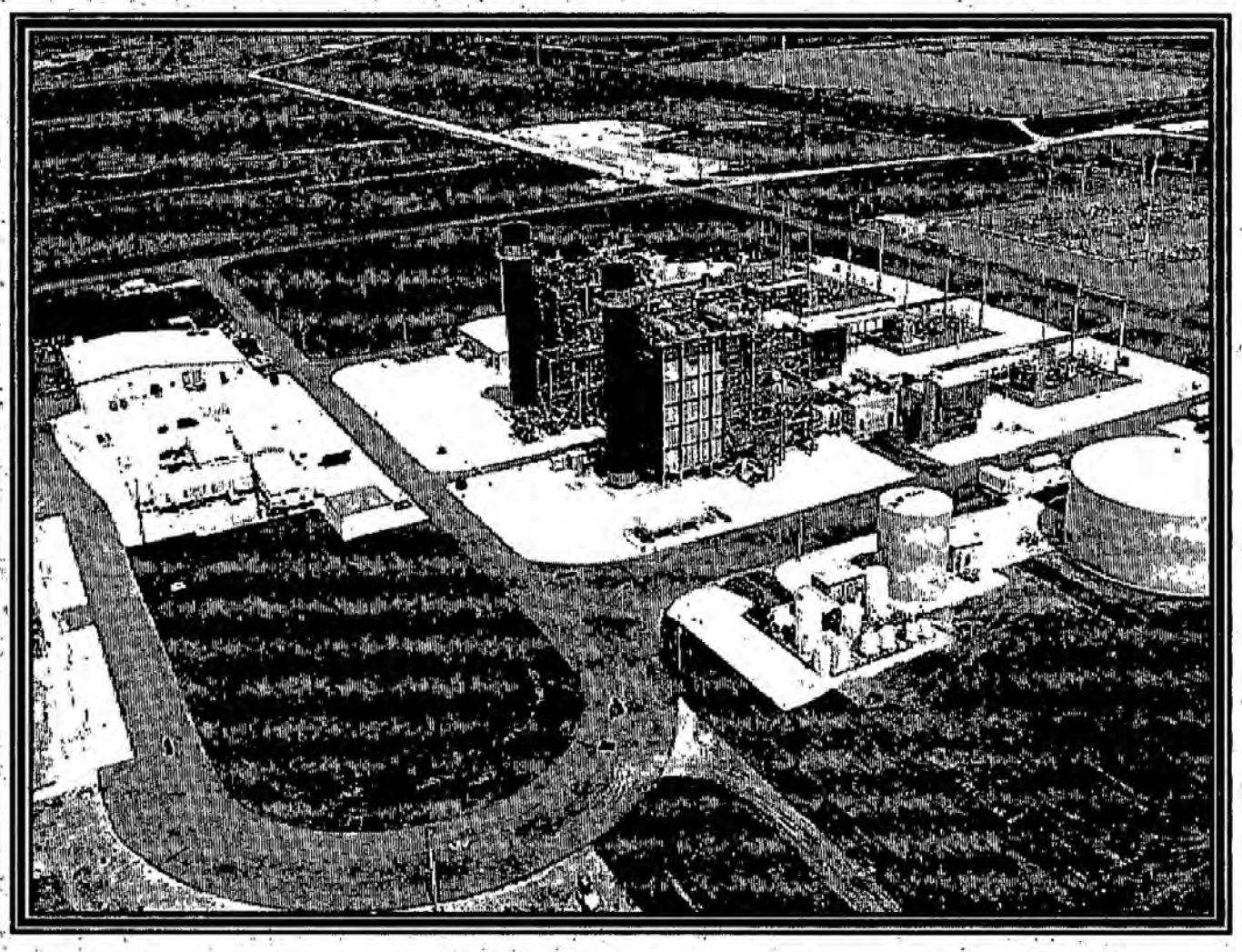
Florida Power
A Progress Energy Company



Supplemental

Site Certification Application

Hines Energy Complex

Power Block 3

September 2002

Volume 1

Florida Power
A Progress Energy Company

September 4, 2002

Mr. Hamilton Oven, P.E., Administrator
Office of Siting Coordination
Florida Department of Environmental Protection
2600 Blair Stone Road, MS 48
Tallahassee, Florida 32399-2400

Re: **Florida Power - Hines Energy Complex**
Power Block 3
Supplemental Site Certification Application to PA 92-33

Dear Mr. Oven:

Please find enclosed the Supplemental Site Certification Application for Hines Power Block 3 to be located at the existing Hines Energy Complex in Polk County. This additional 530 MW (nominal) natural gas fired combined-cycle unit, with secondary distillate fuel oil capability, is consistent with the ultimate site capacity for which the Hines Energy Complex was originally certified.

