APPENDIX A

vj1312
8/10/94

CHAPTER 2: SITE AND VICINITY CHARACTERIZATION

2.1 SITE AND ASSOCIATED FACILITIES DELINEATION

2.1.1 Site Location

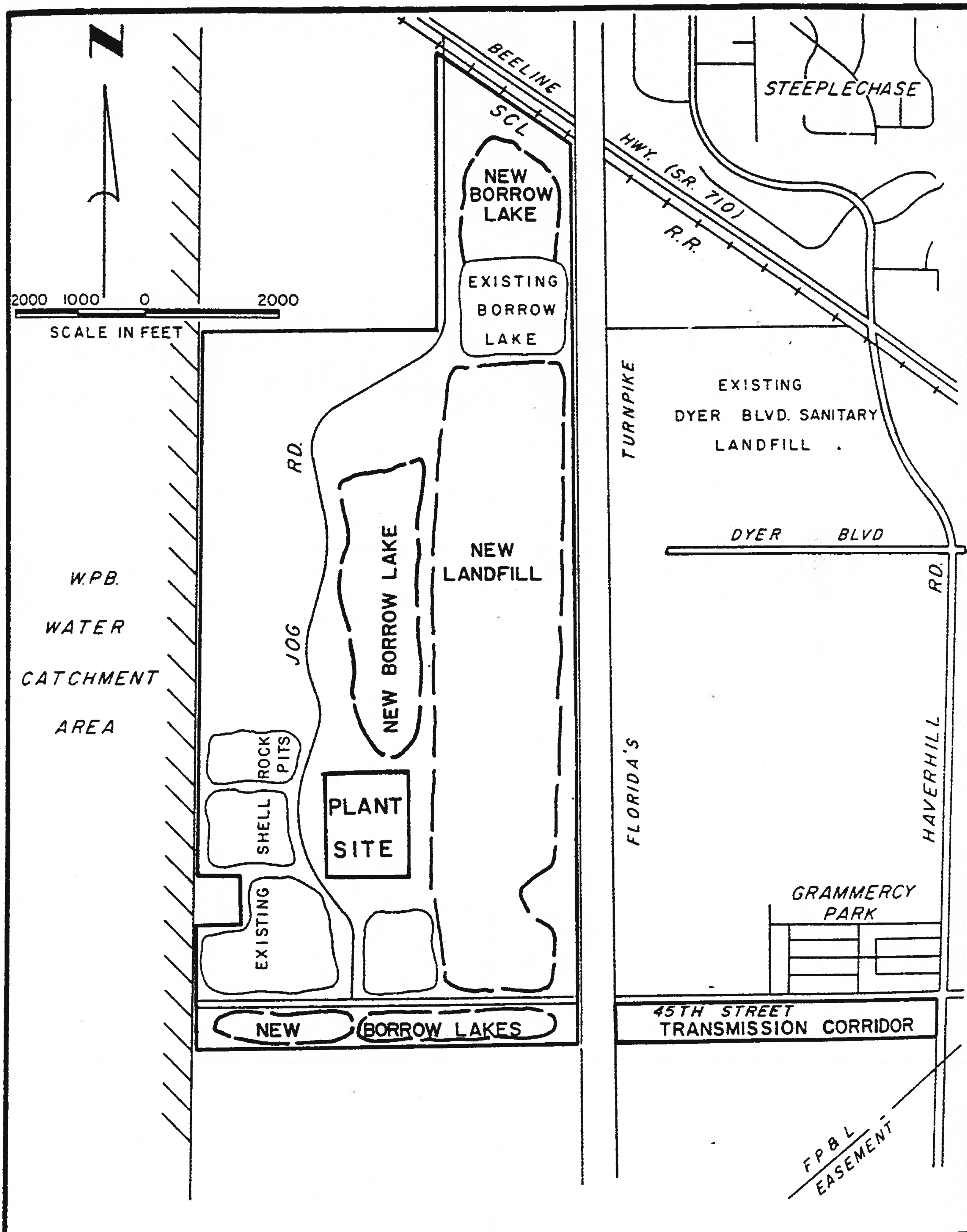
The location of the proposed Resource Recovery Facility within Palm Beach County is illustrated in Figure 2.1-1. The 1,320 acre site is bordered on the north by the Beeline Highway, on the east by Florida's Turnpike, on the south by a line approximately 610 feet south of 45th Street, on the west by the City of West Palm Beach Water Catchment Area, and on the northwest by the Grier Property. A topographical map (showing site perimeter) of the site is included in Appendix 10.4.

The transmission corridor to the existing Florida Power and Light Company (FP & L) transmission lines will traverse the south side of the 73 acre parcel east of Florida's Turnpike and south of 45th Street (Figure 2.1-2). A detailed description of this parcel is contained in Chapter 6.

2.1.2 Existing Uses

At present, there is limited use of the property proposed for development. An occupied house located on a 6.6 acre parcel in the south central portion of the site will be purchased and removed in the course of site development. In the vicinity of the house, there is an operational radio transmission tower. This tower will remain in place during and after construction of the plant and all facilities. A privately-owned unoccupied 10 acre parcel in the southwestern portion of the site may be acquired in the future, but is not essential to the development of the facility. Past and present property use has changed the topography of the site in certain areas. In the northeast portion of the site, there is a 82-acre (approximately) borrow lake which supports an active dredge operation. Dredged material is used for construction fill and cover material at the Dyer Boulevard Landfill located east of Florida's Turnpike. Areas to the north of this borrow lake have been scraped below natural ground elevations, including a 22-acre flooded area which has been excavated to an elevation of three feet below the natural ground elevation. A similar condition exists in the east central portion of the site, approximately 4,000 feet north of 45th Street where a 6.2-acre flooded parcel has been excavated to an elevation of three feet below the natural ground elevation.

Three abandoned shell pit operations, which encompass approximately 171 acres, occupy the southwest corner of the site north of 45th Street. The bottom of the shell pits are approximately six feet below surrounding ground elevations; and the elevations of the berms adjacent to the shell pits are approximately six feet above ground elevations.



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

RESOURCE RECOVERY FACILITY AND ADJACENT PROPERTIES

FIG. 2.1-2

Access to the site is made from 45th Street by traveling north on a shell rock road located between the two shell pits bordering on 45th Street. At the northern boundary of the shell pits, this road proceeds east to the eastern site boundary. Within the site, the road meanders in a northerly direction, terminating at the active borrow lake.

2.1.3 Site Modifications

The proposed site development plan for the site is shown in Figure 2.1-2. Space has been allocated for Class I and Class III Sanitary Landfills, a north-south roadway, borrow lakes, the resource recovery plant, and perimeter buffer zones. The western portion of the site will serve as a multiple-purpose conservation area — habitat preservation, buffer, stormwater retention and wetlands mitigation will all be accomplished in this area. Throughout the rest of the text, these specific usages are discussed with no general reference to the conservation area.

In accordance with the Water Quality Assurance Act of 1983, a landfill cannot be constructed within 3,000 feet of a Class I water body. The West Palm Beach Water Catchment Area (WCA) is classified as a Class I surface water body. (DER Docket Number 83-32R, Rule Number 17-3.161, Classified Waters.) Therefore, all landfill activities will occur within the eastern 1,900 feet of the site in order to comply with these minimum setback requirements. The existing borrow lake in the northeast portion of the site will be expanded to allow maximum utilization of the designated area for dredging fill material to be used at the Dyer Boulevard Landfill, as well as the landfill areas to be constructed on the site.

The western region of the site within the 3,000-foot setback from the WCA will be utilized to accommodate the 40-acre resource recovery plant, including a laydown area, employee parking, wastewater treatment plant and other associated facilities, roadway right-of-way, additional borrow areas, wetlands mitigation and stormwater management. Two borrow lakes will be developed on the property south of 45th Street within the boundaries of the site while allowing for the extension of the north-south roadway south of 45th Street. An access service road for the landfill will be maintained within the 200-foot setback west of the Turnpike canal.

The landfill height has been established to provide the capacity for a Class I and a Class III landfill to serve the County in excess of twenty years. Existing ground elevations on the site average +17.5 feet NGVD (National Geodetic Vertical Datum) (± 1 foot). The base of landfill operation will begin at an elevation of +30 feet NGVD. The proposed final elevations of the designated Class I and Class III landfill areas of the site are +130 feet NGVD.

The proposed land use for the site is summarized as follows:

Class I Landfill	150 acres
Class III Landfill	235 acres
Borrow Lakes	243 acres
Roadway	30 acres
Conservation Area	427 acres
Resource Recovery Plant	40 acres
Buffer, Roads, Ditches, etc.	195 acres
TOTAL SITE	1,320 acres

After the landfill capacity has been exhausted, the landfill area is planned to be developed as a recreation facility.

2.1.4 100-Year Flood Zone

As indicated in Figure 2.1-3, none of the proposed site lies within a 100-Year Flood Zone.

2.2 SOCIO-POLITICAL ENVIRONMENT

2.2.1 Governmental Jurisdictions

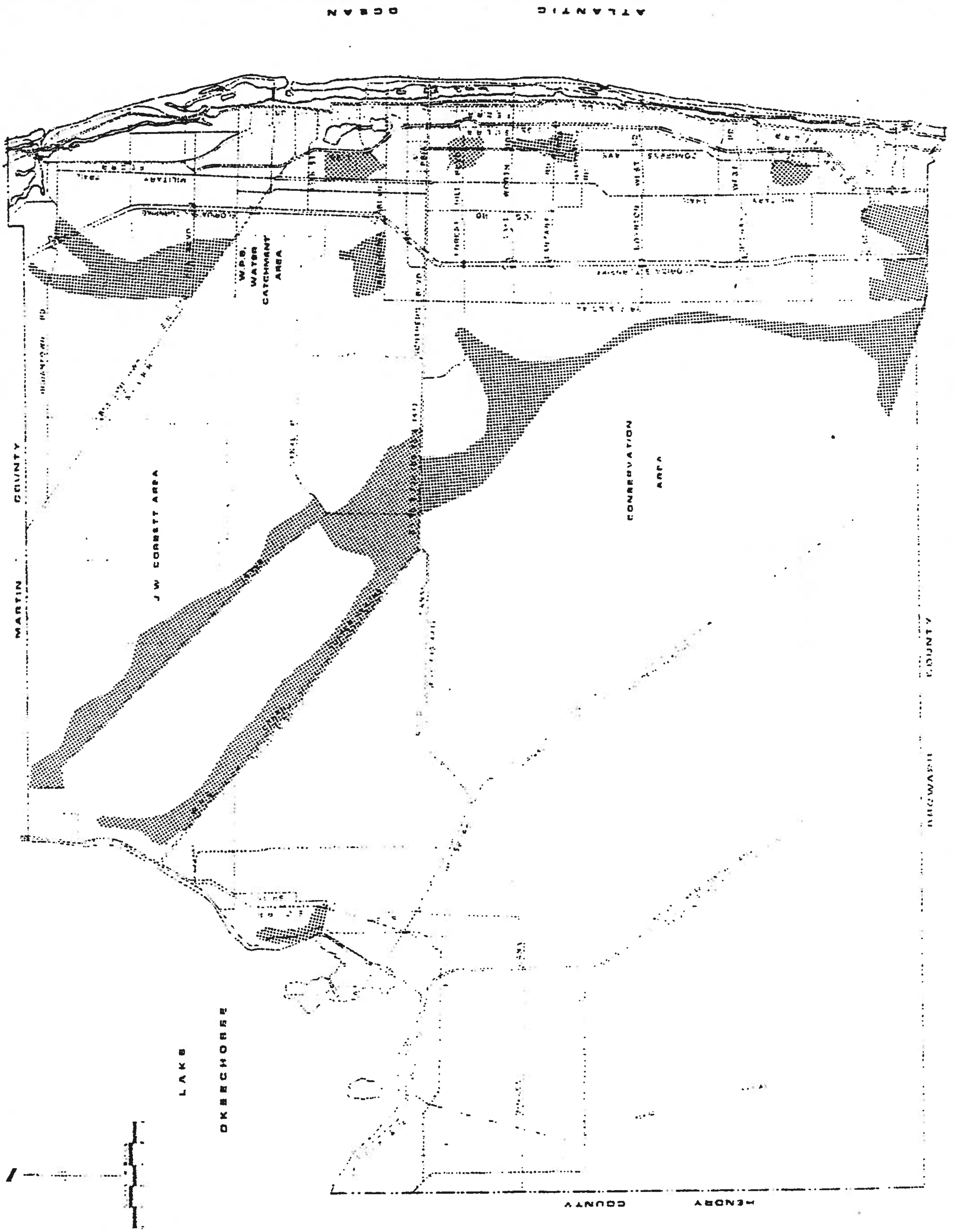
Available maps and literature were examined to identify local, regional, State and Federal areas stipulated in the application guide. In addition to this review, the governmental units listed in Table 2.2-1 were contacted to provide supplemental information.

Information on the special category areas is listed in Table 2.2-2 and shown graphically in Figure 2.2-1 and Figure 2.2-2. Local parks of the Cities of Palm Beach Gardens, Riviera Beach and West Palm Beach, and the Towns of Lake Park and Mangonia Park are located within 5 miles of the site. None of these lie within 1 mile of the plant. The City of West Palm Beach Water Catchment Area is directly adjacent to the western border of the site. This area of approximately 19 square miles is the drinking water source for West Palm Beach, and is a wetland area. While it is not strictly a private holding as indicated in Table 2.2-2, the catchment area is managed for environmental protection by the City.

The existing Dyer Boulevard Landfill is scheduled for closure in 1987. This area is planned to be developed as a recreational facility, and is anticipated to be managed as a Palm Beach County Park.

Table 2.2-1
Agencies Contacted in Survey of Governmental Jurisdictions

FEDERAL	U.S. Fish and Wildlife Service
STATE	Florida Department of State -Bureau of Historical Preservation
	Florida Department of Natural Resources -Recreation and Parks Division
	Florida Agricultural and Consumer Services -Forestry Division
	Florida Game and Freshwater Fish Commission
COUNTY	Parks and Recreation Department
	Planning, Zoning and Building Department -Planning Division
LOCAL	City of Palm Beach Gardens
	City of Riviera Beach
	City of West Palm Beach
	Town of Lake Park
	Town of Mangonia Park



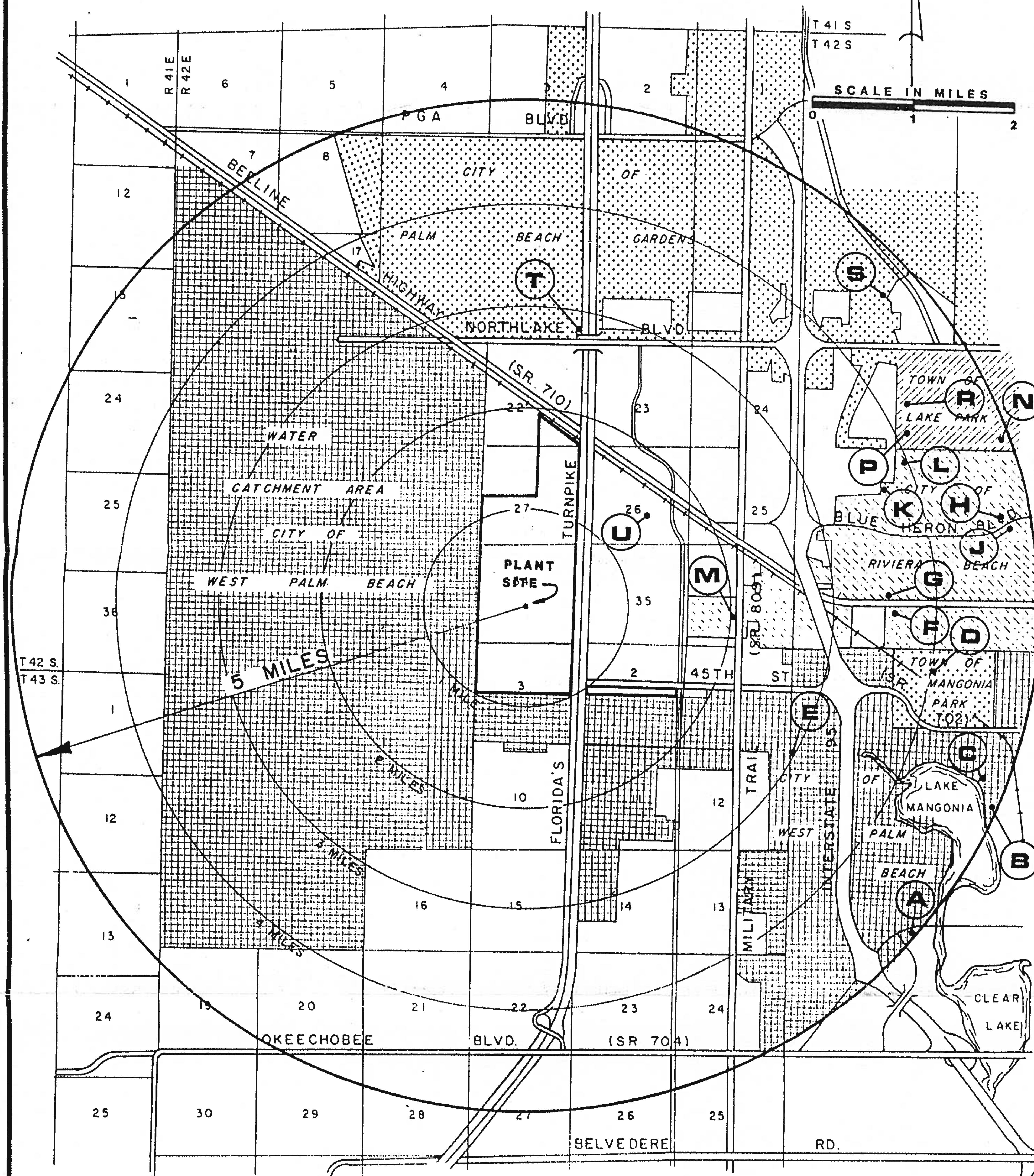
PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

GENERALIZED FLOOD PRONE AREAS

FIG. 2.1-3

LEGEND

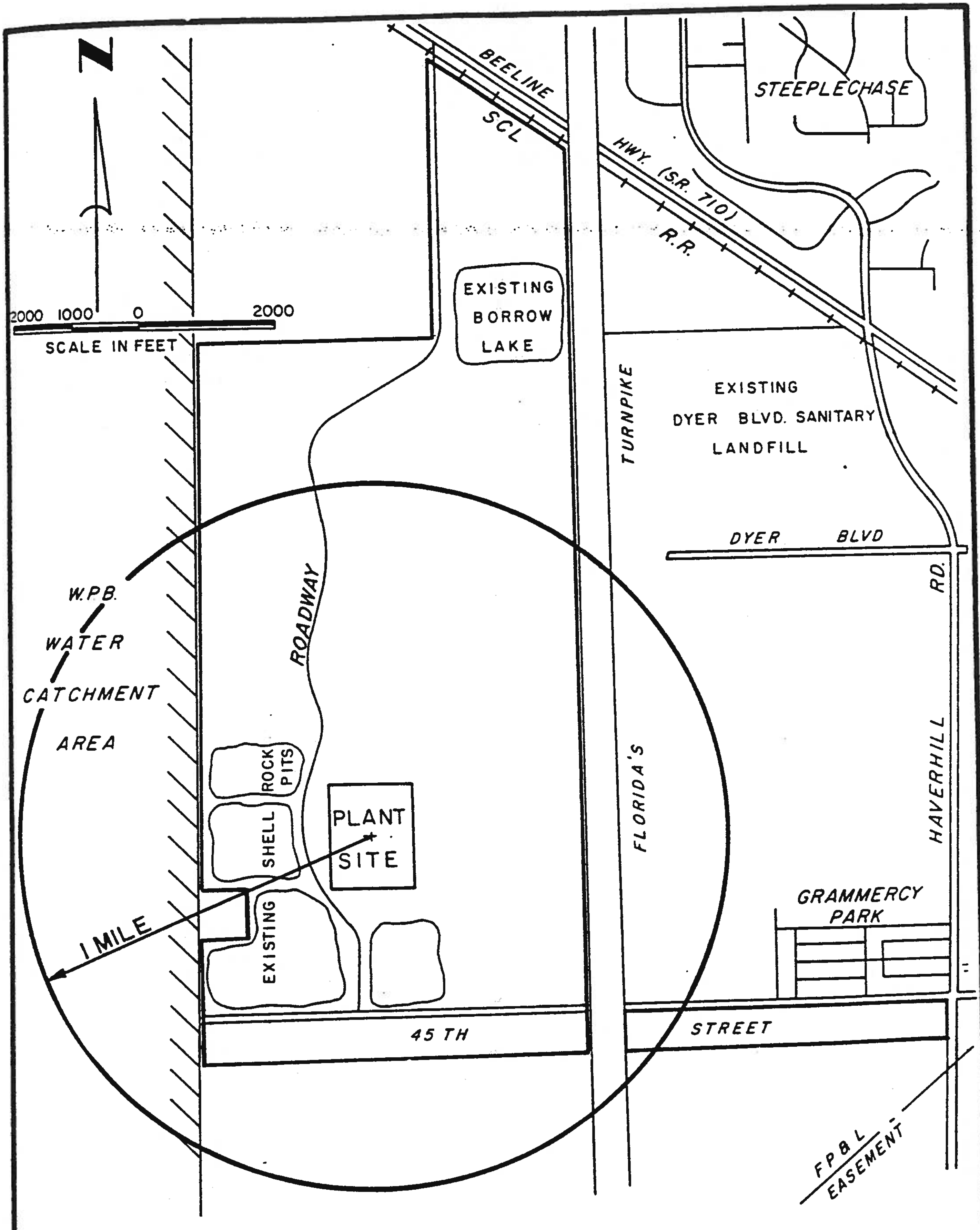
- (A) WEST PALM BEACH MUNICIPAL STADIUM
- (B) LAKE MANGONIA RAMP
- (C) LOST CREEK PARK
- (D) MUNICIPAL PARK
- (E) BEAR LAKES PARK (PROPOSED)
- (F) GEORGE STREET PARK
- (G) TATE COMPLEX
- (H) WELLS RECREATION COMPLEX
- (J) MONROE HEIGHTS PARK
- (K) CUNNINGHAM PARK
- (L) GOODMARK PARK
- (M) LONE PINE PARK
- (N) BANYON PARK
- (P) (PROPOSED PARK)
- (R) PROPOSED PARK
- (S) LAKE CATHERINE PARK
- (T) PGA PARK (PROPOSED)
- (U) DYER BLVD. LANDFILL (PROPOSED PARK)



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

SPECIAL CATEGORY AREAS WITHIN
5 MILES OF PLANT

FIG. 2.2-1



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

SPECIAL CATEGORY AREAS WITHIN
I MILE OF PLANT

FIG. 2.2 -2

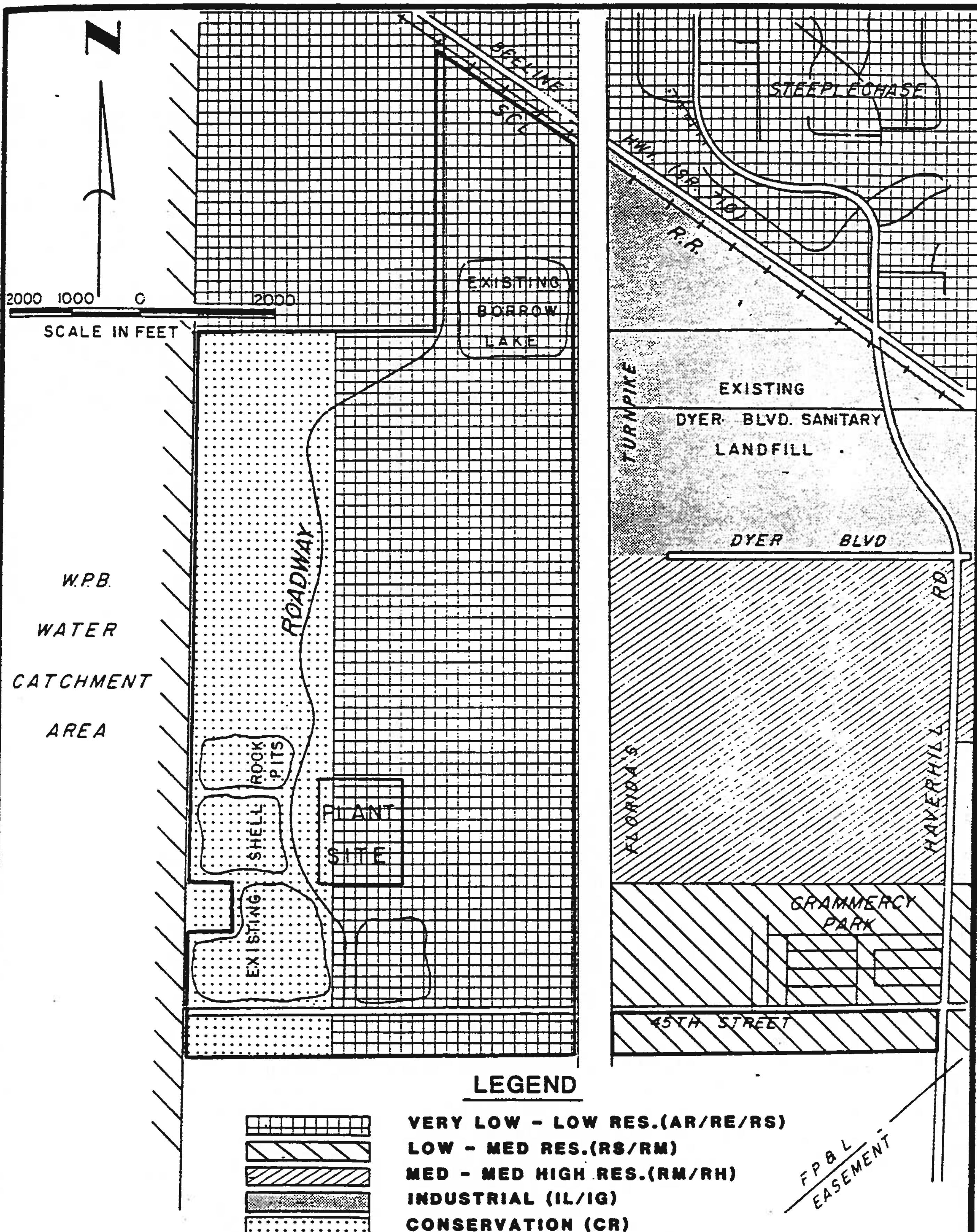
TABLE 2.2-2
OCCURRENCE OF SPECIAL-CATEGORY WITHIN 5 MILES OF THE SITE*

Type of Area	Located within 5 miles
National Parks	NO
National Forests	NO
National Seashores	NO
National Wildlife Refuges	NO
Wilderness Areas	NO
National Monuments	NO
National Memorials	NO
National Marine Sanctuaries	NO
National Estuarine Sanctuaries	NO
RARE Areas	NO
National Wild and Scenic Rivers	NO
Critical Habitat for Endangered Species	NO
State Parks	NO
State Forests	NO
Game Management Areas	NO
Areas of Critical State Concern	NO
Conservation and Recreation Lands	NO
Save our Rivers Lands	NO
State Archeological Landmarks	NO
State Archeological Landmark Zones	NO
Aquatic Preserves	NO
Outstanding Florida Waters	NO
State Wild and Scenic Rivers	NO
Indian Reservations	NO
Military Lands	NO
County Parks	YES (See Text)
Local Parks	YES (See Text)
Private Holdings for Environmental Protection	YES (See Text)

* (See Section 2.2.1 for explanations)

2.2.2 Zoning and Land use Plans

Palm Beach County adopted its Comprehensive Plan, Palm Beach County Ordinance 80-8, effective August 4, 1980. The Land Use Plan provides a system of growth management for Palm Beach County based on land use and residential densities related to the ability of the County to provide adequate community facilities. Some land uses are not specifically regulated by the Plan, including public or semi public activities, utilities, public recreation, and agriculture. These are regulated by the Zoning Ordinance. All requests for change in zoning classification must be consistent with the Comprehensive Plan in addition to meeting all requirements of the Palm Beach County Zoning Ordinance and other applicable county, state and federal laws.



