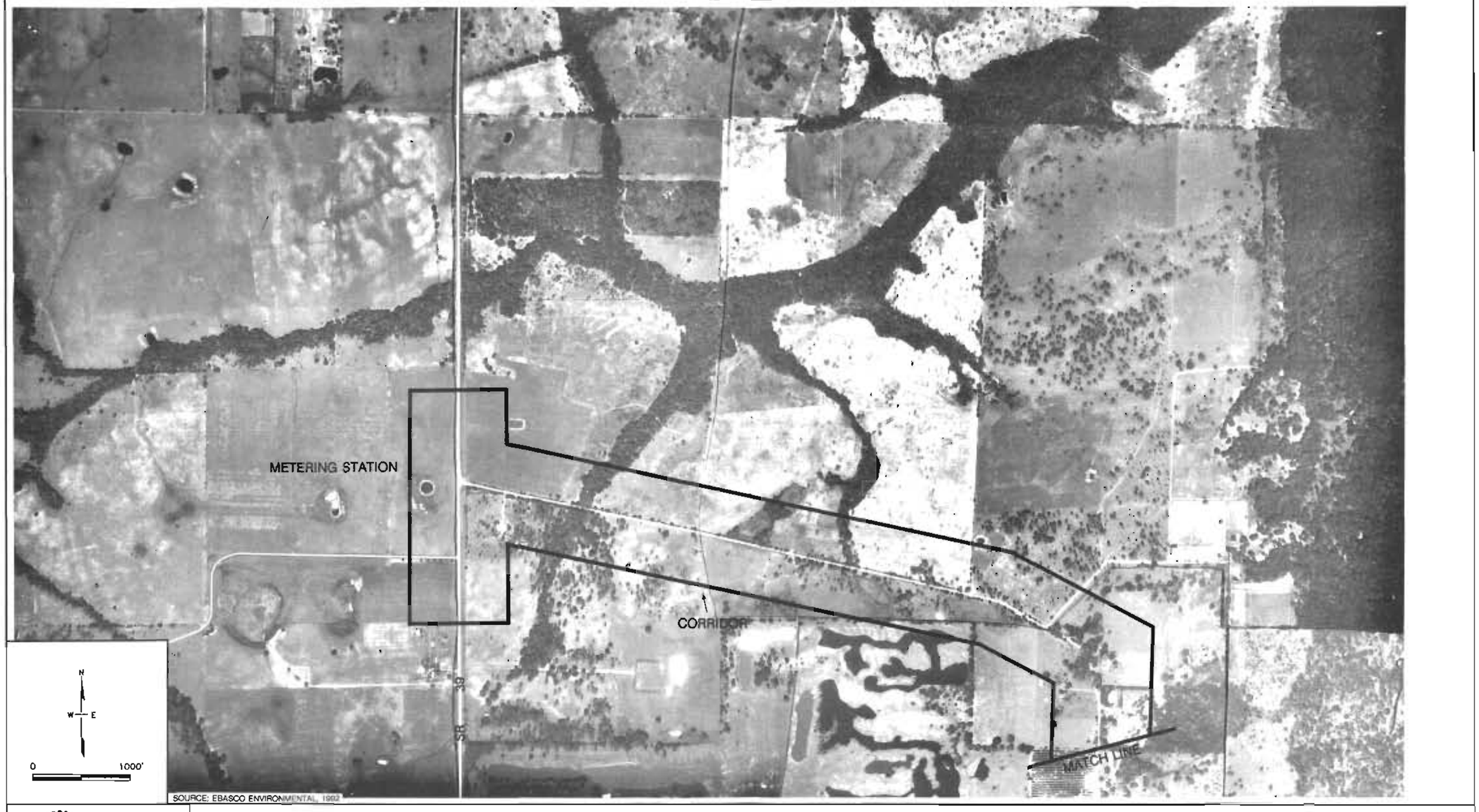
NATURAL GAS PIPELINE PREFERRED CORRIDOR LAYOUT



Florida Power CORPORATION

Polk County Site

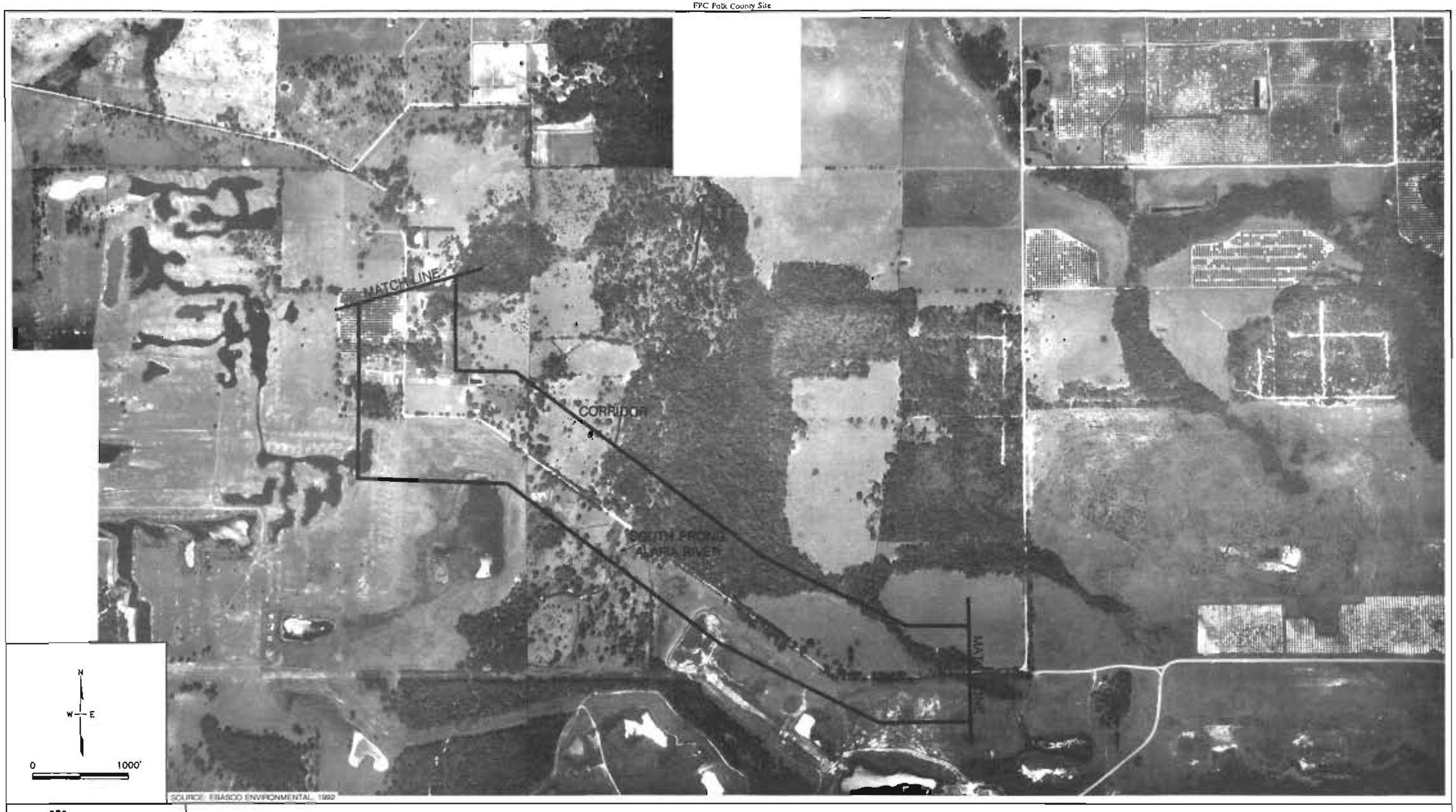
FIGURE 6.2.2-1
PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR KEY



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Polk County Site

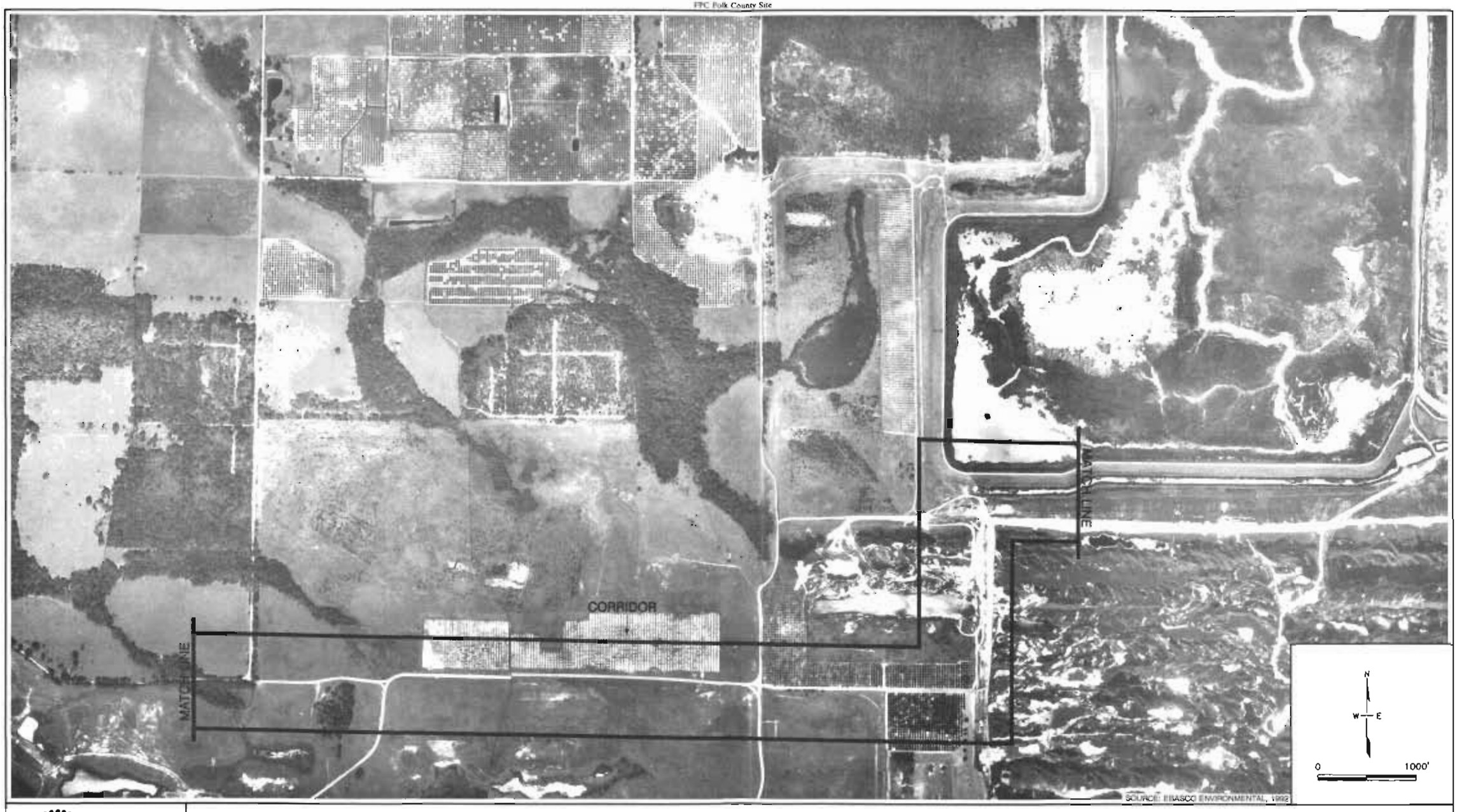
FIGURE 6.2.2-1A
PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR
SHEET A



Florida Power
CORPORATION

Polk County Site

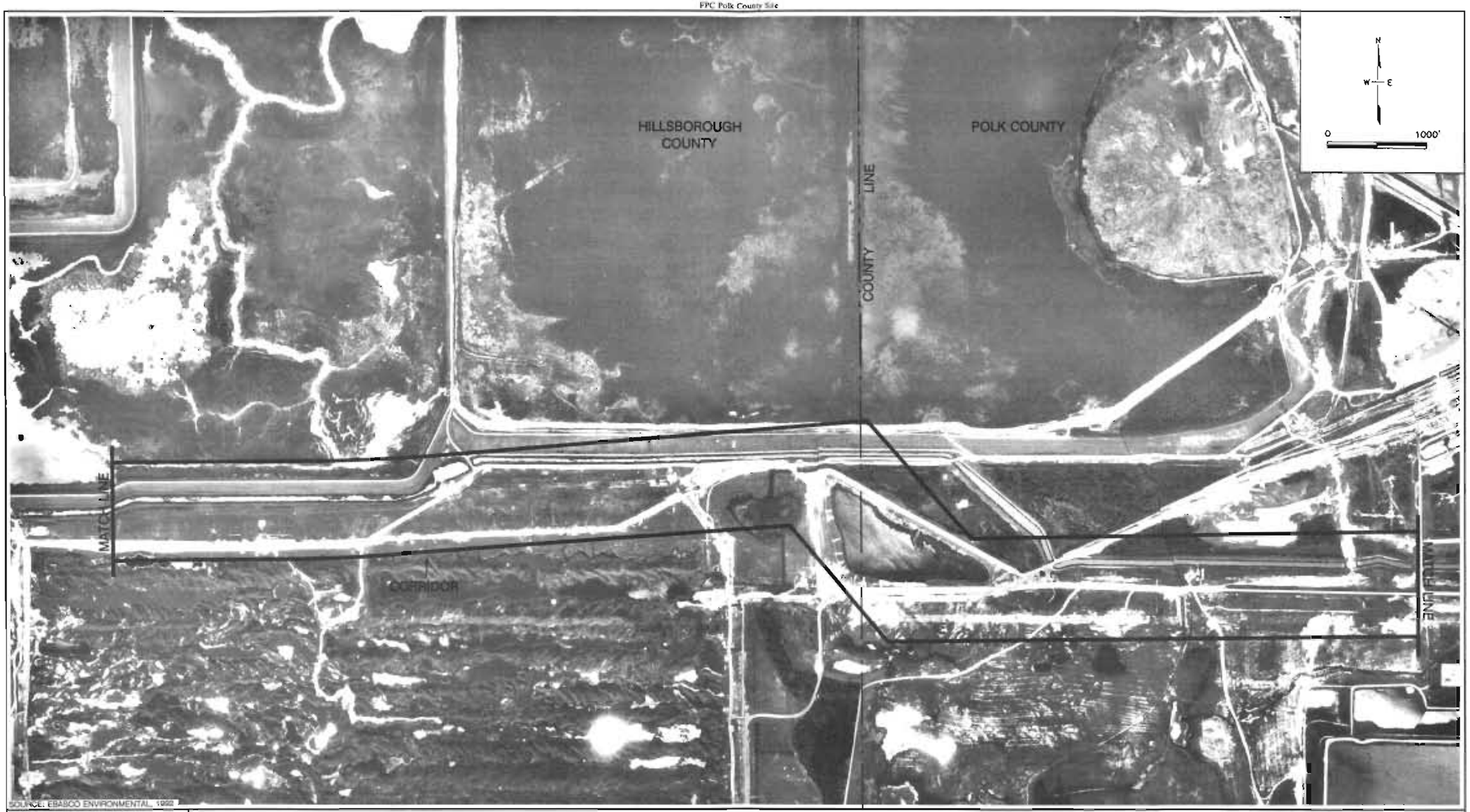
FIGURE 6.2.2-1B
PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR
SHEET B



Florida Power CORPORATION

Polk County Site

FIGURE 6.2.2-1C
PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR
SHEET C



Florida Power CORPORATION

Polk County Site

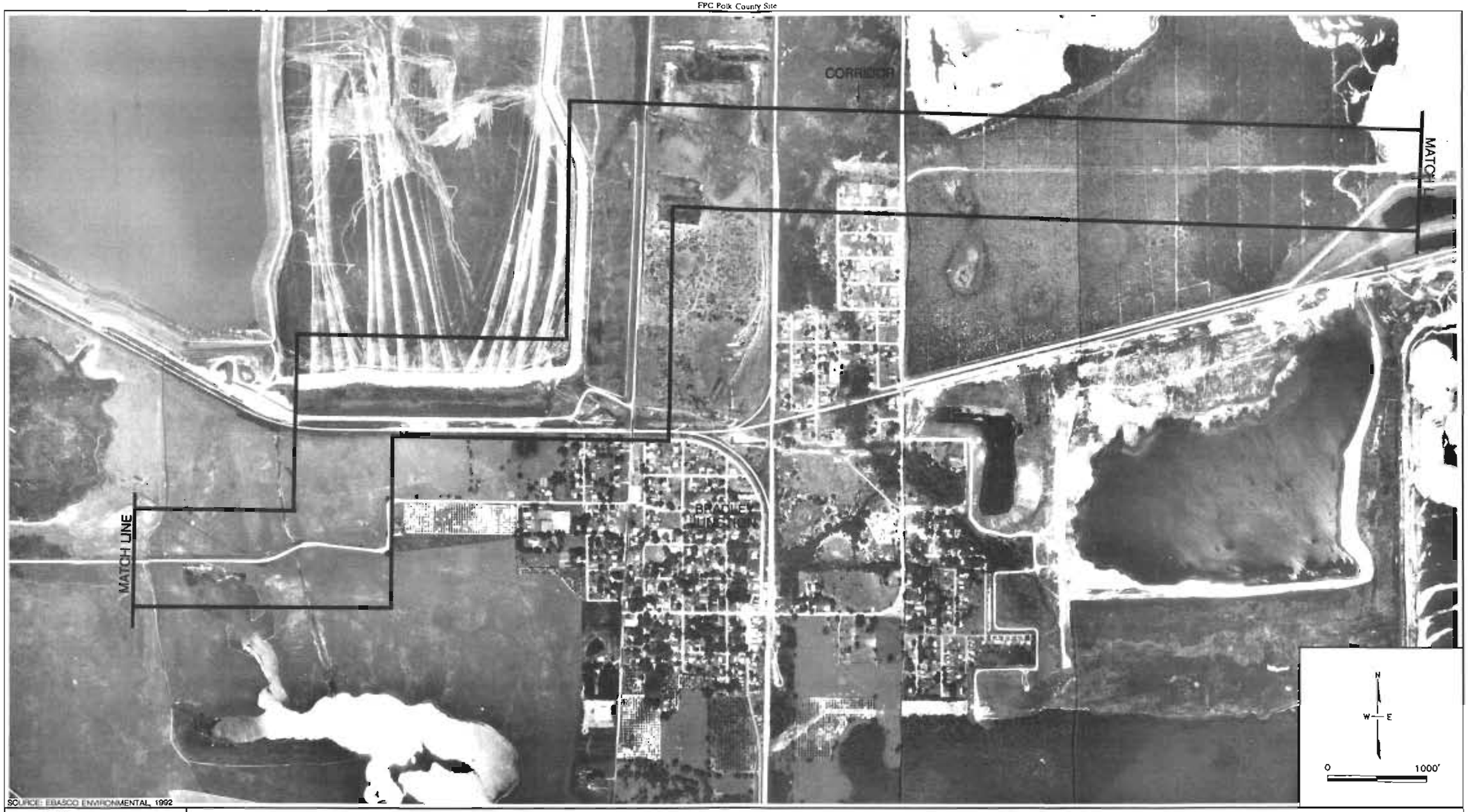
FIGURE 6.2.2-1D
PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR
SHEET D



Florida Power CORPORATION

Polk County Site

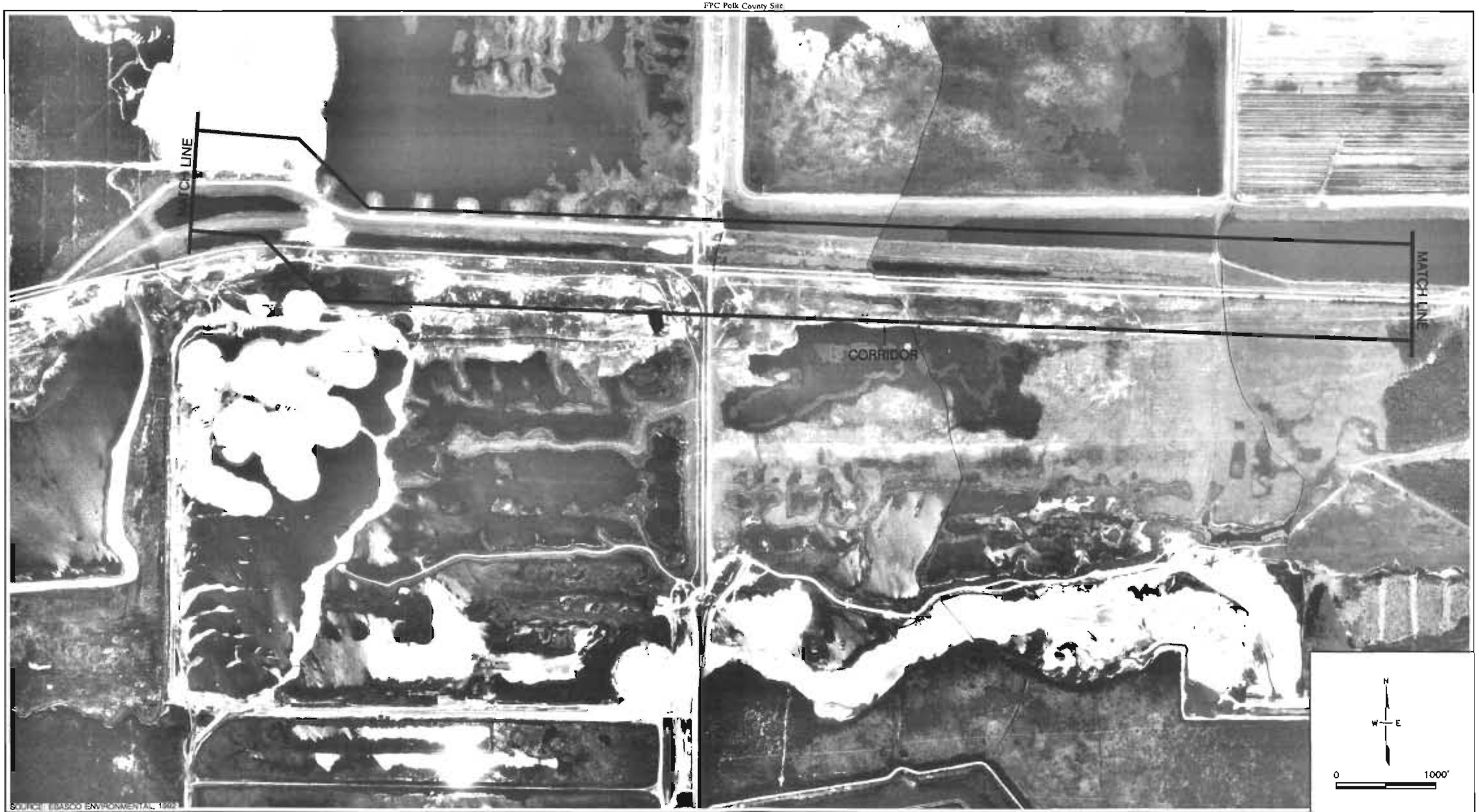
FIGURE 6.2.2-1E
PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR
SHEET E



Florida Power CORPORATION

Polk County Site

FIGURE 6.2.2-1F
PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR
SHEET F



Florida Power CORPORATION

Polk County Site

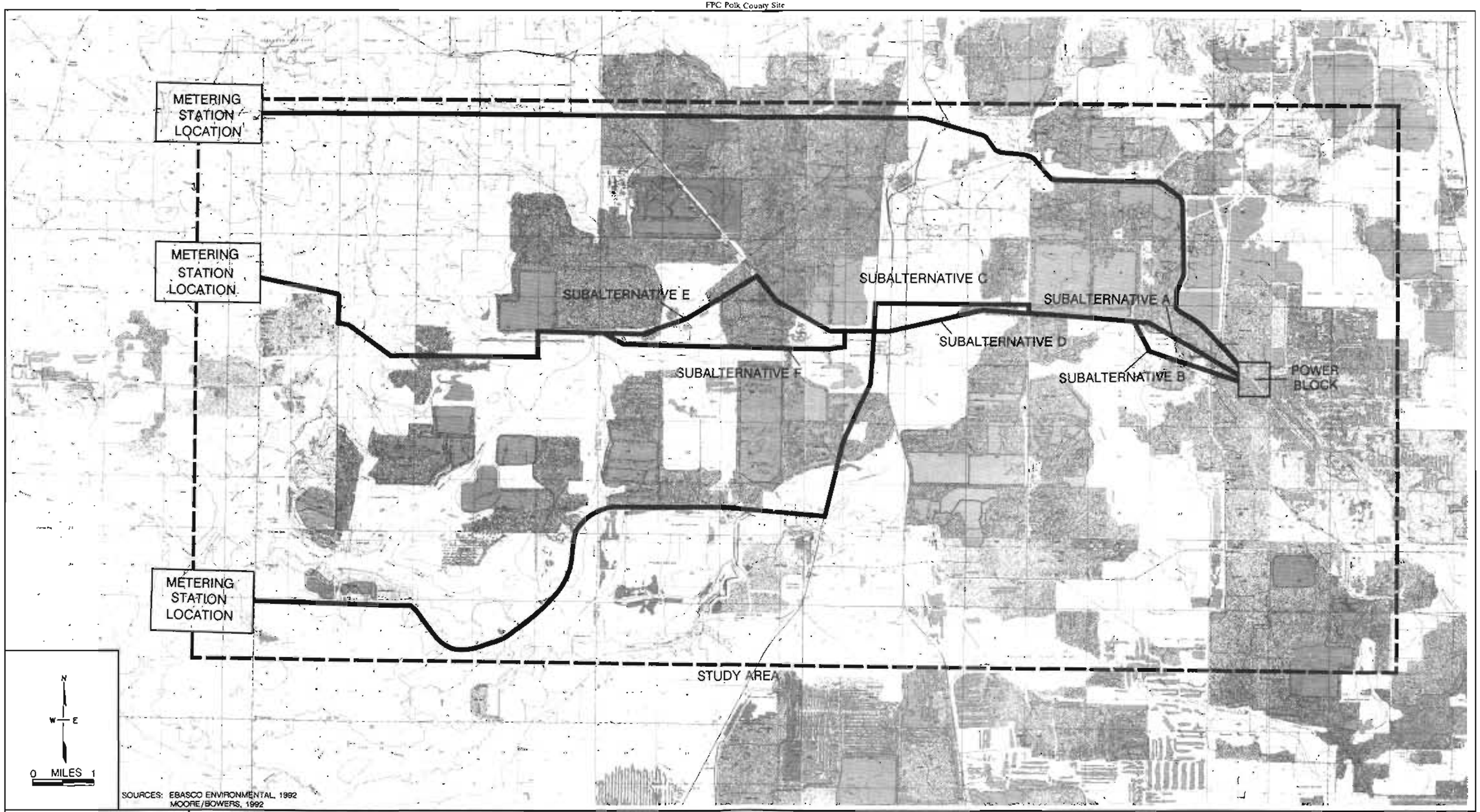
FIGURE 6.2.2-1G
PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR
SHEET G