Enclosed is Check # 107303, payable to the department in the amount of $50,000.00, pursuant to 62-17.293(1)(d), F.A.C., for the supplemental certification of a combined cycle facility.

We look forward to working with you, the Department and other agencies participating in the certification process. Should you, your staff, or any other agency representatives have any questions regarding this application, please do not hesitate to contact me at (813) 826-4363.

Sincerely,

Jamie Hunter
Lead Environmental Specialist
Environmental Services

Enclosures

jjh/JJH042

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

SUPPLEMENTAL SITE CERTIFICATION

FOR THE

FLORIDA POWER

HINES ENERGY COMPLEX

POWER BLOCK 3

POLK COUNTY, FLORIDA

VOLUME I OF I

SEPTEMBER 2002

APPLICANT INFORMATION

Applicant's Official Name **Florida Power**

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

Address of Official Headquarters **P.O. Box 1551, Raleigh, NC 27602**

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

Names, owners, etc. **Florida Power (a Progress Energy Company)**

Name and Title of Chief Executive Officer **Mr. William Cavanaugh III**

Chairman, President and Chief Executive Officer of Progress Energy

Name, Address, and Phone Number of Official Representative responsible for obtaining certification **Mr. John James (Jamie) Hunter**

Florida Power

P.O. Box 14042, MAC BB1A, St. Petersburg, FL 33733

(727) 826-4363

Site Location (county) **Polk**

Nearest Incorporated City **Fort Meade**

Latitude and Longitude **Latitude 27 47 15" Longitude 81 52 21"**

UTM's Northerly **1,255,200**

Easterly **541,600**

Section, Township, Range **S13, T31S, R24E**

Location of any directly associated transmission facilities (counties) **Not Applicable**

Name Plate Generating Capacity **Power Block 3 - nominal 530 MW**

Capacity of Proposed Additions **nominal 530 MW**

Ultimate Site Capacity (where applicable) **3000 MW**

Remarks: (Additional information that will help identify the applicant) **Supplemental Certification Application to PA 92-33**

PROJECT PARTICIPANTS

Florida Power

St. Petersburg, Florida

- Overall Management and Direction
- Engineering

Foster Wheeler Environmental Services, Inc.

Stuart, Florida

- Ecology and Wildlife

Golder and Associates

Gainesville, Florida

- PSD Permit Application
- Noise

Schreuder, Inc.

Tampa, Florida

- Site Civil and Geotechnical Engineering
- Geohydrology

Consensus Builders, Inc.

Tampa, Florida

- Land Use and Socioeconomic

Hopping Green & Sams, P.A.

Tallahassee, Florida

- Environmental Attorneys for Florida Power

PREFACE

In February 1992, the Public Service Commission (PSC) determined the need existed for Florida Power (FP) to develop natural gas-fired combined-cycle generating capacity at FP's Hines Energy Complex, an approximate 8,000-acre site in southwest Polk County. Moreover, the PSC found the need existed for the electricity to be provided by an initial 470 MW (nominal) power plant (Power Block 1) at that site.

In addition, in 1992, the Polk County Board of County Commissioners found the Hines Energy Complex site (formerly referred to by Florida Power as the "Polk County site") to be consistent and in compliance with the County's land use plans and zoning ordinances. The Siting Board entered a final order in February 1993, confirming that the planned 3000 MW of generating capacity for the Hines Energy Complex is consistent and in compliance with the land use plans and zoning requirements of Polk County for that site. Since the site boundaries will not be increased by this application, land use and zoning issues are not at issue in this supplemental application, as provided by section 403.517(3), Florida Statutes.

In 1994, the Governor and Cabinet, sitting as the Siting Board, granted certification to Florida Power, to construct and operate Power Block 1 and for 3000 megawatts (MW) of ultimate site capacity at the Hines Energy Complex. Over a period of 20 years, generating units will be brought on line sequentially to meet needs for electricity up to the ultimate site capacity of 3000 MW.

In the 1994 Certification, the Siting Board made a determination that the Hines Energy Complex site has the ultimate site capacity to support 3000 MW of electrical generating facilities, fired by either natural gas or coal gas, with low sulfur fuel oil as backup. The original proceeding that culminated in that 1994 Certification included extensive evaluations of the worst case capacity constraints and maximum potential environmental effects of the operation of the expected 3000 MW of capacity. These evaluations included assessments of air quality impacts, water quality and wildlife impacts, water use and noise impacts, socioeconomic impacts and benefits, traffic impacts from construction and operation, and other impacts of the entire planned capacity of 3000 MW. This evaluation was undertaken to ensure that the time and expense for processing supplemental applications for additional generating units at the Hines Energy Complex would be significantly reduced, and to allow Florida Power to respond more quickly to changes in the growth in demand for new electrical generating facilities. Also as the Siting Board's 1994 Certification finds, the ultimate site capacity determination provides FLORIDA POWER with assurances that this site has adequate air, water and land resources to accommodate additional electrical generating units like those proposed in this application. The 2002 Supplement Certification for Power Block 2 reconfirmed the adequacy of the site for continued expansion.