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

INTERACTION OF
RESOURCE RECOVERY FACILITY
WITH COMPREHENSIVE PLAN

FIG. 2.2-3

The Authority has requested and received a Special Exception to the Agricultural Residential zoning of the property to allow its use for the Resource Recovery Facility. Three copies of the approved application for Special Exception and all supporting documents have been submitted to FDER under separate cover in the Compliance Document. A brief summary of the rezoning process will be given to indicate steps taken to insure compliance with the Comprehensive Plan for Palm Beach County.

There was a good deal of local controversy during the rezoning process. Because of the sensitive location of the proposed project, in a wetlands area, over the Turnpike Aquifer, adjacent to the City of West Palm Beach Water Catchment Area and within one to two miles of residential areas, the Authority worked closely with local, County, State and Federal agencies as well as concerned citizens in an effort to thoroughly consider all aspects of the proposed project.

The completed application was submitted on August 1, 1984 to the Palm Beach County Department of Planning, Zoning and Building (PZB) and was assigned Petition No. 84-134. At the prehearing workshop with the staff of PZB on August 9, 1984, the consultants working for the Authority addressed a number of questions raised concerning the application. The PZB staff then accepted the application as complete with a few requested modifications.

After a lengthy discussion on September 6, 1984, the Palm Beach County Planning Commission voted to recommend that the Palm Beach County Board of County Commissioners (BCC) deny the request for a Special Exception to the Agricultural Residential zoning. It should be noted that this recommendation was made in spite of the PZB staff's finding that the application was satisfactory, technically acceptable and in keeping with the long-range goals of the County Zoning Ordinance and Comprehensive Plan.

Because of the public interest in this project and time consideration, the BCC chose to deal with this rezoning request at a special meeting on October 10, rather than include it with other rezoning requests at the normally scheduled meeting on September 27, 1984.

At the Board of County Commissioners meeting, held on October 10, 1984, the BCC approved the request for special exception (See Resolution No. R-85-51 in the Compliance Document.) after thoroughly considering all testimony for and against the proposed usage, the compatibility of the Resource Recovery Facility with the County Zoning Ordinance and Comprehensive Plan, and the long-range MSW disposal needs of the County. In approving the special exception, the BCC attached sixteen (16) conditions to the approved rezoning application. The Authority accepted all conditions with the intent that every effort be made to make this project technically excellent and a "good neighbor" to all the citizens of the County.

Figure 2.2-3 indicates the interaction of the Resource Recovery Facility with the Comprehensive Plan land use categories. The planned conservation area occupying the western 2000+ feet of the site will be maintained as a high-quality wetlands area with the north-south roadway occupying part of it.

2.2.3 Demography and Ongoing Land Use

2.2.3.1 Existing Populations

The existing populations of towns and cities at least partially within 5 miles of the Resource Recovery Facility are depicted in Table 2.2-3.

TABLE 2.2-3

Municipality	1980 Census
Palm Beach Gardens	14,407
North Palm Beach	11,344
Lake Park	6,909
Riviera Beach	26,489
Mangonia Park	1,419
West Palm Beach	63,305
Golfview	210
TOTAL	117,083

2.2.3.2. Existing Land Use

Figure 2.2-4 indicates the existing land use within a 5 mile radius from the resource recovery plant.

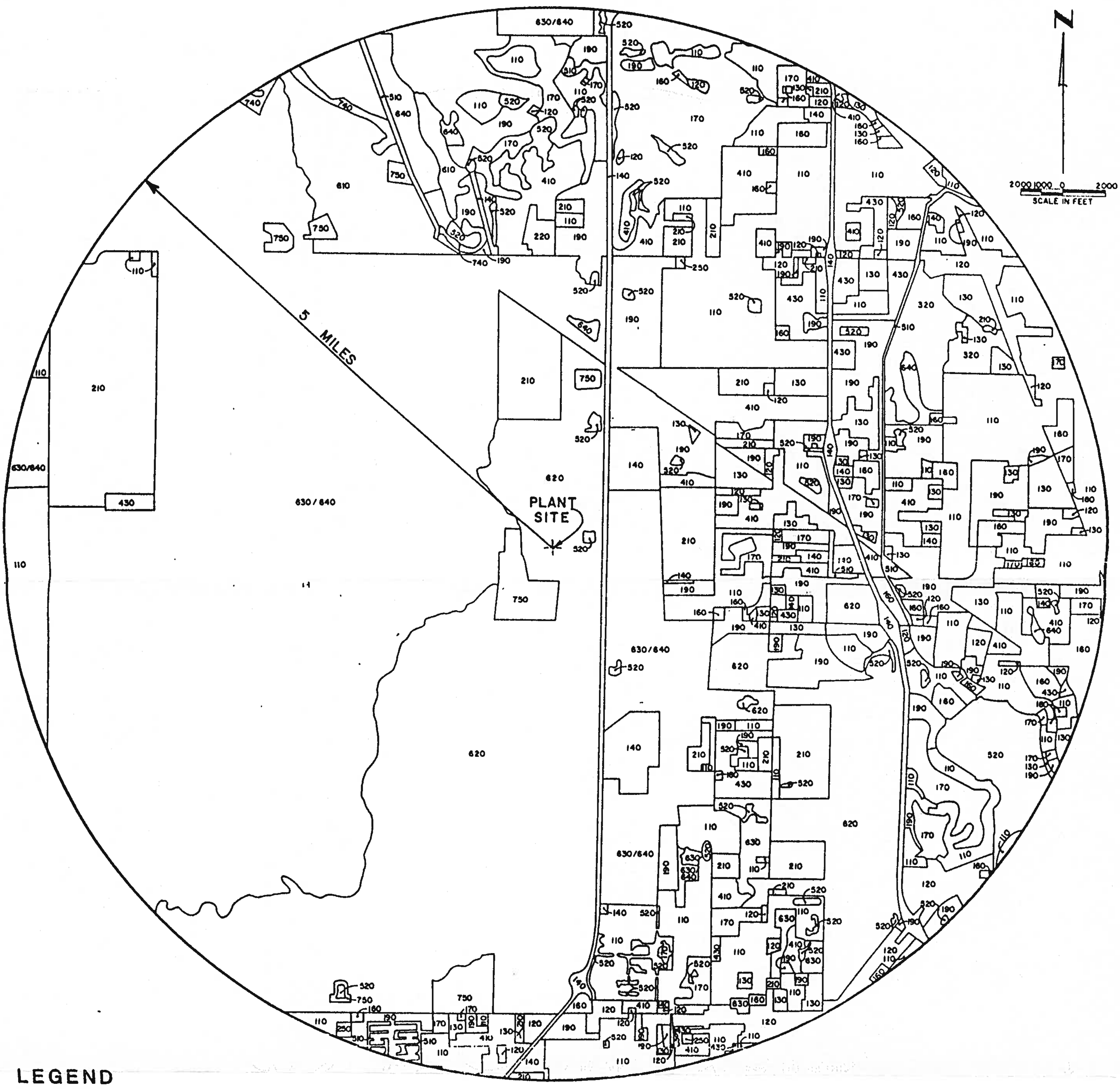
2.2.3.3 Projected Land Uses and Trends

The Land Use Plan for Palm Beach County (Compliance Document) indicates development of light industry and very-low to medium-high residential development within 5 miles of the proposed resource recovery plant. This activity closely correlates with the projected land use throughout the County and is presented in greater detail in Section 2.2.7. The planned conservation areas near the site will not be adversely affected by the operations of the Resource Recovery Facility.

2.2.4 Easements, Title, Agency Works

The site consists of three parcels of property under different ownership. All three parcels are presently being acquired by the Authority. Two parcels comprising 1,313 acres of the total site have an executed Agreement for Sale and Purchase between the owners and the Authority. The Authority will close and have ownership of the site after all permits are obtained. The acquisition of the remaining parcel comprising 7 acres is presently being negotiated with the owner; and in absence of a negotiated agreement will be the subject of eminent domain proceedings. The owner has given permission to include the property in this application.

As a condition to rezoning, the Authority has agreed to grant right-of-way and fund construction of a roadway through the western portion of the site. This road will have to cross the Seaboard Coastline Railroad right-of-way to join the Beeline Highway. The electrical transmission lines will have to cross over Florida's Turnpike in order to reach the existing Florida Power & Light Company easement. Neither of these crossings will call for a change in the existing right-of-way features. The transmission lines will be discussed in more detail in Chapter 6.



LEGEND

110 RESIDENTIAL
120 COMMERCIAL & SERVICES
130 INDUSTRIAL
140 TRANSPORTATION
160 INSTITUTIONAL
170 RECREATIONAL
190 OPEN LAND & OTHERS

210 CROPLAND & PASTURELAND
220 ORCHARDS, GROVES
250 SPECIALTY FARMS
320 SHRUB & BRUSHLAND
410 CONIFEROUS FOREST
430 MIXED FOREST
510 CANALS & STREAMS

520 LAKES & RESERVOIRS
610 WETLANDS-CONIFEROUS FOREST
620 WETLANDS- HARDWOOD MARSH
630 WETLANDS- MIXED FORESTED
640 WETLANDS- NONFORESTED
740 ALTERED LANDS
750 EXTRACTIVE

PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

LAND USE CLASSIFICATIONS
WITHIN 5 MILES OF PLANT

FIG. 2.2-4

2.2.5 Regional Scenic, Cultural and Natural Landmarks

Based on the survey described in Section 2.2.1 "Governmental Jurisdictions", the following areas are found within five miles of the site:

- County Parks
- Municipal Parks
- Holdings for Environmental Protection

None of these areas of cultural interest will be adversely impacted by construction of the proposed plant.

2.2.6 Archaeological and Historic Sites

A request was made to the Florida Department of State, Division of Archives, History and Records Management (DAHRM) for a cultural resource assessment of the site. Their review concluded there are no archaeological or historic sites in the area proposed, and that it is unlikely significant unrecorded sites occur. The facility will in their opinion have no effect on archaeological or historical sites.

2.2.7 Socioeconomics and Public Services

The following discussion will concentrate on the area within a 5-mile radius of the plant; however, related information will be given in less detail for the entire County where appropriate. Palm Beach County had a population of over 652,000 in 1983 (U of FL est.), of which approximately 77,000 (12%) live within a traffic analysis zone that falls, at least partially, within the 5-mile radius from the plant and approximately 7,600 (1.2%) persons live within a traffic analysis zone that falls, at least partially, within a 3-mile radius from the plant. Table 2.2-4 depicts the relevant population information.

TABLE 2.2-4
POPULATIONS LOCATED NEAR THE SITE

	Total	White	Black	Other	Dwelling Units
1 Mile	1,597	1,479	88	30	524
		92.6%	5.6%	1.9%	3.05
2 Mile	1,865	1,797	35	33	718
		96.4%1	.9%	1.8%	2.6
Cumulative	3,462	3,276	123	63	1,248
		94.6%	3.6%	1.8%	2.79
3 Mile	4,105	3,997	56	52	2,246
		97.4%	1.4%	1.3%	1.83
Cumulative	7,567	7,273	179	115	3,488
		96.1%	2.4%	1.5%	2.17
4 Mile	31,105	19,350	11,575	180	15,059
		62.2%	37.2%	0.6%	2.06
Cumulative	38,672	26,623	11,754	295	18,547
		68.8%	30.4%	0.8%	2.09
5 Mile	38,301	29,534	8,299	468	16,098
		77%	21.7%	1.2%	2.4
Cumulative	76,973	56,157	20,053	763	34,645
		73.0%	26.1%	1.0%	2.22

Source: Area Planning Board of Palm Beach County, 1984.

2.2.7.1 Social and Economic Characteristics

As of 1983, the labor force in Palm Beach County consisted of approximately 236 thousand persons. Figure 2.2-5 depicts the employment distribution by occupational area.

The employment projections indicate significant growth in the trade and services areas as Palm Beach County itself grows, while growth in other occupational areas is expected to follow population growth rather closely. The twenty largest major employers in the County are listed in Table 2.2-5 It should be noted that none of these firms lie closer than 4 miles to the RRF. Of the 129 major employers in the County, 19 lie within 5 miles of the plant and none of these firms are closer than 3 miles. However, the number of industrial parks existing within 5 miles of the plant (6 of 26 with 559 acres of 3,648 acres total) are indicative of potential and planned industrial growth near the Resource Recovery Facility.

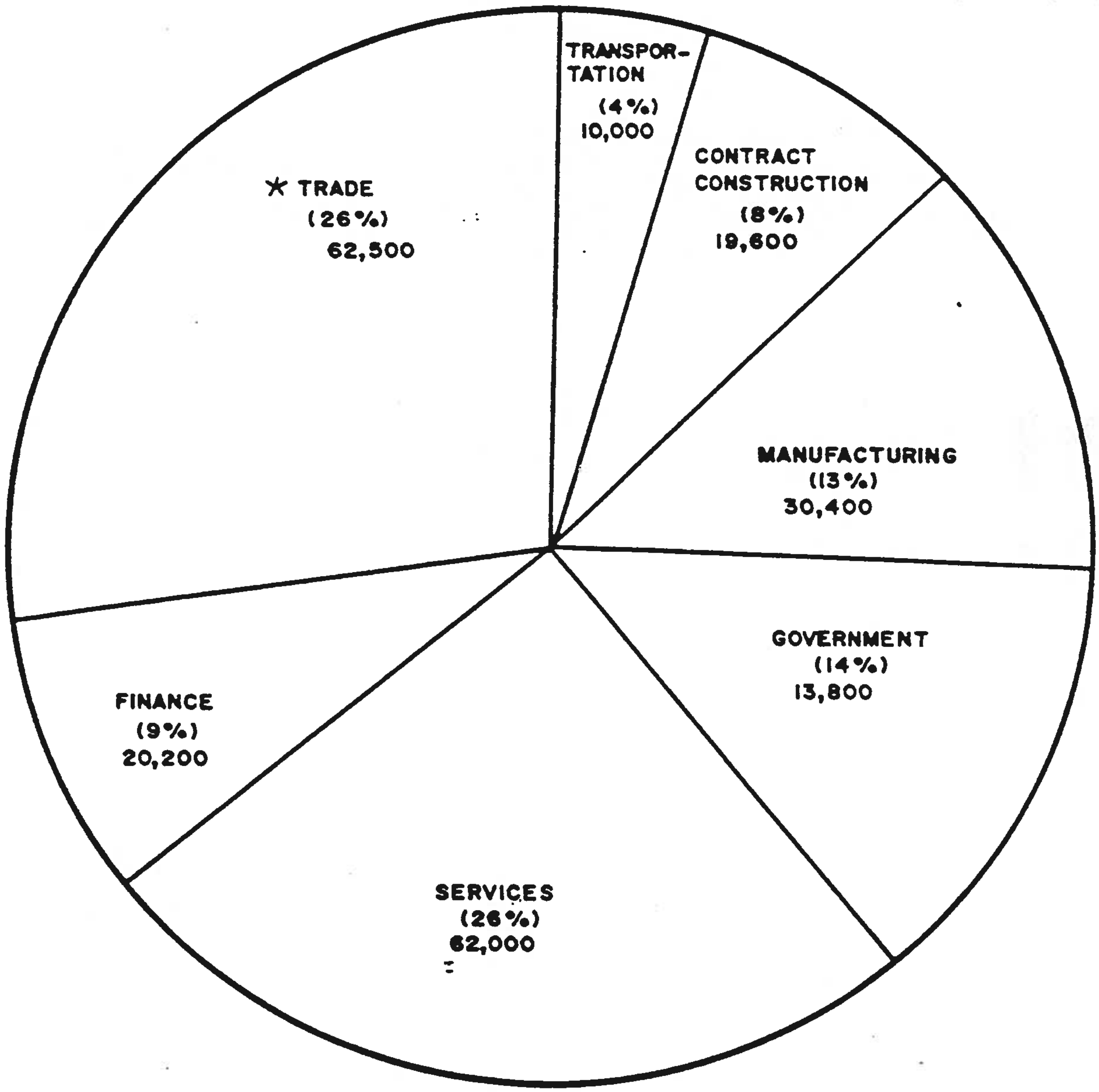
TABLE 2.2-5
LARGEST MAJOR EMPLOYERS IN PALM BEACH COUNTY, OCTOBER 1983

Rank	Employer	No. of Employees
1	IBM Corporation	7,500
2	Pratt & Whitney Aircraft	7,200
3	Sugar Cane Growers Cooperative of Florida	2,930*
4	Southern Bell	2,338
5	U.S. Sugar Corporation	2,100*
6	South Bay Growers, Inc.	2,000*
7	Florida Power & Light Company	1,869
8	Osceola Farms Company	1,510*
9	Duda & Sons Cooperative Association	1,350*
10	Motorola, Inc.	1,200
11	Gulf & Western Food Products Company	1,100*
12	Palm Beach Newspapers, Inc.	1,056
13	Mepco/Electra, Inc.	714**
14	Solitron Devices, Inc.	680**
15	Northern Telecom, Inc.	650**
16	Siemens Corporation	630
17	Mitel, Inc.	575
18	Atlantic Sugar Association	560*
19	Dubois Farms	525
20	Talisman Sugar Corporation	500*

* In-Season.
** Located approximately 4 miles from the stack.
SOURCE: Area Planning Board of Palm Beach County.

The average earnings per capita in the County was $14,150 in 1982.

There were 295,536 dwelling units in the County in 1980, with a population of 576,813, or 1.95 persons per dwelling unit. As presented in Table 2.2-4, 34,645 dwelling units lay within 5 miles of the proposed plant stack. The population within this area was 76,973, or 2.22 persons per dwelling unit. Again, it should be noted that only 3,488



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

EMPLOYMENT DISTRIBUTION BY OCCUPATIONAL AREA

FIG. 2.2-5

dwelling units, 7567 persons (2.17 persons per dwelling unit) lay within the 3-mile radius. There has been a significant growth in the number of dwelling units in the County since the 1980 census, commensurate with the population jump from 577,000 persons in 1980 to 652,000 persons in 1983. Based on the 1984 major residential development activity in the County there is a potential of adding (approximately 100,000) dwelling units, most of which are currently under construction. Of these, 35,575 dwelling units are planned, approved or under construction in residential areas within 5 miles of the plant. Only 7,474 of these lie within the 3-mile radius. There is no planned residential construction activity within 1 mile of the facility. The housing costs in Palm Beach County average $89,500 with a typically wide range.

2.2.7.2 Public Services and Utilities

There are no existing educational facilities within 3 miles of the site; however, there are 23 within 5 miles of the site. Similarly, there are no hospitals within 3 miles of the site, but 2 within the 5-mile radius. There are no recreational areas lying within 1 mile of the site. There are two golf courses within 3 miles of the site and 4 additional golf courses, 1 major recreational facility and 4 planned major recreational facilities within the 5-mile radius. One of these 4 planned facilities is the park to be constructed at the existing Dyer Boulevard Landfill after closure. The Authority has agreed to dedicate not less than 6 acres on site for a Fire/ Rescue Department facility; however, there is no provision for public transportation on site. Police protection will be provided by the County Sheriff's Office and the Florida Highway Patrol. Electrical power will be produced on site in addition to being available through FP&L lines should the combustion plant be temporarily shut down. Water supply will be furnished through on-site potable wells. Although the City of West Palm Beach Wastewater Treatment Plant lies approximately 2 miles southeast of the site, current plans are to dispose of all domestic and industrial wastewater on site via deep well injection. Solid waste disposal is not an issue because that is the primary purpose of the Resource Recovery Facility.

2.2.7.3 Procedures in Case of Extended Plant Shut Down

The Resource Recovery Facility is composed of two main elements:

- RDF Manufacturing Plant (Fuel Preparation)
- Combustion Plant and Power Generation

Plans for the Combustion Plant include two combustion units and one turbo-generator, and space for one additional combustion unit and an additional turbo-generator. The combustion plant will be in operation 24 hours per day, seven days per week.

The RDF Manufacturing Plant will have three RDF processing lines of which two will be operating 16 hours per day, 6 days per week, and the third on standby.

Several scenarios are possible for the plant shut downs, depending whether there is total or partial shut down.

- **Scenario 1 (Total Plant Shut Down)**

  With the complete shut down of all elements of the resource recovery plant, refuse would go directly to the adjacent Class I and III Landfills. There is sufficient space to landfill Class I refuse in excess of 20 years. But additional Class III space would be required and is planned for a south county landfill. Existing landfill space alloted for Class III would be transferred for use of Class I and constructed in accordance with all applicable requirements.

- **Scenario 2 (Total Combustion Shut Down)**

  Total combustion plant shut down could occur in initial years with the loss of the turbine generator or with the simultaneous loss of both boilers.

  The RDF manufacturing plant would continue to process refuse and stockpile RDF in the storage facility until it reached capacity (2 to 3 days). Additional RDF would then be sent to the Class I Landfill. The RDF, being shredded, would not require daily cover, would compact better, and would have recoverable materials removed, all of which would allow more efficient use of the available landfills.

  A partial loss of the combustion facility (1 boiler) would only require that portion of RDF that cannot be combusted or stored to be sent to the Class I landfill.

- **Scenario 3 (Total RDF Manufacturing Plant Shut Down)**

  Total loss of the RDF manufacturing plant is extremely unlikely, since 100% redundancy is planned in that facility. The tipping floor has storage space for approximately 3000 tons of refuse, and once that had been fully utilized it would be necessary to send refuse directly to landfill as depicted in scenario 1.