Florida Power
CORPORATION

Polk County Site

FIGURE 6.2.2-1H
PROPOSED ALTERNATIVE NATURAL GAS PIPELINE CORRIDOR
SHEET H

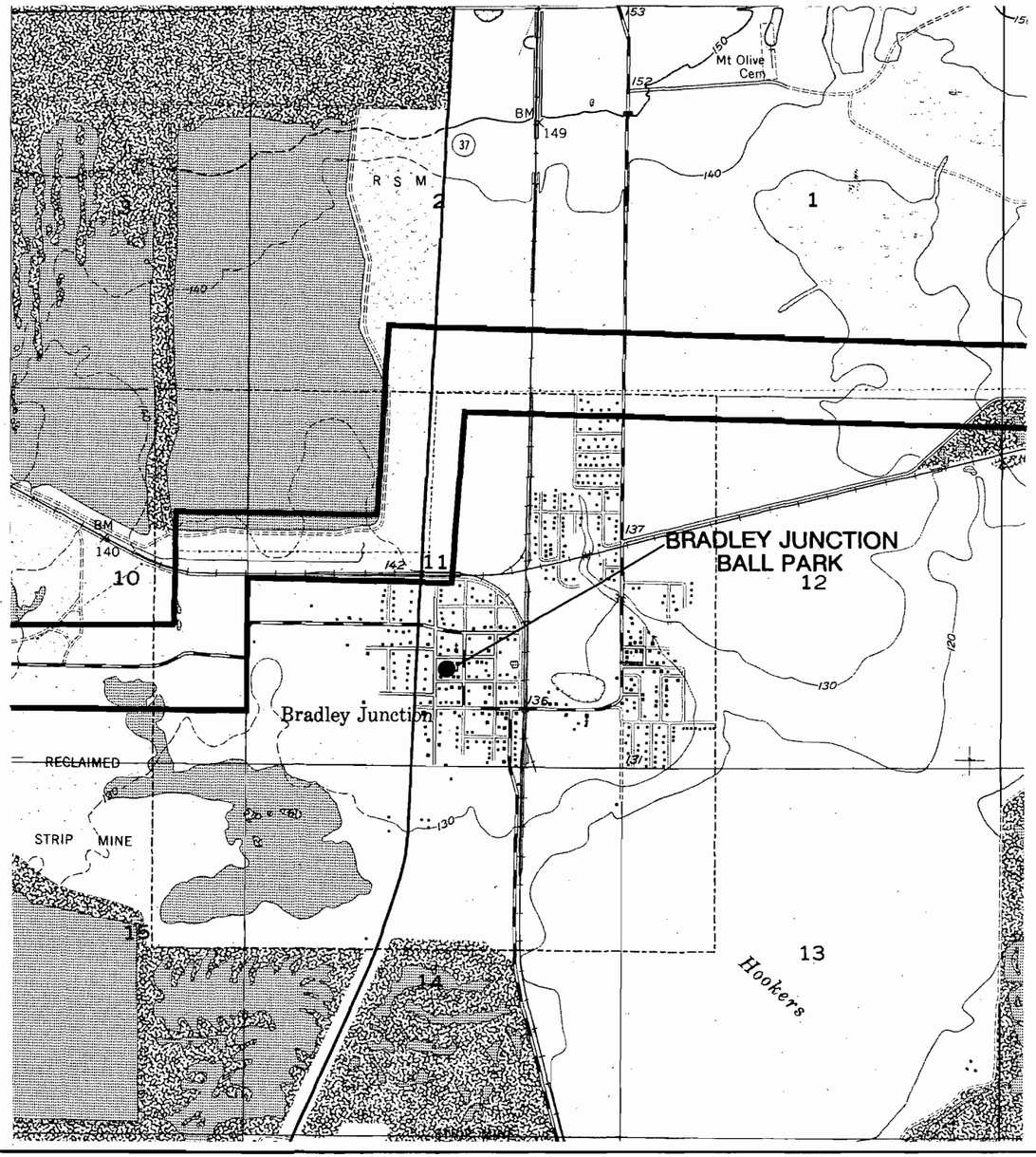


Florida Power CORPORATION

Polk County Site

FIGURE 6.2.5-1

CANDIDATE CORRIDOR ROUTES



LEGEND

NATURAL GAS PIPELINE CORRIDOR BOUNDARY

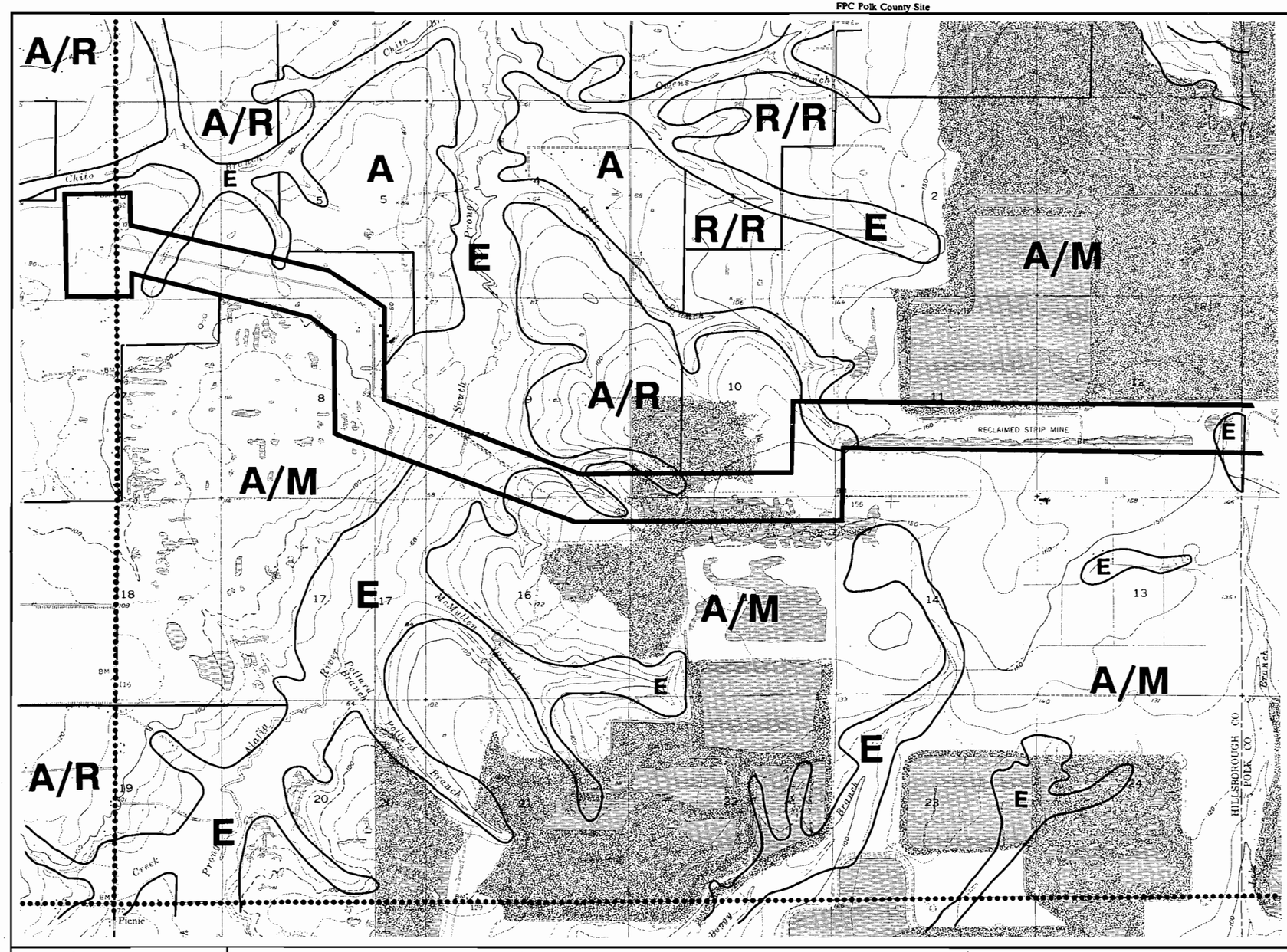
N
W E
0 2000

SOURCES:
HILLSBOROUGH COUNTY
CITY COUNTY PLANNING COMMISSION 1991
POLK COUNTY BOARD OF COUNTY COMMISSIONERS
PLANNING DIVISION 1991
MOORE/BOWERS 1992

Florida Power CORPORATION

Polk County Site

FIGURE 6.2.6-1
LOCAL GOVERNMENT JURISDICTIONS
WITHIN ONE-HALF MILE OF THE CORRIDOR



LEGEND

- NATURAL GAS PIPELINE CORRIDOR BOUNDARY
- SCENIC CORRIDOR
- A AGRICULTURAL
- A/M AGRICULTURE/MINING
- A/R AGRICULTURE/RURAL
- E ENVIRONMENTALLY SENSITIVE AREAS
- R/R RURAL RESIDENTIAL

N
W E
0 3000'

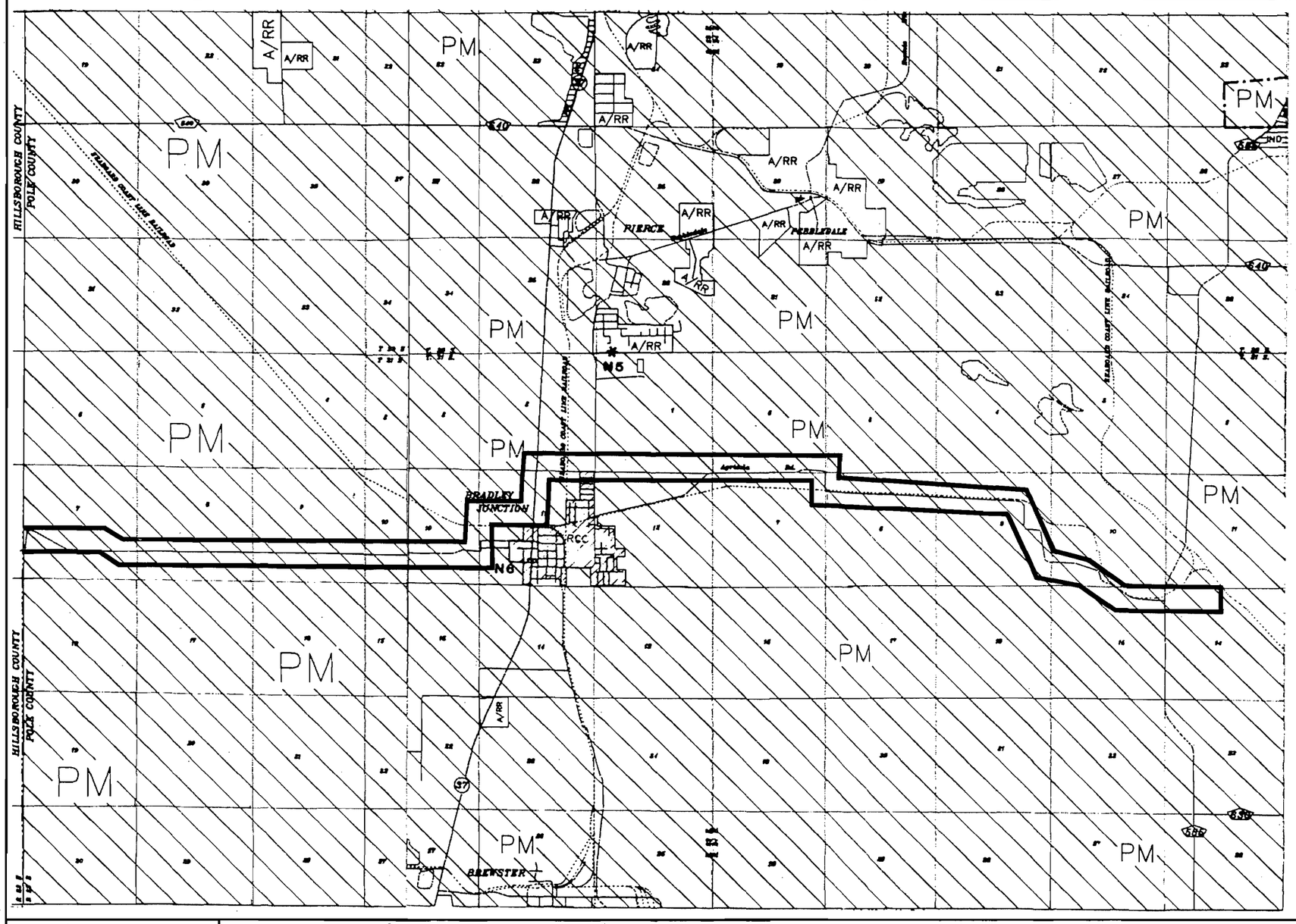
SOURCES:
HILLSBOROUGH COUNTY
CITY COUNTY PLANNING COMMISSION 1991
POLK COUNTY BOARD OF COUNTY COMMISSIONERS
PLANNING DIVISION 1991
MOORE/BOWERS 1992

Florida Power CORPORATION

Polk County Site

FIGURE 6.2.6-2

FUTURE LAND USE DESIGNATIONS
HILLSBOROUGH COUNTY, FLORIDA



LEGEND

NATURAL GAS PIPELINE CORRIDOR

FUTURE LAND USE DESIGNATIONS

A/RR	AGRICULTURE/RESIDENTIAL-RURAL
IND	INDUSTRIAL
PM	PHOSPHATE MINING
RCC	RURAL-CLUSTER CENTER

N
W — E
0 1
MILES

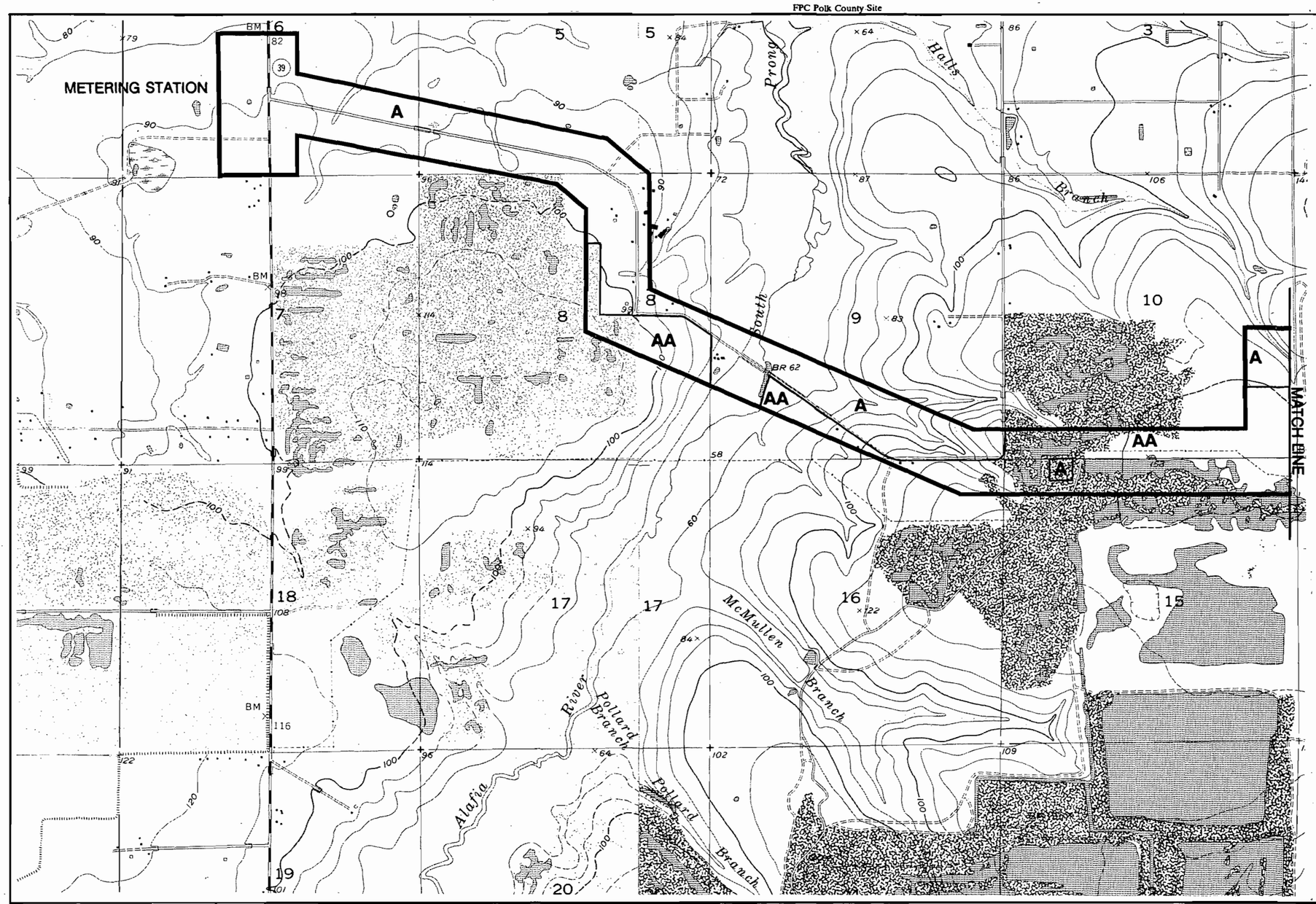
SOURCES:
HILLSBOROUGH COUNTY
CITY COUNTY PLANNING COMMISSION 1991
POLK COUNTY BOARD OF COUNTY COMMISSIONERS
PLANNING DIVISION 1991
MOORE/BOWERS 1992

Florida Power CORPORATION

Polk County Site

FIGURE 6.2.6-3

FUTURE LAND USE DESIGNATIONS
POLK COUNTY, FLORIDA



LEGEND

NATURAL GAS PIPELINE CORRIDOR BOUNDARY

HILLSBOROUGH COUNTY

A AGRICULTURE
AA ACREAGE AGRICULTURAL

POLK COUNTY

GI GENERAL INDUSTRIAL
RC RURAL CONSERVATION

N
W E
0 2000'

SOURCES:
HILLSBOROUGH COUNTY
CITY COUNTY PLANNING COMMISSION 1991
POLK COUNTY BOARD OF COUNTY COMMISSIONERS
PLANNING DIVISION 1991
MOORE/BOWERS 1992

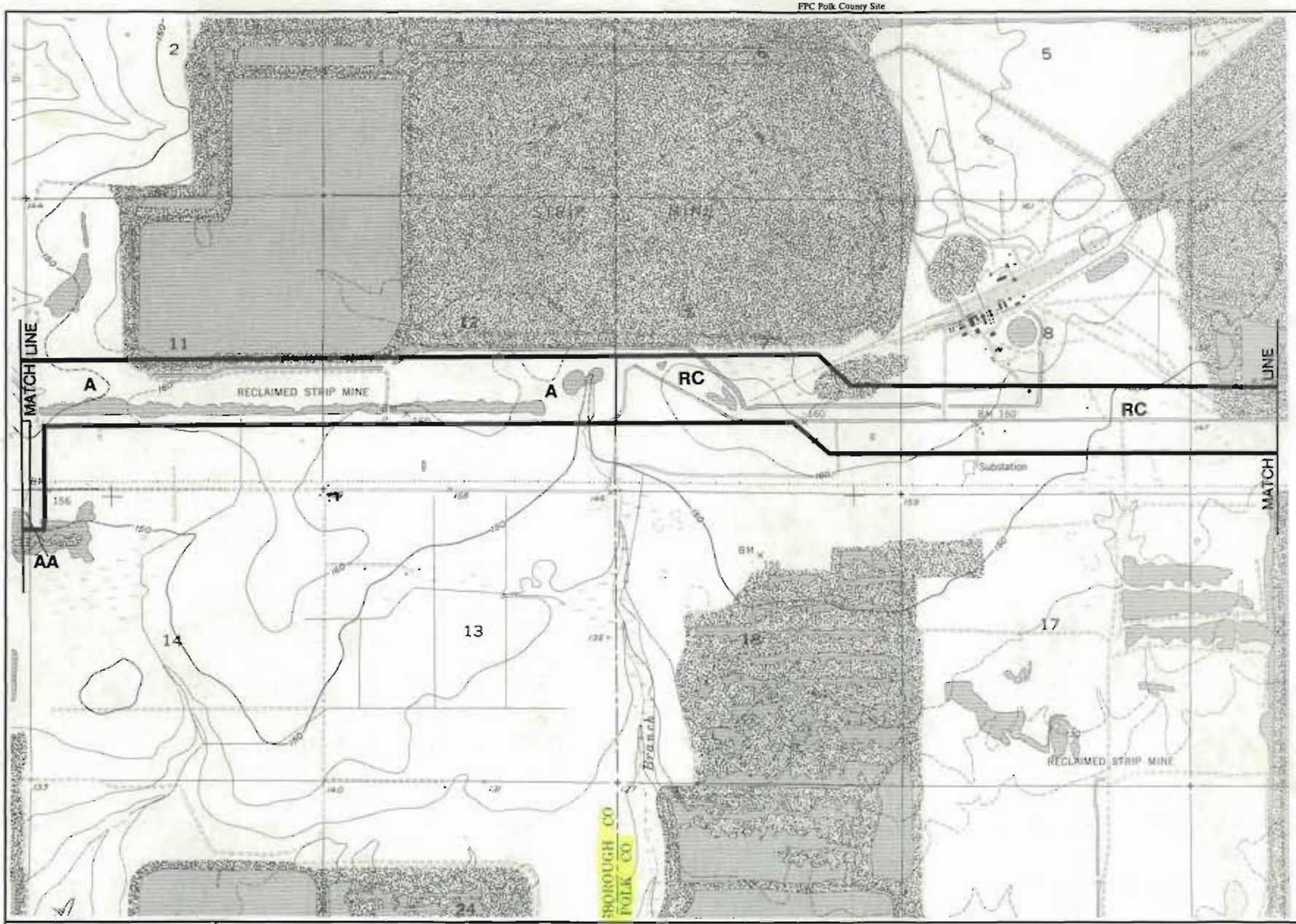
HILLSBORO CO.