As recognized in the 1994 Certification, the Hines Energy Complex site was selected by Florida Power for additional generating capacity after an extensive site selection process, conducted with the assistance of an Environmental Advisory Group. This interdisciplinary group selected a site that achieved the best balance of siting criteria including location near power needs, minimal environmental impact, and cost. Development of the Hines Energy Complex site takes advantage of utilizing an already disturbed phosphate mine site for current and future power needs. Many of the environmental impacts associated with power development on new sites are not at issue here, since the site has been previously altered and disturbed by prior mining activity. The site has the further advantages of being close to Florida Power's load center and being served by electric transmission and rail and highway transportation facilities, which minimizes ancillary impacts.

In 1999, Florida Power began operation of Power Block 1 at the Hines Energy Complex. In 2002, Florida Power began construction on Power Block 2, which is expected to be in service in late 2003. By this application, Florida Power is seeking Supplemental Certification for the construction and operation of Power Block 3, an additional 530 MW (nominal) of generation, under the Florida Electrical Power Plant Siting Act (PPSA), Chapter 403, Part II, and Florida Statutes (F.S.).

To the extent the Siting Board's previous ultimate site capacity determination has already addressed the ultimate impacts and benefits of the development of 3000 MW of electrical generating capacity at the Hines Energy Complex site, they are not addressed in detail in this application. Instead, each area of potential impact and benefit addressed in the 1994 and 2001 Certifications is explained for informational purposes.

This Supplemental Site Certification Application (SSCA) is being filed pursuant to the requirements of the PPSA and Chapter 62-17, F.A.C. The SSCA addresses the environmental and socioeconomic aspects of the additional generating unit at the Hines Energy Complex by presenting information on the existing natural and human environments, the additional generating facilities proposed to be constructed and operated, and the impacts of those additional facilities on those environments. Much of the information contained in this SCA is updated information from the Site Certification Application filed in 1992 (the 1992 SCA) for Power Block 1 and ultimate site certification for the Hines Energy Complex, as well as information provided in the Power Block 2 SSCA, with a focus on the environmental impacts of the construction and operation of Power Block 3. Similar to Power Blocks 1 and 2, Power Block 3 will consist of two combustion turbines (CTs), each equipped with one heat recovery steam generator (HRSG), and a single steam turbine electrical generator (ST). Existing and previously permitted infrastructure, including fuel delivery and storage facilities, electrical transmission lines, potable water supply and treatment, wastewater treatment/disposal and transportation facilities at the Hines Energy Complex are adequate for the operation of Power Blocks 1, 2 and 3.

The project continues to represent a beneficial reuse of an environmentally impacted mined-out phosphate area. Phased construction of numerous generating facilities over a number of years at a single site will enable Florida Power to meet the state's growing need for power with a minimum of environmental impact. The addition of Power Block 3 capacity at the Hines Energy Complex will be accomplished using very efficient generating technology consistent with protection of the environment.

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LIST OF ACRONYMS AND ABBREVIATIONS

1992 SCA	1992 Site Certification Application
ACOE	U.S. Army Corps of Engineers
ARRP	Aquifer Recharge and Recovery Project
BACT	Best Available Control Technology
BEBR	Bureau of Economic and Business Research
BOCC	Board of County Commissioners
BOMR	Bureau of Mine Reclamation
CAA	Clean Air Act
CFR	Code of Federal Regulations
CR	County Road
CT	Combustion Turbine
CUP	Conditional Use Permit
CWA	Clean Water Act
DACS	Florida Department of Agriculture and Consumer Services
dBA	Decibel (A-weighted level)
DCA	Florida Department of Community Affairs
DEP	Florida Department of Environmental Protection
DHR	Florida Department of State, Division of Historical Resources
DHRS	Florida Department of Health and Rehabilitative Services
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
FAA	Federal Aviation Administration
FAAQS	Florida Ambient Air Quality Standards
F.A.C.	Florida Administrative Code
FDLES	Florida Department of Labor and Employment Security
FDNR	Florida Department of Natural Resources
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FFWCC	Florida Fish and Wildlife Conservation Commission (formerly known as Florida Game and Fresh Water Fish Comission)
FGT	Florida Gas Transmission Company
FIPR	Florida Institute for Phosphate Research
FLUCCS	Florida Land Use, Cover and Forms Classification System
FPC	Florida Power Corporation