2.3 BIO-PHYSICAL ENVIRONMENT

2.3.1 Hydrogeology

The hydrogeologic investigations at the site were conducted to determine the physical controls on ground-water movement and the surface-water/ground-water relationship, as well as geochemical controls on the ambient quality of the ground water. Upon implementing the investigations, pertinent data and reports were reviewed and information was extracted for use in refining details of the site-specific testing and data collection program. The methods used for the investigations included well construction, geophysical well logging, surface-resistivity surveys, soil penetration tests, water and soil sampling and analysis, pumping tests, and water-level monitoring.

2.3.1.1 Geologic Description of the Site

Subsurface conditions in the vicinity of the site have been described in reports prepared by the USGS (U.S. Geological Survey) and various geotechnical and engineering consultants. The USGS reports have been generally broad in scope and relate to all or large portions of Palm Beach County; a few published and unpublished reports deal with the site of the nearby Dyer Boulevard Landfill and by association, the site area. Consultants' reports generally address the hydrogeologic conditions at sites of proposed or existing water-supply sources.

Geologically, the materials within several thousand feet of the land surface in south Florida are sedimentary rocks. The subsurface material pertinent to these investigations lies at depths less than about 125 feet, and consists predominantly of sand, shell, sandstone, and limestone. It is unlikely that any contaminant emanating from the land surface and migrating downward could penetrate deeper than 125 feet, because of a reduction in permeability below 125 feet. Consequently, detailed attention to deeper sediments is omitted from consideration in this report.

The Pamlico Sand, of Pleistocene age, is present from land surface to a depth of about 12 feet. The Pamlico Sand generally consists of fine, gray and brown sand, although organic materials and silt are occasionally encountered. The Anastasia Formation, of Pleistocene age, underlies the Pamlico and includes the entire shallow aquifer. The shallow aquifer is the name given to near-surface sediments that have sufficient permeability to yield water to wells in much of southern Florida. The Anastasia Formation is composed of gray and tan quartz sand and shells; between about 50 to 100 feet in depth, these deposits generally are cemented to form a coquina or sandstone. Scott (1977) marks the bottom of the shallow aquifer in the vicinity of the site at a depth of about 125 feet. Below about 125 feet, the Anastasia contains fine-grained materials in a sandy limestone or sandstone. The Anastasia Formation extends to a depth of about 250 feet (Fisher, 1980). Beneath the Anastasia Formation are the Tamiami and Hawthorn Formations that, in the vicinity of the site, have a low permeability and serve to confine the underlying Floridan aquifer. The top of the Floridan aquifer lies at a depth of about 1,000 feet. The Floridan aquifer in the vicinity of the site contains brackish water suitable only for certain types of irrigation uses.

The Anastasia Formation contains the shallow aquifer, the principal source of drinking water in Palm Beach County. A particularly permeable portion of the shallow aquifer occurs in a band of sandstone several miles wide in the east-west direction, and extends nearly the entire length of the County in the north-south direction. This zone tends to underlie the area in the vicinity of Florida's Turnpike at depths that vary between approximately 50 feet and 150 feet. This zone has been called the cavity-riddled zone, or alternately, the Turnpike aquifer; it contains cavities up to 2 inches in diameter that quite frequently are filled with sand. Portions of this cavity-riddled zone underlie the site.

The construction site is located in an area where the near-surface soils were deposited during the fluctuations of sea level that occurred in the last major period of glaciation. During the Pleistocene epoch, which occurred over the time period from 2 million to about 10,000 years ago, worldwide climatic changes were caused by the glaciers that periodically covered up to one-third of the earth's continental surface. Sediments already existing on the plateau were eroded and reworked while new sediments were deposted. Shell beds and lime stones were formed in the shallow seas. In some places, they have become hardened and cemented while in other places, they are unconsolidated.

Since the deposits in the vicinity of the proposed site are the result of many erratic changes in climate and fluctuations of sea levels, a careful determination will be made of the subsurface conditions with borings and penetration tests in order to avoid prematurely terminating foundation elements such as piles and footings in very thin strata that may cause high penetration resistance for a short distance followed by very low impedance in underlying soft or loose strata.

2.3.1.2 Detailed Site Lithologic Description

2.3.1.2.1 General

Subsurface conditions that govern the occurrence and quality of ground water were investigated using a number of techniques that also yield lithologic information; the techniques included: (1) examination of rock cuttings collected during well construction (Wells 1, 2, 3, and 4); (2) collection and analysis of split-spoon samples (at the sites of Wells 5 through 14), (3) performance of pumping tests and analyzing the data, (4) inspection of logs of other wells, (5) collection and interpretation of water-level measurements and (6) chemical analyses of ground-water samples. The data were assembled and geologic cross sections, ground-water contour maps, and ground-water flow diagrams were compiled and evaluated.

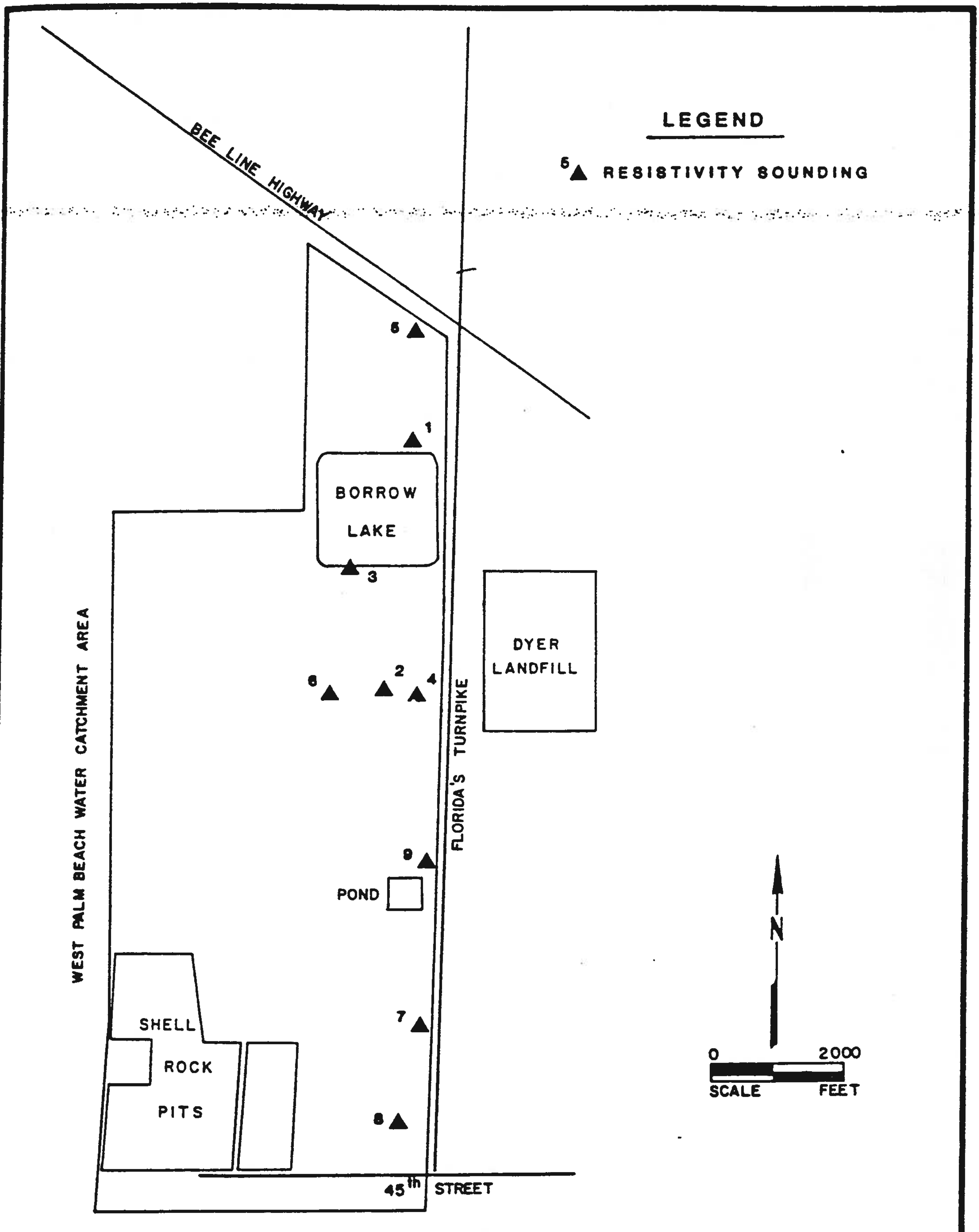
2.3.1.2.1.1 Resistivity Surveys

Early in April 1984, surface-resistivity surveys were conducted at nine locations on the site. These surveys were performed to document the existing earth resistivity and establish the geoelectrical properties of the site. The survey method consists of inducing an electrical current into the earth and simultaneously measuring the resistance of the earth materials to the flow of electrical current; the method is commonly used to supplement information gained from well construction and sampling because it is rapid and comparatively inexpensive.

The resistivity of sediments depends to a large degree on the relative quantity and quality of water that fills the voids between sediment particles or in the sediment matrix. If the water is salty, has characteristics of a leachate, or otherwise contains abundant free ions, then the electrical resistivity of the sediments containing that water will be low (and the conductivity of the water will be high). Also, water-saturated clays, because of the ionic properties of clay, produce low resistivities. Sediments containing water with a relatively low concentration of dissolved matter or those having a low porosity will have a relatively higher resistivity. Using these relationships, an area underlain by leachate-bearing sediments can be defined by its relatively low resistivity in comparison to surrounding higher resistivities.

The method employed to determine resistivity is referred to as resistivity sounding, wherein one pair of electrodes that induces current through the ground and another electrode pair which measures voltage potential are gradually expanded symmetrically from a center point with readings taken at each point. The method employed a "Wenner" array in which the distance between the current electrodes, referred to as the distance "AB", is three times the distance between the potential electrodes (USGS, 1974). The locations of the nine resistivity soundings are shown on Figure 2.3-1. Graphs showing the logarithm of the resistivities versus the logarithm of one-half the current electrode spacing ("AB/2") are presented in Appendix 10.14.2 for each of the nine resistivity soundings. The exact locations of the center and one end of the soundings have been surveyed to determine their horizontal coordinates; these coordinates are also provided in Appendix 10.14.2.

The resistivity soundings were interpreted by comparisons with geologic logs (prepared from wells later installed adjacent to some of the soundings); these comparisons are described in the section below on geologic conditions. Assuming that the water quality within any vertical section remains constant from the top to the bottom in the section, then the variations in resistivity must be attributed to variations in sediment materials and porosities. That assumption was verified and is reported below in the section on ground-water quality. With this information, interpretation of the resistivity soundings focused on variations in sediment characteristics. (Many interpreters of resistivity soundings consider the depth representative of any particular resistivity reading to bear a simple relationship to the current electrode spacing; this practice can be risky because theoretical resistivity values are a function of many variables. Multiple thin sedimentary beds, in particular, present the most difficult interpretive problem. In practice however, an empirical relationship can be employed. The depth represented by any particular resistivity measurement is assumed to be from 1/4 to 1/2 of the AB distance.)



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

LOCATIONS OF
RESISTIVITY SOUNDINGS

FIG. 2.3-1

The resistivity soundings showed that earth resistivities generally range from about 30 to about 800 ohm-feet. Several individual higher and lower measurements or "spikes" occurred but are believed to be due to erratic influences that may include instrument sensitivity, especially at the greatest electrode spacings. RS1 (Resistivity Sounding 1), RS3, RS4, RS6, and RS7 and RS8 showed increasing trends with depth. With the exception of RS2, these trends are slight along their course. The RS2 profile shows a relatively strong increasing resistivity trend with depth and is believed to be due to a ditch filled with water near the center of the electrode array, causing low resistivities at short spacings and becoming less influential at greater spacings.

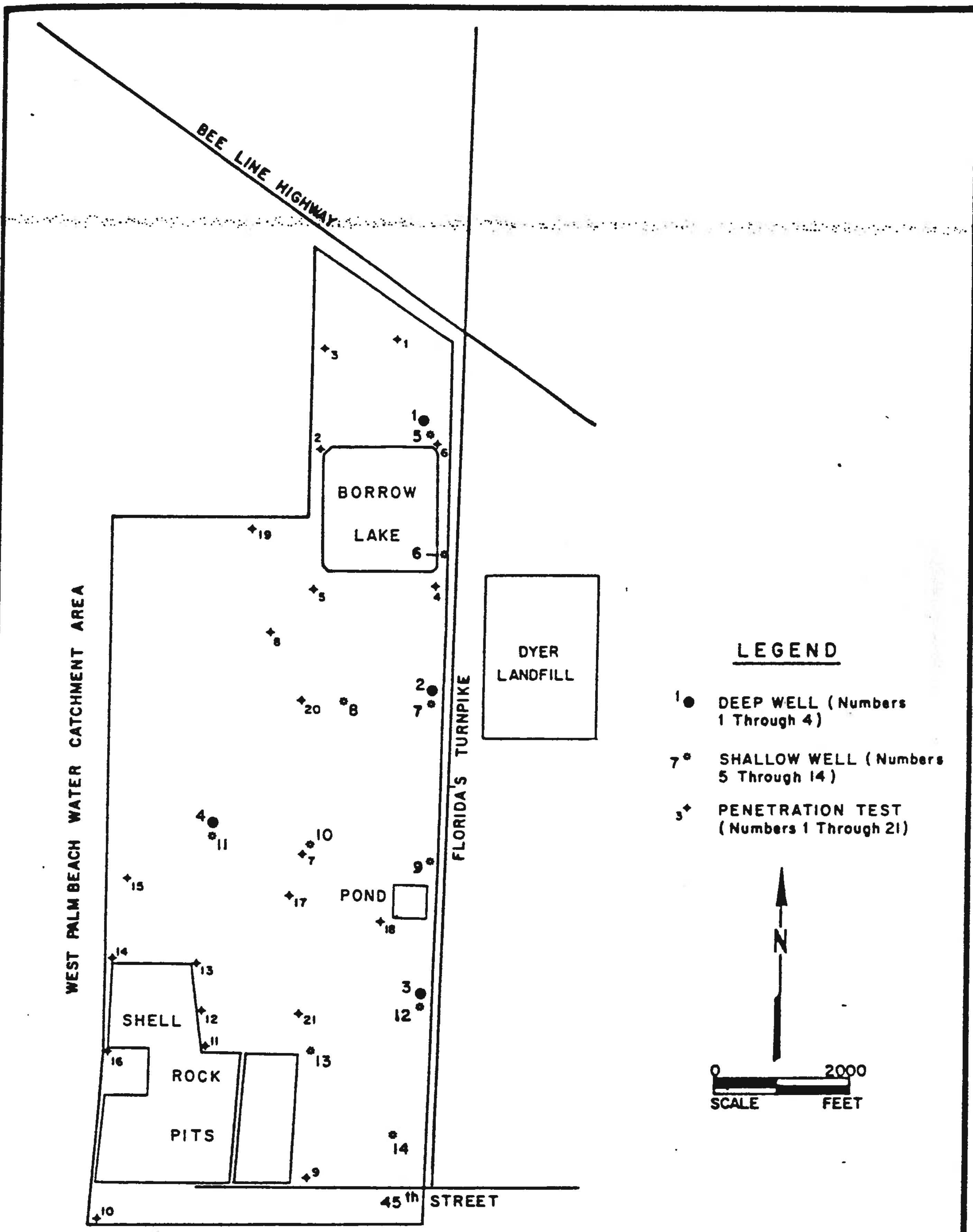
Another noteworthy anomaly was the predominantly low resistivities encountered on RS6 where all apparent resistivities were less than 200 ohm-feet. RS6 was further west than any of the surveys where ground-water levels are closer to land surface than they are to the east (this was verified by ground-water level measurements). This nearness between electrodes and the water table may be responsible for the generally low resistivities detected at RS6.

The practical value of the soundings lies in their documentation of existing conditions. If, in the future, leachate emanates from the Dyer Boulevard Landfill or the proposed landfill on the site due to accidental causes, a resistivity survey could be used to aid in detecting and delineating the plume. Resistivity soundings can be repeated in exactly the same locations using the same spacings to check for any changes in subsurface resistivities that may result from the presence of leachate. The locations of resistivity measurements and spacings between measurements are indicated in Appendix 10.14.2.

It is not certain that all the specific sites of the resistivity soundings will be accessible again following the commencement of landfill operations. If it is feasible (in an environment where fences, pipelines, overhead lines, fill material, and other interfering factors may exist) several profiles of resistivity could be conducted along the periphery of the proposed landfill prior to landfill operations. Such profiles would be conducted by using a "Wenner" array in a line consisting of resistivity measurements taken at one specific and constant electrode configuration. Information on the subsurface resistivity would therefore be continuous along a line, providing complete coverage. It is suggested that the relatively shallow sediments (less than 50 feet deep) be examined using a AB distance of about 150 feet.

2.3.1.2.1.2 Drilling and Well Construction

Between April 18 and May 5, 1984, fourteen wells were constructed on the site by the mud-rotary method and tested to gather geologic and hydrogeologic information. Well locations were selected to provide representative hydrogeologic information with emphasis on the easternmost 2000 feet of the site. Details of the completed wells are presented on Table 2.3-1. Top-of-casing elevations and horizontal coordinates of the wells are shown on Table 2.3-2. Geologic logs are contained in Appendix 10.14.1. In addition, Dutch Cone penetration tests were conducted at 21 locations to determine the suitability of the soil and rock for dredging and use as landfill cover: the results of these tests are presented in Appendix 10.14.3. The penetration tests were conducted between July 5, and July 9, 1984. The locations of boreholes, wells, and tests are shown on Figure 2.3-2.



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

LOCATIONS OF SHALLOW AND DEEP WELLS AND SOIL PENETRATION TESTS

FIG. 2.3-2

TABLE 2.3-1
DETAILS OF WELLS CONSTRUCTED ON THE SITE

Well Number	Total Depth of Borehole	Bottom of Casing Depth	Screened Interval
1	130	79	79 -88
2	120	60	60 -90
3	130	60	60 -90
4	120	60	60 -90
5 through 14	15 -16	5	5-15

Notes:

1. All depths are in feet referenced to ground level.
2. Drilling rates were highly variable because of the various degrees of rock consolidation and types of encountered within small vertical intervals.
3. The well casing in Well 1 is 6-inch-diameter PVC and the well screen is 4-inch-diameter PVC; the well ings and screens in Wells 2 through 4 are 4-inch-diameter PVC; the well casings and screens in Wells through 14 are 2-inch-diameter PVC.
4. Wells 1 through 4 have 6-inch-diameter protective steel sleeves extending 3 feet above grade; Wells 5 through 14 have 3-inch-diameter protective steel sleeves extending 3 feet above grade.

TABLE 2.3-2
ELEVATIONS AND HORIZONTAL COORDINATES OF WELLS CONSTRUCTED ON THE SITE

Well Number	Elevations (in feet above NGVD)			Horizontal Coordinates*** (in feet)	
	Top PVC Casing*	Top Steel Sleeve**	Ground Level	North	East
1	None	19.89	17.4	894,613.7	782,913.4
2	19.78	19.92	16.9	890,222.9	782,743.7
3	19.02	19.42	16.3	885,710.4	782,491.4
4	18.97	19.11	16.9	888,482.8	779,441.8
5	19.80	19.84	17.3	894,606.1	782,913.3
6	19.63	19.67	17.1	892,296.2	782,912.2
7	19.47	19.52	17.3	890,222.8	782,747.9
8	19.74	19.78	16.9	890,294.7	780,597.4
9	18.98	19.02	16.2	887,714.1	782,655.1
10	18.91	18.96	16.6	888,112.1	780,827.8
11	19.40	19.43	16.9	888,490.9	779,440.5
12	18.89	18.96	16.4	885,719.4	782,505.7
13	20.55	20.61	17.9	885,045.5	780,675.5
14	19.08	19.09	16.5	884,541.5	781,478.4

* Top of PVC casing serves as water-level measuring point except for Well 1; top of steel sleeve is measuring point for Well 1.

** Steel protective sleeve fits over PVC casing.

*** Horizontal coordinates based upon Palm Beach County Survey of Sections, from Post, Buckley, & Jernigan, Inc.

Wells 1, 2, 3, and 4 were initially drilled as boreholes to depths ranging between 120 and 130 feet; these are subsequently referred to as the deep wells. Rock cuttings from the boreholes were collected and inspected by a hydrogeologist on the site and the most permeable interval was selected in which to install well screens. The screened intervals generally showed few signs of being cavity-riddled and contained considerable amounts of sand. Evidence gathered during drilling of the first of the deep wells suggested that the sand was unstable; for this reason, well screens and gravel packs were installed. The shallow wells, Wells 5 through 14, also were constructed with screens and gravel packs and tap the shallow sediments between depths of 5 and 15 feet. The reader should note that geologic logs are not provided for Wells 5, 7, 11 and 12 in Appendix 10.14.1 because these wells are adjacent to "deep" Wells 1, 2, 4 and 3, respectively.

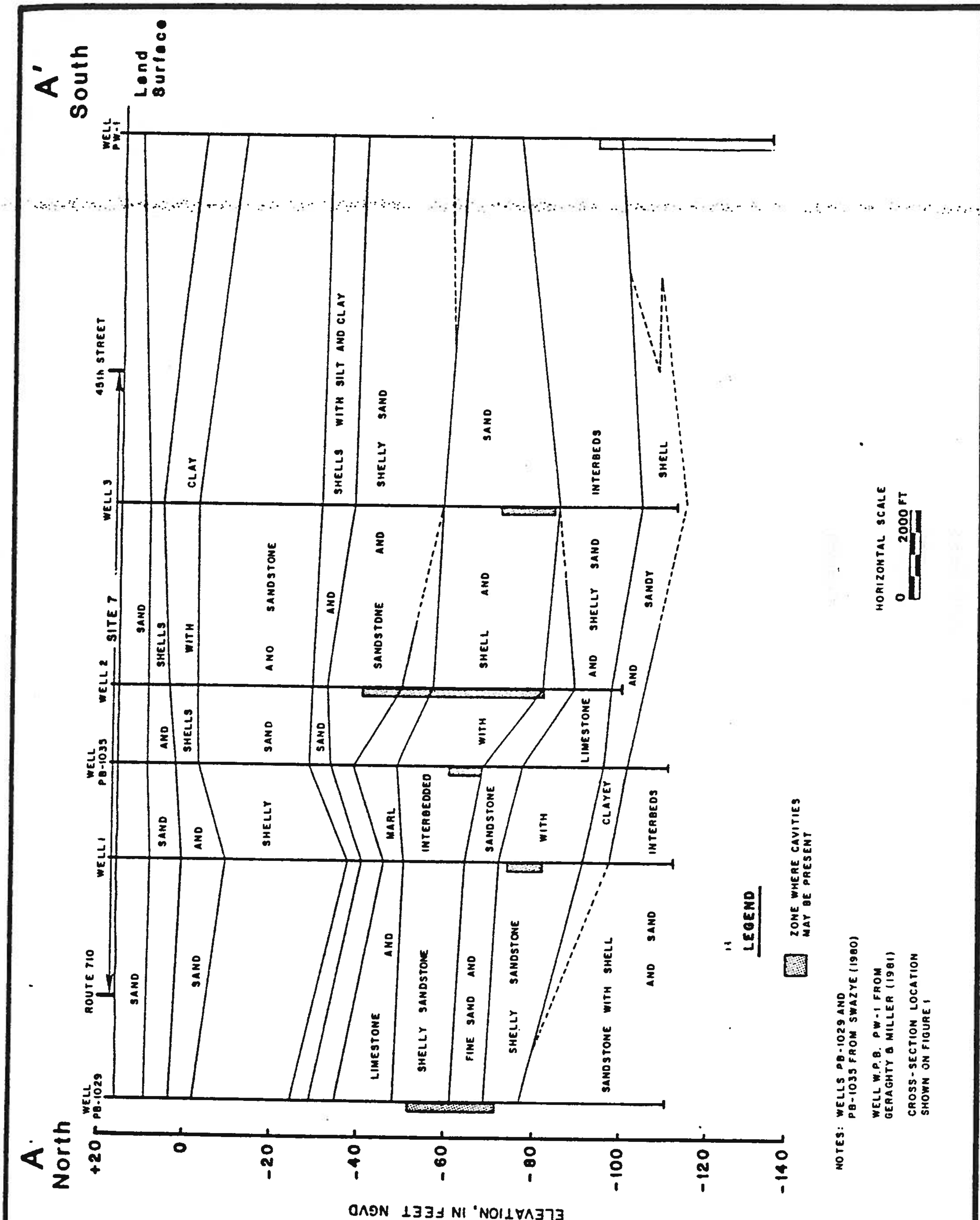
Following their construction, all wells were developed by pumping until the water produced was free of turbidity. The deep wells then were tested by pumping at constant rates for two hours and the shallow wells were pumped for one half hour. During and after each of these pumping tests water levels in the well were measured and the data analyzed to determine aquifer characteristics. Following the pumping tests, the fourteen wells were purged by removing a volume of water equal to 10 times the volume standing in the well and sampled. Finally, well-head elevations and horizontal coordinates were surveyed.