Florida Power CORPORATION

Polk County Site

FIGURE 6.2.6-4A

ZONING DESIGNATIONS IN THE PIPELINE CORRIDOR
SHEET A



LEGEND

NATURAL GAS PIPELINE CORRIDOR BOUNDARY

HILLSBOROUGH COUNTY

A AGRICULTURE
AA ACREAGE AGRICULTURAL

POLK COUNTY

GI GENERAL INDUSTRIAL
RC RURAL CONSERVATION

N
W E
0 2000'

SOURCES:
HILLSBOROUGH COUNTY
CITY COUNTY PLANNING COMMISSION 1991
POLK COUNTY BOARD OF COUNTY COMMISSIONERS
PLANNING DIVISION 1991
MOORE/BOWERS 1992

Florida Power CORPORATION

Polk County Site

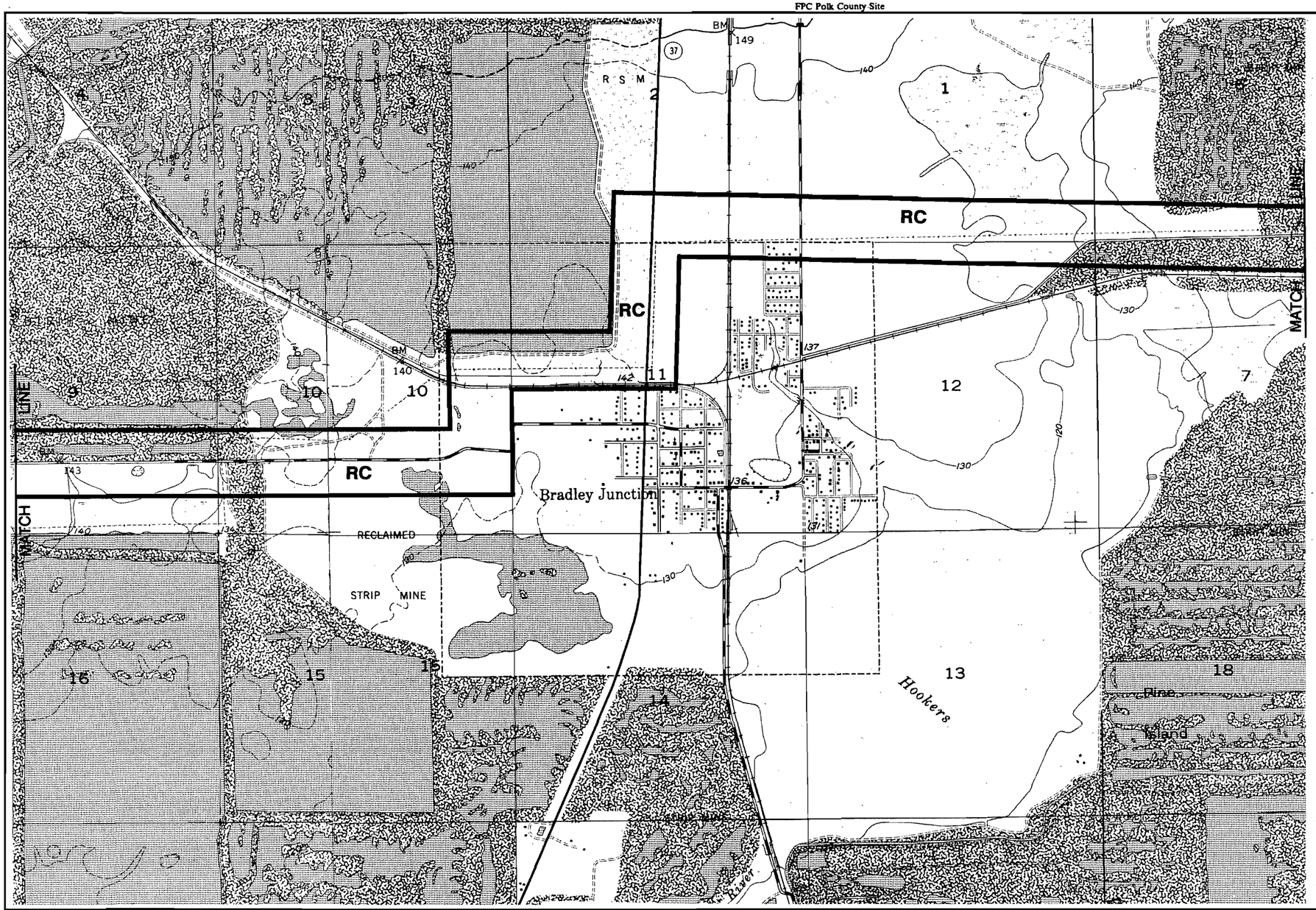
FPC/SCA

FIGURE 6.2.6-4B

ZONING DESIGNATIONS IN THE PIPELINE CORRIDOR
SHEET B

HILLSBORO / POLK COS.

Rev.0
5/92



LEGEND

NATURAL GAS PIPELINE CORRIDOR BOUNDARY

HILLSBOROUGH COUNTY

A AGRICULTURE
AA ACREAGE AGRICULTURAL

POLK COUNTY

GI GENERAL INDUSTRIAL
RC RURAL CONSERVATION

N
W E
0 2000'

SOURCES:
HILLSBOROUGH COUNTY
CITY COUNTY PLANNING COMMISSION 1991
POLK COUNTY BOARD OF COUNTY COMMISSIONERS
PLANNING DIVISION 1991
MOORE/BOWERS 1992

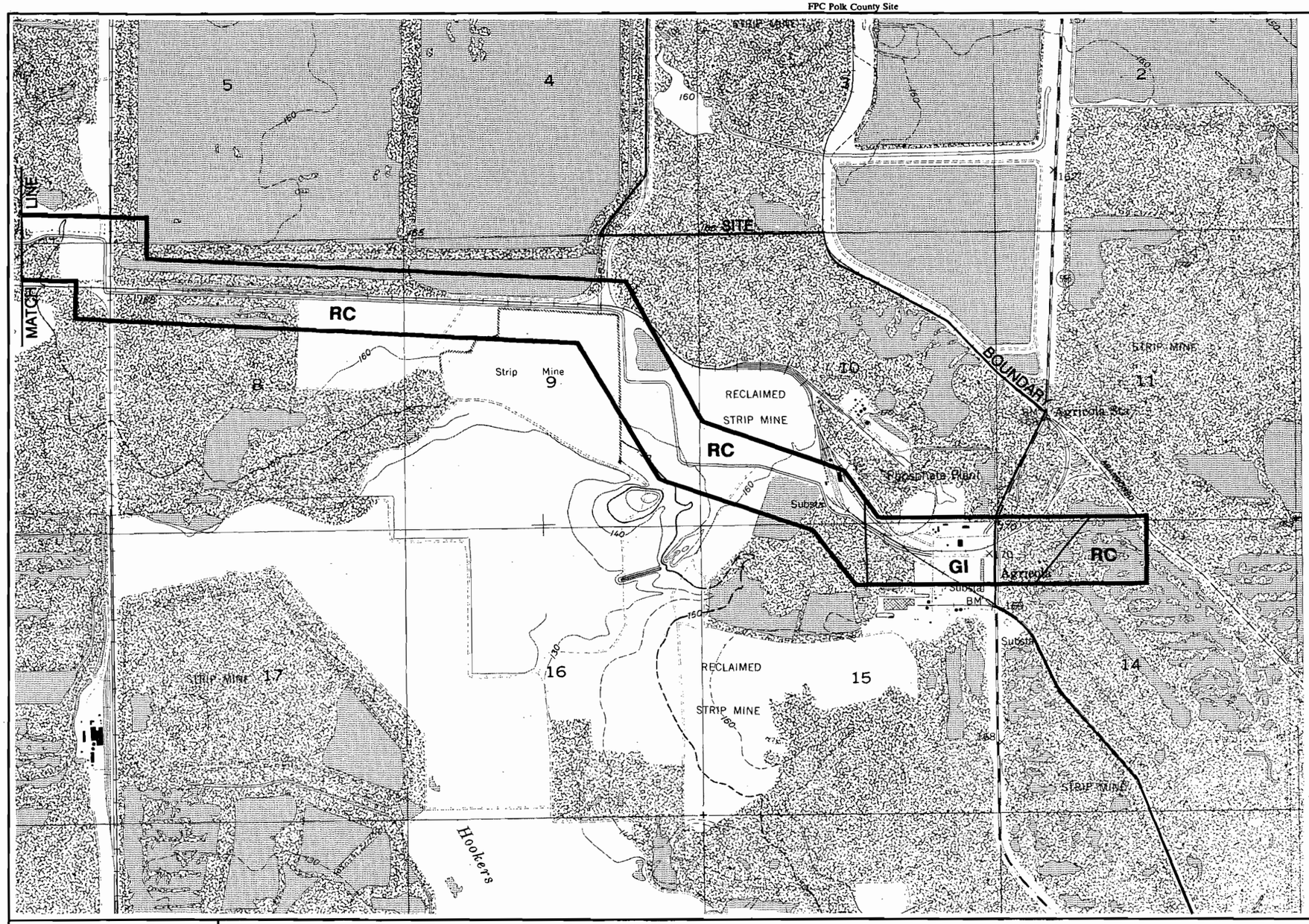
Florida Power CORPORATION

Polk County Site

FIGURE 6.2.6-4C

ZONING DESIGNATIONS IN THE PIPELINE CORRIDOR
SHEET C

Polk Co ✓



LEGEND

NATURAL GAS PIPELINE CORRIDOR BOUNDARY

HILLSBOROUGH COUNTY

A AGRICULTURE
AA ACREAGE AGRICULTURAL

POLK COUNTY

GI GENERAL INDUSTRIAL
RC RURAL CONSERVATION

N
W E
0 2000'

SOURCES:
HILLSBOROUGH COUNTY
CITY COUNTY PLANNING COMMISSION 1991
POLK COUNTY BOARD OF COUNTY COMMISSIONERS
PLANNING DIVISION 1991
MOORE/BOWERS 1992

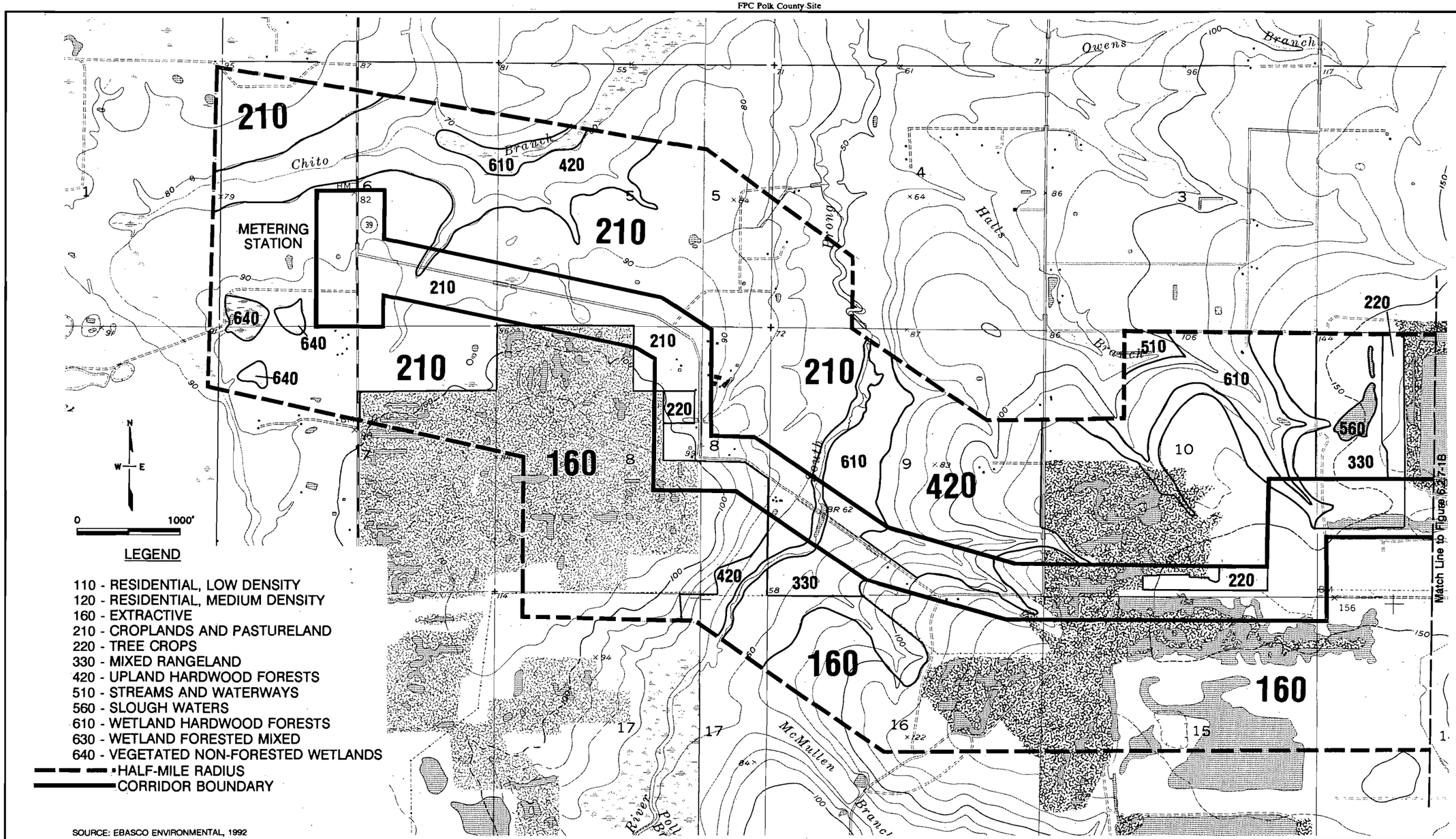
Florida Power CORPORATION

Polk County Site

FIGURE 6.2.6-4D

ZONING DESIGNATIONS IN THE PIPELINE CORRIDOR
SHEET D

Polk Co.



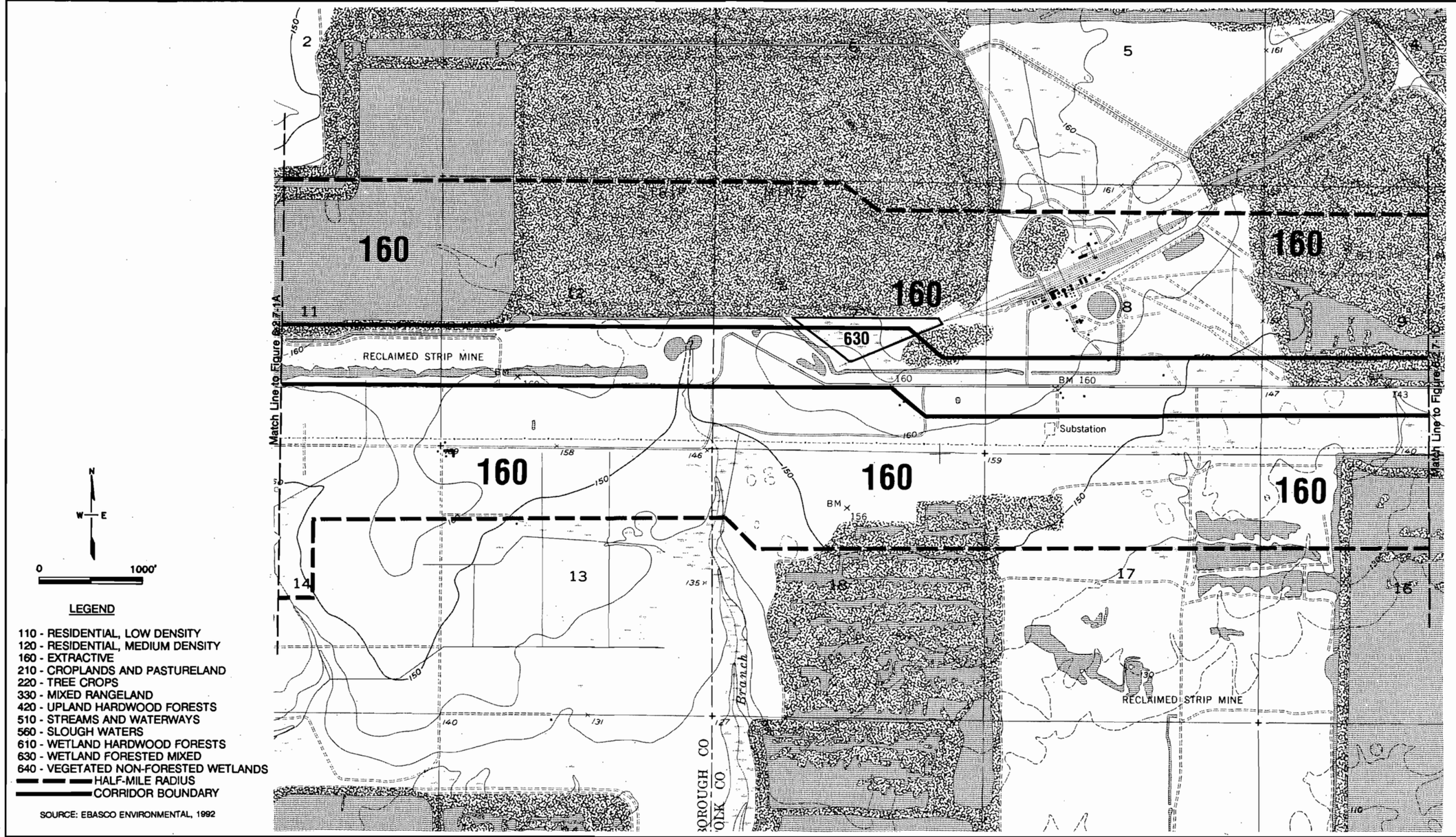
SOURCE: EBASCO ENVIRONMENTAL, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 6.2.7-1A

LAND USE AND VEGETATION IN PREFERRED CORRIDOR
SHEET A

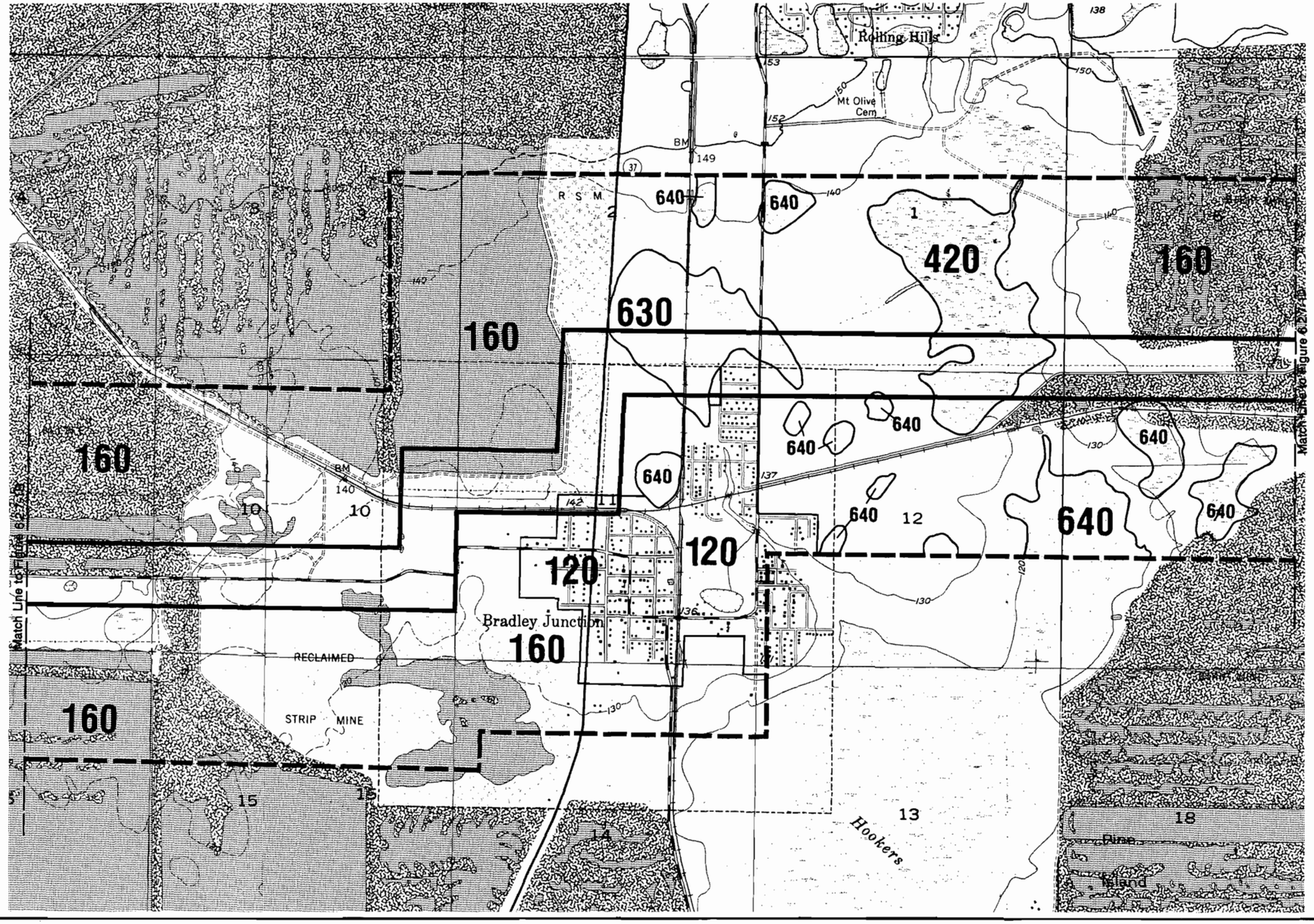


Florida Power CORPORATION

Polk County Site

FIGURE 6.2.7-1B

LAND USE AND VEGETATION IN PREFERRED CORRIDOR
SHEET B

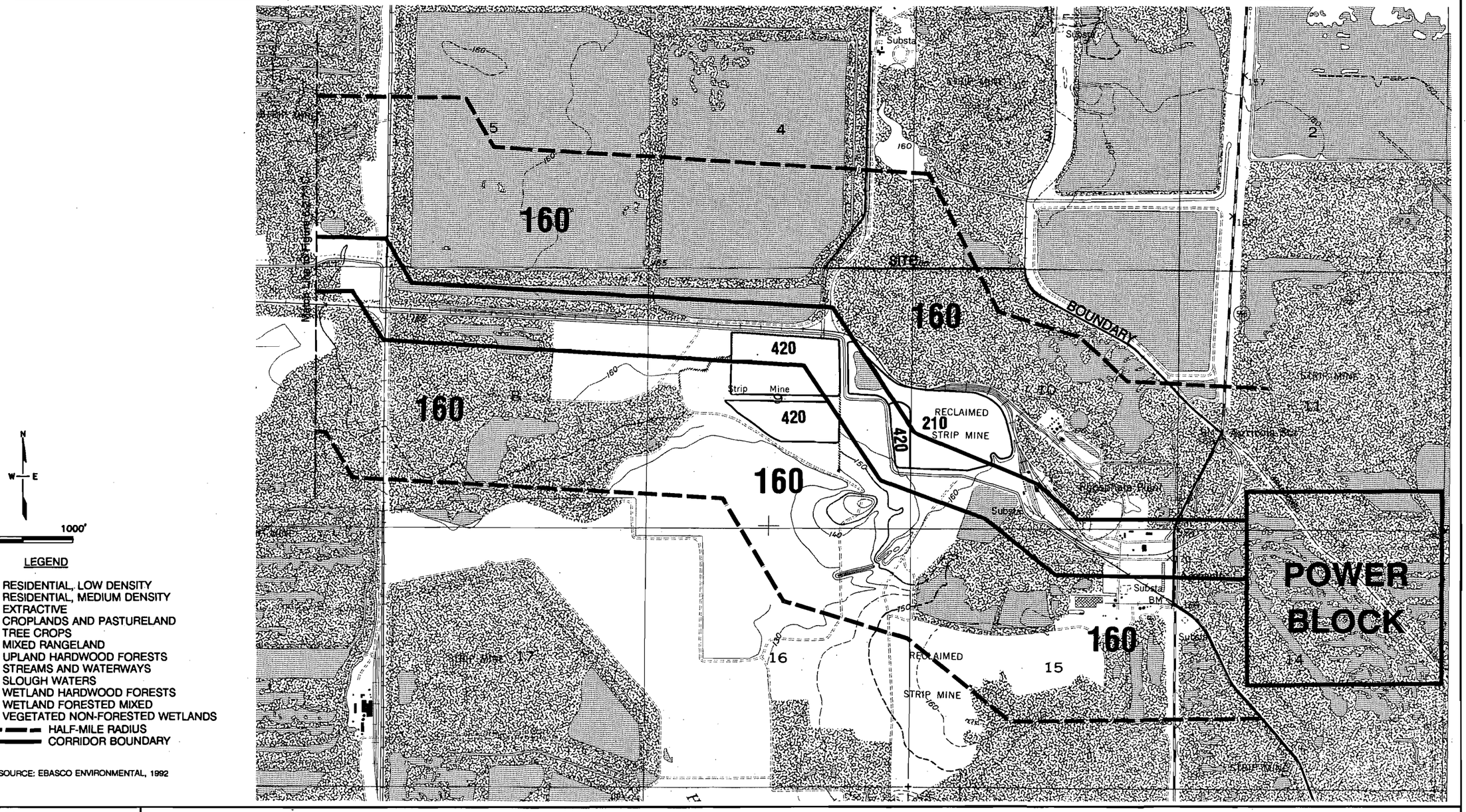


Florida Power CORPORATION

Polk County Site

FIGURE 6.2.7-1C

LAND USE AND VEGETATION IN PREFERRED CORRIDOR SHEET C

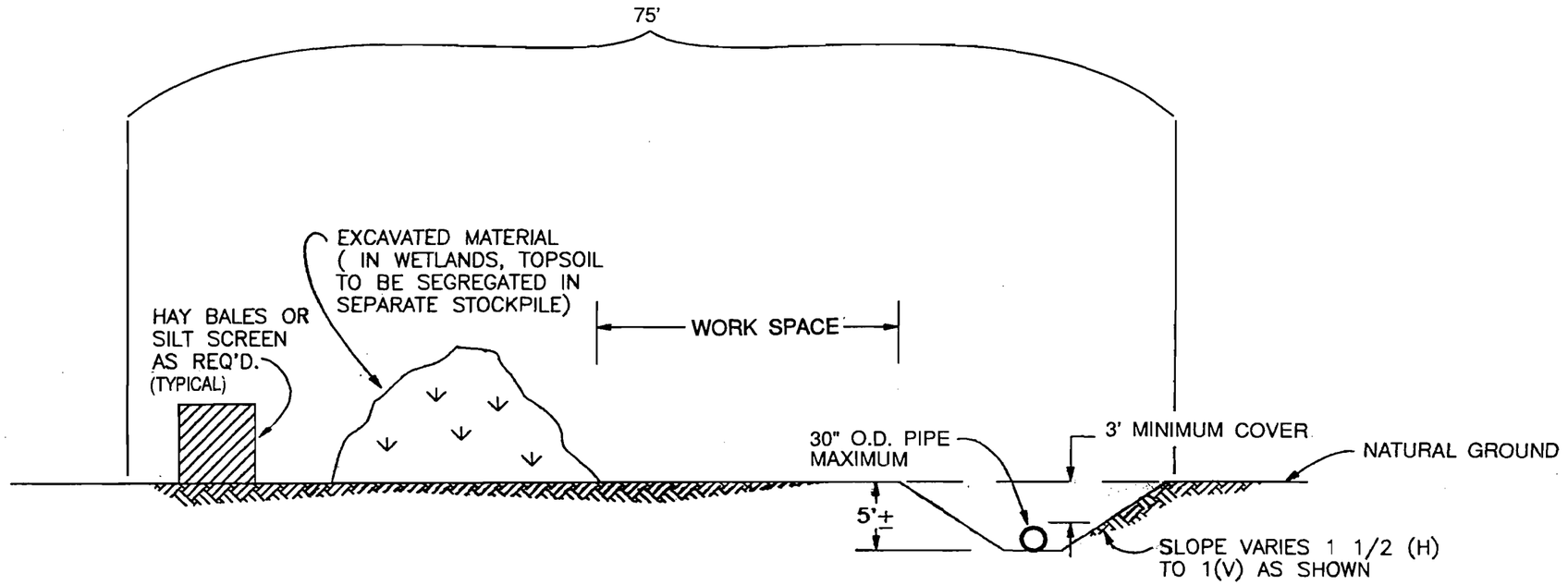


Florida Power CORPORATION

Polk County Site

FIGURE 6.2.7-1D

LAND USE AND VEGETATION PREFERRED CORRIDOR
SHEET D



NOTE:

3' MINIMUM COVER SHOWN WILL BE 5' MINIMUM WHERE PIPELINE CROSSES STREAMS, CREEKS, OR ROADS.