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

F.S.	Florida Statutes
FWS	U.S. Fish and Wildlife Service
GPD	Gallons Per Day
GPM	Gallons Per Minute
HRSG	Heat Recovery Steam Generator
IMC	International Minerals & Chemical Corporation-Agrico
L_{eq}	Equivalent Noise Level
LOS	Level of Service
MGD	Million Gallons Per Day
MOR	Monthly Operating Reports
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NO_x	Nitrogen Oxides
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NSPS	New Source Performance Standards
PB	Power Block
Pb	Lead
PM_{10}	Particulate Matter with diameter of 10 microns or less
ppm	Parts Per Million
PPSA	Florida Electrical Power Plant Siting Act
PSC	Florida Public Service Commission
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation Recovery Act
SAM	Sulfuric Acid Mist
SCA	Supplemental Site Certification Application
SO_2	Sulfur Dioxide
SR	State Road
ST	Steam Turbine
SWFWMD	Southwest Florida Water Management District
TSP	Total Suspended Particulates
USAC	U.S. Agri-Chemical Company
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
VOC	Volatile Organic Compound

SECTION 1

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1.1 NEED SUMMARY

Florida Power (or "the Company") plans to add 530 megawatts (nominal) of electrical generating resources to its system by November 30, 2005, in order to continue to provide reliable, adequate, cost-effective service to its customers. The most cost-effective way for Florida Power to meet this need is to construct a 530 MW (nominal) state of the art natural gas-fired, combined-cycle power plant at Florida Power's existing Hines Energy Complex ("HEC") in Polk County, Florida. This unit is called "Hines 3" or Power Block 3.

The Company has come to the decision to build the Hines 3 unit as the result of the Company's ongoing Resource Planning process involving an extensive analysis of supply-side and demand-side alternatives, based on feasibility, economics, reliability, fuel diversity, and Florida Power's evaluation of its Request for Proposal ("RFP") for competitive supply-side alternatives. As a resolution of the Florida Public Service Commission's Reserve Margin Docket No. 981890-EU, the Company committed to achieve at least a 20 percent Reserve Margin no later than the summer of 2004.

The Company has determined that the Hines 3 unit will best meet the Company's need for additional generating capacity in 2005. To ensure that Florida Power will be pursuing the best available alternative, the Company issued an RFP to solicit supply-side alternatives to building the Hines 3 unit. The Company carefully evaluated resulting proposals based on both price- and non-price attributes. After considering relevant price- and non-price attributes, the Company ultimately concluded that the Hines 3 unit was superior to the competing alternatives offered.

The Company plans to file its petition for a determination of need with the Florida Public Service Commission ("PSC" or the "Commission") for approval to build the Hines 3 unit in September 2002.

1.2 PSC ORDER ON NEED

Florida Power expects to file the Need Determination Petition with the PSC in September 2002. Copies of the Petition will be made available (once submitted) upon request to parties receiving this SSCA.

Florida Power expects to complete the PSC approval process and obtain an affirmative Determination of Need for building Power Block 3 by February 2002.

1.3 SITE SELECTION PROCESS

In January 1989, recognizing that its forecasts indicated a need for additional generation capacity, Florida Power began the comprehensive process of locating a suitable site for a large new generation facility hich resulted in the selection and initial development of the Hines Energy Complex in Polk County, Florida. A large site is desirable in order to maximize the economies of development and long-term operation.

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

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

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

Phase I

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

Phase II

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

Phase III

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

Phase IV

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

Phase V

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

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

As a result of this extensive statewide search, Florida Power selected a location in Polk County as the primary site of its next generating units and an alternative site in Hardee County. Both locations met Florida Power's goal for a large site capable of handling staged development of various generation and fuel options. The 1994 Certification found that the Hines Energy Complex site is capable of supporting 3,000 MW of total generation. The 2001 Supplemental Certification for the incremental expansion of the site to include Power Block 2, reconfirmed the appropriateness of the site for additional generation.

The expansion of the site to include Power Block 3 was anticipated in the 1994 Certification and is within the overall site capacity originally certified. The addition of Power Block 3 to the Hines Energy Complex is the most efficient and economical option currently available to Florida Power for generation expansion.

1.4 TECHNOLOGY SELECTION

1.4.1 Generation Alternatives

Florida Power's need for additional generation is based upon specific system reliability criteria. A system optimization tool was used to generate a significant number of potential generation expansion alternatives that would satisfy Florida Power's system reliability criteria. These alternatives were examined and compared to quantify the costs and benefits of a variety of generation expansion technologies, plant sizes, and construction options.