At locations adjacent to the ten shallow wells, split-spoon sampling was conducted to determine the soil composition. Descriptions of split-spoon samples were incorporated into geologic logs presented in Appendix 10.14.1. Also, selected soil samples were analyzed for their organic carbon content, cation-exchange capacity, and bulk density. The results of these analyses are necessary for predicting the behavior and attenuation of pollutants, should any enter the ground-water system. The significance of the analyses are discussed under Section 5.3.2 of this application.

2.3.1.2.1.3 Geologic Conditions

Rock cuttings collected during well construction were described and geologic logs were prepared and correlated with existing logs prepared by other investigators. Two copies of the geologic logs prepared as part of this investigation are presented in Appendix 10.14.1. Generalized geologic cross sections are shown on Figure 2.3-3 and 2.3-4; the location of the sections are shown on Figure 2.3-5. The sections show that most major stratigraphic units can be traced across the site and beyond its boundaries in the north-south and east-west directions. Because of the orientation of the Florida coastline and the influence it had on sediment deposition during Pleistocene time, there is much more conformity in thickness and extent of individual strata in the north-south than in the east-west direction. The cross sections show that the sediments consist of sand, shells, fine-sized particles (marl, clay, silt), sandstone, and limestone. Various strata are distinguished by dominant types.

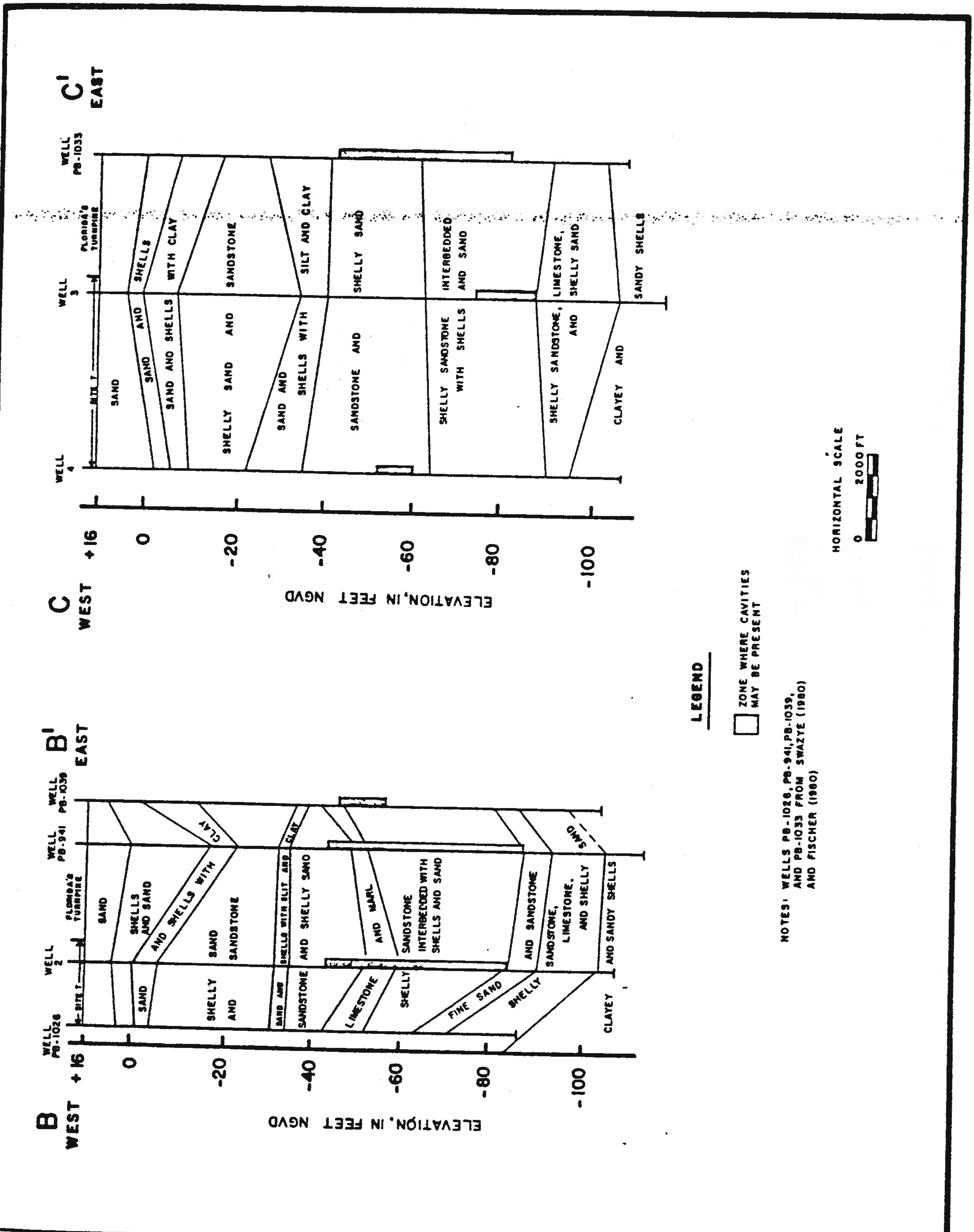
The deepest layer noted on the sections is sandstone interbedded with shells, sand and finer-sized particles. Significant amounts of clay and marl were encountered in Wells 2, 3, and 4 at depths of 117, 120, and 109 feet, respectively. Beneath all of the site, the approximate bottom of the shallow aquifer is considered to be at a depth of 125 feet, in accordance with the analysis by Scott (1977). The rocks above the deepest layer and up to depths of 50 to 60 feet are predominantly sandstone with shell and loose sand. Across the mid-section of



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

GEOLOGIC CROSS SECTION
FROM NORTH TO SOUTH

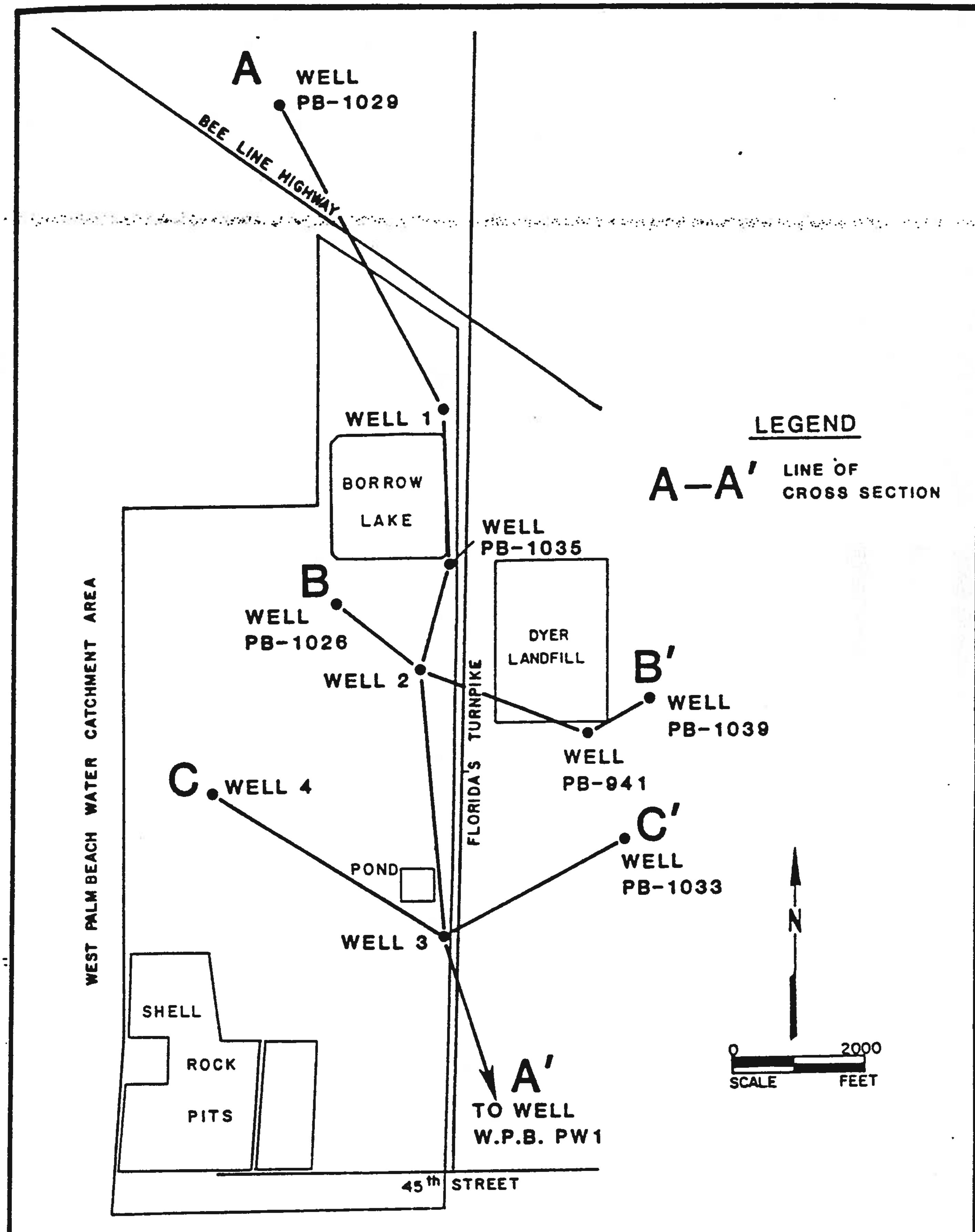
FIG. 2.3-3



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

GEOLOGIC CROSS SECTIONS
FROM WEST TO EAST

FIG. 2.3-4



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

LOCATIONS OF GEOLOGIC
CROSS SECTIONS

FIG. 2.3-5

the site, the sandstone dips toward the east and thickens slightly (Section B-B' of Figure 2.3-5); the thickness continues eastward of Florida's Turnpike. Within the sandstone layers are a marly limestone bed and a layer of fine sand that enter from the north and pinch out beneath the site. The sandstone layers also contain the cavity-riddled zone described by Fischer (1980) or its stratigraphic equivalent. Hydrogeologically, the sandstone is considered the principal portion of the shallow aquifer -the portion that would yield water most readily if tapped by a well.

Predominantly unconsolidated sand and shell beds are present above the sandstone layers; two of these beds contain significant amounts of silt and clay (Figures 2.3-3 and 2.3-4). The sand and shell beds also contain sandstone layers in places. Dutch Cone penetration tests performed at 21 locations on and near the site to determine the thickness of unconsolidated sediments and its suitability as landfill cover material showed that several relatively hard layers of sandstone are present predominantly in the northeastern and southwestern parts of the site. These layers range in depth between about 29 feet and 52 feet below grade, but have thicknesses of only a few feet. The most persistent lie between depths of 29 and 36 feet below grade. These layers can be correlated only generally between test sites and appear to have a limited extent (Appendix 10.14.3).

The uppermost of the sand and shall beds containing silt and clay lies between depths of 10 and 25 feet below grade. The lower one occurs between 25 and 57 feet below grade. These layers probably retard the vertical movement of ground water. The uppermost layer of sediment is sand. Silt and organic materials are encountered in this sand between depths of 2 and 12 feet grade.

The sandstone that forms the most permeable part of the shallow aquifer showed little sign of being cavity-riddled as described further east by Fischer (1980). Some evidence was shown and included lost circulation of drilling fluids (in Well 4), the presence of calcite crystal faces in the cuttings indicating the presence of voids, and the appearance of etched surfaces on cuttings that are characteristic of dissolution. The zones indicating these signs are shown on the cross sections. These zones generally occur in the sandstone. Evidence from the short-term pumping tests (Section 2.3.2.1) suggests that the rock cavities that may be present are filled with sand, thus resulting in permeabilities that are lower than those that occur elsewhere.

From a hydraulic perspective, the materials described in the geologic logs as shown in Appendix 10.4.1, have "grain sizes" that range from clay size to consolidated masses of limestone. Sands, where they occur, are fine to medium in size. Shells apparently occur in broken dime-size fragments and smaller. The porosities of clay, marl, and silt-sized materials are estimated to range from 40 to 50 percent. Sand-size materials are estimated to have porosities between 30 and 40 percent. Intergranular porosities of sandstone and secondary porosities of limestones are estimated to range from 10 to 20 percent, except where large cavities have developed; cavity zones could have porosities as high as 40 percent. The only occurrences of the loss of drilling mud was at 65 and 72 feet below grade in Well 4; approximately 50 gallons was lost at each depth. The porosities estimated above are based on information provided by Walton (1970) and inspections of drill cuttings derived during well construction.

With few exceptions, geologic information obtained in well construction shows only a general correlation with the surface resistivity data, primarily because of a lack of contrast in the electrical properties of the material. Well 1 lies about 600 feet from RS1. Resistivities from near land surface to perhaps 100 feet below grade vary generally in a range between

130 and 500 ohm-feet. Two low resistivity measurements occur at a 1/2 AB distance (not depth) near 90 feet and appear to reflect the marly materials present from 63 to 68 feet in depth. A spike of high resistivity at a 1/2 AB distance of 260 feet cannot be attributed to any particular layer and probably is related to performance of the equipment. Well 2 lies adjacent to RS4. The resistivities decrease generally to a level of 110 ohm-feet at a 1/2 AB distance of 160 feet suggestive of the increasing clay content below a depth of 97 feet. Well 3 was constructed near RS7. The resistivity ranges generally between 185 and 460 ohm-feet; two exceptions suggest clayey layers at a 1/2 AB distance of 39 and 105 feet. These may correspond to a silty shell bed from 17 to 18 feet in depth and a clay bed from 47 to 54 feet depth. Again, the many thin layers of sediment that probably have different resistivities tend to complicate the resistivity sounding and make if difficult to attribute specific resistivity characteristics to specific sediments.

Gamma ray logs were made in Wells 1, 2, and 3 following well construction. By correlation with geologic logs prepared during well construction, the zones of major gamma ray activity were revealed to contain phosphate mineral. Such occurrences are observed in the rock cuttings by gray and black sand and shell; these minerals are common in most of Florida. On the site, the phosphatic minerals were encountered generally in the shallow unconsolidated sediments and also in a shelly sand layer in the generally consolidated sediments between depths of 68 and 75 feet in Well 1. Gamma ray logs are presented in Appendix 10.14.5.

The geologic information on the site discussed above indicates that the sediments present above a depth of 50 feet are generally unconsolidated and have a permeability lower than the more consolidated sediments between 50 and 100 feet. On this basis, the most rapid lateral flow of ground water will occur in the zone from 50 to 100 feet below grade; however, sediments above 50 feet also are capable of transmitting lateral flow but at a lower rate. The upper sediments are more important in conducting water vertically between the surface and the deeper more permeable zone. As discussed in Section 2.3.2.1 of this application, the vertical direction of water movement depends on the water-level relationship between the two zones.

2.3.1.2.1.4 **Injection Zone**

Wastewater generated on the site will be injected into the highly permeable "boulder zone" that lies between depths of about 3,000 and 3,800 feet. The use of the boulder zone for the injection of wastewater has become common in southern Florida (Florida Department of Environmental Regulation, 1983). The boulder zone consists of dolomite that has been extensively altered by fracturing and dissolution, thus creating caverns. This zone contains water having similar chemical quality to sea water and is isolated from overlying less saline ground water of the Floridan aquifer by about 800 feet of relatively low-permeability limestone. The temperature of water in the boulder zone is about 52 degrees Fahrenheit (Geraghty & Miller, Inc., 1980).

The boulder zone occurs within the Cedar Keys Formation and Oldsmar Limestone of Paleocene and Lower Eocene age, respectively (Chen, 1964). Thick confining units overlie the injection zone and underlie the shallow aquifer. Above the boulder zone and below the shallow aquifer are rocks of Upper Eocene age, Oligocene age, and Miocene age.

2.3.1.2.1.5 Soils

The soils of the site were described by the U.S. Department of Agriculture (1978). The soils types and their descriptions that occur on the site are listed on Table 2.3-3. Of a total of 16 soil types, four have a dominant presence on the site and occupy 50 percent of the entire site. Existing rock pits comprise about 22 percent of the entire site. Acreages of the major soils types also are listed on the table. These soils generally lie nearly level and are poorly drained.

TABLE 2.3-3
DESCRIPTION OF THE SITE SOILS

Soils Types That Comprise Fifty Percent of The Site

Basinger and Myakka sands, depressional: 112 acres; very poorly drained, soils in shallow depressions.

Hallandale sand: 101 acres; poorly drained, sandy soil that has a dark colored, weakly cemented layer below a depth of 30 inches over a loamy layer.

Riviera sand, depressional: 221 acres; poorly drained soil that has a loamy sub- occurs in shallow, well defined depressions.

Soils Types That Comprise Twenty-Eight Percent of The Site

Anclote fine sand: very poorly drained, deep sand soil.

Arents -urban land complex: somewhat poorly drained sandy soil.

Basinger fine sand: poorly drained, deep sandy soil.

Boca fine sand: poorly drained, with loamy subsoil.

Chobee fine sandy loam: very poorly drained, with layer of dark colored fine loam and subsoil of sandy clay loam.

Floridana fine sand: very poorly drained, with thick, black sandy surface layer and loamy subsoil.

Holopaw fine sand: poorly drained, with a thick sandy surface layer and loamy soil.

Okeelanta muck: very poorly drained organic soil with sandy mineral material depth of 40 inches.

Pinellas fine sand: poorly drained, with sandy calcareous subsurface layer and loamy subsoil.

Riviera sand: Poorly drained, with thick sandy subsurface layer that tongues into loamy subsoil.

Tequesta muck: very poorly drained, with thin organic layer on surface overlying a mineral soil.

Winder fine sand: poorly drained, with sandy subsurface layer that tongues into a loamy subsoil.

2.3.1.2.1.6 Additional Information

Other information requested in the application guidelines under Section 2.3.1.2 (Detailed Site Lithologic Description) are discussed for the purpose of continuity under the following items: Section 2.3.2.1 - vertical and horizontal permeabilities (hydraulic conductivities), and Section 5.3.2 - cation-exchange capacities.

2.3.1.2.2 The Resource Recovery Plant Site

2.3.1.2.2.1 Preliminary Soil Investigations

Preliminary soil investigations in the vicinity of the proposed site include four wash borings taken (Appendix 10.13) and 21 cone penetration tests (Appendix 10.14.3). In addition, detailed geologic logs are available from ten wells in the vicinity of the site (Appendix 10.14.1). The following discussion is based on information contained in the cited appendices.

The boring logs and the geologic logs of the wells contain detailed descriptions of the soils encountered at various depths. In addition, the boring logs contain a record of the number of hammer blows required to drive a standard sampler through four successive six-inch increments of depth during the process of obtaining each sample. Samples are normally taken every 5 feet of depth and at intermediate depths where major changes of soil type occur. Because the same driving energy (a 140-pound hammer falling 30 inches) and the same type of sampler (1-3/8 inch I.D. by 2 inch O.D. split spoon) is used almost universally in this country, it is possible to correlate the number of blows required to drive a fixed distance (1 foot) from site to site with the relative density for granular soils or the consistency of clay soils. Thus, the standard penetration resistance, N (the number of blows required to drive the sampler one foot) has become an important predictive tool in foundation design. At each sample location, the weighted average number of blows per foot is interpreted from the three or four records of blows per six inches that are observed at each sample location.

In the cone penetration test, also called a Dutch Cone test, a special conical probe is slowly pushed into the ground and the resistance to penetration is recorded at close intervals (every 20 cm) until the full depth of the investigation is attained. The probe consists of a conical tip mounted on an inner rod and a "friction jacket" which fits over a concentric outer rod. The whole assembly is first pushed to the desired test depth after which the cone is extended 3.5 cm while the jacket remains stationary. The whole assembly (jacket and cone) is then advanced another 3.5 cm as a unit. During both of these operations, the penetration resistance is measured using hydraulic gauges located at the surface. After each pair of readings, the cone is retracted into the jacket and the unit is pushed to the next sampling depth. The penetration resistance of the cone moving alone and moving with the friction jacket are both used to infer the type of soil being penetrated and the relative density and consistency of the material at the depth of the tip.

The Dutch Cone tests have been used extensively in Europe for many years and many correlations between cone resistance and soil properties have been made. In recent years, its use has greatly increased in the United States and it has been proved to be a very useful and reliable method of soil exploration. The one disadvantage is that samples of soil are not available for visual inspection or testing. An excellent comparison and correlation between the standard penetration test and the cone penetrating test has been given by Schmertmann (1970).

The cone penetration tests, the geologic logs of wells, and the borings indicate that the area is covered by a layer of shelly sand to a depth of about 50 to 70 feet. Small amounts of clay and silt are mixed with the sand in some cases. Within this thick stratum, there are a number of substrata where the penetration resistance (to both the cone penetrometer and the standard sampling spoon) increases over short increments of depth indicating that varying degrees of cementation and/or densification have occurred. These strata are often only a few feet thick and appear to overlay very loose sand in some cases. In the remainder of this stratum, the blow counts on the sampling spoon, which generally fall in the range of 9 to 20, and the cone penetration resistance, typically in the range of 20 to 40 tons per square foot (tsf), suggest that the relative density is fairly low. Because of the wide separation between boring and penetrometer sites, only very limited substrata correlation in the horizontal direction is possible.

Generally, between depths of 50 to 70 feet, penetration resistance increases dramatically, indicating the top of a sandstone bed. Borings were extended to a depth great enough to ensure the presence of this layer; adequate support for deep foundations supporting major structural elements will be provided by this layer.

2.3.1.2.2.2 Factors Affecting Foundation Design

As indicated above, there appears to be a competent bearing layer starting at a depth in the range from 50 to 70 feet over most of the site. Piles or piers driven or socketed into this stratum will be used for the foundations of major structures.

Smaller lightweight structures will either be founded on spread footings or shorter piles driven to depths such that the tips are located in one of the shallow sub-strata where the borings indicate higher penetration resistance to either the sampling spoon or static cone penetrometer. However, because of the variability of the penetration resistance, it will be necessary to perform borings and possibly cone penetration tests at the precise locations chosen for each of the structures. These borings would also reveal any isolated zones of cohesive soils that are sometimes found in this type of deposit. In particular, care will be taken to insure that there are no very loose or soft compressible zones immediately under the thin strata where the pile tips are located. Because most of the samples from the borings and wells contained significant amounts of shells or shell fragments which may be more compressible than ordinary sands or gravels, this factor will be taken into account in estimating settlements of the facilities with shallower foundations.

In the cases where the footings or short piles are utilized, full consideration will be taken of the fact that vibrational loading of either the footing itself or nearby structures, or subsequent construction involving nearby pile driving, has the potential of causing a considerable amount of unpredictable settlement owing to the low relative density of the cohesionless soils that form a large part of the upper strata. Thus, care and planning in designing both present and future facilities will be exercised to avoid damage to such structures. Moreover, settlement that may be caused by vibratory loads can also produce additional loads on foundations which utilize longer piles because of the potential for dragdown resulting from negative skin friction on the upper portions of the piles.

In planning foundations for major structures on longer piles, specifications will provide for pile and hammer capacity sufficient to permit overdriving to punch through any thin substrata that are encountered in the upper 50 to 70 feet. The final driving resistance that will ensure a satisfactory pile capacity will depend in part on the crushing strength of the underlying sandstone. Since this rock may be fairly porous and rather lightly cemented, tests to reliably determine point resistance will be conducted.

2.3.1.3 Geologic Maps

The major structures to be installed on the site are the resource recovery plant and the landfills. The geologic conditions beneath the proposed sites of these structures are not unique on the site as a whole; geologic conditions on the entirety of the site are substantially uniform. The land surface elevation generally varies between + 17 and + 18 feet NGVD (National Geodetic Vertical Datum) and averages about + 17.5 feet NGVD. Infrared and conventional aerial photographs of the site show no signs of fracture traces nor are they known to exist or expected.