NOT TO SCALE

Source: Ebasco Environmental, 1992

Florida Power CORPORATION
Polk County Site

FIGURE 6.2.8-1
TYPICAL CROSS-SECTION
NATURAL GAS PIPELINE DURING CONSTRUCTION

6.3 OTHER LINEAR FACILITIES

Currently, FPC is investigating the possibility of utilizing water and sewer lines from Fort Meade to serve the FPC power plant. Such lines, if they were to be used, would likely be routed and permitted by the City of Fort Meade. As a result, they are not discussed in this SCA.

The use of reclaimed water from the City of Bartow Sewage Treatment Plant (STP) for use as makeup to the power plant cooling pond is also being considered and may be incorporated into the initial phase of the project. As discussed in Section 3.5.1, the use of this water as makeup is expected to allow a one-for-one decrease in volume of groundwater withdrawal. A pipeline connecting the Bartow wastewater treatment system to the cooling pond system of the Polk County Site is presented in this application (Figure 6.3.0-1). Although the full extent of the reclaimed water pipeline corridor is shown in the figures in this section, FPC anticipates that the City of Bartow will determine the location of the pipeline from the STP to the southern City boundary. Thus, that portion of the reclaimed water pipeline corridor north of this boundary is shown on these figures for illustration purposes only. FPC is seeking to certify only that portion of the corridor from the Bartow municipal boundary south to the plant site.

6.3.1 Project Introduction

At the present time, the City of Bartow discharges its treated wastewater into the International Minerals & Chemical Corporation (IMC) settling pond (CS-10) associated with the IMC Clear Springs Mine. The mean flow of this discharge for 1991 has been estimated at 2.53 MGD. By 1998, it is estimated that the quantity will be on the order of 3 MGD, and by 2005 it may be on the order of 5 MGD.

The City of Bartow is presently planning to replace its existing STP with a new Sequencing Batch Reactor (SBR) type plant. The new plant is being sized for 4 MGD of flow, with capability of expansion to 5 MGD, as required. The new plant will be required to meet the following limits:

Biochemical Oxygen Demand (BOD_5)	20 mg/l
Total Suspended Solids (TSS)	20 mg/l
Total N	12 mg/l

Based on a flow rate of 5 MGD, a distance on the order of eight miles, and a static lift of about 70 feet, a 2-foot diameter pipe will be adequate. However, potential for future additions from other facilities may require up to a 3-foot diameter pipe. For this pipe, a permanent right-of-way width of about 26 feet will be adequate. This right-of-way will be established within the 1,000-foot wide corridor presented for certification.

6.3.2 Corridor Location and Layout

The corridor extends from the Bartow STP area, centered along Wabash Street, until it intersects the CSX rail line just east of U.S. Highway 17 (about 0.75 mile west of the Bartow STP, as shown on Figures 6.3.2-1A through 6.3.2-1C). The corridor then follows the rail line south for about 7 miles, the last 5 miles of which are collocated with an existing FPC 69 kV transmission line. The pipeline crosses U.S. Highway 17 via an underpass just south of Homeland, then extends westward about 1 mile to the site boundary. The pipeline continues westward until it reaches the easternmost end of N-16, the initial cooling pond parcel.

6.3.3 Reclaimed Water Pipeline and Road Design Characteristics

At this time, the pipeline design characteristics have not been finalized. It is expected that a nominal 2- to 4-foot diameter pipe (design velocity of 6 feet per second) will be adequate. The pipeline will likely be of concrete pipe or of comparable specifications.

6.3.4 Cost Projections

These costs would be determined by the City, but typical costs are expected to range from $800,000 to $1,600,000 dollars per mile, or from $7.2 million to $14.4 million total dollars (1995) for the approximate 9 miles of pipeline. Land acquisition costs are not included because it has not been determined whether land used will be under an easement or ownership.

6.3.5 Corridor Selection

No corridor selection process was undertaken because of the use of an existing railroad right-of-way and other existing linear features leading directly to the site. Inspection of the existing right-of-way and adjacent land uses resulted in a conclusion that minimal additional access is needed.

6.3.6 Socio-Political Environment of the Corridor Area

6.3.6.1 Governmental Jurisdictions

The proposed reclaimed water effluent pipeline runs from the City of Bartow STP, located in northeast Bartow near the Peace River, to the FPC Polk County Site. The pipeline begins within the City of Bartow and continues through unincorporated Polk County for the remainder of the corridor. Bartow is the only municipality located within 0.5 mile of the pipeline at any point. The pipeline passes through the unincorporated community of Homeland, as it follows U.S. 17 and the CSX railroad south from Bartow. FPC will be responsible for corridor certification from the southern boundary of the City of Bartow to the site.

The proposed corridor follows existing linear facilities (road, railroad or transmission line) for its entire length. Much of the area crossed has been disturbed by phosphate mining. Polk County owns two parks near Homeland which are within 0.5 mile of the pipeline corridor (Figures 6.3.6-1A and 6.3.6-1B). The County's IMC Peace River Park is a 640-acre regional park which is not yet developed. The second park is the 3-acre Homeland Historic and Pioneer Park. Both parks are discussed in Section 2.2.1 of the SCA. There are no state parks or other special features located within 0.5 mile of the corridor.

6.3.6.2 Zoning and Land Use Plans

POLK COUNTY FUTURE LAND USE

The Polk County Comprehensive Plan (Polk County BOCC, 1991) states that utilities, including water and sewer transmission, collection, and distribution facilities, are allowed in all land use classifications, subject to County approval.

Future land use categories crossed by the reclaimed water pipeline in unincorporated Polk County are illustrated in Figure 6.3.6-2. The pipeline crosses seven future land use categories on the County's 2010 Future Land Use map. The majority of the land use categories lie along U.S. 17, which the pipeline corridor follows south out of Bartow. The proposed corridor crosses Residential-Low and Linear Commercial Corridor land use categories as it leaves Bartow. Business-Park Center, Industrial, Agriculture/Residential-Rural, and Phosphate Mining categories are also crossed as the corridor runs along U.S. 17. All of the lands crossed by the

corridor, once it heads west from U.S. 17, are designated as Phosphate Mining in the County's plan.

The Polk County Comprehensive Plan established the Residential-Low (RL) land use category to provide for the low-density residential needs of its residents. These areas are characterized by single-family dwellings, duplexes, and small-scale multi-family units. Allowed land uses in this category include single-family units, duplexes, small-scale multi-family units, and family-care homes.

Lands designated as Business-Park Centers (BPCs) are intended to promote employment opportunities within the region through the establishment of various types of business parks, including office parks, light-industrial facilities, and mixed-use employment parks. These centers may contain minor commercial facilities and wholesale facilities which support other businesses located in the BPC. These areas should be located at the intersections of arterial roads but are not intended to accommodate major commercial or other similar high-traffic producing facilities.

The plan describes Phosphate Mining (PM) areas as those areas with existing or proposed phosphate mining operations, and non-reclaimed mined lands. The corridor mainly crosses phosphate lands which have been mined. The plan states that construction, operation and maintenance of uses ancillary to electric power generation facilities are permitted within this land use category.

The Agricultural/Residential-Rural (A/RR) category is designed to encourage the continuation of productive agricultural uses and to provide for low-density residential development within unincorporated rural areas of the County. The A/RR designation allows farm labor residential uses, utility structures associated with farm operations, and residential uses, including low-density single-family homes (one unit per 5 acres), Rural Residential Developments (RRD), and Rural Mixed-Use Developments (RMD). Residential densities allowed in RRDs are 2.5 units per gross acre while the density is limited to two dwelling units per acre for the RMDs.

Sites and facilities which are accessible to the general public and which are oriented toward providing recreation services are designated as Recreation and Open Space (ROS). County-owned or County-maintained open spaces, community and regional parks, and facilities and services associated with these parks, make up the majority of this category. A portion of this

land use category, corresponding to Polk County's Peace River Park, is included in the proposed corridor as it travels south along U.S. 17.

The Future Land Use Element states that lands classified in the Industrial (IND) future land use category are characterized by facilities for the processing, fabrication, manufacturing, recycling and distribution of goods. Uses found within the BPC are also permitted in the IND category. Industrial development is to be located within developed areas unless the nature of the industrial activity requires a rural setting. Factors to be taken into consideration on establishing these areas include accessibility to transportation facilities, nearness to incompatible land uses, and environmental factors. Commercial development may be allowed in this land use category, provided that the development is limited to providing service to employees and visitors of the industrial developments. Rural-Cluster Centers (RCC) are designed to allow for retail and service establishments to serve the needs of surrounding rural residents. The Institutional (INST) land use category includes educational facilities, government administration buildings, public safety structures, cultural facilities, and health care facilities. The area designated as Institutional on the map of the wastewater effluent pipeline corridor contains the City of Bartow waste water treatment plant where the pipeline begins.

POLK COUNTY ZONING

The Polk County zoning designations included in the pipeline corridor are shown on Figures 6.3.6-3A and 6.3.6-3B and listed below (Polk County BOCC, 1983). The corridor runs parallel to U.S. 17 from Bartow south to the Pembroke area. Most of the zoning districts are encountered along this portion of the corridor. Once the corridor leaves U.S. 17 and heads west toward the Polk County Site, the only zoning district crossed is Rural Conservation (RC).

The zoning districts crossed by the pipeline in Polk County include:

- General Industrial District (GI)
- Rural Conservation District (RC)
- Commercial District - Regional Commercial (C-3)
- Commercial District - Heavy Commercial (C-4)
- Single Family District (SF-1M)

- Single Family District (SF-3M)
- Residence District (R-2)
- Residence District (R-3)
- Preservation Area (PA)

Water and wastewater transmission lines are defined as Class I Essential Services in the Polk County Zoning Ordinance. Class I Essential Services are allowed as permitted uses in all of the zoning districts crossed by the pipeline.

6.3.6.3 Easements, Title, Agency Works

When crossings of state roads are made, they must conform to the specifications outlined in FDOT's Utility Accommodation Guide (FDOT, 1990). State roads to be crossed by the pipeline include U.S. 17/98 and SR 60. Approval for crossing state roads and CR 640 will be obtained through the site certification process. It is anticipated that the reclaimed water line will pass under U.S. 17 south of Homeland at the same location the CSX railroad passes under U.S. 17. No other easements, title, or agency works permits are expected to be required.

6.3.6.4 Vicinity Scenic, Cultural and Natural Landmarks

The pipeline corridor follows U.S. 17 and the CSX railroad south from Bartow. Once the corridor heads west from U.S. 17, it passes primarily through lands which have been disturbed by phosphate mining. No scenic, cultural, or natural landmarks are found in the vicinity of the wastewater pipeline corridor in Polk County.

6.3.6.5 Archaeological and Historic Sites

The corridor crosses primarily through lands that have been disturbed by phosphate mining. In addition, the corridor follows existing linear facilities, such as other water pipelines, transmission lines, and roads throughout its entire length. The DHR issued a letter dated July 21, 1992 stating that no archaeological or historical sites are recorded, or are likely to be present, within the proposed corridor (Appendix 10.5.2).

6.3.7 Bio-Physical Environment of the Corridor Area

6.3.7.1 Land Use/Vegetation

Land use and vegetation of the preferred corridor (south of the City of Bartow) and its vicinity are presented on Figure 6.3.7-1. Mapped information is labeled using the FLUCCS system (FDOT, 1985). Aerial photographs (scale 1:12,000) showing the preferred corridor and the area extending 0.5 mile from each corridor edge are presented on Figure 6.3.2-1.

The corridor is located primarily in lands that are, or have been, used for phosphate mining. Other existing land uses within one-half mile of the corridor include vacant, undeveloped lands and some low density residential uses.

Vegetation communities found in the corridor are similar to those which are described in Section 2.3.5 and shown on Figures 6.3.7-1A and 6.3.7-1B.

6.3.7.2 Affected Waters and Wetlands

The preferred corridor alignment was selected, in part, to minimize impacts to water bodies and wetlands. The corridor crosses a series of small wetlands disturbed by mining operations and roadside ditches. It also crosses the Camp Meeting Ground Branch twice west of U.S Highway 17/98.

6.3.7.3 Ecology

This section presents a discussion of the corridor status of species identified as threatened or endangered, or species of special concern by the U.S. Fish and Wildlife Service, FGFWFC, and Florida Department of Agriculture and Consumer Services. Section 2.3.6 includes a discussion of those species afforded special protection which potentially occur in Polk County and surrounding counties and which can occur at the project site. Plant and animal species status listed in that section (Tables 2.3.6-9 and 2.3.6-10) also apply to the reclaimed water pipeline corridor. Vegetation community types occurring in the corridor are similar to those occurring at the Polk County Site or which would occur at the site with existing reclamation plans implemented.

The probability of occurrence of threatened and endangered species in the preferred corridor is based on discussions with agency personnel and observations by project ecologists. There are no records of nesting or breeding occurrences in the corridor or its vicinity for any threatened or endangered animals (FNAI, 1992). Because vertebrates are mobile, their movements and activity patterns may take them into appropriate habitats within the corridor. A variety of wading birds, for example, have been observed feeding in the corridor. The corridor is not known to include habitats critical for the support of a population of threatened or endangered species or species of special concern.

6.3.7.4 Other Environmental Features

No other biophysical features have been identified which are to be included in this Application.

6.3.8 Effects of Right-of-Way Preparation and Pipeline Construction

6.3.8.1 Construction Techniques

Where pipeline construction will take place, the following tasks may be undertaken. Pipeline construction activities differ slightly from pipeline to pipeline, but generally include the following which are described in more detail below:

- Surveying/staking the center line and right-of-way
- Right-of-way preparation
- Ditching/trenching
- Stringing of the line pipe
- Backfilling

SURVEY

Following right-of-way selection and acquisition, the entire route will be surveyed. The centerline of the pipeline right-of-way will be marked at about 200-foot intervals.

RIGHT-OF-WAY CLEARING, GRUBBING, AND EXCAVATION

Within the right-of-way staked by the surveying crew, the contractor personnel will clear the terrain to provide a work platform or working strip allowing unimpeded progress of the construction activities.

The right-of-way will first be cleared of brush and timber in accordance with the contract specifications and any permit or regulatory limitations. The stumps will be grubbed and all materials cleared will be disposed of in a manner consistent with the construction permits and applicable state and local requirements. This may include burial on-site, burning, or hauling off-site. Generally, machetes, chain saws, bulldozers, backhoes, and trucks are the tools and equipment used during that operation.

Next, the top soil layer within the right-of-way will be stripped with a dozer or grader and bermed to one side of the working strip. The top soil will be saved to eventually be spread back over the stripped area during restoration of the right-of-way.

The work platform is then graded to provide smooth access to all equipment used in the following phases of construction.

TRENCH CONSTRUCTION

This operation is called ditching and can be performed in a number of ways, based on the local conditions of the area crossed by the line. The two criteria in selecting a ditching method are the depth of the trench and the soil conditions.

The depth of the ditch shown on the construction drawings or set by the project specification is established as a function of:

- The diameter of line pipe
- The cover requirements, or depth of backfill over the pipe
- The need for placement of select fill under the pipeline in the ditch bottom
- Special conditions such as crossing of other buried structures such as pipes, cables, etc.

For this pipeline, except in rocky areas if any are crossed along the route, the minimum depth of cover will be 30 inches in undeveloped sections of the route and 36 inches along inhabited areas. The total depth of the trench will thus be 6 to 9 feet.

Backhoes offer the largest range of application in ditching, but their use is also limited in rock. Backhoes however can excavate rock from a trench after it has been ripped by a dozer or blasted with explosives.

Ditching for conventional drainage ditch crossings can be accomplished with backhoes or draglines. The choice of equipment will depend on the size of the ditch, water depth and current velocity, make-up of the channel bed, and required trench depth. Where it is important to control the water turbidity or to limit its increase as a result of construction activities, various methods are available as a function of site-specific conditions. For small ditches, siltation barriers can be installed immediately downstream of the crossing. These siltation barriers consist of suspended fabric and/or hay bales.

PIPE INSTALLATION

Pipe installation, known as stringing pipe, is normally accomplished just after the ditch has been opened. It essentially sets up the work for the actual assembly of the pipeline. The pipes are laid at a slight angle from the ditch to allow for some overlap.

HIGHWAY AND RIVER CROSSINGS

To eliminate the disturbance to traffic or river systems caused by using the open cut method of trenching across a roadway, boring techniques have been developed. The operation consists of drilling a hole horizontally under the road or river bed while inserting a pipe in that hole. The minimum depth of cover between the top of the pipe and either the road surface or the river bottom of the adjacent ditches is regulated by the U.S. DOT and the county.

A boring machine is generally a motor-driven auger equipped with a control panel and is mounted on a frame designed to straddle a pipe. A winch or hydraulic jacks provide the force applied to the auger and the pipe for their horizontal progress.

BACKFILLING

Care is taken to return the excavated soils to their original location, especially the top soil. Special precautions and measures will be taken in wetland areas to either prevent excavation of the hard pan or, where the hard pan must be penetrated, to restore its integrity to preserve the wetland.

6.3.8.2 Impact on Water Bodies and Uses

FPC will provide detailed information on dredging and filling (locations and volumes) to FDER after the preferred corridor is certified, when the right-of-way location is confirmed and engineering is completed. Permanent access roads will not be needed. Temporary culverts may be needed when crossing the man-made ditches and drainages along the right-of-way. This will be done to prevent excessive flow velocities and ponding. Following construction, the culverts will be removed and the drainages restored to pre-construction configurations. The need for culverts and fill will be minimized by using existing roads for access, where possible.

Locally, vegetation will be disturbed by the construction of the pipeline. Disturbed areas will be allowed to revegetate naturally. Water quality will be maintained through the use of filtration devices, such as staked hay bales and fabric fences. All applicable FDER water quality standards will be met. Seeding and mulching will be used, as required, to control erosion on steep slopes, for example, along ditch banks. Construction may require dewatering, but such dewatering would be performed according to a pre-approved dewatering plan. The construction will not create any new connections to waters of the state.

Pipeline impacts of the corridor on water bodies and wetlands will be minimal. Existing runoff and drainage patterns will be maintained by construction techniques, culvert placement, and maximized use of existing access roads. Water quality will be maintained by appropriate clearing procedures and use of sediment and erosion control measures.

6.3.8.3 Solid Wastes

Construction solid wastes will be minimal and will be buried, burned in accordance with state and local regulations, or hauled off-site to an approved landfill.

6.3.8.4 Changes to Vegetation, Wildlife, and Aquatic Life

No significant permanent changes to animal and plant populations are expected. Most of the corridor is currently in road or railroad right-of-way, pasture, and other landcovers, as a result of the land being associated with phosphate mining. Following construction, vegetation in these open areas, including wetlands, will be allowed to return to its original condition and maintained in an early successional state.

6.3.8.5 Impact on Human Populations

All facilities of the pipeline installed in a state or county road right-of-way are to be designed and constructed in accordance with specifications outlined in FDOT's Utility Accommodation Guide, 1990. Construction would begin in 1995, and it is expected that it would take approximately 4 to 6 months to complete.

The pipeline corridor follows existing linear facilities through sparsely populated areas that have been dominated by the phosphate industry. The use of existing rights-of-way and the short duration of construction activities in any given location should minimize any inconvenience which might occur.

6.3.8.6 Impact on Regional Scenic, Cultural, and Natural Landmarks

There were no regional scenic, cultural, or natural landmarks identified within 0.5 mile of the pipeline corridor.

6.3.8.7 Impact on Archaeological and Historic Sites

According to DHR, it is unlikely that any significant archaeological or historic sites are located in the corridor. In the event that an unforeseen discovery of archaeological materials is made during construction, all activities with a potential to disturb those materials will be halted until an evaluation of their potential significance is made by a professional archaeologist. If the materials are determined to be significant, the DHR will be consulted to identify mitigative measures.

6.3.9 Post-Construction Impacts and Effects of Maintenance

6.3.9.1 Maintenance Techniques

The primary regular maintenance activity consists of a visual inspection of the right-of-way. These patrols can be carried out on foot, by vehicle where possible, or even from the air. These inspections ensure that no activity detrimental to the safety of the pipeline is taking place within or in the vicinity of the right-of-way and that the pipeline is not leaking. The inspection also verifies that no encroachment of the right-of-way is occurring.

The right-of-way will be mowed periodically to provide good visibility to patrols. Generally, no heavy vegetation will be allowed to reestablish along the route.

During the life of a pipeline, repairs that would involve heavy equipment and materials to be mobilized should not be necessary. If such repairs do become necessary, they would take place on an emergency basis and be of very short duration.

6.3.9.2 Right-of-Way Uses

The roots of trees and other large vegetation can cause damage to the pipe and, therefore, such vegetation will not be allowed within the right-of-way. Movement of heavy equipment over the pipeline should not be allowed indiscriminately either. Only machinery that will not be hazardous to the integrity of the pipeline can operate within the right-of-way.

Surface usage of the land for establishing lawns or grazing of animals is acceptable. Warning markers will identify the pipeline at regular intervals and remind owners along the right-of-way of its presence underground.

6.3.9.3 Changes in Species Populations

The right-of-way will include no above ground structures except for occasional warning signs. In a short time, ground cover over most of the land will be reestablished and indistinguishable from surrounding ground cover.

No threatened or endangered animals or species of special concern are known to require land occupied in the corridor. Locally, cattle grazing, mining activities, transmission line right-of-way maintenance, traffic and human activity render pipeline and surrounding habitat types poorly suited for habitation by such species. No known endangered plant populations occur in the corridor. For the above reasons, no measurable changes to populations of important species are expected as the result of right-of-way maintenance.

6.3.9.4 Effects of Public Access

The pipeline corridor follows existing linear facilities for nearly all of its length. No new access roads are to be constructed and public access to previously inaccessible areas is not expected to increase.

6.3.10 Other Post-Construction Effects

No other post construction effects are expected.

6.3.11 References

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DHR (Florida Department of State, Division of Historical Resources). 1992. Letter from George W. Percy, Director, DHR, Tallahassee, Florida to M. Tuttell, Moore/Bowers, Tampa, Florida. July 21, 1992.