In developing these expansion alternatives, Florida Power considered three major constraints. First, Florida Power examined the commercial availability of each technology for use in utility-scale applications. In order for a particular technology to be considered commercially available, the technology must be able to be built and operated on an appropriate commercial scale in continuous service by or for an electric utility. Although many of the technologies evaluated are not currently commercially available, they were still assessed based on the other two criteria, technical feasibility and cost. Reasonable levels of detail for emerging technologies were developed to allow Florida Power to screen the technology options and to stay abreast of potential economic benefits as they mature.

Second, technical feasibility for commercially available technologies was satisfied if the technology met FP's particular generation requirements and would integrate well into FP's system.

Finally, for each alternative, an estimate of the levelized cost of energy production, or "busbar" cost, accounting for capital, fuel, and O&M costs over the typical life expectancy of the unit, was developed. For most technologies, the performance and costs are based on a specific size unit

The generation alternatives that were evaluated included Pulverized Coal (PC), Combustion Turbines (CTs), Combined Cycle (CCs), Atmospheric Fluidized Bed Combustion (AFBC), and coal gasification/combined cycle (CGCC). Each of the alternatives included generation units modeled to come into service between 2002 and 2011.

FP's economic evaluation of these alternatives included cumulative present worth revenue requirement comparisons. In addition, Florida Power evaluated several uncertainties for each alternative based on the high, base, and low demand and energy forecasts; and the high, base, and low fuel price forecasts. The final result of this analysis was a comparison of cumulative present worth revenue requirements of each of the alternatives on FP's system.

A third combined cycle unit at the Hines Energy Complex emerged from all of these calculations as the most cost-effective alternative. In other words, this unit is expected to lead to the lowest cost of service and the

lowest rates, when viewed on a present value or present worth basis. The units also do not pose any unusual risks in the event that some of the key planning assumptions used by Florida Power turn out to vary according to their expected probability distribution.

1.4.2 Combined Cycle Design

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

The approximate average annual electrical output measured in MW for this unit is expressed as the "nominal" output. The proposed Power Block 3 has a nominal output of 530 MW. The actual output of this unit can vary seasonally above and below the nominal output.

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

[redacted]

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2.1 SITE AND ASSOCIATED FACILITIES DELINEATION

The Hines Energy Complex is located in southwest Polk County, Florida, approximately 5 miles northwest of Fort Meade, 7 miles southwest of Bartow, and about 40 miles east of Tampa (Figure 2.1-1). Homeland, the nearest unincorporated community; lies about one mile to the northeast of the site boundary. The site is bounded on the north by County Road (CR) 640, and the south by U.S. Agri-Chemicals Corporation (USAC) property. CR 555 runs through the site.

2.1.1 Description of the Site and Surrounding Area

The Hines Energy Complex site encompasses approximately 8,000 acres. The portion of the site on which the combustion turbines, associated HSRGs, and steam turbine will be located is referred to as the Plant Island. The site lies in a region of the state dominated by phosphate mining operations including mines, settling ponds, sand tailings piles, gypsum stacks, and chemical and beneficiation plants. The adjacent land uses consist almost entirely of active phosphate mining, or mined and reclaimed lands. From the standpoint of land use compatibility, the availability of transportation facilities, the lack of noise and visual impacts during construction and operation activities, the Siting Board has already determined the site location to be suitable for power plant facilities. A discussion of land use in the area of the Hines Energy Complex site is presented in Section 2.2 of this SSCA.

2.1.2 Site Delineation

Figure 2.1.2-1 shows the facilities that will be located at the Hines Energy Complex during operation of Power Blocks 1, 2 and 3. During operation of Power Blocks 1, 2 and 3, the overall Hines Energy Complex site will be subdivided into six major areas as follows:

- Plant Island 704 acres
- Cooling Pond 722 acres
- Brine Pond 311 acres
- Buffer/Mitigation Area 2,128 acres
- Water Crop Areas 4,019 acres
- McCullough Creek Watershed 470 acres

No portion of the Hines Energy Complex is within the 100-year floodplain of any surface water body in the area. The site is located entirely within the Peace River basin. The only significant areas impacted by the addition of Power Block 3 are located within the Plant Island.