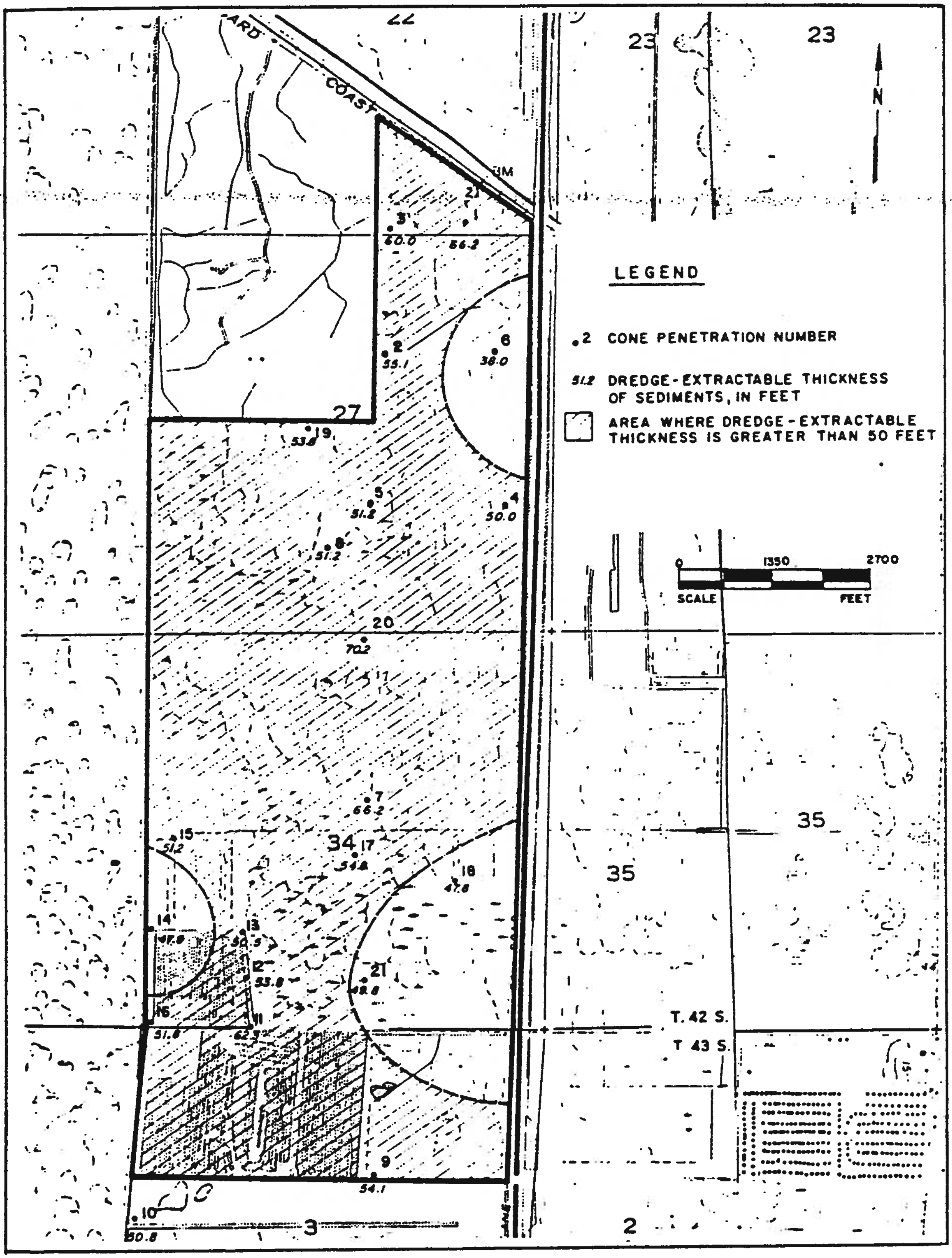
The thickness of unconsolidated sediments appropriate for dredging as landfill cover material beneath the site was investigated by making 21 Dutch Cone penetration tests distributed over the entire site [Appendix 10.14.3]. These tests were performed in locations chosen to be uniformly distributed on the site to the extent allowed by established access and access by four-wheel drive vehicles. The thickness of generally unconsolidated sediments beneath the site varies little over the site as shown on Figure 2.3-6. The thickness averages approximately 50 feet.

The capacity of soils and geologic materials beneath the site to attenuate contaminants was investigated by split-spoon soil sampling at the sites of Wells 5 through 14. At each of these wells, samples were derived approximately at two-foot intervals to a depth of 10 feet, then at five-foot intervals to 20 feet, and at 10-foot intervals to total depth. The total depth was determined at the point where sediment hardness prevented further sampling. At three of the 10 sites (adjacent to Wells 1, 2 and 4), samples were taken at depths greater than 30 feet below grade.

Soil samples were analyzed for their organic carbon concentration and their cation-exchange capacity. The significance of these analyses relative to contaminant attenuation is discussed under Section 5.3.2 of this application and the results of analyses are reported in Appendix 10.14.4. With regard to the OCC (organic carbon concentration), the depth of approximately 30 feet separates shallow soils having an average OCC of 1.22 percent from those at greater depths which have an average OCC of 2.19 percent. The higher average OCC soils have a greater capacity to attenuate contaminants. There was little discernible difference between CEC (cation-exchange capacities) values above and below a depth of 30 feet. The average CEC for all soil samples is 3.70 milli-equivalents per 100 grams. There is no basis for mapping the distribution of attenuation properties of the area.

2.3.2 Subsurface Hydrology

The borrow lakes are the principal feature of the proposed resource recovery plant, landfills and associated facilities that will affect subsurface waters. By design, there will be no effect on subsurface water by effluent. Borrow lakes will be excavated into the uppermost 50 feet of sediments on the site. The hydrogeologic characteristics of these sediments are described under Section 2.3.2.1 of this application.



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

THICKNESS OF DREDGE-EXTRACTABLE SEDIMENTS

FIG. 2.3-6

Hydrogeologic investigations undertaken on the site included well construction, pumping tests, water-level monitoring, and water sampling and analysis. Data generated by these testing methods were compiled to characterize hydraulic properties of the aquifer, ground-water flow rates and directions, and ground-water quality in the context of the geological setting.

2.3.2.1 Subsurface Hydrologic Data for the Site

The hydraulic character of an aquifer system is described in terms of parameters referred to as the transmissivity, porosity, storage coefficient, and depending on the nature of the aquifer, the specific yield or leakance coefficient. These parameters are determined by analyses of data obtained from pumping tests. The transmissivity is a measure of the ease of water flow through the aquifer. The transmissivity of an aquifer equals the horizontal permeability multiplied by the aquifer thickness. Porosity is a measure of the open space within a volume of rock. The "effective" porosity refers to rock openings that are interconnected. The storage coefficient is the volume of water released from storage per unit surface area of the aquifer per unit change in head. The specific yield of an aquifer is the ratio of water volume that can be drained from a specific volume of aquifer, to the aquifer volume affected. The leakance coefficient is a property of confining material; it is the vertical permeability of the confining unit divided by the vertical thickness of the confining unit. With known aquifer parameters, water levels and flow rates in the aquifer can be predicted in response to any stress on the aquifer such as pumping or recharge. Additionally, the direction and rate of movement of ground water and solutes (dissolved substance) can be determined.

Following the construction and development of the "deep" wells (Wells 1 through 4), pumping and recovery tests were conducted on each well. Analyses of data from the deep wells by a method devised by Cooper and Jacob (Walton, 1970), yielded aquifer transmissivities that ranged from 30,000 to 70,000 gpd/ft (gallons per day per foot) and averaged 50,000 gpd/ft. Transmissivities determined from analyses of the pumping test data are listed on Table 2.3-4. The wells tap the cavity-riddled zone or its stratigraphic equivalent. Well screens were installed between depths of 60 and 90 feet, below the silty and clayey layers that lie above 50 feet, and above the less permeable and interbedded layers that lie 100 feet and below. Because the tests were short in duration and pumping is not likely to have affected the aquifer at depths shallower than 50 feet or deeper than 100 feet, the thickness of the aquifer affected during the tests averages 50 feet. The horizontal permeability of the cavity-riddled zone is estimated to average 1,000 gpd/sq.ft. (gallons per day per square foot). The horizontal permeability of the deep zone is lower on the site than a few miles northeast and southeast. A probable reason for the relatively low permeability of the deep zone is that sand fills the poorly-developed existing cavities, thus resulting in a reduced permeability relative to a truly cavity-riddled rock. The vertical permeability of the deep zone cannot be estimated based on the pumping tests data, but because of the sedimentary layering encountered, it is judged to be between 0.1 and 0.2 of the horizontal permeability. Based on observations of drill cuttings collected during well construction, the porosity is estimated to be about 20 percent.

The recovery portions of the pumping-test data from Wells 5 through 14 also were analyzed by the Cooper and Jacob method and yielded transmissivities that ranged from 6,000 to 15,000 gpd/ft and averaged 9,000 gpd/ft. Four of the ten tests performed on shallow wells produced erratic data and could not be analyzed. The wells tap sand and shell beds through the interval from 5 feet to 15 feet below grade; because the water table was about two feet below land surface and because of the underlying clayey bed, the thickness of the zone affected by the pumping was about 13 feet. The average horizontal permeability of this zone is calculated to be 700 gpd/sq.ft.

The vertical permeability of sediment in the upper 15 feet was estimated based on the soil permeability within about 50 inches of the land surface. The materials in the uppermost 50 inches are similar in composition to those between 50 inches and 20 feet below grade. Of the dominant soils types found within the area of the site (these include the Hallendale, Oldsmar, and Riviera soils), all have vertical permeabilities that average about 160 gpd/sq.ft. (U.S. Department of Agriculture, 1978). This vertical permeability is about 0.2 of the average horizontal permeability determined in the shallow-well pumping tests.

The transmissivity of the entire aquifer thickness between the water table and its bottom at 125 feet was estimated based on the analyses above and the geologic logs. Based on apparently similar lithologic characteristics, the sand and shell beds between the approximate depths of 15 and 50 feet (including those that contain silt and clay) are estimated to have an average horizontal permeability equal to the beds above 15 feet, or 700 gpd/sq.ft. On the same basis, this permeability also is estimated for sediments between 100 and 125 feet. Multiplying the various permeabilities by their respective thicknesses and summing the results yields a transmissivity for the entire aquifer thickness of 101,000 gpd/ft. A map showing the distribution of the regional transmissivity is shown on Figure 2.3-7 and is based on the test results from the site and data from other tests in the area.

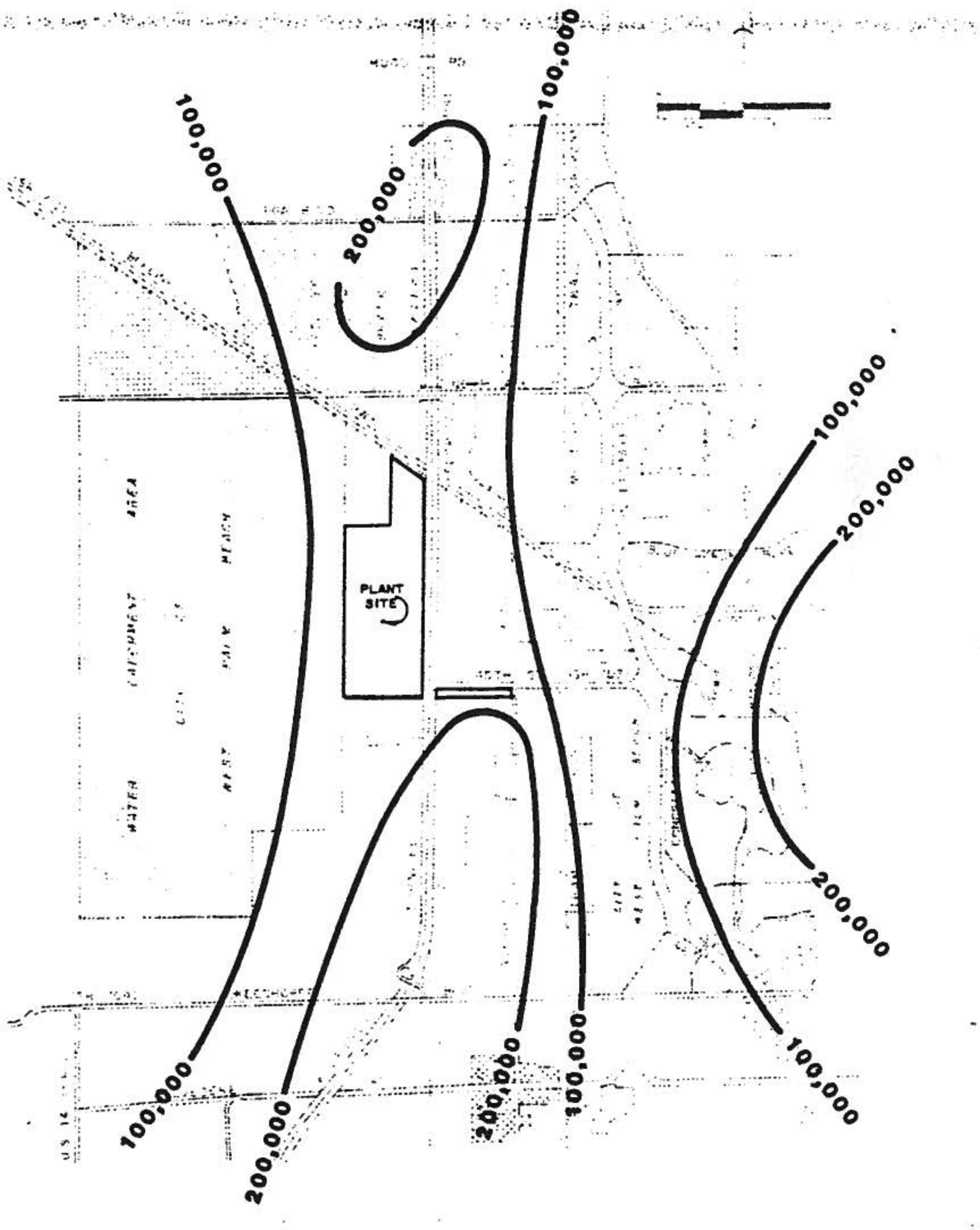
TABLE 2.3-4
AQUIFER TRANSMISSIVITIES DETERMINED FROM
SHORT-TERM PUMPING TESTS CONDUCTED ON THE SITE WELLS

Well Number	Coefficient of Transmissivity (a)
1	48,000 gallons per day per foot
2	54,000 gallons per day per foot
3	30,000 gallons per day per foot
4	70,000 gallons per day per foot
5	15,000 gallons per day per foot
6	(b)
7	(b)
8	(b)
9	24,000 gallons per day per foot
10	15,000 gallons per day per foot
11	13,000 gallons per day per foot
12	17,000 gallons per day per foot
13	12,000 gallons per day per foot
14	22,000 gallons per day per foot

(a) derived by use of the water-level recovery data and the Cooper and Jacob method (Walton, 1970)
(b) test results were inconclusive

LEGEND

—200,000— AQUIFER TRANSMISSIVITY CONTOUR, IN GALLONS PER DAY PER FOOT



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

APPROXIMATE DISTRIBUTION OF TRANSMISSIVITY IN THE SHALLOW AQUIFER

FIG. 2.3-7

Based on a comparison of water levels in the shallow (0 to 15 feet) and deep (50 to 100 feet) zones discussed below, the aquifer is concluded to behave as an unconfined system. As discussed below, there is generally only a small difference between shallow and deep water levels. Therefore, in addition to the aquifer transmissivity, the specific yield (analogous to the storage coefficient) must be estimated to allow the prediction of the aquifer response to stress such as pumping.

The specific yield of unconfined aquifers in south Florida generally ranges from 0.10 to 0.20. The particle-size distribution of the site soils (including the Hallendale, Oldsmar, and Riviera soil types) were analyzed according to a method described by Fetter (1980) and concluded to have a specific yield of about 0.20. Because it is the unconsolidated sand that would be dewatered during pumping from the principal aquifer, a specific yield of 0.20 is concluded to be representative of the unconfined aquifer at the site.

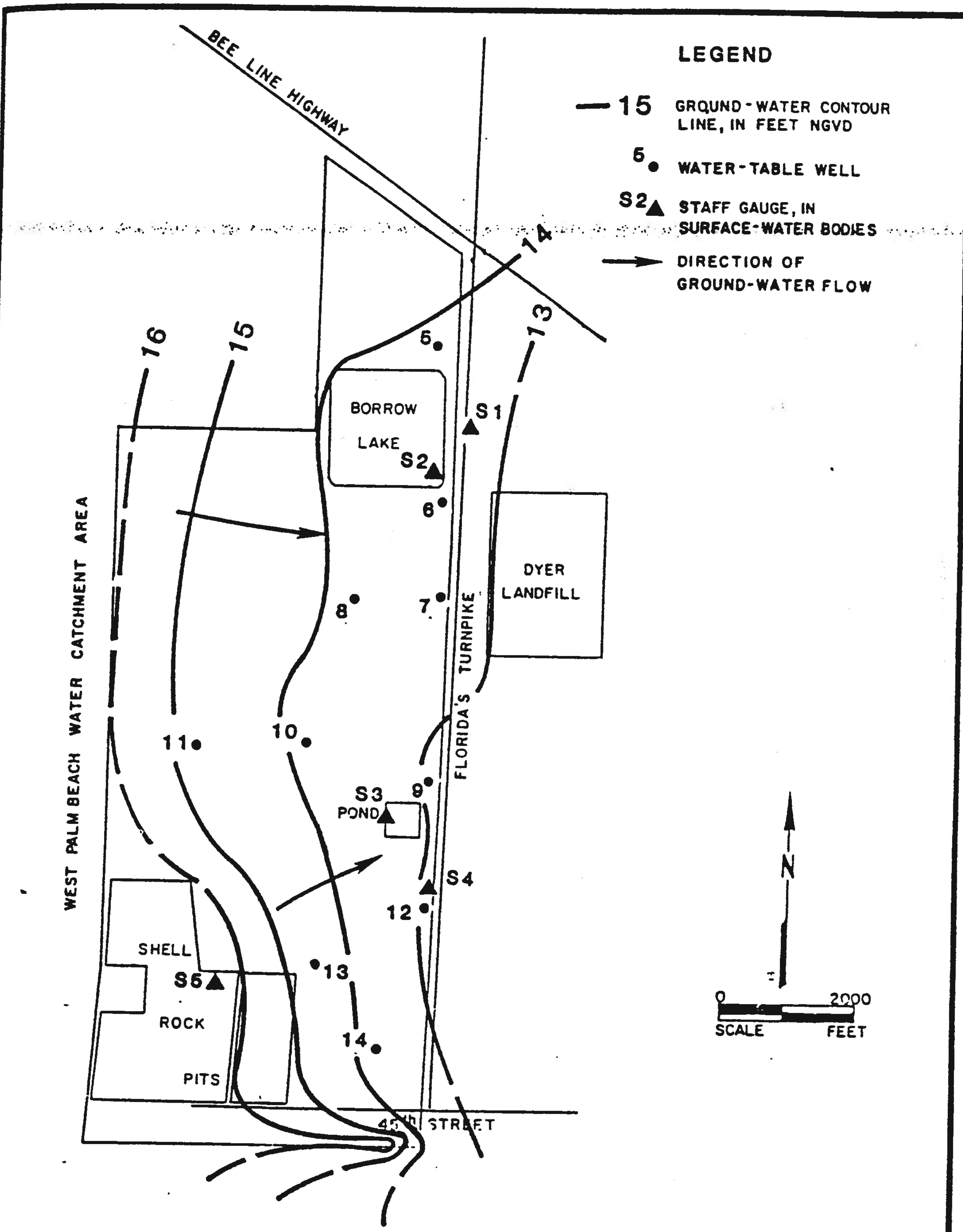
In contrast to findings on the site, aquifer tests conducted about 3/4-mile east of Florida's Turnpike (Fischer, 1980) and about 1 mile east near Military Trail suggested that the aquifer behaves as a leaky confined aquifer. The distinction between an unconfined aquifer and a leaky confined aquifer is related to the vertical permeability of the zone above the principal aquifer, the thickness of that zone, and the transmissivity of the aquifer.

2.3.2.1.1 Ground-Water Levels, Flow Paths and Fluctuations

Ground-water levels were measured both manually and automatically during the period from May 15 to July 23, 1984. In addition, five staff gauges for measuring surface-water levels and three rain gauges were installed and monitored during the same period. Included in the network of wells was an existing well (Well PB-1035) installed in 1977 by the U.S. Geological Survey. Wells 1 through 4, that tap the principal aquifer, were fitted with automatic water-level recorders. Water levels in Wells 5 through 14, Well PB-1035, the staff gauges, and the rain gauges, were measured twice per week and following significant rainfall events. The tops of casings of all the wells and the tops of the staff gauges were surveyed to determine their elevations with reference to NGVD (National Geodetic Vertical Datum). Data generated during monitoring are presented in Appendix 10.14.6.

Ground-water levels measured in wells on the site fluctuated generally through a range from + 13 feet to + 17.5 feet NGVD depending on location. The pattern of fluctuations and the ranges in water-level elevations in the deep wells compared to the shallow wells were similar but distinct; differences between the two depended upon the time in question relative to the incidence of rainfall. The influence of the WCA (West Palm Beach Water Catchment Area) and other surface-water bodies also were apparent in the water-level data. The WCA has a major influence on the ground-water elevations and the gradient across the site. The effects of alternating rainfall and dry periods are superimposed on water levels dominantly controlled by the WCA.

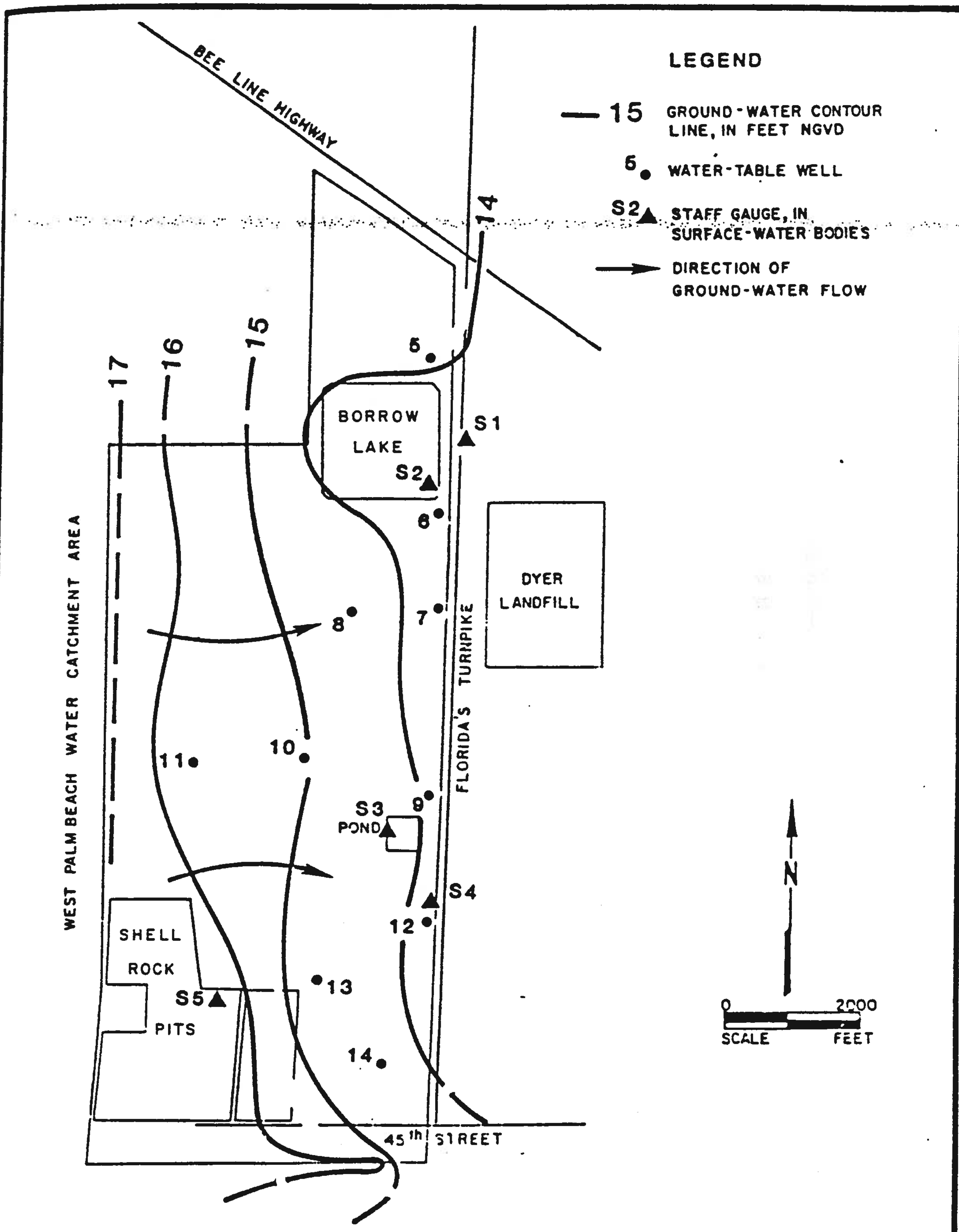
Figures 2.3-8 and 2.3-9 are contour maps showing elevations of ground-water levels as measured in shallow wells and surface-water bodies on May 23, and July 19, 1984. Water levels on those dates are representative of relatively stable conditions over the entire site at the end of moderately dry periods. Although the actual levels at any particular point are different on each of the selected dates, water-level contours on both dates form a similar and