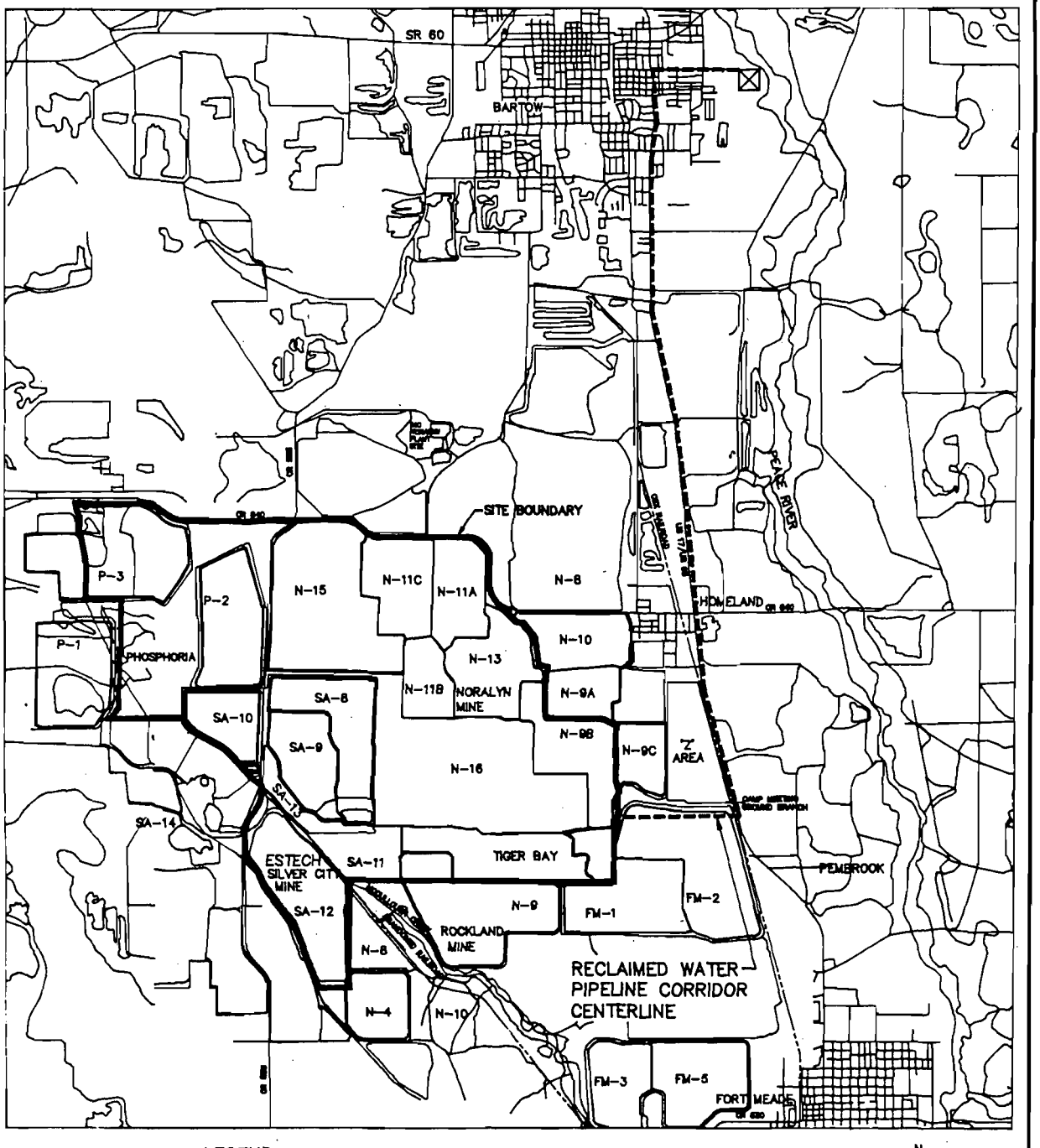
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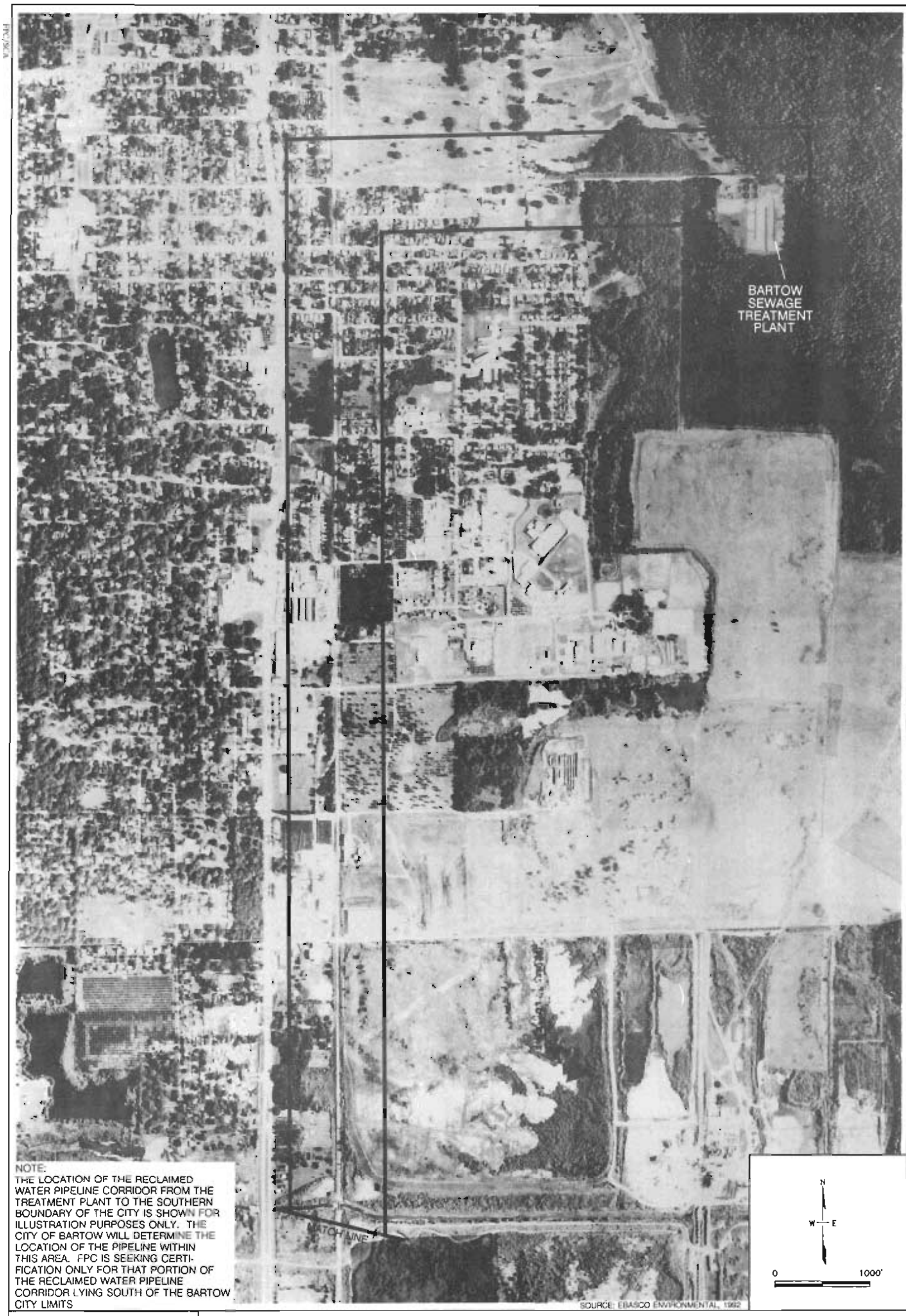


SOURCE: EBASCO ENVIRONMENTAL, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 6.3.0-1
RECLAIMED WATER PIPELINE CORRIDOR CENTERLINE LOCATION MAP



FPC Polk County Site

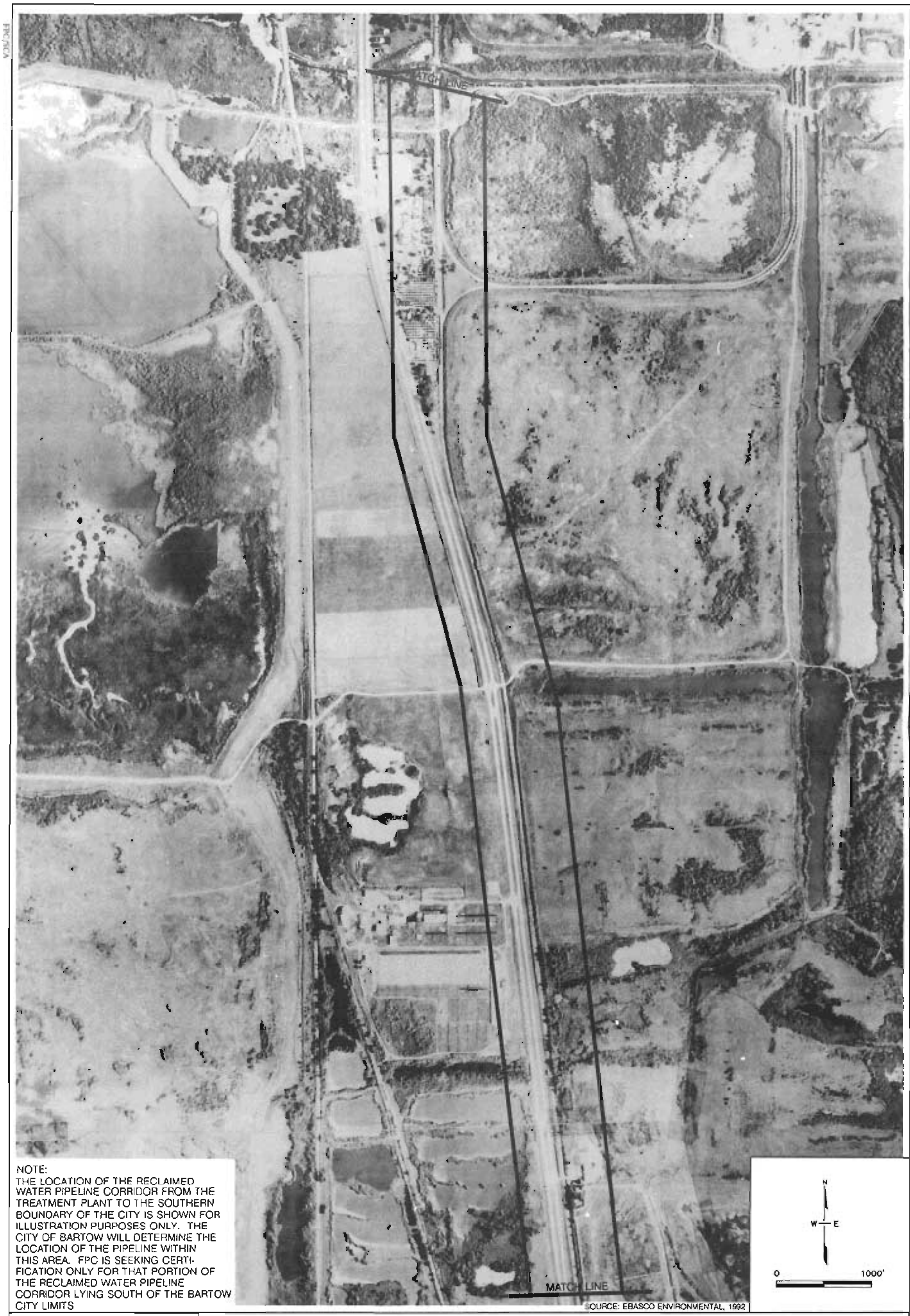
6.3-17

Florida Power CORPORATION

Polk County Site

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8/92

FIGURE 6.3.2-1A
BARTOW SEWAGE TREATMENT PLANT
RECLAIMED WATER PIPELINE CORRIDOR
SHEET A



NOTE:
THE LOCATION OF THE RECLAIMED WATER PIPELINE CORRIDOR FROM THE TREATMENT PLANT TO THE SOUTHERN BOUNDARY OF THE CITY IS SHOWN FOR ILLUSTRATION PURPOSES ONLY. THE CITY OF BARTOW WILL DETERMINE THE LOCATION OF THE PIPELINE WITHIN THIS AREA. FPC IS SEEKING CERTIFICATION ONLY FOR THAT PORTION OF THE RECLAIMED WATER PIPELINE CORRIDOR LYING SOUTH OF THE BARTOW CITY LIMITS

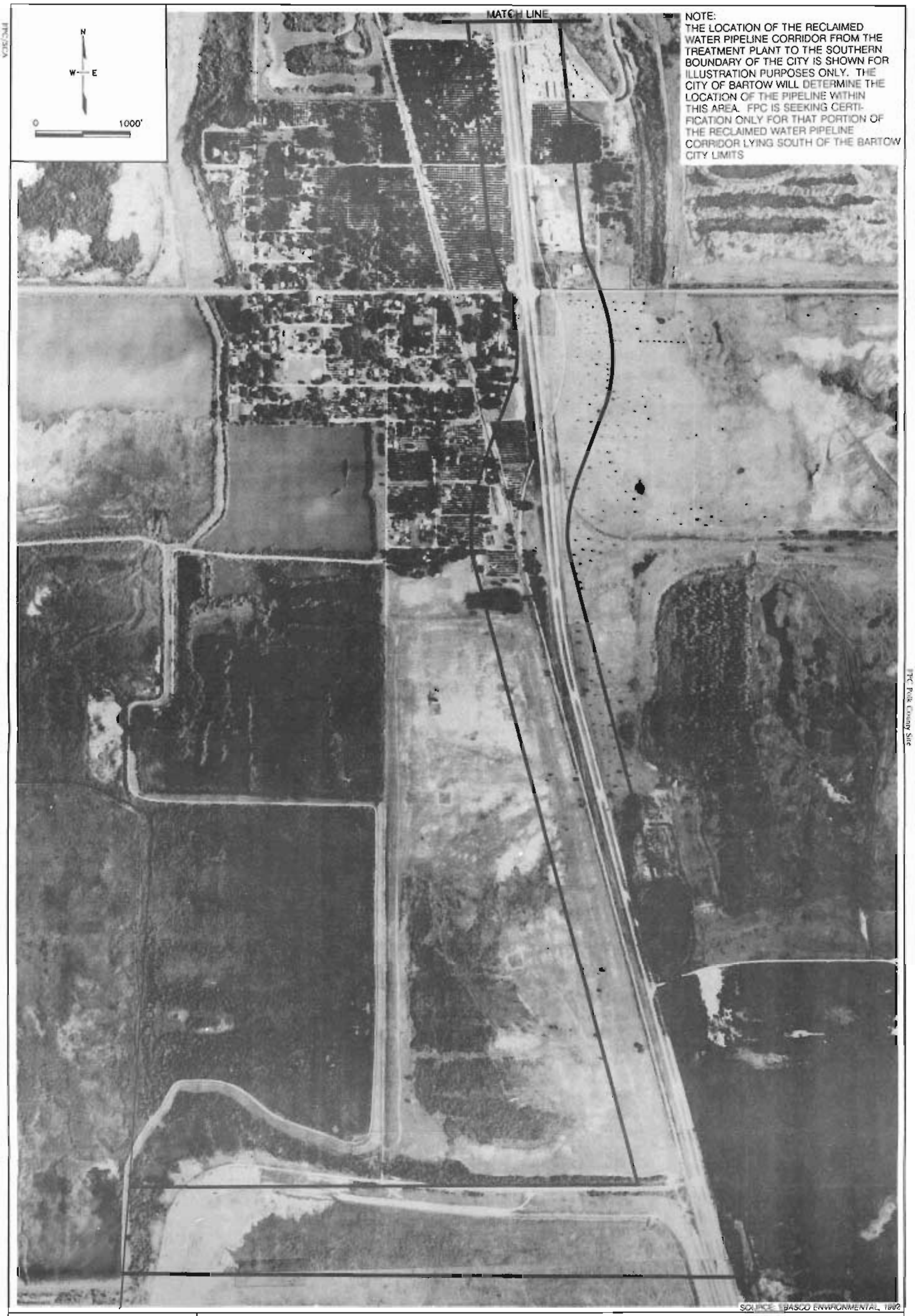
SOURCE: EBASCO ENVIRONMENTAL, 1992

Florida Power
CORPORATION

Polk County Site

FIGURE 6.3.2-1B
BARTOW SEWAGE TREATMENT PLANT
RECLAIMED WATER PIPELINE CORRIDOR
SHEET B

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FPC Polk County Site

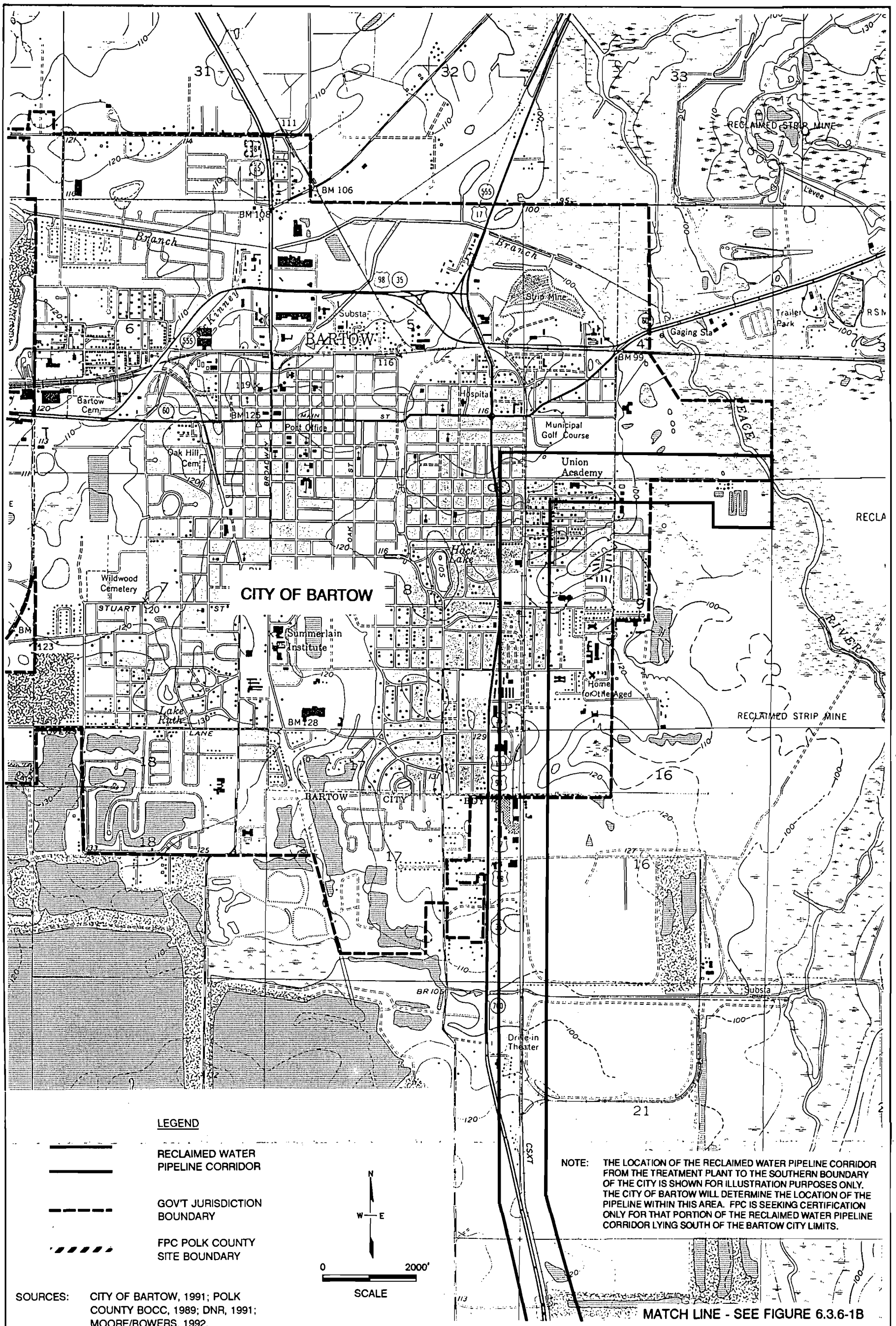
6.3-19

Florida Power CORPORATION

Polk County Site

Rev.0 8/92

FIGURE 6.3.2-1C
BARTOW SEWAGE TREATMENT PLANT
RECLAIMED WATER PIPELINE CORRIDOR
SHEET C



Florida Power CORPORATION

Polk County Site

FIGURE 6.3.6-1A
LOCAL GOVERNMENT JURISDICTIONS WITHIN 1/2 MILE OF THE RECLAIMED WATER PIPELINE CORRIDOR
SHEET A

MATCH LINE - SEE FIGURE 6.3.6-1A

RECLAIMED STRIP MINE

IMC/PEACE RIVER PARK

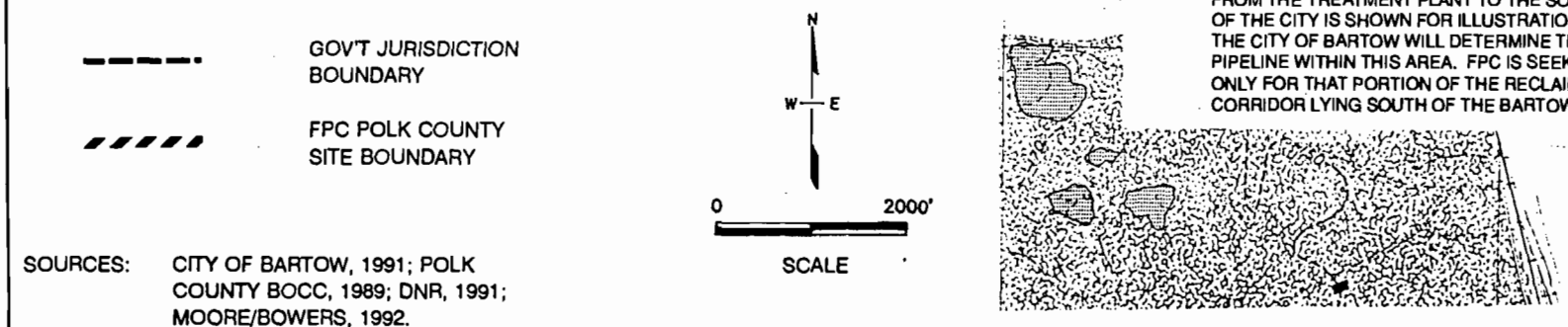
HOMELAND HISTORIC AND PIONEER PARK

Homeland

RECLAIMED STRIP MINE

RECLAIMED STRIP MINE

Pembro



NOTE: THE LOCATION OF THE RECLAIMED WATER PIPELINE CORRIDOR FROM THE TREATMENT PLANT TO THE SOUTHERN BOUNDARY OF THE CITY IS SHOWN FOR ILLUSTRATION PURPOSES ONLY. THE CITY OF BARTOW WILL DETERMINE THE LOCATION OF THE PIPELINE WITHIN THIS AREA. FPC IS SEEKING CERTIFICATION ONLY FOR THAT PORTION OF THE RECLAIMED WATER PIPELINE CORRIDOR LYING SOUTH OF THE BARTOW CITY LIMITS.

LEGEND

- RECLAIMED WATER PIPELINE CORRIDOR
- GOV'T JURISDICTION BOUNDARY
- FPC POLK COUNTY SITE BOUNDARY

N W E

0 2000'

SCALE

SOURCES: CITY OF BARTOW, 1991; POLK COUNTY BOCC, 1989; DNR, 1991; MOORE/BOWERS, 1992.

Florida Power CORPORATION

Polk County Site

FIGURE 6.3.6-1B
LOCAL GOVERNMENT JURISDICTIONS WITHIN 1/2 MILE OF THE RECLAIMED WATER PIPELINE CORRIDOR
SHEET B

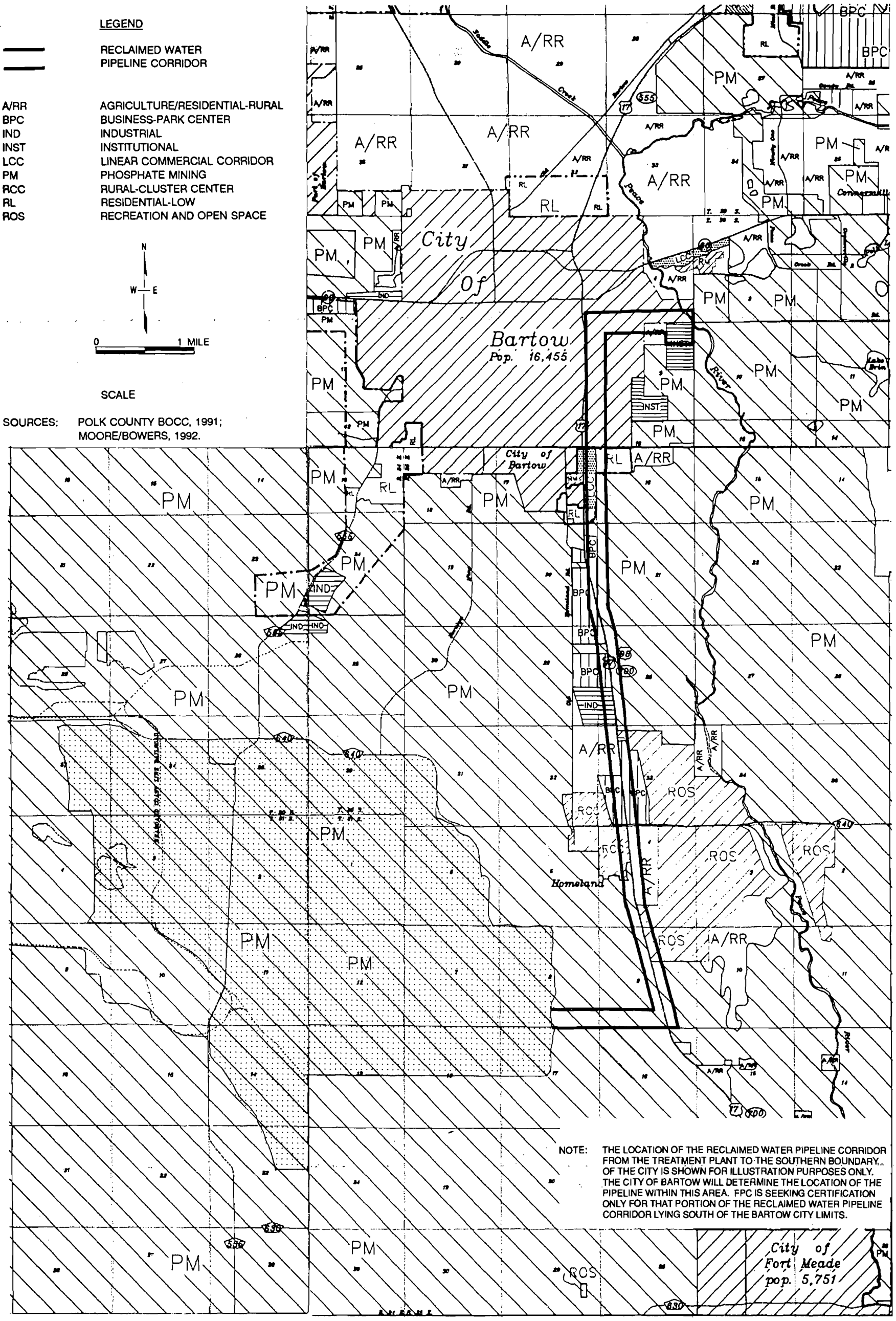
LEGEND

———	RECLAIMED WATER
———	PIPELINE CORRIDOR
A/RR	AGRICULTURE/RESIDENTIAL-RURAL
BPC	BUSINESS-PARK CENTER
IND	INDUSTRIAL
INST	INSTITUTIONAL
LCC	LINEAR COMMERCIAL CORRIDOR
PM	PHOSPHATE MINING
RCC	RURAL-CLUSTER CENTER
RL	RESIDENTIAL-LOW
ROS	RECREATION AND OPEN SPACE

N
W — E
0 1 MILE

SCALE

SOURCES: POLK COUNTY BOCC, 1991;
MOORE/BOWERS, 1992.