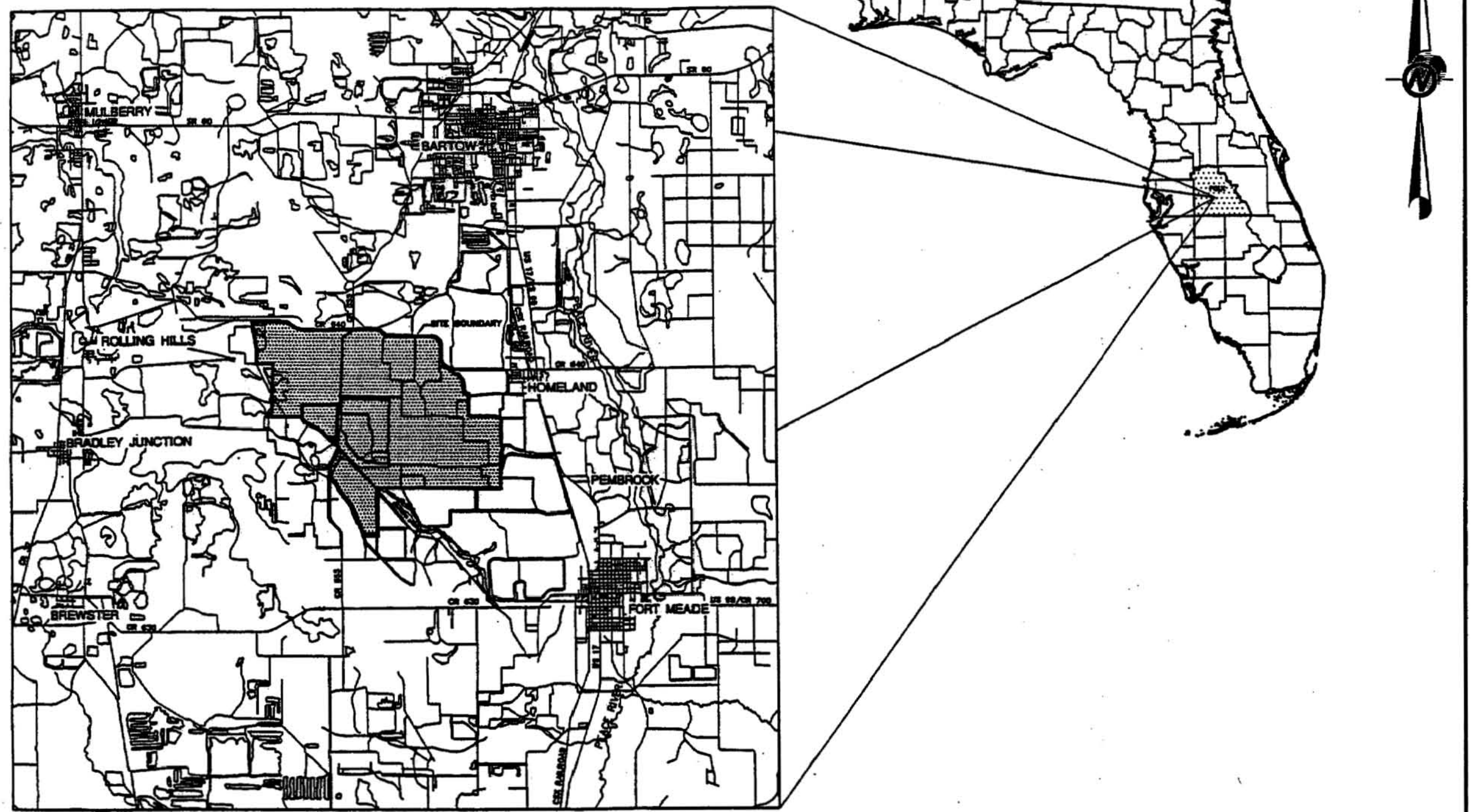
2.1.3 References

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

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

Florida Power Corporation. 1992. Polk County Site. Site Certification Application.