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

WATER-TABLE CONTOUR MAP
MAY 23, 1984

FIG. 2.3-8



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

WATER-TABLE CONTOUR MAP
JULY 19, 1984

FIG. 2.3-9

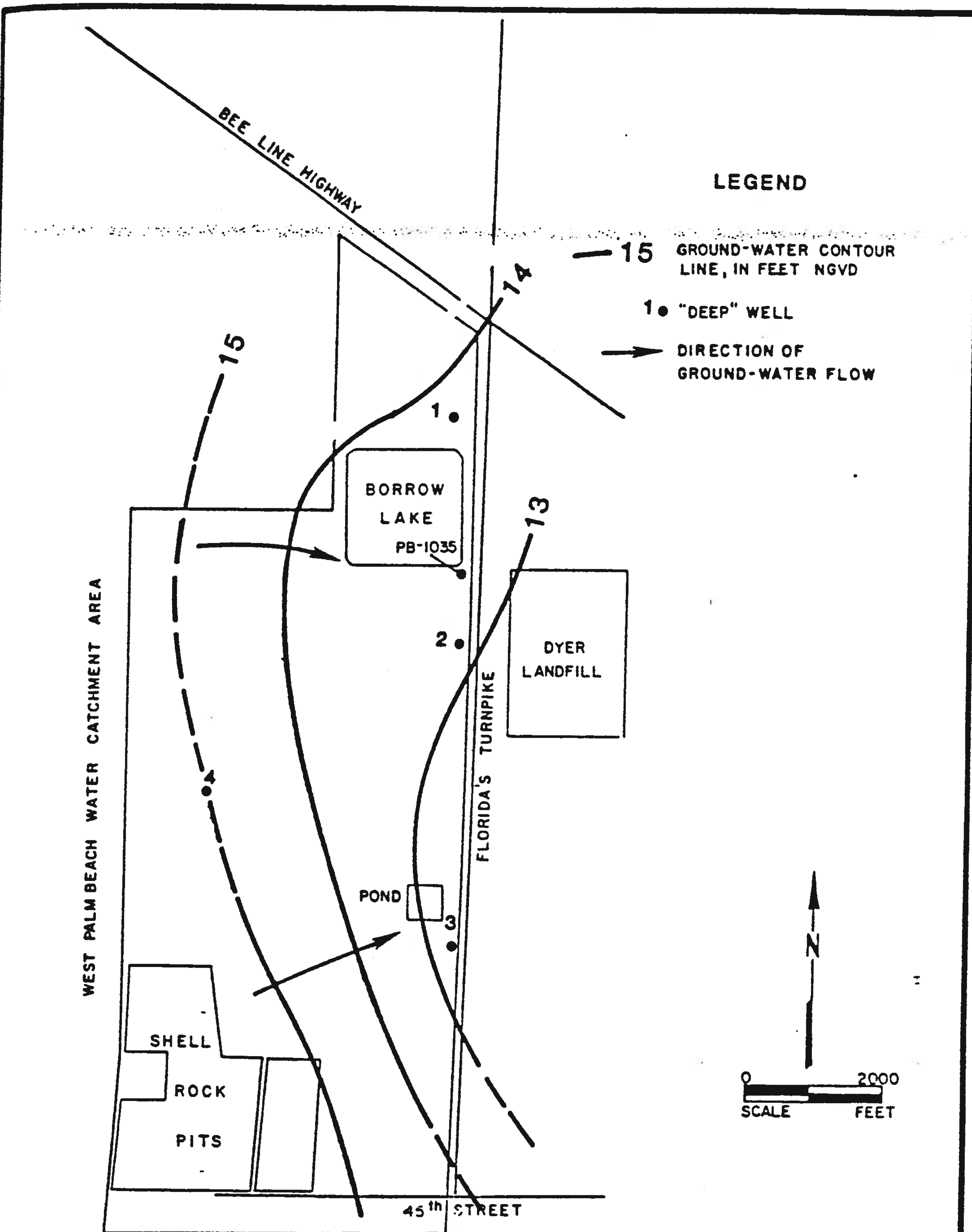
consistent pattern. Water-level contours following a significant rainfall indicate a rapidly changing pattern and would reflect the distribution of rainfall over the site. During the data-collection period, water levels in shallow wells fluctuated between elevations shown on Figure 2.3-8 and a level that was an average of 2.27 feet higher. Arrows shown on the figures indicate the direction of ground-water flow through shallow sediments.

The data show that water-level elevations in shallow sediments decrease from the WCA (on the west) to the eastern border of the site. The water in the WCA is held artificially at a level generally greater than + 17.5 feet NGVD by the City of West Palm Beach for use in the municipal water system. Seepage occurs from the WCA and into the shallow and deep sediments toward the east. The abandoned borrow lakes in the southwest corner of the site apparently are hydraulically connected through permeable soils to the WCA because they tend to have a water level similar to the WCA. Water levels in the active borrow lake in the northeastern corner of the site are depressed an average of 0.84 feet relative to the adjacent Well 5 because of pumping of water from the lake. This is because of water losses in the slurry route between the Dyer Boulevard Landfill and the return point at the borrow lake. Ground-water from the shallow zone flows into the lake because the water level is lower in the lake than the adjacent shallow zone. On the other hand, the water levels in the canals along Florida's Turnpike and in a long-abandoned pond near the east-central part of the site are higher than in adjacent shallow sediments. On average, the water levels in these surface-water bodies are 0.21 feet higher than the adjacent Well 12. Water levels in those surface-water bodies remain above the water-table level for several possible reasons. Among the reasons are: surface-water bodies receive more recharge by surface-water runoff; they are less effected by plant transpiration; and they probably have a poor hydraulic connection to the sandy sediments because of a developed organic mat along their bottoms.

Figure 2.3-10 and 2.3-11 show contours indicative of water levels in the deep wells on May 23, and July 19, 1984. Water-level contours on both dates are similar and show a consistent pattern. The water levels in the deep zone are quite similar to those in the shallow zone. Again the ground-water flow direction is from west to east because of the influence on the WCA. Although muted somewhat, the surface-water features (lakes and canals) are shown to be influential in the deep zone, and in the same manner as in the shallow zone. This is expected in an unconfined aquifer. Given that the horizontal ground-water gradients in the two zones are approximately equal and that the permeability in the deep zone is higher, the rate of lateral flow through the deep zone is greater than in the shallow zone.

Relationships of the water levels in the shallow and deep zones are shown on Figure 2.3-12 and 2.3-13. These figures are hydrographs reflecting water levels measured during the study period on adjacent deep and shallow wells. Hydrographs of Wells 4 (deep) and 11 (shallow) shown on Figure 2.3-12 are representative of conditions in the interior of the site, where water is frequently ponded at land surface. The hydrographs show that near the end of relatively dry periods (May 23, June 15, and June 22 and July 19) the water levels in the deep zone are higher than in the shallow zone. During and after periods of rainfall, the opposite is true. This is because rainfall, first incident on the shallow zone, moves downward because of the resulting higher water levels in the shallow zone. As evapotranspiration occurs from the shallow zone (in excess of rainfall), water levels there are lowered and water from the deep zone moves upward. Rainfall, therefore, recharges the shallow and deep zones and dry periods deplete water from both zones by evapotranspiration.

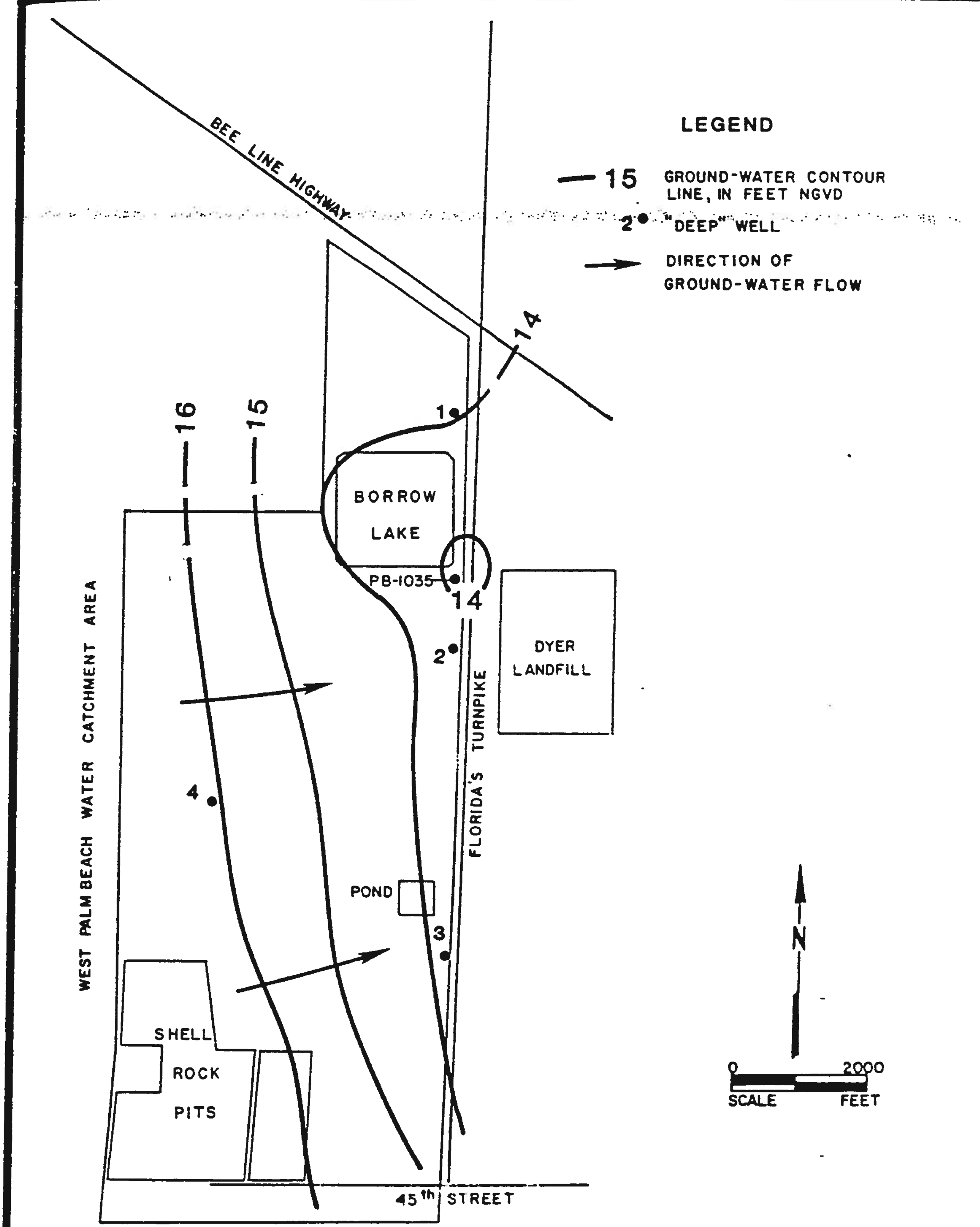
A similar relationship between the shallow and deep zones is shown by data from Wells 2 (deep) and 7 (shallow) shown on Figure 2.3-13; these wells are located in the east-central part of the site where standing water is not common. The distinction between water-



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

GROUND-WATER CONTOUR MAP
DEEP ZONE
MAY 23, 1984

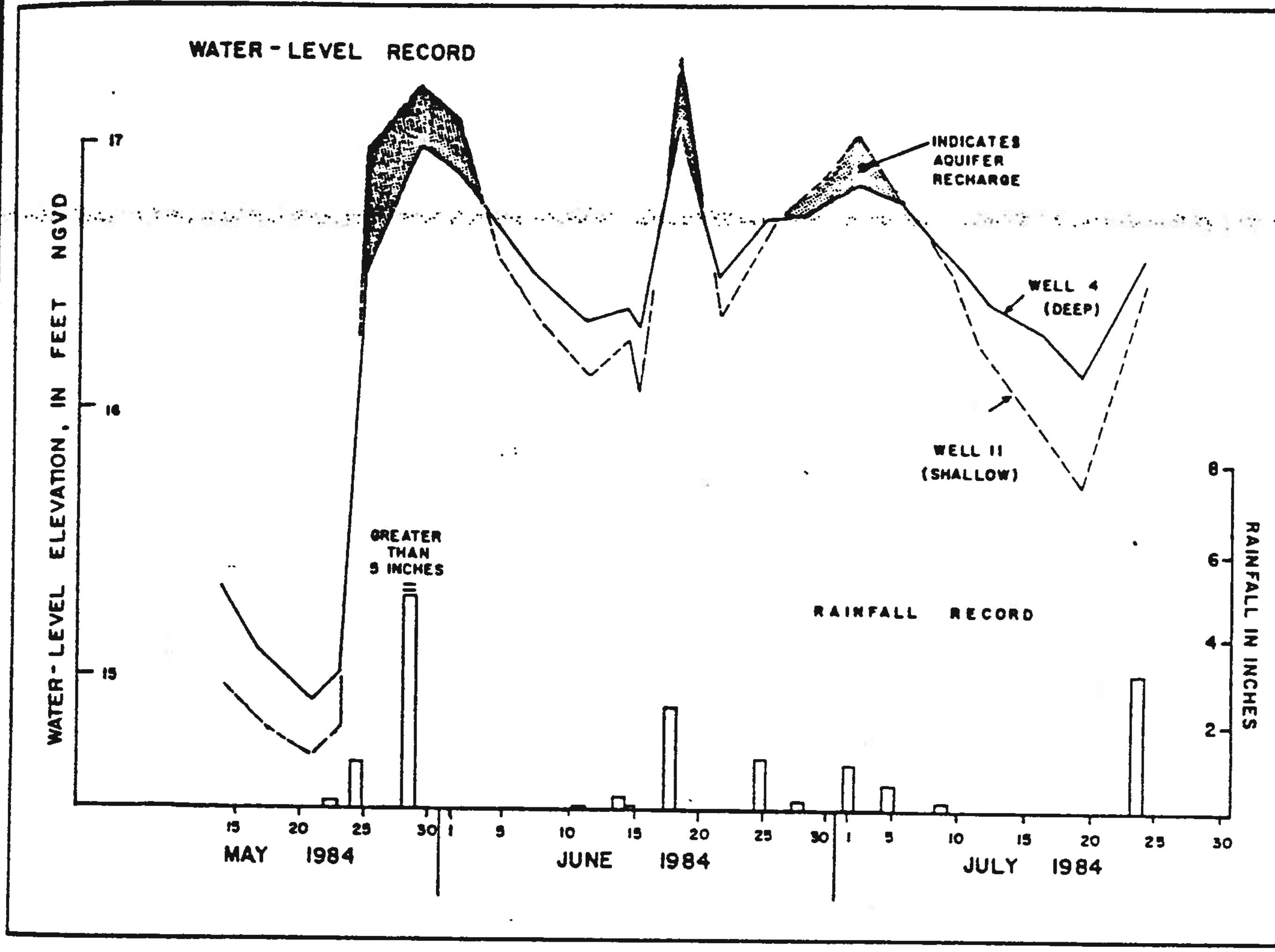
FIG. 2.3-10



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

GROUND-WATER CONTOUR MAP
DEEP ZONE
JULY 19, 1984

FIG. 2.3-11

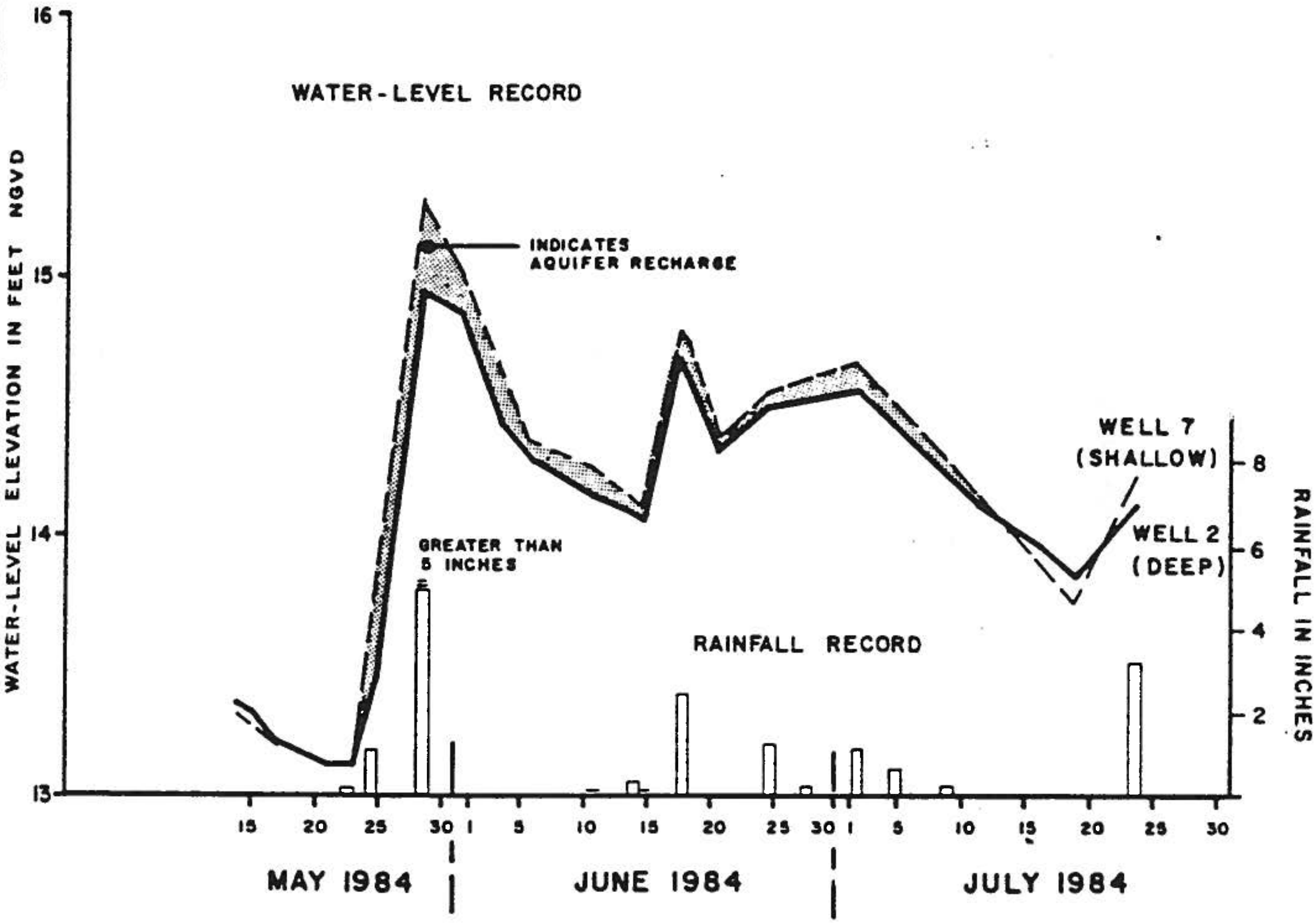


NOTE: WATER LEVELS AND ACCUMULATED RAINFALL WERE MEASURED TWICE WEEKLY

PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

WATER-LEVELS IN WELLS 4 AND 11 AND RAINFALL RECORD

FIG. 2.3-12



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

WATER-LEVELS IN
WELLS 2 AND 7
AND RAINFALL RECORD

FIG. 2.3-13

level elevations in shallow and deep zones, however, is not as great as further west. Only during the longest dry periods when evapotranspiration lowers water levels in the shallow zone, do water levels in the deep zone exceed those in the shallow zone. In contrast to the site of Wells 4 and 11, water levels at this site are maintained higher in the shallow zone because of the permanent nearby surface-water bodies discussed above.

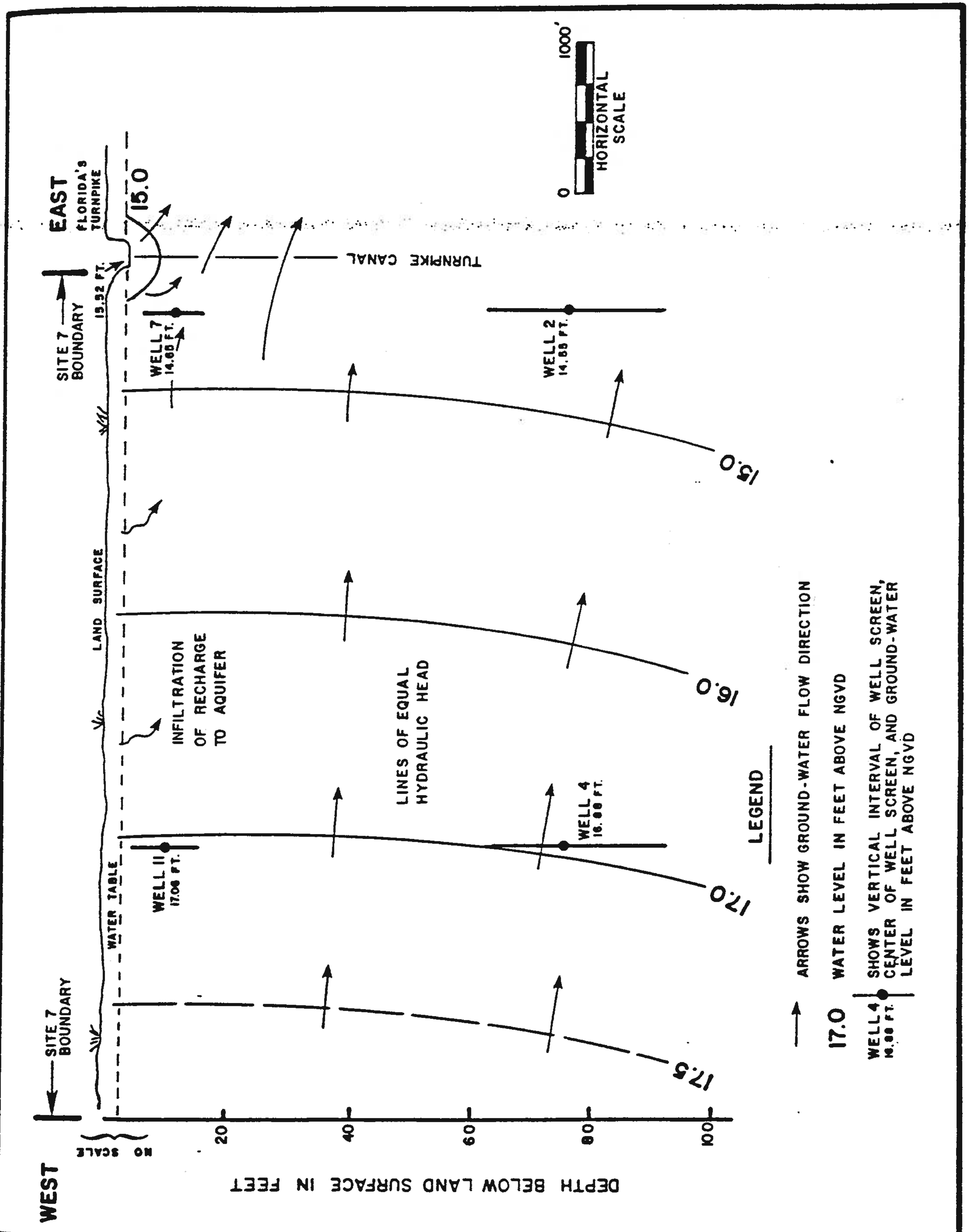
Figure 2.3-14 shows the shallow-deep zone relationship in cross section on July 2nd following a one-inch rainfall. The lines of equal hydraulic head (equivalent to ground-water contours) show the effect of rainfall by the higher levels in the shallow zone and that water flows downward as well as toward the east during this period. The shallow-deep relationship on July 19th, near the end of a dry period, is shown on Figure 2.3-15. The lines of equal head show that water flows upward from the deep to the shallow zone, and of course, toward the east. The dry-period depiction indicates that water in the deep zone is readily available from the west because of the WCA and its relatively high and constant hydraulic head. Both Figures 2.3-14 and 2.3-15 indicate that seepage from the west to the shallow ("shallow" is used in the regional context) aquifer occurs at all times as water from the WCA percolates into the shallow and the deep zones and eastward.