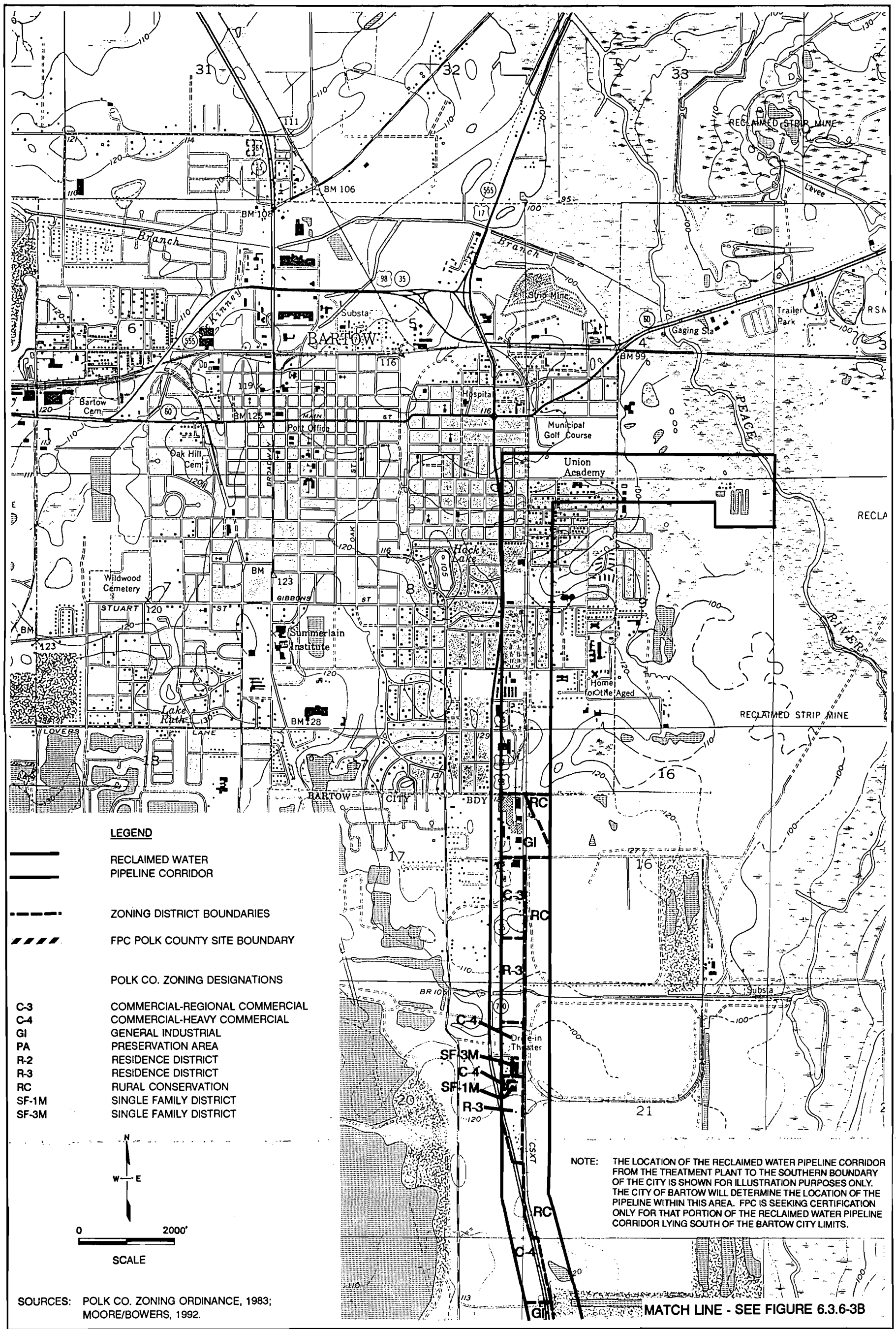


NOTE: THE LOCATION OF THE RECLAIMED WATER PIPELINE CORRIDOR FROM THE TREATMENT PLANT TO THE SOUTHERN BOUNDARY OF THE CITY IS SHOWN FOR ILLUSTRATION PURPOSES ONLY. THE CITY OF BARTOW WILL DETERMINE THE LOCATION OF THE PIPELINE WITHIN THIS AREA. FPC IS SEEKING CERTIFICATION ONLY FOR THAT PORTION OF THE RECLAIMED WATER PIPELINE CORRIDOR LYING SOUTH OF THE BARTOW CITY LIMITS.

Florida Power CORPORATION

Polk County Site

FIGURE 6.3.6-2
POLK COUNTY FUTURE LAND USE DESIGNATIONS WITHIN THE RECLAIMED WATER PIPELINE CORRIDOR



LEGEND

RECLAIMED WATER PIPELINE CORRIDOR

ZONING DISTRICT BOUNDARIES

FPC POLK COUNTY SITE BOUNDARY

POLK CO. ZONING DESIGNATIONS

C-3	COMMERCIAL-REGIONAL COMMERCIAL
C-4	COMMERCIAL-HEAVY COMMERCIAL
GI	GENERAL INDUSTRIAL
PA	PRESERVATION AREA
R-2	RESIDENCE DISTRICT
R-3	RESIDENCE DISTRICT
RC	RURAL CONSERVATION
SF-1M	SINGLE FAMILY DISTRICT
SF-3M	SINGLE FAMILY DISTRICT

N W E

0 2000'

SCALE

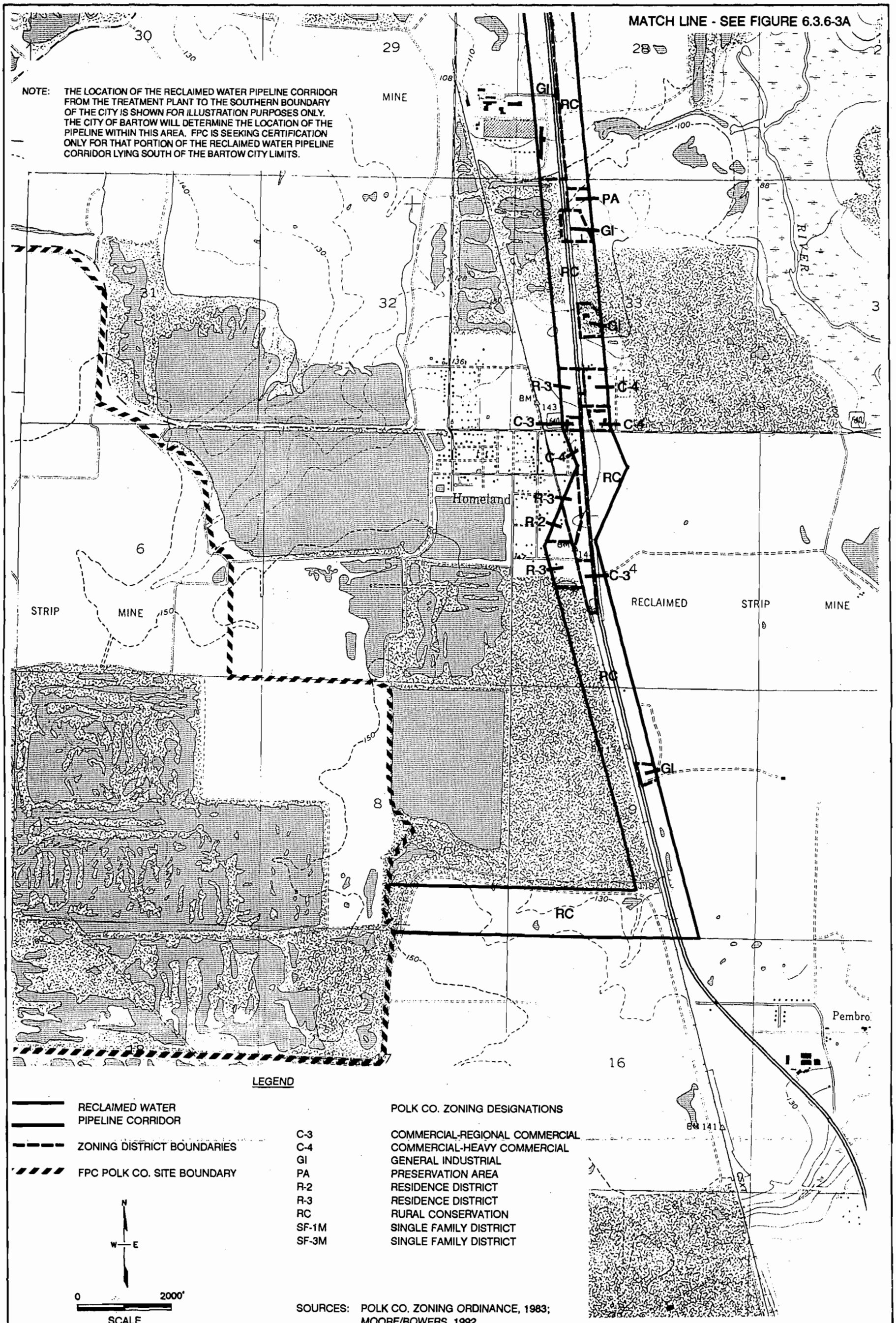
SOURCES: POLK CO. ZONING ORDINANCE, 1983; MOORE/BOWERS, 1992.

NOTE: THE LOCATION OF THE RECLAIMED WATER PIPELINE CORRIDOR FROM THE TREATMENT PLANT TO THE SOUTHERN BOUNDARY OF THE CITY IS SHOWN FOR ILLUSTRATION PURPOSES ONLY. THE CITY OF BARTOW WILL DETERMINE THE LOCATION OF THE PIPELINE WITHIN THIS AREA. FPC IS SEEKING CERTIFICATION ONLY FOR THAT PORTION OF THE RECLAIMED WATER PIPELINE CORRIDOR LYING SOUTH OF THE BARTOW CITY LIMITS.

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FIGURE 6.3.6-3A
POLK COUNTY ZONING DESIGNATIONS WITHIN THE RECLAIMED WATER PIPELINE CORRIDOR SHEET A



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Polk County Site

FIGURE 6.3.6-3B
POLK COUNTY ZONING DESIGNATIONS WITHIN THE RECLAIMED WATER PIPELINE CORRIDOR SHEET B

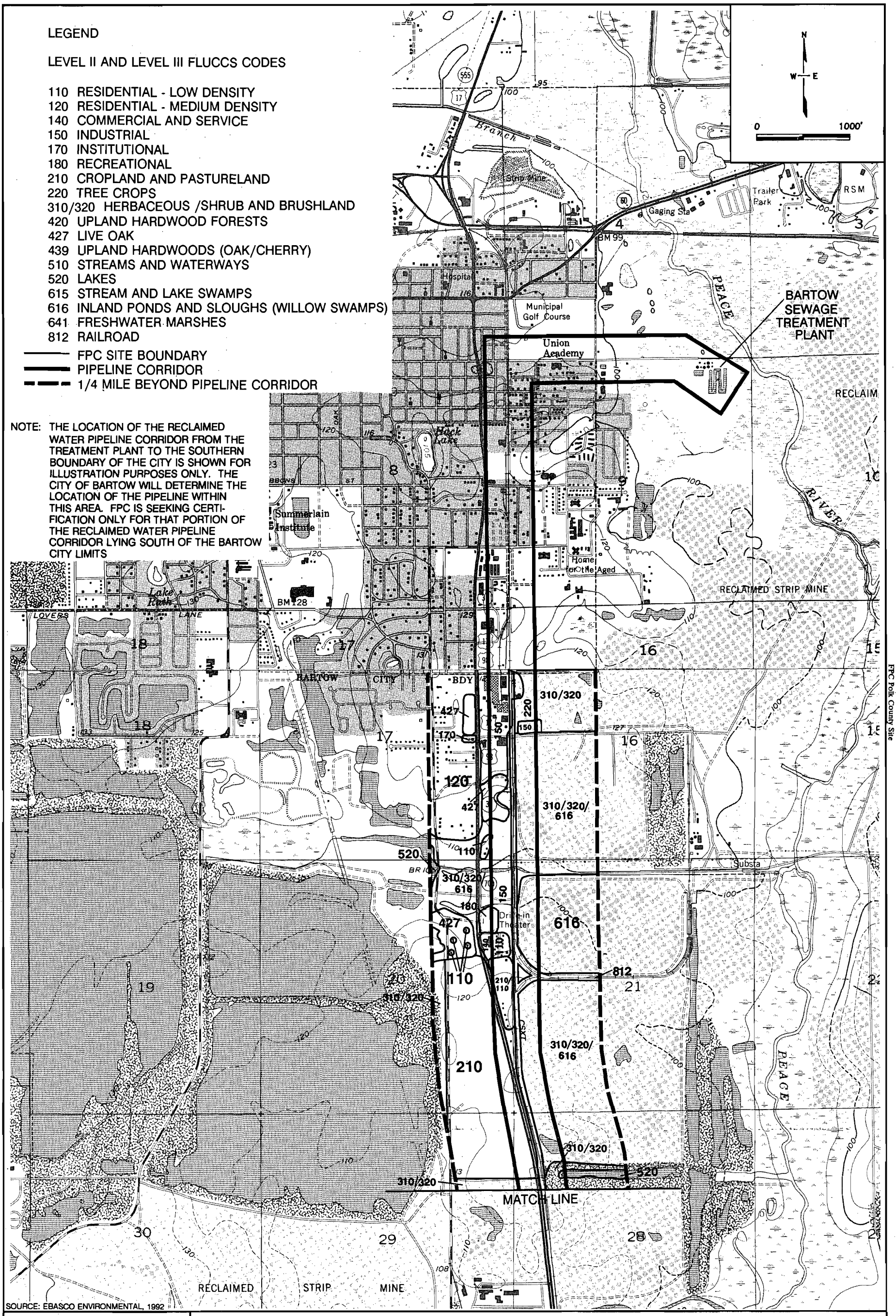
LEGEND

LEVEL II AND LEVEL III FLUCCS CODES

110 RESIDENTIAL - LOW DENSITY
120 RESIDENTIAL - MEDIUM DENSITY
140 COMMERCIAL AND SERVICE
150 INDUSTRIAL
170 INSTITUTIONAL
180 RECREATIONAL
210 CROPLAND AND PASTURELAND
220 TREE CROPS
310/320 HERBACEOUS /SHRUB AND BRUSHLAND
420 UPLAND HARDWOOD FORESTS
427 LIVE OAK
439 UPLAND HARDWOODS (OAK/CHERRY)
510 STREAMS AND WATERWAYS
520 LAKES
615 STREAM AND LAKE SWAMPS
616 INLAND PONDS AND SLOUGHS (WILLOW SWAMPS)
641 FRESHWATER MARSHES
812 RAILROAD

FPC SITE BOUNDARY
PIPELINE CORRIDOR
1/4 MILE BEYOND PIPELINE CORRIDOR

NOTE: THE LOCATION OF THE RECLAIMED WATER PIPELINE CORRIDOR FROM THE TREATMENT PLANT TO THE SOUTHERN BOUNDARY OF THE CITY IS SHOWN FOR ILLUSTRATION PURPOSES ONLY. THE CITY OF BARTOW WILL DETERMINE THE LOCATION OF THE PIPELINE WITHIN THIS AREA. FPC IS SEEKING CERTIFICATION ONLY FOR THAT PORTION OF THE RECLAIMED WATER PIPELINE CORRIDOR LYING SOUTH OF THE BARTOW CITY LIMITS



Florida Power CORPORATION

Polk County Site

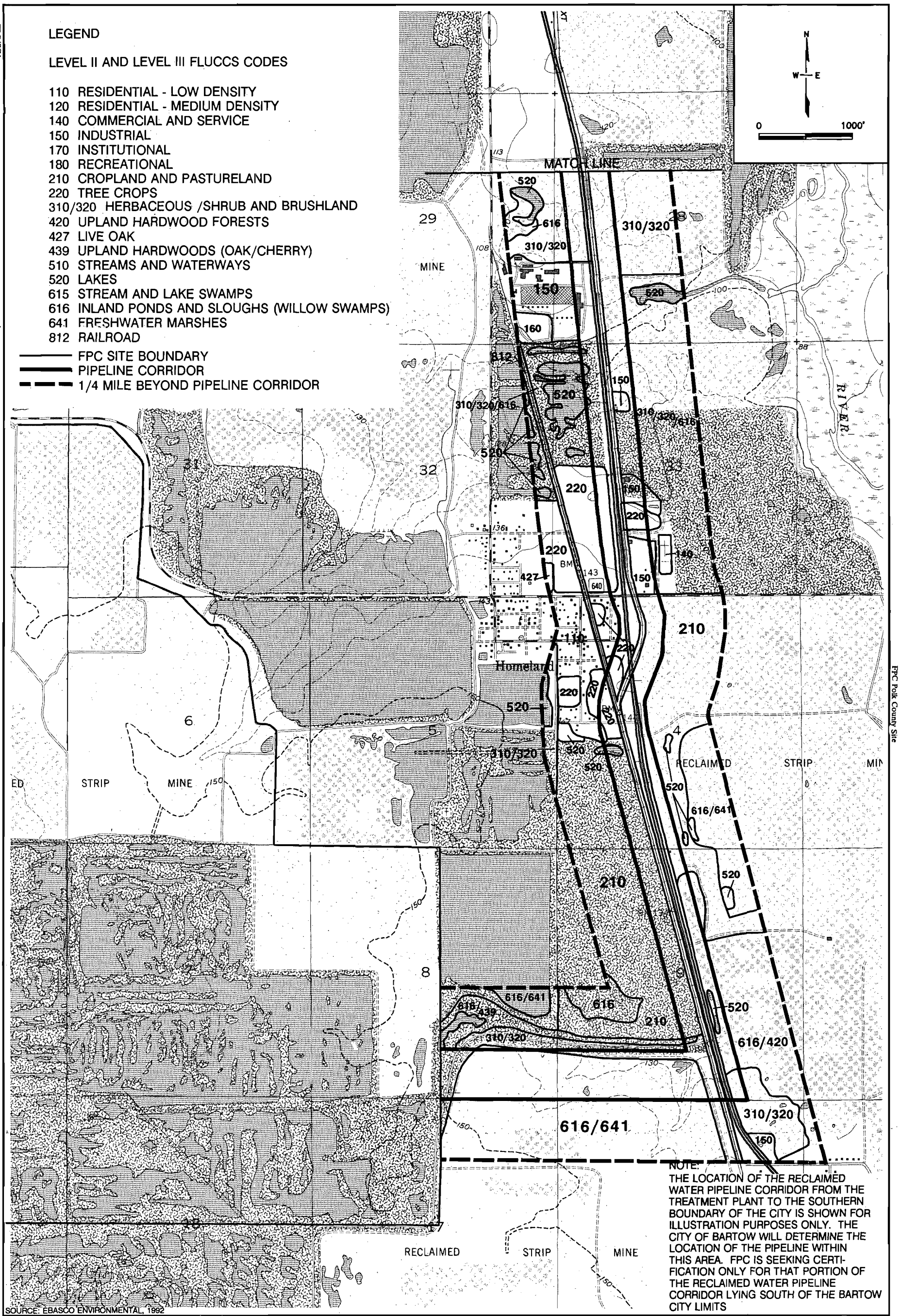
FIGURE 6.3.7-1A
LAND USE AND VEGETATION OF THE PREFERRED RECLAIMED WATER PIPELINE CORRIDOR AND AREA ONE QUARTER MILE BEYOND EACH EDGE OF CORRIDOR
SHEET A

LEGEND

LEVEL II AND LEVEL III FLUCCS CODES

110 RESIDENTIAL - LOW DENSITY
120 RESIDENTIAL - MEDIUM DENSITY
140 COMMERCIAL AND SERVICE
150 INDUSTRIAL
170 INSTITUTIONAL
180 RECREATIONAL
210 CROPLAND AND PASTURELAND
220 TREE CROPS
310/320 HERBACEOUS /SHRUB AND BRUSHLAND
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615 STREAM AND LAKE SWAMPS
616 INLAND PONDS AND SLOUGHS (WILLOW SWAMPS)
641 FRESHWATER MARSHES
812 RAILROAD

FPC SITE BOUNDARY
PIPELINE CORRIDOR
1/4 MILE BEYOND PIPELINE CORRIDOR



SOURCE: EBASCO ENVIRONMENTAL, 1992

NOTE:
THE LOCATION OF THE RECLAIMED WATER PIPELINE CORRIDOR FROM THE TREATMENT PLANT TO THE SOUTHERN BOUNDARY OF THE CITY IS SHOWN FOR ILLUSTRATION PURPOSES ONLY. THE CITY OF BARTOW WILL DETERMINE THE LOCATION OF THE PIPELINE WITHIN THIS AREA. FPC IS SEEKING CERTIFICATION ONLY FOR THAT PORTION OF THE RECLAIMED WATER PIPELINE CORRIDOR LYING SOUTH OF THE BARTOW CITY LIMITS

Florida Power CORPORATION

Polk County Site

FIGURE 6.3.7-1B
LAND USE AND VEGETATION OF THE PREFERRED RECLAIMED WATER PIPELINE CORRIDOR AND AREA ONE QUARTER MILE BEYOND EACH EDGE OF CORRIDOR
SHEET B

TABLE OF CONTENTS

CHAPTER 7

ECONOMIC AND SOCIAL EFFECTS OF PROJECT CONSTRUCTION AND OPERATION

Section/Title			Page
7.0	ECONOMIC AND SOCIAL EFFECTS OF PROJECT CONSTRUCTION AND OPERATION		7.0-1
	7.1 SOCIOECONOMIC BENEFITS		7.1-1
	7.2 SOCIOECONOMIC COSTS		7.2-1
	7.2.1	Temporary External Costs	7.2-1
	7.2.2	Long-Term External Costs	7.2-1
		7.2.2.1 Impact on Community Services	7.2-1
		7.2.2.2 Aesthetic and Scenic Values	7.2-2
	7.2.3	Long-Term Cost and Benefit Summary	7.2-4
	7.3 REFERENCES		7.3-1

LIST OF TABLES

Table/Title		Page
7.1.0-1	LOCAL PROPERTY TAX REVENUES	7.1-4
7.2.2-1	NET BENEFIT SUMMARY FOR POWER PLANTS AT COMPLETION	7.2-5

LIST OF FIGURES

Figure/Title		Page
7.1.0-1	OPERATIONS EMPLOYMENT ESTIMATES	7.1-5
7.1.0-2	OPERATING EMPLOYEE WAGES	7.1-6
7.1.0-3	LOCAL PROPERTY TAX REVENUES	7.1-7
7.2.2-1	PHOTOGRAPHIC SIMULATION OF PLANT FACILITIES	7.2-6
7.2.2-2	PHOTOGRAPHIC SIMULATION VIEWPOINT LOCATION	7.2-7

7.0 ECONOMIC AND SOCIAL EFFECTS OF PROJECT CONSTRUCTION AND OPERATION

Economic benefits will accrue to Polk County both from the construction and operation of the FPC Polk County Site. Construction benefits including increased employment and wages during the 25-year construction period have been presented in Section 4.10. Operation benefits will include increased employment, wages, property taxes, and direct purchases associated with the project. This chapter will present a discussion of the benefits and costs associated with operation of the project. So as not to overstate the economic benefits of the project, two operation scenarios will be examined. The first scenario will be the one in which the site is built out with all natural gas units (Case C). The other scenario will be the one in which natural gas units will be used at the site through 2010 and then coal gasification (CG) units will be constructed to complete the site (Case A). From the standpoint of socioeconomic benefits, Case A and Case B (which includes 2 PC units) are very similar. Case A (with CG units) represents the best case in terms of highest capital investment, so it was chosen for the analysis presented here.

7.1 SOCIOECONOMIC BENEFITS

The Polk County Site will provide a substantial net benefit to Polk County, both in terms of the large increase in property tax base that will occur, and the project's employment and payroll. The level of permanent employment provided will depend on the technology used for later phases of the project. This analysis will look at the benefits accruing to the County after construction of the ultimate site capacity is complete, which may occur in or about 2018. All revenues and costs are listed in 1991 dollars.

Increased employment and wages are the major benefits of the power plant project. Permanent employment resulting from natural gas-fired power plants is estimated at 100 persons at completion. These jobs would result in annual wages of $3.6 million. The coal gasification (CG) scenario (Case A) would result in employment of 510 persons at completion with annual wages of approximately $18 million (Figures 7.1.0-1 and 7.1.0-2). Since Polk County has historically had an unemployment rate higher than the state average, such employment will be beneficial.

In addition to the increase in direct employment at the site, the increased economic activity in the county will have a multiplier effect, resulting in the creation of jobs in related industries, such as maintenance, repair, construction, and utilities (e.g. water, sewer, gas, and electric), and in the service and retail sectors of the economy. Estimates of the indirect jobs created are based on multipliers developed specifically for Polk County by the U.S. Department of Commerce, Bureau of Economic Analysis. These multipliers are used to relate the amount of electricity sales generated by the new plants to the jobs created as the revenues circulate through the county's economy. The millions of dollars of sales generated will result in thousands of jobs throughout the county, primarily in industries closely related to electric utilities and retail and service businesses. The natural gas plant scenario would result indirectly in the creation of approximately 9,380 jobs in the Polk County economy, with wages of approximately $271 million. The CG scenario would result indirectly in the creation of approximately 9,300 jobs with wages of approximately $267 million.