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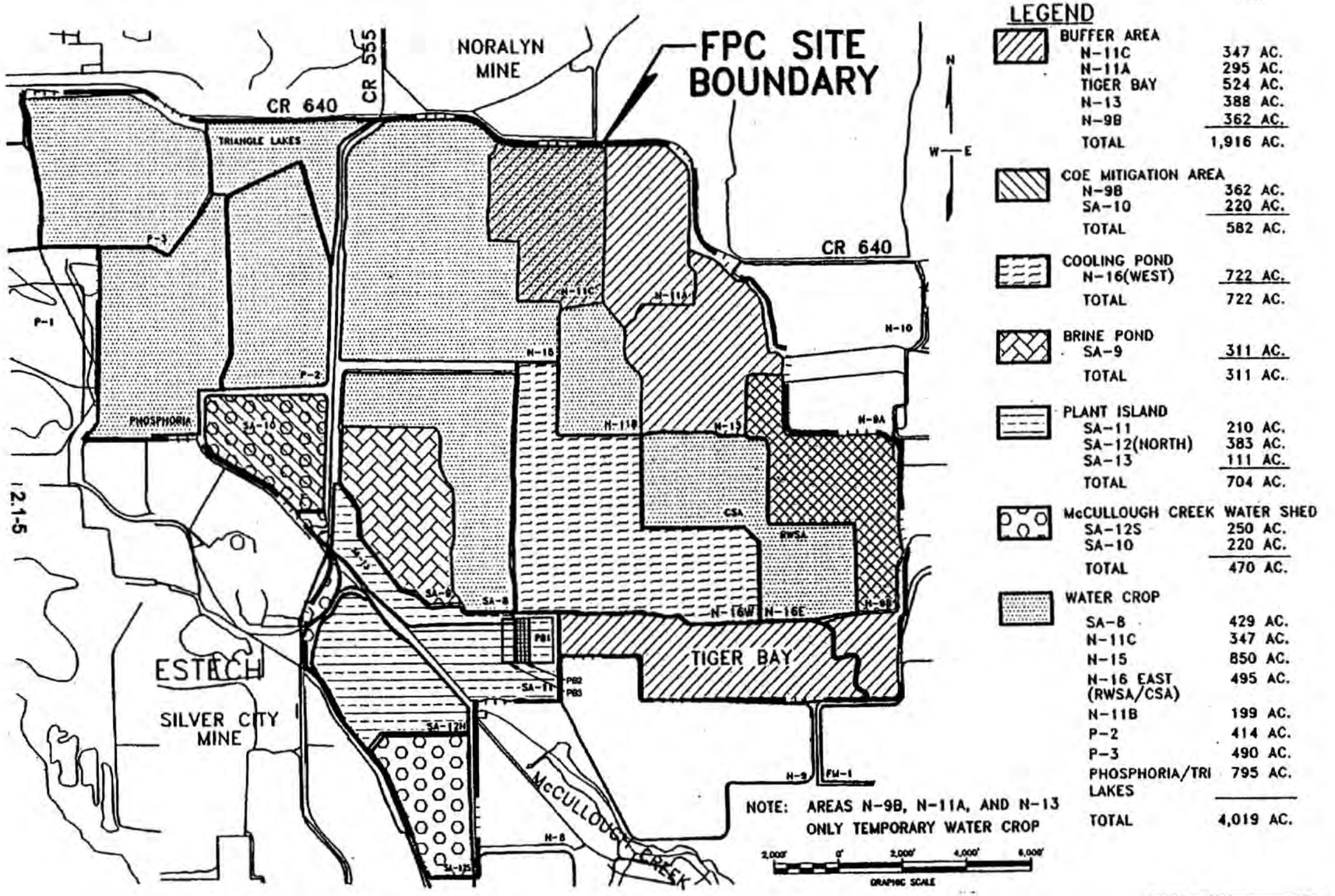
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A Progress Energy Company

Hines Energy Complex

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FIGURE 2.1-1
SITE LOCATION MAP

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LEGEND

BUFFER AREA		
	N-11C	347 AC.
	N-11A	295 AC.
	TIGER BAY	524 AC.
	N-13	388 AC.
	N-9B	362 AC.
	TOTAL	1,916 AC.
COE MITIGATION AREA		
	N-9B	362 AC.
	SA-10	220 AC.
	TOTAL	582 AC.
COOLING POND		
	N-16(WEST)	722 AC.
	TOTAL	722 AC.
BRINE POND		
	SA-9	311 AC.
	TOTAL	311 AC.
PLANT ISLAND		
	SA-11	210 AC.
	SA-12(NORTH)	383 AC.
	SA-13	111 AC.
	TOTAL	704 AC.
McCULLOUGH CREEK WATER SHED		
	SA-12S	250 AC.
	SA-10	220 AC.
	TOTAL	470 AC.
WATER CROP		
	SA-8	429 AC.
	N-11C	347 AC.
	N-15	850 AC.
	N-16 EAST (RWSA/CSA)	495 AC.
	N-11B	199 AC.
	P-2	414 AC.
	P-3	490 AC.
	PHOSPHORIA/TRI LAKES	795 AC.
	TOTAL	4,019 AC.

NOTE: AREAS N-9B, N-11A, AND N-13 ONLY TEMPORARY WATER CROP

Florida Power
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Hines Energy Complex

Poor Original

FIGURE 2.1.2-1
HINES ENERGY COMPLEX POWER BLOCK 3 SITE PLAN

2.2 SOCIOPOLITICAL ENVIRONMENT

2.2.1 Governmental Jurisdictions

The Hines Energy Complex site is located in an unincorporated area of southwest Polk County, approximately 7 miles southwest of Bartow, 5 miles northwest of the city of Fort Meade, and 1 mile southwest of Homeland, an unincorporated community. As Figure 2.2.1-1 indicates, the city of Fort Meade is the only governmental jurisdiction within a five-mile radius of the Plant Island, where Power Block 3 will be located.