Based on water-level data and the results of pumping tests, it is possible to estimate the ground-water flow through the shallow aquifer from west to east using Darcy's Law (Walton, 1970). That relationship states that the ground-water flow velocity is directly proportional to the permeability and ground-water gradient and inversely proportional to the porosity. In the shallow zone (to a depth of 50 feet), an average permeability of 700 gpd/sq.ft. (gallons per day per square foot), an average gradient of 0.0007 ft./ft. (from Figure 2.3-15), and an average porosity (approximately equal to the storage coefficient) of 0.20, result in an average ground-water flow velocity of 0.33 feet per day. In the deep zone (50 to 100 feet in depth), the average permeability is 1,000 gpd/sq.ft., and the gradient and porosity are 0.0007 ft./ft. and 0.20, respectively, resulting in an average ground-water flow velocity of 0.47 feet per day. Ground-water would flow through the deep zone across the west-east extent of the site (approximately one mile) in a period of about 30 years under these conditions.

There are no other aquifers that potentially may be impacted by the proposed facilities on the site. The underlying Floridan aquifer exhibits a potentiometric surface about 20 feet above land surface in the area of the site (Franks, 1982). Confining units that occur between the top of the Floridan aquifer and the bottom of the shallow aquifer are as much as 875 feet thick and allow only an immeasureably small upward migration of water from the Floridan aquifer.

2.3.2.1.2 Ground-Water Quality

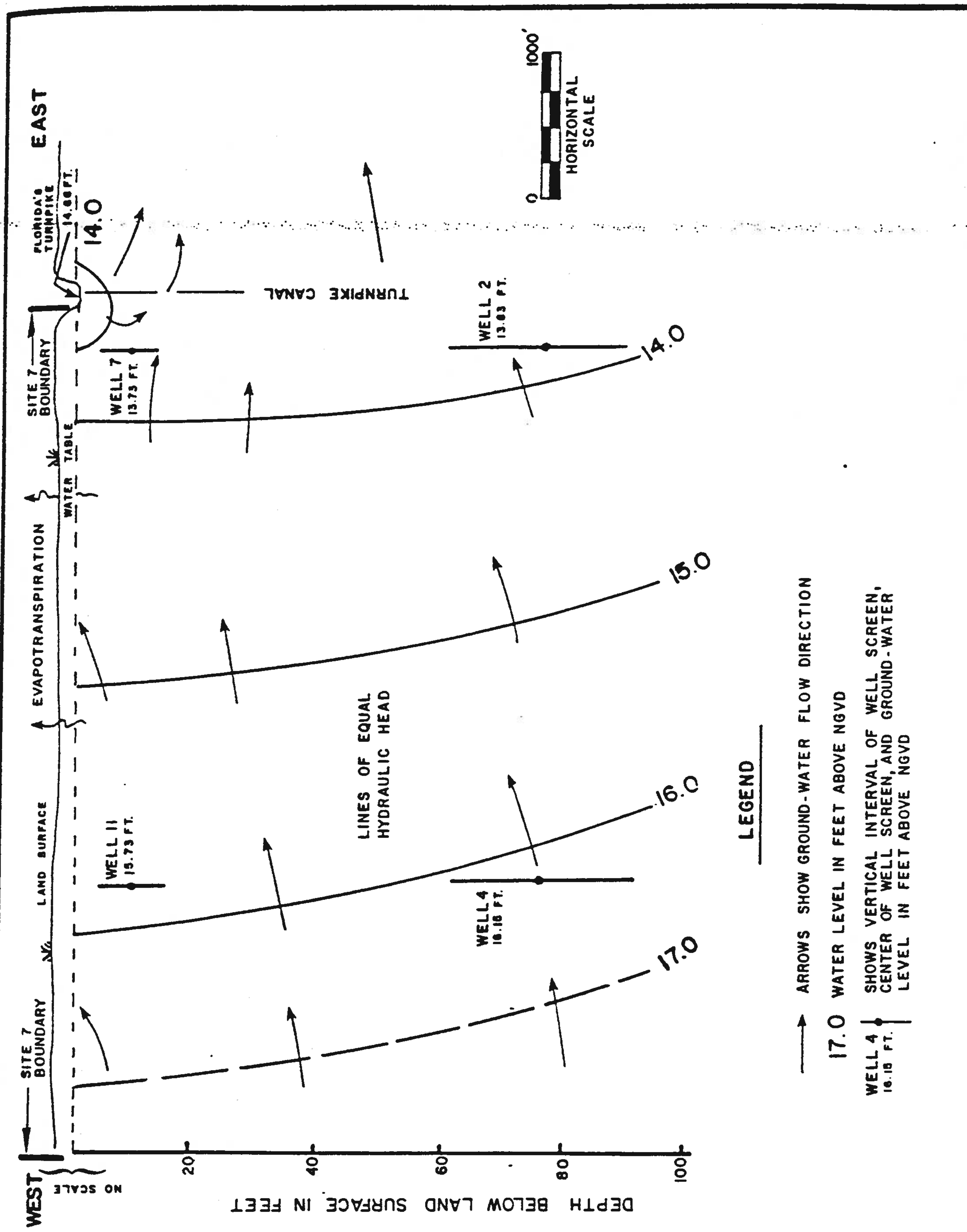
Following the pumping tests on Wells 1 through 14, water was purged from each well by pumping and water samples were collected and analyzed. Before and during well drilling, precautions were taken to ensure that water samples to be pumped from the wells would not be affected by construction practices. Drilling rigs and accompanying equipment were steam cleaned before entering the site. Only water from a nearby public water supply well and bentonite were used in drilling fluids. Sections of the PVC well casings were joined with stainless steel screws and no PVC glue was used. Gravel pack material was washed with potable water before installation. To prevent surface water from mixing with ground-water, the annulus of each well was grouted with neat cement between land surface and the bottom of the casing.



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

HYDROGEOLOGIC CROSS SECTION FOLLOWING RAINFALL– JULY 2, 1984

FIG. 2.3–14



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

HYDROGEOLOGIC CROSS SECTION DURING DRY PERIOD- JULY 19, 1984

FIG. 2.3-15

After each water sample was collected, the water temperature, pH and specific conductance were measured in the field. The samples were preserved and taken to the laboratory for analysis. Samples from all wells were analyzed for parameters listed in the Primary and Secondary Drinking Water Regulations (Rules of the Florida Department of Environmental Regulation, Chapter 17-22). Samples from Wells 1, 2, 3, 4, 5, 6, 7, 9, and 12 were also analyzed for 130 Priority Pollutants (Florida Department of Environmental Regulation) including the general categories of Purgeable Organics, Base Neutrals, Acid-Extractable Organics, and Pesticides/PCB's. The results of the analyses are reported in Appendix 10.14.4.

The quality of ground-water beneath the site is good; it is characteristically hard for water in a limestone environment. The deep wells produce water samples with higher average total hardness than shallow wells; the total hardness (as calcium carbonate) range for all wells was from 164 to 467 mgl (milligrams per liter). The pH of all samples ranged from 6.8 to 7.2 as measured in the field. The concentrations of total dissolved solids (TDS) found in deep wells ranged from 370 to 522 mgl. Only the sample from Well 2 contained a TDS concentration greater than the 500-mgl limit recommended by the FDER (Florida Department of Environmental Regulation) as the MCL (Maximum Contaminant Level) for public water supply systems. The TDS range for samples from the shallow wells was from 235 to 485 mgl. The concentration of chloride ranged from 24.2 to 65.4 mgl in the deep wells; again, the highest value occurred in Well 2. In shallow wells, the chloride range was from 5.8 to 35.9 mgl.

None of the 130 Priority Pollutants were detected in any of the samples with the exception of zinc. Where detected, the concentrations of zinc were 0.01 mgl which is the limit of detection. Zinc apparently occurs naturally. There were no instances of a well sample exceeding the MCL of any Primary Drinking Water standard.

There were several instances where MCL's of the Secondary Drinking Water standards were exceeded. The parameters are the saturation index, color, odor threshold, turbidity, iron, manganese, and the single case in which the MCL for TDS was exceeded as discussed above. The amounts by which these parameters exceeded the MCLs are not significant in that such concentrations are natural and can be reduced by common treatment processes. In the instance where the TDS concentration exceeds the MCL (Well 2), higher-than-background concentrations of chloride (47.6 mgl) and sodium (65.4 mgl) also were contained in the sample and explain this anomaly. These concentrations of chloride and sodium, however, are well below their respective MCLs and may have resulted from one of many piles of illegally disposed trash on the site.

In summary, the quality of ground water beneath the site is good and the water can and will be used as a potable supply for the facility. There are no significant instances where drinking-water MCLs are exceeded. In the few cases where MCLs are exceeded, they are only secondary standards, and the subject parameters can be handled by treatment.

2.3.2.2 **Karst Hydrogeology**

There are no known or expected paleokarst features that may cause a change in the hydrologic regime beneath the site. Infrared and black and white aerial photography were inspected and with the exception of wetland drainage sloughs near the center of the site, no apparent lineation of surficial features were deciphered. These sloughs conduct sheet flow toward the southeast and northeast from the west-central part of the site; the center of the sloughs are as much as one foot lower than land on either side. These drainageways appear to be entrenched where sandy surficial sediments were slightly lower upon deposition. No evidence exists suggesting that these sloughs are founded in subsided or faulted rock. Likewise, no apparent evidence of vertical or potentially hazardous karstic development was exhibited in the results of the resistivity surveys.

Data generated during well construction revealed cavity zones at depths of 65 and 72 feet only at the location of Well 4. While such zones are common at approximately that depth in the region of the site, the development of cavities generally is confined to a horizontal bed and not extensive in a vertical direction; the supporting capability of near-surface soils and geologic materials is therefore not compromised.

Aerial photographs and topographic maps show that the site contains numerous circular-shaped depressions in the soil surface. These are typically 400 to 800 feet in diameter and are occupied by Basinger soils (sand, depressional) and Riviera soils (sand, depressional) (U.S. Department of Agriculture, 1978). These circular-shaped features apparently were natural depressions in the surface of the Pamlico Sand Formation that received runoff from adjacent higher land. Because of the uniform nature of the surficial sands, surficial erosion apparently took place uniformly around the depression until a circular-shape depression resulted. There is no evidence that these depressions are traceable to depths greater than about five feet.

2.3.3 Site Water Budget and Area Uses

The factors influencing the groundwater resources of the site are appropriately described in a water budget. The annual average rainfall on the site is 62 inches (MacVicar, 1981). The annual evapotranspiration from the water table on the site is estimated to be 39.5 inches; this number is a refinement of an evapotranspiration estimation based on a method described by Dohrenwend (1977), as derived from a site-specific groundwater flow model described fully in Appendix 10.14.7. Considered in the initial estimate for evapotranspiration were the temperature, the climatic type, and the vegetative type and density. The annual gross recharge to the aquifer is estimated to be 30 inches (Camp, Dresser & McKee, 1980). Because the water table evapotranspiration rate exceeds the estimated gross aquifer recharge as indicated in the cited model, there is no net aquifer recharge on the site during the average year. The reason for this is that the water table lies within three feet of the land surface causing a high rate of evapotranspiration from the water table. Ground-water levels are maintained high because of the WCA (West Palm Beach Water Catchment Area); water constantly seeps eastward from the WCA. One probable exception to this analysis occurs in the extreme eastern part of the site where the canals along Florida's Turnpike receive some surface water runoff and have levels generally above the underlying water table; net recharge to the aquifer may occur in this area. East of the site, ground-water levels and water table evapotranspiration rates are lower; net groundwater recharge occurs in these areas.

Surface water runoff from the site is restricted to a single outlet in the southeastern part of the site where a connection to the EPB-10 canal (east of the Turnpike) exists. This outlet drains surface water from the abandoned shell pits in the southern part of the site. Because of the restricted outlet and apparently small effect this outlet has on surface-water and ground-water levels, the annual rate of surface-water runoff considering the water budget for all of the site is estimated to be about 5 inches.

The remaining component of the water budget is the evapotranspiration that occurs from the unsaturated soil and surface water of the site. This residual in the water budget must equal 17.5 inches (rainfall of 62 inches equals the water table evapotranspiration of 39.5 inches plus surface water runoff of 5 inches, plus above water table evapotranspiration of 17.5 inches). This figure appears to be reasonable because of the large wetland areas present on the site.

The subsurface flow of ground-water beneath the site from west to east is estimated to be one million gallons per day during moderately dry periods. This flow is based on the application of Darcy's Law and includes use of the average ground-water gradient (0.0007) measured on May 23 and June 19, 1984 (when moderately dry conditions prevailed, the transmissivity of the shallow aquifer (101,000 gallons per day per foot), and the length of the site normal to the ground-water flow direction (14,000 feet). This flow is regarded as the base flow and originates from the WCA.

Other factors not included in the water budget discussed above but requested under Section 2.3.3 of this application are the annual distribution of rainfall and temperature on a monthly basis and the annual lake evaporation rate; these are shown on Table 2.3-5. The rainfall data were adapted from a document by the South Florida Water Management District (1977); the temperature data are from the Water Information Center, Inc. (1974). The annual lake evaporation is 49 inches per year (Florida Department of Natural Resources, 1974).

TABLE 2.3-5
ANNUAL DISTRIBUTION OF RAINFALL AND TEMPERATURE IN THE VICINITY OF THE SITE

Month	Rainfall in Inches	Temperature (F)
January	1.24	66.9
February	1.86	67.6
March	2.48	70.0
April	3.10	73.6
May	4.96	77.0
June	11.16	80.2
July	8.68	81.5
August	9.92	82.0
September	9.92	81.0
October	5.58	77.4
November	1.86	72.0
December	1.24	68.2
Mean	5.16	74.8
Standard Deviation	3.63	5.5

In the general region of the site are water-supply sources for municipal and private utilities; these sources include one from a surface-water reservoir while the balance are from the shallow aquifer. The West Palm Beach Water Catchment Area (WCA) is located along the western border of the site. Water captured from rainfall within this area is used to provide drinking water to the City of West Palm Beach. The WCA has been designated a Class I water by the Florida Department of Environmental Regulation, and as such, a 3,000-foot setback distance is required between the WCA and the nearest point of a Class I or III Landfill. Water within the WCA is controlled at elevations generally between +17.5 and +18.5 feet NGVD (National Geodetic Vertical Datum).

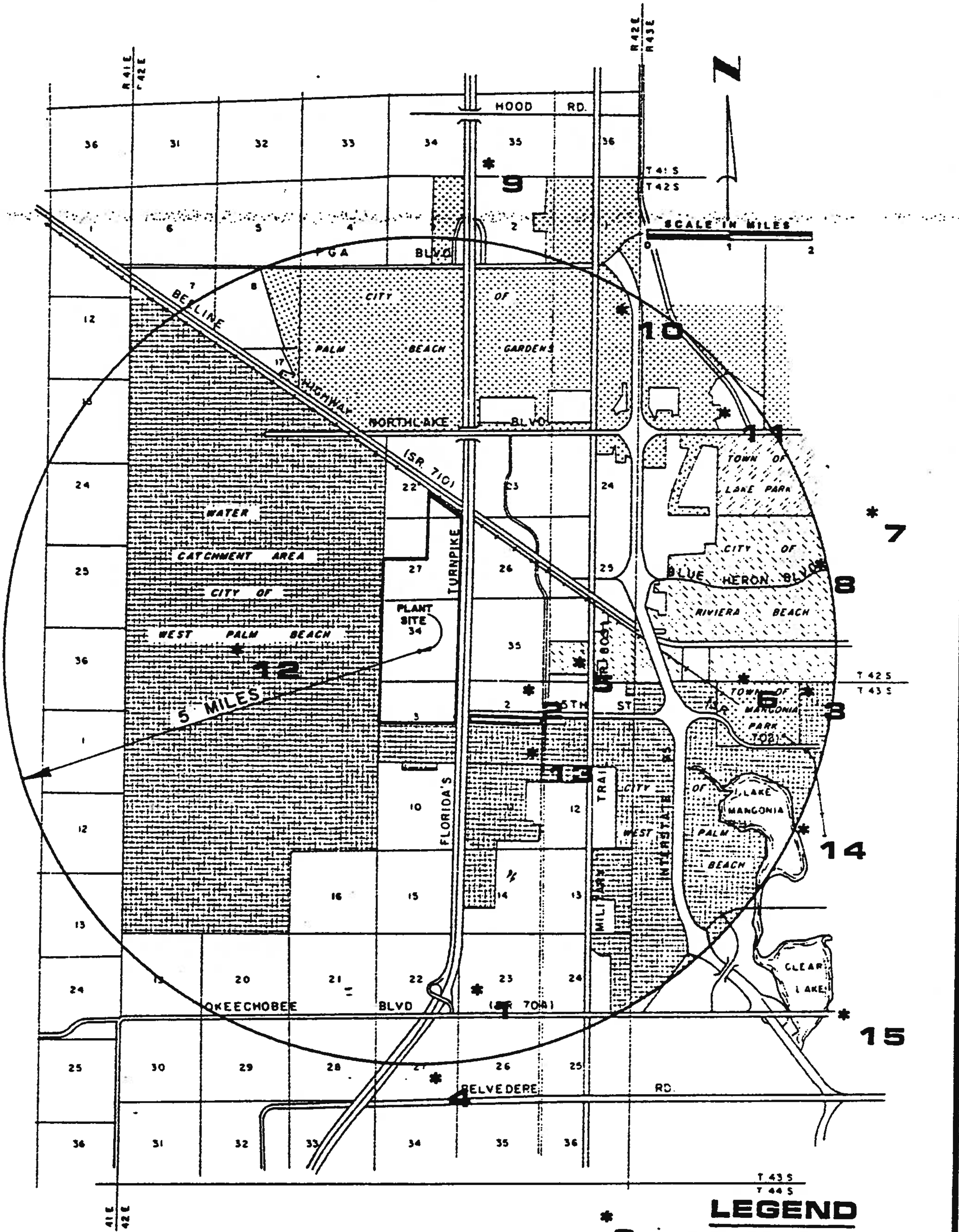
Within five miles of the site, the shallow aquifer is tapped by wells that are used to supply water to the utility systems shown on Figure 2.3-16. The systems indicated include all those operated under conditions of a Consumptive Water Use Permit issued by the South Florida Water Management District. Table 2.3-6 shows the system names and their respective permitted withdrawal rates (from the files of the South Florida Water Management District). Water-supply sources shown on Table 2.3-6 are keyed to Figure 2.3-16.

TABLE 2.3-6
PERMITTED PUBLIC WATER SUPPLY SOURCES
LOCATED WITHIN FIVE MILES OF THE SITE

No. on Figure 2.3-16	System Name and Average Daily Water Use (g)	Transmissivity Coefficient (gpd/ft)	Storage Coefficient (unitless)	Leakage Coefficient (gpd/cu.ft)
1	Century Utilities, Inc. 1.62 mgd	1,000,000 (a)	0.013 (b)	(c)
2	Consolidated Utilities, Inc. 0.24 mgd	84,000 (b)	(c)	0.017 (b)
3	Mangonia Park Utilities, Inc. 0.57 mgd	84,000 (b)	(c)	0.0068 (b)
4	Palm Beach Co., System 1 6.50 mgd	1,300,000 (g)	0.013 (g)	(c)
	City of Riviera Beach			
5	Wellfield A–1.76 mgd	84,000 (g)	(c)	0.0068 (d)
6	Wellfield B–1.18 mgd	84,000 (b)	(c)	0.0068 (b)
7	Wellfield C–1.61 mgd	84,000 (b)	(c)	0.0068 (b)
8	Wellfield D–1.40 mgd	84,000 (b)	(c)	0.0068 (b)
	Seacoast Utilities, Inc.			
9	Wellfield A–12.30 mgd	400,000 (d)	0.0004 (d)	(c)
10	Wellfield B–2.52 mgd	54,000 (d)	(c)	1.017 (d)
11	Wellfield C–4.51 mgd	66,000 (d)	(c)	1.0 (e)
	City of West Palm Beach			
12	Water Catchment Area,	(f)	(f)	(f)
13	M-Canal,	(f)	(f)	(f)
14	Lake Mangonia,	(f)	(f)	(f)
15	Clear Lake	(f)	(f)	(f)

(a) based on specific capacity test, from SFWMD files.
(b) based on determination from nearby pumping test
(c) not available or not measured
(d) determined from pumping test, from G&M files
(e) based on interpretation of regional data from G&M files
(f) not applicable, water is from surface source
(g) from SFWMD files

Abbreviations:
SFWMD, abbreviates South Florida Water Management District
G&M, abbreviates Geraghty & Miller, Inc.
gpd/cu.ft., abbreviates gallons per day per cubic foot
mgd, abbreviates millions of gallons per day



LEGEND

* 2 WATER-SUPPLY FACILITIES (KEYED TO TABLE 2.3-6)

PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

PERMITTED PUBLIC
WATER-SUPPLY FACILITY
WITHIN FIVE MILES

FIG. 2.3-16

Potable wells located within one mile of the site are shown on Figure 2.3-17. With the exception of the well of Consolidated Utilities, Inc. (also shown on Figure 2.3-16), these wells are private domestic wells or wells used by small businesses that are pumped at rates probably less than 1,000 gallons per day. These wells are generally two to six inches in diameter and tap the shallow aquifer.

2.3.4 Surficial Hydrology

2.3.4.1 Hydrologic Characterization

Surface water flow on the site is influenced by wetland areas present at the site. The average depth of standing water typically occurring in the wetlands is approximately one foot.

Recent aerial photographs depict wetlands in the center of the project site. At one time, there existed a hydraulic connection between the surface waters in these wetlands and the area to the west of the site designated as the West Palm Beach Water Catchment Area (WCA). However, this historical connection is now disrupted by a dike that runs along the eastern boundary of the WCA.

Wetlands in the central portion of the site are hydraulically interconnected, directing flow from west to east across the site. This wetland network presently has three discharge points on the eastern boundary of the site, releasing excess surface water into the canal along Florida's Turnpike as shown in Figure 2.3-18. The Turnpike canal, in the vicinity of the site, is not part of any drainage system and has no outlet. It is believed that the installation of this canal was for the primary purpose of interception and ground-water recharge of runoff from the southbound lanes of the Turnpike. The hydraulic connections that presently exist between the wetlands on the site and the Turnpike canal will be interrupted by landfill construction.

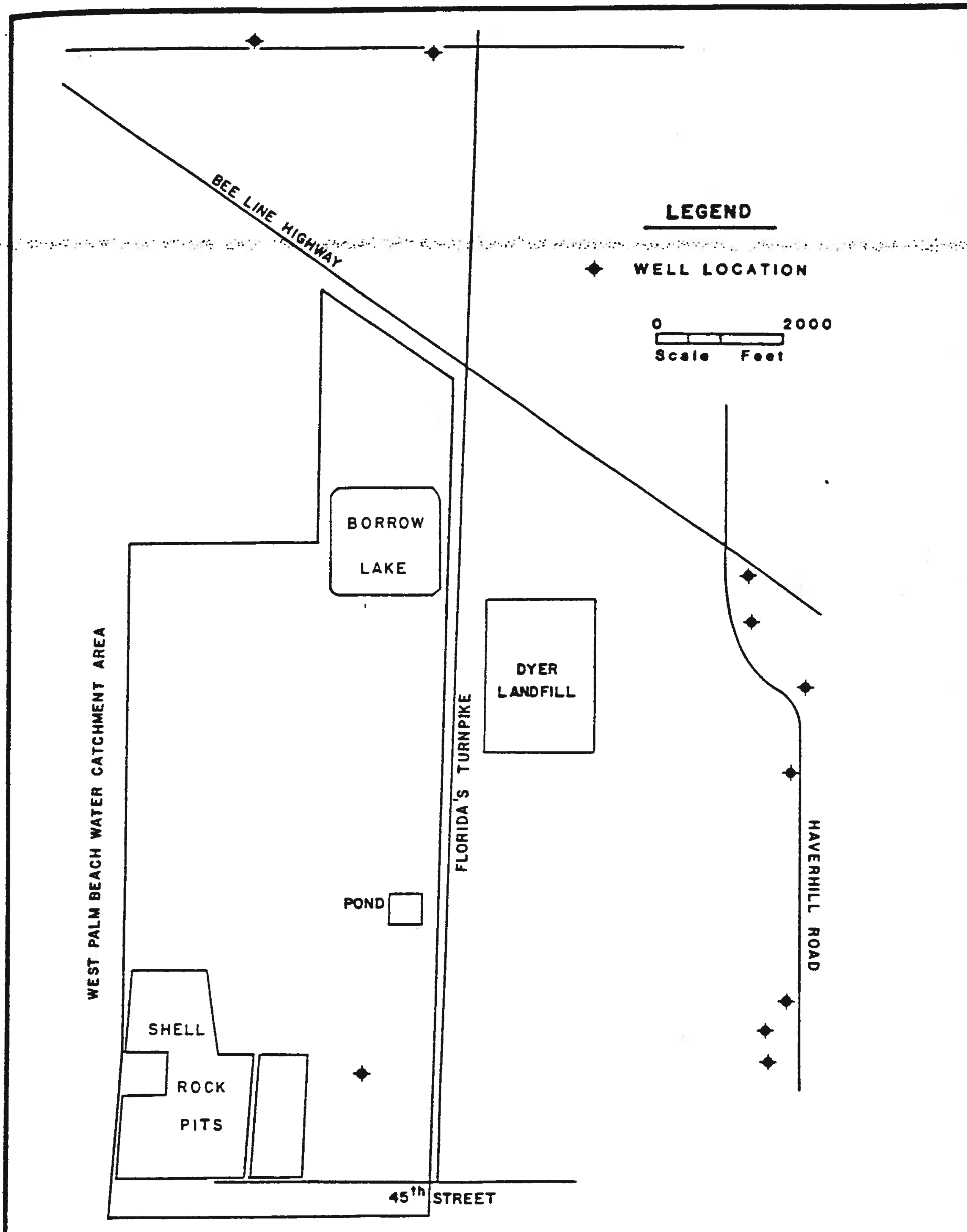
A canal in the southeast portion of the site, running east from the abandoned shell pits and under the Turnpike, hydraulically connects limited areas of the site with the EPB-10 Canal. The elevation in the EPB-10 canal controls, to a certain extent, the surface water elevations on the site. The EPB-10 Canal is part of the Northern Palm Beach Water Control District system which ultimately flows into the C-17 Canal (part of the South Florida Water Management District System).