The local property tax revenues resulting from construction of the power plants are illustrated on Figure 7.1.0-3 and listed in Table 7.1.0-1. These estimates are based on 1991 millage rates and take into account the exemption for pollution control equipment at the site. Annual property tax revenues for the natural gas-fired power plants are estimated to be $11.1 million for the

county and $13.3 million for the county school board by the year 2018. For the CG case, property taxes are estimated to be $19.8 million annually for the county and $23.8 million annually for the Polk County school system after 2018. An additional $22,950 in taxes would be paid annually to Fire District 2 by 2018. Property tax revenues to Southwest Florida Water Management District (SWFWMD) are not included in the local property tax revenues shown in Table 7.1.0-1. The natural gas scenario would result in SWFWMD tax revenues of $690,000 annually after 2018, while the CG scenario would result in revenues of $1.2 million annually.

In addition to the property tax revenues generated by the power plants, the county will receive property taxes from the plants' employees who move into Polk County and buy homes. Operation employment will include some positions which require skills not available in the local area. Other positions, especially administrative and maintenance positions, may be filled locally. It is expected that up to 45 percent of the positions can be filled locally, and that 55 to 60 percent of the positions are likely to be filled by people currently outside Polk County who would relocate to the area. The natural gas scenario would result in 100 employees or about 57 new households. Assuming the average household size for Polk County reported in the 1990 Census, 2.53 persons per household, the total population increase due to the new employees would be 144 persons. Assuming that each of the new households represents the purchase of an average priced house ($74,000), employees under the natural gas scenario would be expected to generate annual property taxes of $19,140 for the county and $22,935 for the school board, after 2018. Under the CG scenario, which results in an estimated 510 employees at completion, approximately 293 new households would be formed by plant employees. This would result in a total population increase of 741 persons. The CG scenario would generate annual property taxes of $101,964 for the county and $122,181 for the school board, after 2018. Fire district fees paid will depend on the location of the employees' houses. Polk County is divided into two fire districts. Since it is not known which fire district plant employees would live in, fire district fees are estimated based on the average of fees for Fire Districts 1 and 2.

Other revenues to Polk County will include sales taxes on operating supplies purchased by Florida Power Corporation (FPC) in the county, gasoline taxes, and other fees assessed against the project. Local purchases of materials and services are expected to be significant based on experience at other FPC facilities. For example, FPC's Crystal River Energy Complex, which includes four pulverized coal (PC) units and one nuclear unit, employs approximately 1,200 persons, and has a capacity of just over 3,000 megawatts (MW), purchases supplies and services from 232 companies located throughout Citrus County, including businesses in Inverness,

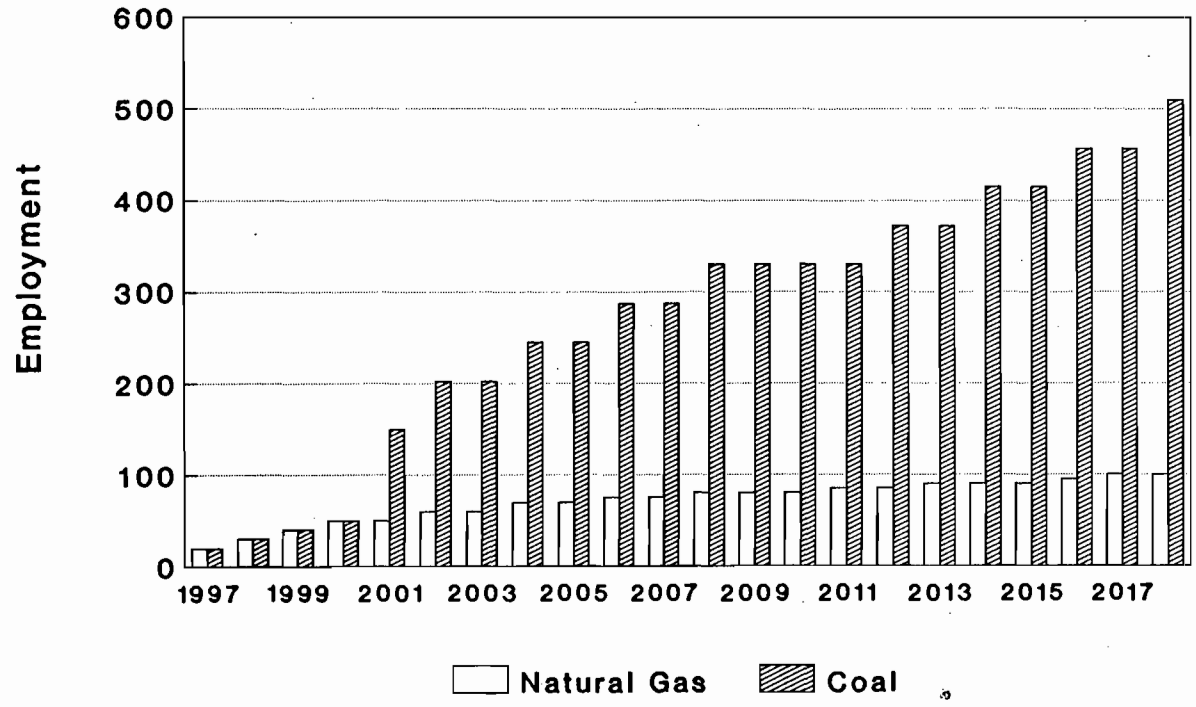
Homasassa, and Lecanto. FPC purchased $8.38 million in materials and services from these local companies in 1991.

TABLE 7.1.0-1
LOCAL PROPERTY TAX REVENUES

Year	Natural Gas Scenario	Coal Gasification Scenario
1994	0.37	0.37
1995	0.75	0.75
1996	1.26	1.26
1997	3.08	3.08
1998	5.47	5.47
1999	7.56	7.57
2000	8.5	8.52
2001	9.5	9.59
2002	10.38	10.53
2003	11.39	11.6
2004	11.92	12.2
2005	12.93	13.27
2006	13.83	14.23
2007	14.82	15.28
2008	15.37	21.52
2009	15.39	31.33
2010	15.72	28.48
2011	16.73	30.66
2012	17.63	32.14
2013	18.64	34.33
2014	19.53	35.94
2015	20.55	38.13
2016	21.70	40.05
2017	23.44	42.75
2018	24.43	43.63

Note: Revenues shown are in (million) 1991 dollars

Sources: FPC, 1992; Polk County Tax Collector, 1991; Moore/Bowers, 1992

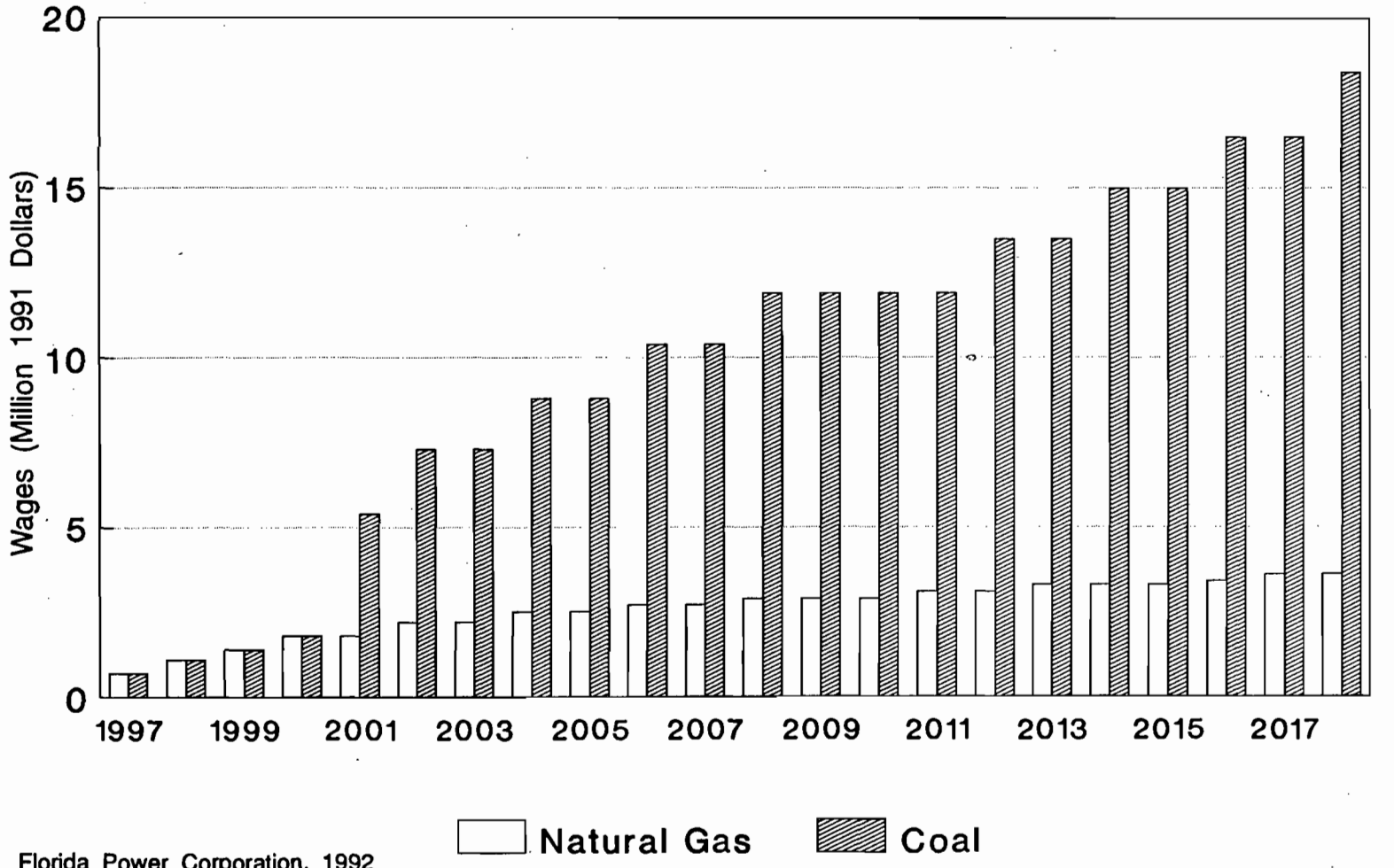


Sources: Florida Power Corporation, 1992
Moore/Bowers, 1992

Florida Power CORPORATION

Polk County Site

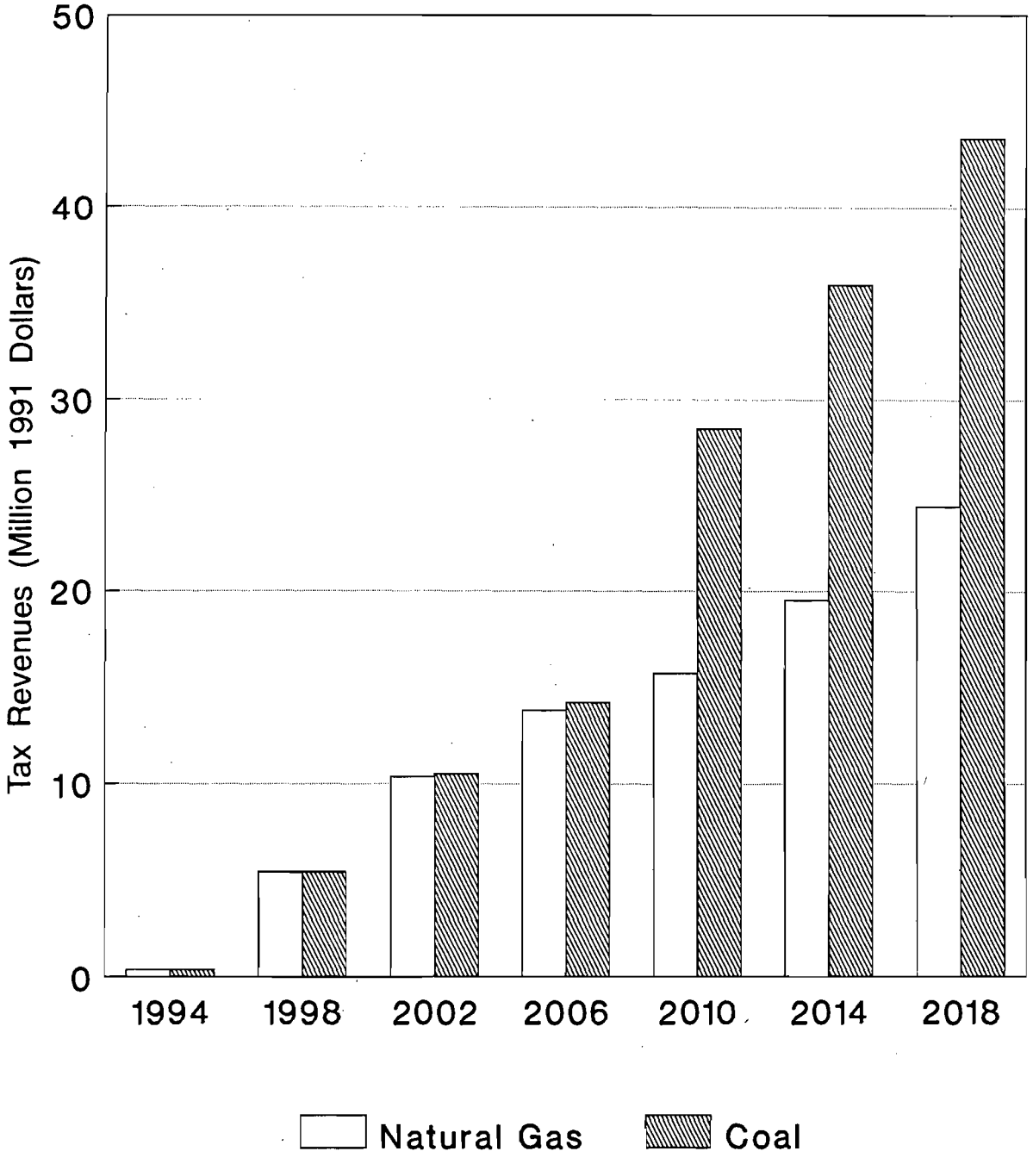
FIGURE 7.1.0-1
OPERATIONS EMPLOYMENT ESTIMATES



Sources: Florida Power Corporation, 1992
Moore/Bowers, 1992

Florida Power CORPORATION
Polk County Site

FIGURE 7.1.0-2
OPERATING EMPLOYEE WAGES



Sources: Florida Power Corporation, 1992
Polk County Tax Collector, 1991; Moore/Bowers, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 7.1.0-3
LOCAL PROPERTY TAX REVENUES

7.2 SOCIOECONOMIC COSTS

7.2.1 Temporary External Costs

The majority of the site construction workforce is expected to commute on a daily basis. As discussed in Section 4.6.2, the few construction workers who may relocate to the area are most likely to reside in metropolitan areas, such as Tampa or Lakeland, which have sufficient residential rental properties to serve a temporary construction workforce. The City of Fort Meade has expressed interest in promoting development in the City in order to meet the housing and service needs of the construction workforce during the construction period. Although there are only a limited number of residential rental properties available, properties have been zoned for multi-family development and have the utilities available in anticipation of an increase in housing demand. However, as discussed earlier, demands upon the City of Fort Meade from the construction workforce are expected to be minimal.

7.2.2 Long-Term External Costs

7.2.2.1 Impact On Community Services

The long-term socioeconomic costs associated with the project reflect the cost of providing services to the population which has moved into Polk County due to the project, i.e., the employees and their families (the impact population). The power plant site itself will make very minor use of community services. Long-term costs include government expenditures on utilities, public safety, health care, and other government services. A per capita method has been used to estimate these costs, which are expressed in 1991 dollars. The county's 1991-1992 budget reflects expenditures on general government, physical environment, recreation and culture, human services, transportation, internal services, and public safety. Information on education expenditures was obtained from the Polk County school board.

The total cost of services associated with the project's impact population is estimated at $123,764 annually for the natural gas scenario and $658,490 for the CG scenario. Educational expenditures represent 25 percent of the socioeconomic cost. Other significant costs are for public safety (emergency medical services, fire protection, police protection) and for physical environment (utilities, solid waste management, etc.). Public safety and physical environment expenditures each represent 19 percent of the socioeconomic cost. Human services, including

the county hospital, the county nursing home, and health services, represent 14 percent of the socioeconomic cost, and spending on general government, recreation and culture, transportation, and internal services represent the remaining 23 percent of the cost.

Education expenditures per student for 1991 in Polk County were $3,965, including both capital and operating expenditures. The Polk County school board reported that 10 percent of these expenditures were funded by the federal government, 65 percent by the state, and 25 percent by the county. Therefore, the cost to the county for educational services is estimated at approximately $991 per student. Based on an estimated 31 students, educational costs associated with the natural gas scenario total $30,729 annually, while the cost estimated for the CG scenario totals $162,524 for an estimated 164 students. Estimated per capita costs for other services, such as public safety, transportation, and human services, are listed in Table 7.2.2-1.

7.2.2.2 Aesthetic and Scenic Values

SITE LANDSCAPE DESCRIPTION

The Polk County Site is located in southwest Polk County, approximately 3.5 miles northwest of Fort Meade, 3 miles south of Bartow and about one mile southwest of Homeland. It is bounded by CR 640 on the north, a U.S. Agrichemical Company (USAC) mine and Camp Meeting Ground Branch on the south and southeast, and the Estech Silver City Mine and plant on the west. CR 555 runs through the site.

The site consists of approximately 8,000 acres which have been previously disturbed by, or are currently engaged in, phosphate mining activities. Most of the site consists of clay settling areas and mined-out areas. Elevated dams are located on the north boundary along CR 640 and, for a distance of about 2 miles, along the east side of CR 555. Currently, the only structures on the site are railroad tracks, the Agricola and Barcola Substations, and the 230kV and 138kV transmission lines which serve these substations. Tiger Bay, an area that has been reclaimed under Florida Department of Natural Resources (FDNR) mine reclamation requirements, will remain as part of the buffer area.

SURROUNDING LAND USES

The Polk County Site is located away from existing residential areas. Adjacent land uses consist entirely of phosphate mining, except for one mobile home on the corner of CR 555 and CR 640. The two nearest communities, Homeland and Fort Meade, are about 3.5 and 4.5 miles from the power block area, respectively. The cooling pond and buffer areas will be the areas closest to these communities. Three residences, located on CR 630 east of CR 555, are approximately 2.5 miles from the proposed power block area. The Elim Primitive Baptist Church, located on the west side of CR 555, is approximately 1.5 miles from the proposed power block.

PROPOSED DEVELOPMENT FEATURES

Under the pulverized coal (PC) development scenario (Case B), as shown on Figure 3.2.1-2, the Polk County Site will include eight 200 foot stacks, two 250 foot stacks, and two stacks that might be as tall as 625 feet above grade. Associated buildings and equipment are all expected to be less than 245 feet in height. The plant layout is in an east-west direction which reduces visual impact from CR 555, the nearest opportunity for viewing.

LINE-OF-SIGHT DETERMINATIONS

The purpose of this analysis was to determine key viewpoint areas where the proposed project would be seen, partially seen, and not seen. To determine these areas, line-of-sight drawings were prepared by establishing landscape control points. In order to determine the key viewpoints, the number of times the project will be observed, the duration of the view, the number of observers viewing the project, and the distance over which the project will be seen were considered. Aerial photographs were used as a data source for existing vegetation.

KEY VIEWPOINT ANALYSIS

In addition to traveler view points, nearby locations which may have a view of the project include some residences on CR 630, the churches located on CR 555, and a residence at the intersection of CR 555 and CR 640. Key viewpoints were determined based on analysis of available land use data and field observations. Prior to the field work, a copy of the project site plan was superimposed on a current aerial photograph of the site in order to locate key viewpoints. Field observations provided a photographically documented observer's image of the

project site and surroundings from the various key viewpoints. Selected photographs were used in assessing potential visual impacts of the proposed project on travelers along CR 555, CR 630 and CR 640.

The traveler's view from CR 555 south of the proposed site entrance drive was determined to be the worst case view and a visual simulation was prepared for that key viewpoint. Figure 7.2.2-1 is a photographic simulation of the view of the project to observers from the worst case viewpoint along CR 555. The simulation depicts existing conditions and vegetation with the addition of the power plant facilities. The existing transmission lines seen in the photograph are likely to be replaced with single pole structures carrying multiple circuits for the ultimate site development, and the Agricola Substation seen in the left side of the photograph may be removed in the future. In addition, the visible structures and the coal storage area are anticipated to be screened from view to a large extent along CR 555 upon maturity of a 100-feet wide landscape buffer as shown on Figures 3.2.1-3A, 3.2.1-3B and 3.2.1-3C. Once the buffer is in place, the view depicted in the simulation will be visible, primarily for northbound travelers, for only a short distance along CR 555. For northbound travelers traveling at the posted speed of 55 miles per hour along CR 555, it is estimated that the full plant development would be in view for less than two minutes. Figure 7.2.2-2 locates the position from which the original series of photographs were taken to prepare the simulation.

Finally, regardless of the view, the actual opportunities for viewing the facility while traveling along CR 555 are not expected to be substantial due to the low volume of traffic for non-plant based travelers, thus further minimizing potential for visual impact.

7.2.3 Long-Term Cost and Benefit Summary

Table 7.2.2-1 illustrates the net benefit resulting from the Polk County Site project at completion. Socioeconomic costs associated with the project are estimated at $123,764 annually for the natural gas scenario and $658,490 annually for the CG scenario, each after the year 2018. However, these costs will be outweighed greatly by the property taxes generated annually after construction of the power plants. The net fiscal benefit associated with the Polk County Site and the project's employees is estimated at over $24 million per year for the natural gas scenario and at over $43 million annually for the CG scenario.

TABLE 7.2.2-1
NET BENEFIT SUMMARY FOR
POWER PLANTS AT COMPLETION

		Natural Gas	Coal Gasification
REVENUES (1991 Dollars)			
Plant Property Taxes	County	$ 11,110,000	$ 19,840,000
	School Board	$ 13,320,000	$ 23,780,000
Employee Property Taxes	County	$ 19,140	$ 101,964
	School Board	$ 22,935	$ 122,181
Fire District Taxes	Plant[1]	$ 22,950	$ 22,950
	Employees[2]	$ 1,554	$ 8,277
Total Revenues		$ 24,496,579	$ 43,875,372
ESTIMATED EXPENDITURES[3] (1991 Dollars)			
General Government		$ 15,389	$ 82,036
Physical Environment		$ 23,702	$ 126,355
Recreation and Culture		$ 2,061	$ 10,989
Educational Services		$ 30,729	$ 162,524
Human Services		$ 17,640	$ 94,040
Transportation		$ 9,712	$ 51,774
Internal Services		$ 738	$ 3,935
Public Safety		$ 23,793	$ 126,837
Total Expenditures		$ 123,764	$ 658,490
NET BENEFIT		$ 24,372,815	$ 43,216,882

[1] Taxes based on estimated square footage of plant facilities.
[2] Taxes based on average of fees for Fire District 1 and Fire District 2.
[3] Expenditures estimated based on per capita method.

Sources: Polk County Office of Management & Budget, 1992
Polk County Tax Collector, 1991
Polk County School Board, 1991
Central Florida Economic Development Council, 1992
Moore/Bowers, 1992



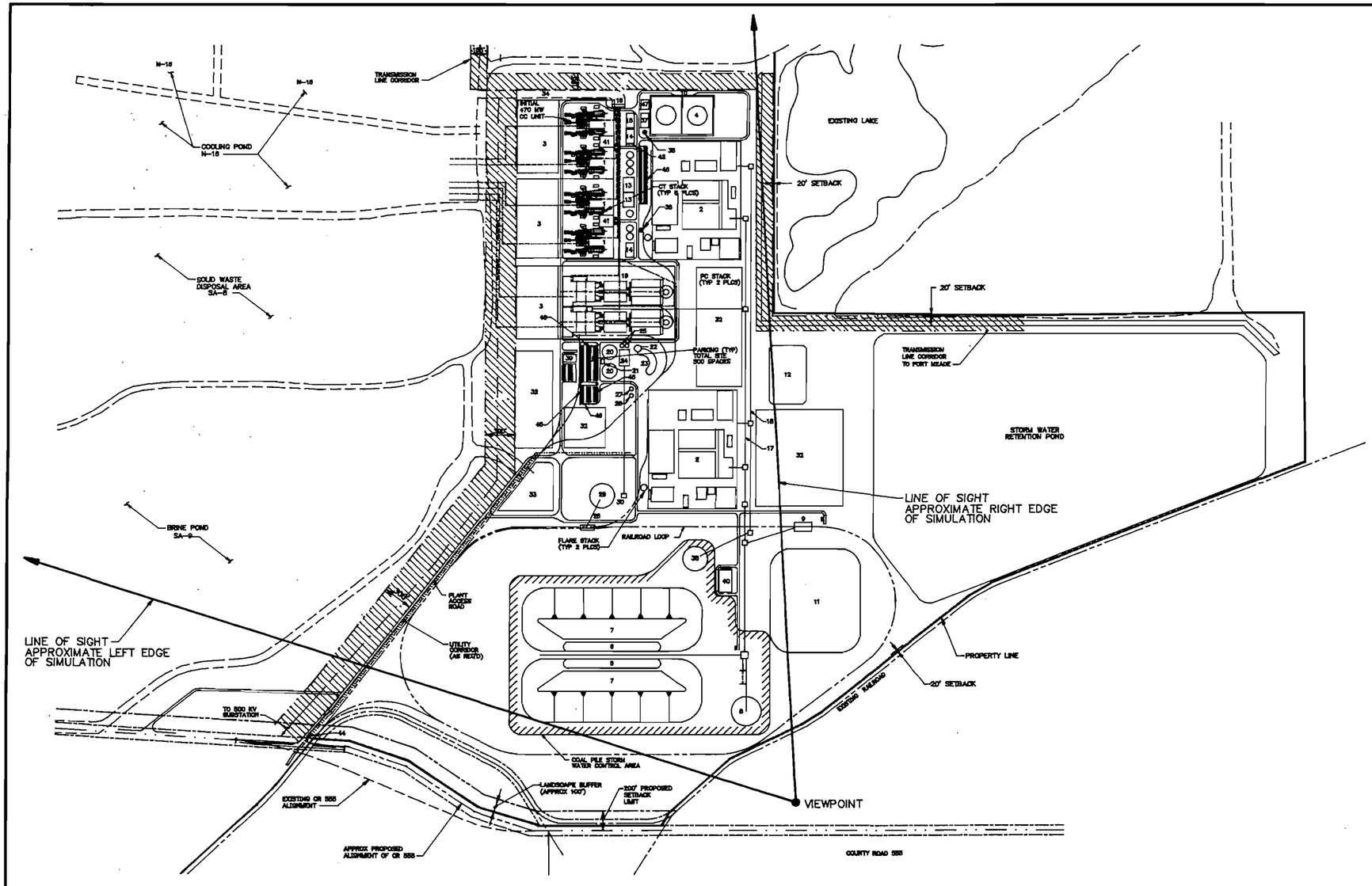
NOTE: VIEW LOOKING NORTHEAST FROM
CR 555 (SEE FIGURE 7.2.2-2).

SOURCES: BLACK & VEATCH, 1992; MOORE/BOWERS, 1992.

Florida Power CORPORATION
Polk County Site

FIGURE 7.2.2-1

PHOTOGRAPHIC SIMULATION OF PLANT FACILITIES



LEGEND

1. COMBUSTION TURBINE COMBINED CYCLE UNIT
2. GASIFICATION PLANT
3. SWITCHYARD
4. FUEL OIL TANKS AND CONTAINMENT
5. NOT USED
6. ACTIVE COAL PILE
7. COAL PILE STORAGE
8. EMERGENCY COAL STOCKOUT
9. COAL CAR UNLOADING FACILITY
10. FUEL UNLOADING FACILITY (TRUCK)
11. COAL RUNOFF POND
12. RECYCLE BASIN
13. WATER TREATMENT BUILDING
14. WAREHOUSE
15. MAINTENANCE SHOP
16. CIRCULATING WATER INTAKE STRUCTURE
17. COAL CONVEYOR
18. SLAG CONVEYOR
19. PC POWER MODULE
20. THICKENER
21. THICKENER BUILDING
22. EMERGENCY SLUDGE STOCKOUT
23. NORMAL SLUDGE STOCKOUT
24. SLUDGE CONDITIONING BUILDING
25. SCRUBBER ADDITIVE STORAGE TANKS
26. LIME STORAGE SILO
27. FLY ASH SILO
28. SCRUBBER ADDITIVE UNLOADING FACILITY
29. SCRUBBER ADDITIVE STOCKOUT
30. SCRUBBER ADDITIVE RECLAIM HOPPER
31. NOT USED
32. CONSTRUCTION LAYDOWN AREA
33. CONSTRUCTION PARKING AREA
34. CIRCULATING WATER INLET CHANNEL
35. WATER SUPPLY WELL 1
36. WATER SUPPLY WELL 2
37. SEWAGE TREATMENT PLANT
38. SLAG STOCKOUT
39. ADMINISTRATION BUILDING
40. YARD MAINTENANCE BUILDING
41. CC CONTROL/ADMIN BUILDING
42. VEHICULAR FUEL STORAGE
43. NOT USED
44. GUARDHOUSE
45. SCREEN FENCE
46. SECURITY FENCE
47. INITIAL CONSTRUCTION POWER FACILITIES

N E W

0 1200'

SOURCES: BLACK & VEATCH, 1992
MOORE/BOWERS, 1992

Florida Power CORPORATION

Polk County Site

FIGURE 7.2.2-2
PHOTOGRAPHIC SIMULATION VIEWPOINT LOCATION

7.3 REFERENCES

Central Florida Economic Development Council. 1992. Telephone conversation between Geoff Matthews, Bartow, Florida, and M. Tuttell, Moore/Bowers, Tampa, Florida. February 6, 1992.

City of Fort Meade, City Manager's Office. 1992. Telephone conversation between Charles Saddler, City Manager, Fort Meade, Florida, and M. Tuttell, Moore/Bowers, Tampa, Florida. January 23, 1992.

FDLES, Division of Labor, Employment and Training, Region V Office. 1992. Telephone conversation between Susan Peacock, Lakeland, Florida, and M. Tuttell, Moore/Bowers, Tampa, Florida. February 13, 1992.

Metric Construction Company, Hardee County Power Plant Site. 1992. Telephone conversation between Clinton Mayo, Paymaster, Hardee County, Florida, and M. Tuttell, Moore/Bowers, Tampa, Florida. February 3, 1992.

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Polk County Tax Collector. 1991. Telephone conversation between Tax Collector Staff, Bartow, Florida, and M. Tuttell, Moore/Bowers, Tampa, Florida. December 6, 1991.

U.S. Department of Commerce, Bureau of Economic Analysis. 1991. Economic Multipliers For Polk County (unpublished data), Washington D.C.

Urban Land Institute. 1975. Industrial Development Handbook, Washington, D.C.

TABLE OF CONTENTS

CHAPTER 8

Section/Title	Page
8.0 SITE AND DESIGN ALTERNATIVES	8.0-1

8.0 SITE AND DESIGN ALTERNATIVES

This optional chapter is not being submitted as part of the Site Certification Application because it is not anticipated that an Environmental Impact Statement required by the National Environmental Policy Act will be necessary for this project.

TABLE OF CONTENTS

CHAPTER 9

Section/Title		Page
9.0	COORDINATION	9.0-1

LIST OF TABLES

Table/Title		Page
9.0-1	FEDERAL, STATE, REGIONAL, AND LOCAL GOVERNMENT AGENCY CONTACTS (TWELVE PAGES)	9.0-2

9.0 COORDINATION

Table 9.0-1 presents a list of individuals within federal, state, regional, and local government agencies who were contacted to provide input to this project.

TABLE 9.0-1
FEDERAL, STATE, REGIONAL, AND LOCAL GOVERNMENT AGENCY CONTACTS

Date	Agency	Contact	Type of Contact	Subject	Project Representative
04/21/89	FDER	J. Shearer	Meeting	Site selection process	FPC
04/24/89	DCA	P. Bradshaw	Meeting	Site selection process	FPC
04/28/89	FDNR	D. Duden	Meeting	Site selection process	FPC
06/26/89	FDER	S. Smallwood	Meeting	Site selection process	FPC
07/19/89	FDER/DCA/FDNR/DOS/ FGFWFC/PSC/Governor's Office	H. Oven	Meeting	Site selection process	FPC
02/27/90	FDER	H. Oven	Meeting	Site selection process	FPC
11/20/90	FDNR	J. Craft	Meeting	Discussion of project at conceptual level	FPC
02/14/91	FDNR	J. Craft	Tour	Tour of Crystal River Energy Complex	FPC
03/18/91	FDER	H. Oven	Meeting	Project Status Review	FPC
03/18/91	FDNR	J. Bakker	Meeting	Project Status Review	FPC
06/03/91	CFRPC	B. Sodt	Meeting	Status of mining DRIs	MB
06/04/91	FDNR	J. Craft, J. Bakker	Meeting	Review of project site drawings and reclamation	FPC/D&M
06/07/91	SWFWMD	T. Abel	Meeting	Groundwater withdrawals	FPC/D&M
06/07/91	Polk County	D. Martin	Telephone	Comprehensive Plan language	MB
06/14/91	FDER	M. Linn, T. Eagan	Meeting	Air Monitoring Plan	FPC/EED
06/14/91	FDER	M. Linn, C. Holladay	Telephone	Air station meteorological modeling	EED

TABLE 9.0-1
FEDERAL, STATE, REGIONAL, AND LOCAL GOVERNMENT AGENCY CONTACTS

Date	Agency	Contact	Type of Contact	Subject	Project Representative
06/21/91	FDER	J. Smyth	Meeting	Access files for regulatory review	D&M
06/24/91	Polk County	D. Martin	Meeting	County Comprehensive Plan	FPC
06/25/91	FDER	B. Rodgers	Meeting	Access files for regulatory review	D&M
06/27/91	FDNR	S. Partney, R. Murphy	Telephone	Hydrologic modeling for McCullough Creek	D&M
07/10/91	Polk County	G. Daniels	Telephone	Traffic volume information	K-H
07/11/91	Polk County	G. Daniels	Telephone	Traffic volumes	K-H
07/11/91	FDOT	C. Cerepak	Telephone	Traffic volumes	K-H
07/16/91	FDNR	J. Bakker	Meeting	Regulatory procedures for modifications to Reclamation Conceptual Plans	FPC/D&M
07/23/91	FDER	H. Oven	Meeting	POS	FPC
08/13/91	SWFWMD	T. Abel, B. Wirth	Meeting	Water supply	FPC/EED/D&M
08/15/91	FDNR	C. Cooksey	Meeting	Reclamation rules and modifications	FPC/D&M
08/22/91	FDNR	J. Craft	Meeting	Reclamation Plans	FPC/D&M
08/27/91	FDER	H. Oven	Letter	Submittal of Draft POS	FPC
08/29/91	FDER	H. Oven	Letter	Submittal of Air Quality Monitoring Plan	FPC
08/30/91	FDNR	J. Bakker	Meeting	POS	FPC/EED/D&M
08/30/91	FDER	S. Palmer	Meeting	POS - Water issues	FPC/EED
08/30/91	FDER	J. Watts	Meeting	POS - QAPP	FPC/EED

TABLE 9.0-1
FEDERAL, STATE, REGIONAL, AND LOCAL GOVERNMENT AGENCY CONTACTS

Date	Agency	Contact	Type of Contact	Subject	Project Representative
09/04/91	FDER	H. Oven	Letter	SOQAP Submittal	FPC
09/05/91	FDER	H. Oven	Letter	Air quality modeling protocol	FPC
09/05/91	FDER	H. Oven	Letter	Submittal of Draft Air Quality Monitoring Plan	FPC
09/06/91	Polk County	D. Martin	Meeting	POS, CUP	FPC/EED/D&M/MB
09/06/91	CFRPC	D. Leonard	Meeting	POS	FPC/EED/D&M
09/09/91	FDER	M. Linn	Meeting	Air Monitoring Plan and Procedures Manual	FPC/EED
09/11/91	FDER	K. Colaw, R. Arbes	Meeting	Reviw of SOQAP comments from FDER	EED
09/12/91	FDER	H. Oven	Letter	Air Quality Monitoring Plan	FPC
09/12/91	FDNR	S. Partney, R. Murphy	Meeting	Reclamation strategy	D&M
09/13/91	FDNR	R. Murphy, G. Hendenon	Meeting	Technical aspects of reclamation	D&M
09/20/91	FDER	H. Oven	Letter	POS Submittal	FPC
09/23/91	FDER	G. Maier	Meeting	POS	FPC/EED
09/23/91	FDER	R. Arbes	Letter	EPA National Participation Program	FPC
09/25/91	FDER	R. Arbes	Letter	MET/AQ Program Monitoring Issues	FPC
10/01/91	FDER/DCA/FDNR/FGFWFC/ DOT/HRS	H. Oven	Meeting	Scoping of POS	FPC/EED/D&M
10/03/91	FDER	D. Stuart	Letter	Audit program for sulfur dioxide	EED
10/04/91	FDER	D. Stuart	Letter	MET/AQ Program Monitoring Issues	FPC

TABLE 9.0-1
FEDERAL, STATE, REGIONAL, AND LOCAL GOVERNMENT AGENCY CONTACTS

Date	Agency	Contact	Type of Contact	Subject	Project Representative
10/08/91	FDER	S. Palmer	Letter	QAPP Submittal	FPC
10/08/91	FDER	J. May	Site visit	Site visit	FPC
10/10/91	FDER	H. Oven	Letter	Notice of Intent to File SCA	FPC
10/14/91	Hillsborough County	F. Karl	Letter	POS Submittal	FPC
10/17/91	FGFWFC	T. King	Meeting	Wildlife aspects of project	FPC/EED
10/21/91	FDNR	J. Bakker	Meeting	Conceptual plan modifications and wildlife/environmental benefits	FPC/EED/D&M
10/25/91	FDER	D. Stuart	Letter	SOQAP	FPC
10/31/91	Hillsborough County	F. Karl	Meeting	POS	FPC/MB
11/04/91	Polk County	D. Martin	Meeting	CUP	FPC/EED/MB
11/06/91	FDER	T. Collins	Letter	SAROAD Site information, AIRS site/monitor ID forms	FPC
11/14/91	FDNR	J. Bakker	Meeting	Buffer area and wildlife corridor	FPC/EED/D&M
11/15/91	FDER	K. Colaw	Meeting	SOQAP	EED
11/19/91	FDER	G. Carroll	Meeting	Air Quality Audit	EED
11/19/91	Polk County	D. Martin	Meeting	CUP	FPC/EED/D&M/MB
11/20/91	PSC	B. Easley	Hearing	Need Determination	FPC
11/21/91	PSC	B. Easley	Hearing	Need Determination	FPC
11/26/91	SWFWMD	T. Abel	Meeting	Groundwater modeling	FPC/EED/D&M

TABLE 9.0-1
FEDERAL, STATE, REGIONAL, AND LOCAL GOVERNMENT AGENCY CONTACTS

Date	Agency	Contact	Type of Contact	Subject	Project Representative
12/02/91	FDER	D. Stuart	Letter	SOQAP	FPC
12/03/91	Polk County	D. Martin	Letter	Pre-Application Package for CUP	FPC
12/11/91	FDER	R. Arbes	Telephone	Air Quality - PM10	EED
12/12/91	Polk County/FDOT	D. Martin	Meeting	CUP - Pre-Application Conference	FPC/EED/MB/K-H
12/16/91	FDNR/SWFWMD	J. Bakker, D. Turner	Meeting	Reclamation Plan Modifications	FPC/EED/D&M
12/16/91	FDER	T. Bell	Meeting	POS	FPC/EED/D&M
12/16/91	Polk County	K. Seggerman	Telephone	Clarification of Traffic Study	K-H
12/16/91	FDOT	G. Cerepak	Telephone	Traffic Count Information	K-H
12/18/91	FDOT	J. Baxter	Meeting	Traffic Count Information	K-H
12/20/91	FDER	J. Watts	Telephone	FDER comments on project QAPP	EED
12/31/91	FDER	D. Stuart	Letter	Air Quality audit schedule	EED
01/08/92	Polk County	R. Jackson	Meeting	County role in SCA review	FPC/EED
01/08/92	Polk County	D. Martin	Meeting	CUP application approach	FPC/EED/D&M
01/10/92	Polk County	K. Seggerman	Telephone	Project status and Rights-of-way	K-H
01/10/92	Polk County	T. Pierce	Telephone	Rights-of-way	K-H
01/13/92	FDER	G. Carroll	Telephone	Audit information for AQ station	EED
01/13/92	FDER	G. Carroll	Telephone	Air Quality Audits	EED

TABLE 9.0-1
FEDERAL, STATE, REGIONAL, AND LOCAL GOVERNMENT AGENCY CONTACTS

Date	Agency	Contact	Type of Contact	Subject	Project Representative
01/23/92	FDER	T. Bell	Letter	Submittal of Approved Reclamation Plans	FPC
01/24/92	Polk County	D. Martin	Letter	CUP Appication Submittal	FPC
01/24/92	FDER	S. Palmer	Letter	Response to Agency Comments on POS	FPC
02/04/92	CFRPC	B. Sodt	Telephone	Transportation issues	K-H
02/11/92	Florida Natural Areas Inventory	Dr. S. Jones	Meeting	Protected species in site areas	EED
02/12/92	General Public	General Public	Newsletter	Project Newsletter (Open House)	MB
02/12/92	Polk County	D. Martin, M. Carpanini	Meeting	CUP and SCA review	FPC/EED/MB
02/13/92	FDER	J. Watts	Telephone	FDER comments on project QAPP	EED
02/14/92	FDER	D. Stuart	Letter	SOQAP	FPC
02/14/92	Polk County	M. Bennett, B. Study	Telephone	Noise ordinances and Noise Study requirements	EED
02/14/92	City of Fort Meade	J. Borg	Telephone	Noise ordinances	EED
02/14/92	City of Bartow	W. Jones	Telephone	Noise ordinances	EED
02/18/92	FDER	G. Carroll	Meeting	Air Quality Audit	EED
02/19/92	FDNR	J. Bakker	Meeting	Reclamation submittals and wildlife corridor	FPC/EED/D&M
02/20/92	Polk County	D. Martin	Meeting	POS, CUP, Air Monitoring Program, and Air Modeling	FPC/EED/MB
02/20/92	Polk County	L. Novak	Telephone	Air Impacts, CUP Application	EED
02/21/92	FDER	C. Cooksey	Meeting	Conceptual Reclamation Plan	D&M

TABLE 9.0-1
FEDERAL, STATE, REGIONAL, AND LOCAL GOVERNMENT AGENCY CONTACTS

Date	Agency	Contact	Type of Contact	Subject	Project Representative
02/24/92	Polk County	D. Martin	Letter	CUP Application Supplement Submittal	FPC
02/24/92	CFRPC	B. Sodt	Letter	CUP Application Transmittal	FPC
02/25/92	Polk County	C. Deardorf	Telephone	CUP	MB
02/27/92	General Public	General Public	Open House	Open House	FPC/EED/D&M/MB
02/28/92	Polk County	L. Novak	Letter	POS, CUP, CUP Supplement, Air Quality Monitoring Program Transmittal	FPC
03/02/92	Polk County	K. Seggerman	Telephone	CUP, Traffic	MB
03/04/92	FDNR	J. Bakker	Meeting	Reclamation Plan Modifications	FPC
03/05/92	Polk County	P. McLemore	Meeting	Water and Solid Waste	FPC/EED/MB/D&M
03/05/92	FDER	S. Labie	Letter	COMQAP - Precision and Accuracy Values	EED
03/06/92	FDER/Polk County/NPS	T. Rogers,L. Novak,J. Viemont, B. Olsen,J. Notar	Meeting/ Teleconference	Class I Area Analysis	FPC/EED
03/09/92	FDER	G. Rodriguez	Meeting	POS - Wetland Jurisdictions	FPC/EED/D&M
03/09/92	FDER	T. Rogers	Letter	Modeling Protocol	FPC
03/10/92	SWFWMD	B. Starford	Meeting	Present Water Supply Modeling Data	D&M
03/11/92	EPA	R. Cunningham	Meeting	Present project description pursuant to request for New Source Development	FPC/EED
03/11/92	Polk County	K. Seggerman	Telephone	Response to CUP questions	K-H

TABLE 9.0-1
FEDERAL, STATE, REGIONAL, AND LOCAL GOVERNMENT AGENCY CONTACTS

Date	Agency	Contact	Type of Contact	Subject	Project Representative
03/12/92	FDNR	B. Cates	Meeting	Wildlife corridor enhancement	D&M
03/13/92	Polk County	K. Seggerman	Telephone	Response to CUP questions	K-H
03/16/92	Polk County/FDOT	D. Martin	Meeting	CUP impact review	FPC/EED/MB/K-H
03/18/92	Polk County	K. Seggerman	Meeting	CUP traffic issues	MB/K-H
03/19/92	Polk County	D. Myslip	Telephone	CUP airport zoning	MB
03/20/92	Polk County	K. Seggerman	Memo	Transportation Issues	K-H
03/20/92	Polk County	J. Howell	Telephone	Rights-of-way	K-H
03/20/92	Polk County	K. Seggerman	Meeting	Rights-of-way requirements	K-H
03/20/92	FDNR	C. Albin	Meeting	Wildlife corridor concept	FPC/D&M
03/20/92	Polk County	C. Deardorf	Telephone	CUP	MB
03/25/92	SWFWMD	B. Starford	Meeting	Update water supply modeling data	FPC/EED/D&M
03/30/91	Polk County	D. Martin	Letter	Responses to Comments on CUP Application	FPC
03/31/92	ACOE	P. Baker	Meeting	ACOE Wetlands Jurisdiction	FPC
04/01/92	Polk County	L. Novak	Meeting	Air Impacts, CUP Application	FPC/EED
04/02/92	Hillsborough County	J. Bourey	Meeting	Gas Pipeline Lateral	FPC/EED/MB
04/02/92	FDER	L. Griffin	Telephone	Consistency Application Procedures	EED
04/08/92	Polk County	Zoning Advisory Board	Presentation	CUP	FPC/EED/MB

TABLE 9.0-1
FEDERAL, STATE, REGIONAL, AND LOCAL GOVERNMENT AGENCY CONTACTS

Date	Agency	Contact	Type of Contact	Subject	Project Representative
04/10/92	EPA	D. Williams	Meeting	New Source Determination	FPC/EED
04/14/92	FDER	G. Maier, R. Vanderslice	Meeting	Agency comments on POS	FPC/EED
04/14/92	ACOE	J. Bachelor	Meeting	ACOE Wetlands Jurisdiction	FPC/EED
04/14/92	Polk County	County Commissioners	Presentation	CUP	FPC/EED/MB
04/15/92	FDNR	J. Craft	Meeting	Reclamaton Plan Modifications	FPC
04/16/92	Polk County	C. Deardorf	Telephone	CUP	MB
04/22/92	FDNR	J. Craft	Meeting	Reclamation Plan Modificatons	FPC/EED
04/23/92	Polk County	D. Martin	Meeting	CUP	FPC/MB
04/29/92	FDER	A. Morgan	Telephone	Comments on POS - Water Quality	EED
04/29/92	Polk County	D. Martin	Meeting	CUP	FPC/MB
05/05/92	City of Bartow	J. O'Connor	Meeting	Use of sanitary sewage effluent from City of Bartow	FPC
05/07/92	Polk County	D. Martin	Meeting	CUP	FPC/MB
05/13/92	Polk County	J. Spence	Meeting	Water Use	FPC/EED/D&M
05/13/92	Polk County Zoning Advisory Board	P. McLemore	Hearing	CUP Hearing	FPC/EED/D&M/MB
05/15/92	Hillsborough County Planning & Development	G. Boles	Meeting	Backup Gas Pipeline	FPC/MB

TABLE 9.0-1
FEDERAL, STATE, REGIONAL, AND LOCAL GOVERNMENT AGENCY CONTACTS

Date	Agency	Contact	Type of Contact	Subject	Project Representative
06/26/92	FDER	R. Donelan	Letter	Binding Written Agreement	FPC
07/22/92	ACOE	R. Silver	Site Visit	Site Visit	FPC/EED
07/27/92	Hillsborough County	M. Allgire	Meeting	Back-up Gas Pipeline	FPC/MB

Notes:

FPC = Florida Power Corporation
EED = Ebasco Environmental Division
MB = Moore/Bowers
D&M = Dames & Moore
K-H = Kimley-Horn & Associates, Inc.
ACOE = U.A. Army Corps of Engineers
CFRPC = Central Florida Regional Planning Council
DCA = Florida Dept. of Community Affairs
DOS = Florida Department of State
EPA = U.S. Environmental Protection Agency
FDER = Florida Dept. of Environmental Regulation
FDNR = Florida Dept. of Natural Resources
FGFWFC = Florida Game & Fresh Water Fish Commission
HRS = Florida Dept. of Health and Rehabilitative Services
NPS = National Park Service
PSC = Florida Public Service Commission
SWFWMD = Southwest Florida Water Management District

TABLE 9.0-1
FEDERAL, STATE, REGIONAL, AND LOCAL GOVERNMENT AGENCY CONTACTS

Date	Agency	Contact	Type of Contact	Subject	Project Representative
05/19/92	Polk County	D. Martin	Meeting	CUP	FPC
05/19/92	FDER	M. Morgan	Tour	Site tour	FPC/EED
05/21/92	FDER	S. Palmer	Letter	Response to Agency Comments on POS	FPC
05/21/92	FDNR/SWFWMD	J. Bakker	Meeting	Reclamation Plan modifications	FPC/EED/D&M
05/22/92	Polk County	D. Martin	Meeting	CUP	FPC/MB
05/24/92	General Public	General Public	Newsletter	Project Newsletter (CUP)	MB
05/28/92	FDNR	S. Partney	Meeting	McCullough Creek hydrology	D&M
06/02/92	Polk County Board of County Commissioners	C. Foss	Meeting	Approval of CUP	FPC
06/02/92	Florida Natural Areas Inventory	Dr. S. Jones	Meeting	Protected species in Site areas	EED
06/15/92	FDER	D. Stuart	Letter	Air Quality Monitoring Report	FPC
06/16/92	Polk County	D. Martin	Letter	Submittal of CUP Exhibit D	FPC
06/17/92	City of Bartow	D. Allen	Meeting	Use of sewage effluent	FPC/EED/B&V
06/17/92	City of Mulberry	C. Adcock	Meeting	Use of sewage effluent	FPC/EED/B&V
06/18/92	Polk County Utilities Division	S. Shealey	Meeting	Use of sewage effluent	FPC/EED/B&V
06/18/92	City of Lakeland	V. Caballero	Meeting	Use of sewage effluent	FPC/EED/B&V
06/19/92	ACOE	J. Hall	Meeting	Wetlands jurisdiction	FPC
06/24/92	FDER	H. Oven	Meeting	Agency Comments on POS	FPC/EED