One other canal is present on the site. This large canal forms the southern boundary of the Gladstone tract south of 45th Street to intercept runoff from property north of the City of West Palm Beach property. This canal has no apparent hydraulic connections with any surface water body or control ditches.

2.3.4.2 Measurement Programs

The background surface-water quality of the site was established by analysis of surface waters found at eleven selected sample locations on the site. The sample points were located so as to: (1) determine if there was any surface-water quality differential across the site; (2) reveal any change in water quality within an existing wetland network; and (3) allow evaluation of changes in surface-water quality once facility construction and/or operation begins.

Sampling and analyses were performed with the analytical results summarized in Tables 2.3-7a through 2.3-7d.



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

LOCATION OF
POTABLE WATER WELLS
WITHIN ONE MILE OF SITE

FIG. 2.3-17

As listed in Table 2.3-7a, the surface-water quality is satisfactory when compared to Florida State drinking water regulations. Organic and metals levels are satisfactory. The only problems at the sample locations are color and to a lesser extent, turbidity. The color levels for samples SW-3, 4, 5, 6, 9, 10 and 12 are all well over the color standard (15 Pt-Co Units). Coliform counts at SW-4, 6 and 10 are high.

TABLE 2.3-7a
GENERAL WATER ANALYSIS FOR SECONDARY DRINKING WATER REGULATIONS

Methods: This water was analyzed according to "Standards Methods for the Examination of Water and Wastewater," Latest Edition, APHA, AWWA and WPCF

DETERMINATION	(MCL)	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-8	SW-9	SW-10	SW-11	SW-12
Total Dissolved Solids, TDS	(500)	224	90	94	58	84	158	124	252	166	162	220
Phenolphthalein Alkalinity, $CaCO_3$		0	0	0	0	0	0	0	0	0	0	0
Total Alkalinity, $CaCO_3$		151	20.0	47.6	59.8	49.7	110	70.0	151	106	90.5	80.0
Carbonate Alkalinity, $CaCO_3$		0	0	0	0	0	0	0	0	0	0	0
Bicarbonate Alkalinity, $CaCO_3$		151	20.0	47.6	59.8	49.7	110	70.0	151	106	90.5	80.0
Carbonates, $CaCO_3$		0	0	0	0	0	0	0	0	0	0	0
Bicarbonates, HCO_3		184	24.8	58.1	72.9	60.6	134	85.4	184	129	110	98
Hydroxides, as OH		0	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide, CO_2		6.16	4.19	1.94	12.2	2.03	7.11	2.26	3.09	1.72	2.32	3.28
Chloride, Cl	(250)	26.2	11.1	18.9	4.7	3.7	21.0	5.8	15.5	20.1	23.7	42.6
Sulfate, SO_4	(250)	2.7	<1.0	<1.0	<1.0	<1.0	<1.0	5.0	3.0	<1.0	4.6	7.5
Fluoride, F	(1.4-2.4)	0.164	0.054	0.076	0.043	0.023	0.075	0.055	0.373	0.087	0.162	0.135
pH (Laboratory)	(6.5-8.5)	7.7	7.0	7.7	7.0	7.7	7.5	7.8	8.0	8.1	7.9	7.7
pHs	7.49	9.21	8.31	8.47	8.27	7.75	8.04	7.38	7.77	7.87		7.95
Stability Index		7.28	11.4	8.92	9.94	8.85	8.00	8.27	6.77	7.43	7.83	8.2
Saturation Index, corrosivity	(±0.2)	0.21	-2.21	-0.61	-1.47	-0.57	-0.25	-0.24	0.62	0.33	0.03	-0.25
Color, PCU	(15)	10	40	60	>100	80	50	40	>100	50	10	60
Odor Threshold	(3)	1	1	1	1	1	1	1	1	1	1	1
Turbidity, NTU	(5)	0.7	1.9	1.6	1.1	0.9	0.2	1.3	89	0.4	1.1	2.4
Hydrogen Sulfide, H_2S	(F-F)	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Specific Conductance, umhos		320	63	155	91	140	225	150	310	248	230	290
Foaming Agents (MBAS)	(0.5)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium, Na	(160)	19.6	6.49	7.17	3.25	7.20	12.6	4.25	13.0	12.8	18.1	32.95
Nitrate Nitrogen, N	(10)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.39	<0.02	<0.02	<0.02
Total Hardness, $CaCO_3$		153	23.1	59.8	33.9	<61.21	105	<78.9	191	105	103	105
Calcium Hardness, $CaCO_3$		139	16.6	55.7	29.8	57.1	96.4	74.8	181	96.9	91.2	80.3
Magnesium Hardness, $CaCO_3$		13.7	6.54	<4.12	4.15	<4.12	8.47	<4.12	10.6	8.49	11.9	24.9
Calcium, Ca		55.9	6.64	22.3	11.9	22.84	38.6	29.9	72.2	38.8	36.5	32.1
Magnesium, Mg		3.32	1.59	<1.00	1.01	<1.00	2.06	<1.00	2.58	2.06	2.90	6.04
Magnesium Hardness, $CaCO_3$		13.7	6.54	4.12	4.15	4.12	8.47	<4.12	10.6	8.49	11.9	24.9
Calcium, Ca		55.9	6.64	22.3	11.9	22.84	38.6	29.9	72.2	38.8	36.5	32.1
Magnesium, Mg		3.32	1.59	1.00	1.01	1.00	2.06	<1.00	2.58	2.06	2.90	6.04
Iron, Fe	(0.3)	0.20	<0.10	0.21	0.17	<0.10	<0.10	<0.10	1.44	<0.10	0.13	0.11
Manganese, Mn	(0.05)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Copper, Cu	(1.0)	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc, Zn	(5)	<0.01	<0.01	<0.05	<0.05	<0.05	<0.05	<0.01	<0.01	<0.05	<0.01	<0.01

Results expressed in Mg/l unless otherwise designed.
< = Less Than.
> = Greater Than.
MCL = Maximum Contaminant Levels

TABLE 2.3-7b
PRIMARY DRINKING WATER REGULATIONS ANALYSIS (ORGANIC AND INORGANIC)

METHODS & LIMITS: In accordance with Federal Register-Vol. 40, No. 248, Part IV Wednesday, December 24, 1975. U.S. Environmental Protection Agency, National Interim Primary Drinking Water Regulations.

RESULTS

CONTAMINANT	(MCL)	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-8	SW-9	SW-10	SW-11	SW-12
INORGANIC:												
Arsenic, As	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Barium, Ba	1.0	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium, Cd	0.010	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium, Cr	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lead, Pb	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury, Hg	0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Selenium, Se	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Silver, Ag	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoride, F	1.4–2.4	0.164	0.054	0.076	0.043	0.023	0.075	0.055	0.373	0.087	0.162	0.135
Turbidity, NTU	5	0.7	1.9	1.6	1.1	0.9	0.2	1.3	8.9	0.4	1.1	2.4
Nitrate Nitrogen, NO_3-N	10	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.39	<0.02	<0.02	<0.02
ORGANIC:												
Endrin	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lindane	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Methoxychlor	0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Toxaphene	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2, 4-D	0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2, 4,5-TP (Silvex)	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Results are expressed in mg/1 (ppm).
MCL = Maximum Contaminant Levels   < = Less Than

TABLE 2.3-7c
REPORT OF ANALYSIS

ACID EXTRACTABLE ORGANICS	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-8	SW-9	SW-10	SW-11	SW-12
Phenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2-Nitrophenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
4-Nitrophenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2, 4-Dinitrophenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2-Chlorophenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2,4-Dichlorophenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2,4,6-Trichlorophenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2,4-Dimethylphenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
2-Methyl-4,6-Dinitrophenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
4-Chloro-3-Methyl Phenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pentachlorophenol	—	—	—	<0.01	<0.01	<0.01	—	—	<0.01	—	—
BASE NEUTRALS											
bis(2-Ethylhexyl)phthalate	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Di-n-octyl phthalate	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dimethyl phthalate	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Diethyl phthalate	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Di-n-butyl phthalate	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Butyl benzyl phthalate	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB'S											
Aroclor 1016	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Aroclor 1221	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Aroclor 1232	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Aroclor 1242	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Aroclor 1248	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Aroclor 1254	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Aroclor 1260	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Results expressed in mg/l unless otherwise designated.
< = Less Than.

TABLE 2.3-7d
REPORT OF ANALYSIS

MISCELLANEOUS	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-8	SW-9	SW-10	SW-11	SW-1
Ammonia, ionized	0.04	0.07	0.04	0.50	1.47	0.07	0.04	0.07	0.30	0.04	0.16
Ammonia, unionized	0.014	0.0007	0.0005	<0.03	0.07	<0.03	0.0005	0.03	0.03	0.0005	0.0013
Total Kjeldahl Nitrogen, TKN	0.86	2.07	0.81	4.37	4.16	1.0	0.81	0.98	1.08	0.98	1.30
Total Nitrogen, TN	0.86	2.07	0.81	4.37	4.16	1.0	0.81	0.98	1.08	0.98	1.30
Nitrate Nitrogen, N (NO_2-N)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate Nitrogen, N (NO_3-N)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	0.39	<0.02	<0.02	<0.02
Organic Nitrogen, ON	0.82	2.0	0.77	3.87	2.62	0.93	0.77	0.91	0.75	0.94	1.14
Fecal Coliform/ 100 ml (MFT)	<1	<1	<1	6	11	53	1	<1	300	6	<1
Total Coliform/ 100 ml (MFT)	5	2	<1	3,700	80	500	1	3	600	7	2
Oil & Grease, infrared	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
BOD_5-day	7.9	5.4	4.2	6.2	1.8	0.7	4.2	2.9	0.9	5.0	12.0
Cyanide, CN	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005
Chemical Oxygen Demand, COD	26.0	61.0	27.0	95	72	55	27.0	48.0	51	38.0	65.0
Dissolved Oxygen, DO (Field-Fixed)	7.9	5.8	9.8	5.6	11.7	4.4	9.8	*	9.4	9.55	0.5
Total Phosphate, P (T-PO_4-P)	0.32	0.32	0.32	<0.03	<0.03	<0.03	0.16	0.22	<0.03	0.16	<0.03
Fécal Streptococci/ 100 ml (MFT)	—	—	19,700	—	—	—	—	—	—	—	—
MISCELLANEOUSMETALS											
Beryllium, Be	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium Trivalent, Cr^{+3}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium Hexavalent, Cr^{+6}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel, Ni	<0.01	<0.01	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01	<0.02	<0.01	<0.01

* Sample not field-fixed, no value.
Results expressed in mg/l unless otherwise designated.
< = Less Than.

2.3.5 Land Use and Vegetation

Twelve major land use and vegetation types have been identified on the site, as depicted in Figure 2.3-18. These types are classified to level III of the **Florida Land Use and Cover Classification System**. These types are: Single Unit, Low Density Housing (111), Broadcasting Tower (153), Palmetto Prairies (321), Pine Flatwoods (411), Other Hardwoods (422), Canals (513), Cypress Wetland Forest (611), Freshwater Swamp (621), Freshwater Marsh (641), Scraped Areas (741), Sand, Gravel or Clay Extractive (753), and Abandoned Extractive (755).

The only area of low density housing (111) is the Roane parcel at the south end of the site. The size of this parcel (6.6 acres) requires that it be included in the land use map required for the power plant siting permit.

The Broadcasting Tower (153) use includes the small area surrounding the broadcasting tower at the south end of the site. The total area in this land use is less than the 10 acres required for inclusion in the power plant siting permit.

The area of the active dredge lake at the north end of the site falls into two land use categories. The lake itself is Extractive use (753). The cleared area surrounding the active borrow lake is a Scraped (741) or Altered land use (740), as is most of the area south of 45th Street. The vegetative cover of the northern scraped area is a mixture of herbs and grasses that have established themselves since the area was disturbed. The dredge lake itself may also be classified in the Lake land use class (521) but this is secondary to the extractive use.

Three areas within the site fall into the Abandoned Extractive class (755). The abandoned lakes at the southern end of the site, the small abandoned lake 4,000 feet north of 45th Street and adjacent to the Turnpike and the abandoned lake north of the currently active dredge lake all fall into the Abandoned Extractive category (755). The drier portions of the southern area are dominated by brazilian pepper and australian pine; the wetter segments by cattail, spatterdock and duckweed. The other areas are dominated by cattail, grasses and sedges. Abandoned Extractive is the primary land use classification, but these areas may also be classified as lakes, similar to the active lake.

The Canal class (513) covers three areas. The drainage canal at the southern end of the site, running from the abandoned borrow lakes under the Turnpike is one canal. The large canal that forms the southern border of the Gladstone tract south of 45th Street is the other large canal on the site. The system of drainage ditches connecting the internal marshes at the center of the project is the third system in this land use class. Vegetation in these canals is a mixture of spatterdock, cattail, spikerush and pickerelweed.

The remaining six classes identify the areas of relatively undisturbed vegetative cover on the site. Pine flatwoods (411) occupies a large portion of the uplands on the site. The dominant tree species is slash pine, with an understory of saw palmetto, and myrtle in wetter areas. Andropogons and other grasses are mixed with a number of herbs, including many polygalas, in the groundlayer. Much of the flatwoods area on the site is stocked with pole size or smaller pines. These areas are not the optimal quality habitat for this type. Past grazing and disturbance may have played a role in reducing the quality of these areas.

Palmetto prairies (321) occur in an admixture with the pine flatwoods. Palmetto dominates this community, with grasses in the understory and gallberry and occasionally myrtle sharing the canopy with palmetto. The palmetto and pine flatwoods occur in close association, with definite boundaries difficult to determine, and indicated in part by a reduction in the cover of the overstory pines.

Pine flatwoods intergrade with Sabal Palm hammocks (422) on the site. Epiphytic ferns and orchids occur in this plant community. Ferns are the dominant groundlayer plants in these hammocks. Vines, such as smilax, woodbine and poison ivy are also abundant in this community. Many of these hammocks are relatively intact and undisturbed.

The upland flatwoods and hammocks intergrade with wetter habitats on the site. In the transitional areas between upland and wetland, strands of Cypress forest (611) occur. This community type also occupies depressional pockets in the uplands, and forms cypress heads in some of the larger wetland areas. Cypress is, of course, the dominant species. Bromeliads are abundant in this community. Willow and maple may occur as understory species. The groundlayer is a mixture of upland and wetland herbs and grasses, with the dominant group varying with moisture conditions prevailing at each specific location.

Inland ponds and sloughs are the Freshwater swamp (621) vegetation types occuring on the site. Maple and willow dominate the wetter phases of this type, and myrtle the drier phases. Many of the myrtle dominated areas have little or no groundlayer flora. Pickerelweek, arrowhead, and sawgrass dominate the groundcover of the wetter areas. Most of the wetland areas that have been drained or disturbed in the central region of the site are myrtle dominated freshwater swamps.

There are two distinct types of Freshwater marsh (641) occurring on the site. Wet prairie is the marsh community that occupies the drier phases of the marsh type. Grasses and sedges, such as andropogon and rhyncospora occur abundantly in this type. St. John's wort and cocoaplum are abundant shrubs. Slash pine occurs as scattered and stunted individuals in the wet prairies. Fringes of wet prairie surround many of the freshwater swamp areas on the site.

The wetter phase of this community type occurs as either sawgrass marsh, or marsh dominated by spikerush and pickerelweed. The most notable feature of this community is the absence of trees and woody vegetation. Many of the least disturbed wetland areas on the site are this type of marsh. These marshes often occur with a surrounding cypress strand.

2.3.6 Ecology

A single species on the Federal threatened species list was directly observed on the site during the surveys. This was the American Alligator (**Alligator missippiensis**). This species is also on the Florida Game and Freshwater Fish Commission (FGFWFC) species of special concern list. This species was observed in the larger canals and in the abandoned borrow lake area. Many of the marsh areas on the site are lacking water of a depth great enough to provide optimal alligator habitat.

Four other species identified as species of special concern by the FGFWFC were directly observed on the site. All are bird species. They are: Little Blue Heron (**Florida caerulea**), Snowy Egret (**Egretta thula**), Tricolor Heron (**Hydranassa tricolor**), and Limpkin (**Aramus quarauna pictus**). All of the species are closely associated with wetland habitats. Our surveys indicate that the areas most heavily utilized by these species on the site are the large marshes at the west end of the site. The swamp areas in the central portion of the site appear to be used for foraging after heavy rains.

Five species considered game or furbearers were observed on the site. Game animals were White-tailed Deer (**Odocoileus virginianus**) and Wild Hog (**Sus scrofa**). Furbearers observed were Opossum (**Didelphis marsupialis**), Raccoon (**Procyon lotor**), and Bobcat (**Lynx rufus**). Each of these species typically have ranges that cover both upland and wetland habitats. All are common to undeveloped areas in this part of the state.

All species of orchids are on the Florida threatened species list. Two species were observed on the site and several more may be present. The Wild Pine Bromeliad (**Tillandsia fasciculata**) was observed on the site and is listed as endangered, primarily because of heavy pressure from plant collectors. All other species of bromeliads, except Spanish Moss and Ball Moss are listed as threatened. One other threatened bromeliad was observed, and several other probably occur mainly within the cypress woods that are scattered over the site.

Two species on the Federal and State Endangered lists were not observed on the site during the initial survey. The Wood Stork (**Mycteria americana**) may occasionally visit the site for foraging, but there is a low probability any nesting or long term residence takes place. The situation is similar for the Snail Kite (**Rostrhamus sociabilis**). Both of these species would more likely make use of wetlands in the adjacent water catchment area, and visit the site on a more or less chance basis. Snail kites were observed in the conservation area on April 27, 1985, during an Authority sponsored wilderness walk hosting local environmental groups. It appears that the snail kites are not nesting on site, but are in the area because of the recent drought.

The Red-Cockaded Woodpecker (**Picoides borealis**) is listed as endangered Federally, and threatened by the State. It was not observed on the site. This species is dependent on mature stands of pine for its habitat. The pine flatwoods present on the site are a marginal habitat for this bird, and only a slight change of its occurence on or use of the site exists.

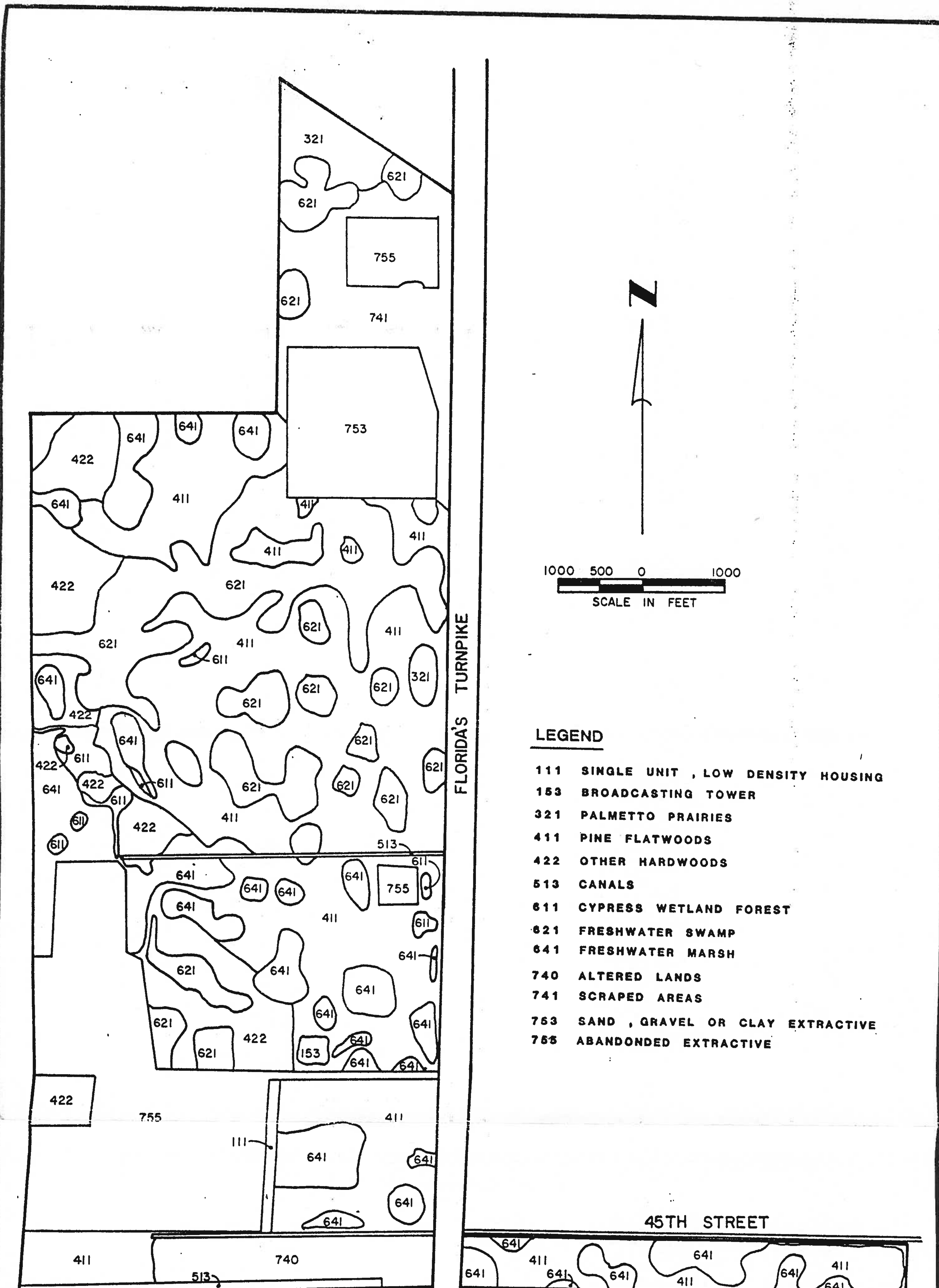
The Southeastern kestrel (**Falco sparverius paulus**) is listed as threatened by the State of Florida. It was not observed on the site, but may utilize the area on an irregular basis. Kestrel's occur in the area but it is difficult to determine if the individuals are part of the threatened population or migrants from other populations passing through the area.

A portion of the fauna of the site was not extensively surveyed, due to the season in which the surveys were conducted. Bird species that may utilize the site during migration may not have been present during the survey period. This type of use undoubtedly occurs on a transient basis. All habitats are likely to receive use by migratory birds. The only two important species with any probability of using the site are Bachman's warbler (**Vermivora bachmanii**) and Kirtland's warbler (**Dendroica kirtlandii**). These species migrate through Florida and the Gulf States. The site is in the general migration corridor, but has no exceptional features to attract these species. The probability of their using the site is very remote.

The discussion above identifies the important species that may occur within 5 miles of the site. As stated, the presence of extensive wetlands in this 5 mile area increases the probability that important species associated with wetlands will occur. This site presents no outstanding or exceptional features to attract important species. The populations that utilize the site would be present in approximately equal abundance in any similar area in the region.

The single most comprehensive work on the ecology of the area is the 1974 publication **Environments of South Florida: Present and Past** (Gleason 1974). This compendium of work by a number of authors covers features from hydrology and soils through wildlife.

Several more specific works on the vegetation of the area include Long (1974), Austin (1976) and Richardson's detailed analysis of the vegetation of western Palm Beach County (Richardson 1977). All of these works are included in the citation list at the end of this report. These papers were published in the **Florida Scientist**, which contains a number of other papers that pertain to a lesser degree to the area. This journal is the best sources of material concerning the ecology of the area.



PALM BEACH COUNTY
SOLID WASTE AUTHORITY
RESOURCE RECOVERY FACILITY

LAND USE CLASSIFICATIONS

FIG. 2.3-18