Figure 2.2.1-2 identifies the parks and recreation areas within 5 miles of the Plant Island. As shown in the Figure 2.2.1-2, there are none of these special areas within 1 mile of the Plant Island. In addition, none of the following areas are found within 5 miles of the Plant Island:

- National Parks
- National Forests
- National Seashores
- National Wildlife Refuges
- National Wilderness Areas
- National Memorials or Monuments
- National Marine and Estuarine Sanctuaries
- Roadless Area Review and Evaluation Areas
- National Wild and Scenic Rivers
- Critical Habitat of Endangered Species
- State Parks
- State Forests
- Areas of Critical State Concern
- Conservation and Recreation Lands
- State Archaeological Landmarks or Landmark Zones
- Save Our Rivers Lands
- State Aquatic Preserves
- Outstanding Florida Waters
- Scenic and Wild Rivers
- Special Management Areas
- Indian Reservations
- Military Lands

2.2.2 Zoning and Land Use Plans

The Hines Energy Complex has been determined to be consistent and in compliance with the Polk County zoning standards and land use plans. In November 1992, Polk County adopted a Comprehensive Plan in accordance with the Local Government Comprehensive Plan and Land Development Regulation Act, Chapter 163, Part II, F.S. The plan was revised in March and August 2000.

The Polk County Board of County Commissioners approved a conditional use permit (CUP) for the Hines Energy Complex on June 2, 1992. On January 26, 1994, the Siting Board entered its order finding the Hines Energy Complex site to be consistent and in compliance with the Polk County land use plans and zoning standards. Since the site boundaries will not be expanded and the additional generating capacity will be within the approved ultimate site capacity certified by the Siting Board, land use and zoning issues are not an issue in this proceeding, in accordance with section 403.517(3), F.S. The planned development of Power Block 3 is consistent with the approved final order and CUP.

2.2.3 Demography and Ongoing Land Use

Two municipalities, Bartow and Fort Meade, are located within 5 miles of the Hines Energy Complex site boundaries. According to the U.S. Census, the City of Bartow, with a 2000 population of 15,340, is the third largest city in Polk County. The City of Fort Meade had a 2000 population of 5,691. Unincorporated communities in southwest Polk County include Homeland, located about one mile northeast of the site boundaries; Bradley Junction, located about 5 miles west of the Hines Energy Complex site; and Rolling Hills, located about 5 miles northwest of the Hines Energy Complex site.

The rate of population growth in Florida and Polk County is illustrated on Figure 2.2.3-1. Florida's population increased 23.5 percent from 1990 to 2000. Polk County's population growth rate has changed from 40.8 percent growth in the 1970s, to 19 percent growth in the 1990s. Although Polk County's population increased 19 percent from the 1990 census to the 2000 census, most of the growth occurred in the northern part of the County. The 2000 census shows relatively little growth in population since 1990 in most areas in the southern portion of the County. Bartow's population increased only 4 percent from 14,716 in 1990 to 15,340 in 2000, while Fort Meade grew 14 percent, increasing from 4,993 inhabitants to 5,691. The census tract west of the site (161) and census tracts in and near Bartow actually lost population between 1990 and 2000. The census

Other census tracts in the area grew at a rate of 10 to 16 percent. The relatively low population growth in southern Polk County has been attributed to the loss of jobs in the area resulting from the migration of citrus and mining jobs to areas south of Polk County (Rufty, 1991).

The 2000 census calculated the Polk County population at 483,924, which made Polk County the eighth largest county in the state. The University of Florida Bureau of Economic and Business Research projects that Polk County's population will reach 554,900 by 2010 and 591,100 by 2015 (medium projections).

The Hines Energy Complex site is located in southwestern Polk County in an area, which has been dominated by phosphate mining operations, including mines, clay settling ponds, sand tailings piles, gypsum stacks, and chemical and beneficiation plants. Most of the area within a 5-mile radius of the Plant Island consists of lands being actively mined, unreclaimed mining land, and lands in various stages of reclamation. Most of the reclaimed lands revert to pastureland or land-and-lakes after reclamation. Other land uses found within a 5-mile area include pastureland, citrus groves, and limited residential, commercial and industrial uses. Land uses within the 5-mile radius of the Plant Island are mapped on Figure 2.2.3-2.

2.2.4 Easements, Title, Agency Works

County Road (CR) 555 runs through the Hines Energy Complex and CR 640 borders the site on the north. No new public easements, or public title, agency works or crossing approvals are required for development of Power Block 3.

2.2.5 Regional Scenic, Cultural and Natural Landmarks

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

2.2.6 Archaeological and Historic sites

According to a letter from the Florida Department of State, Division of Historical Resources (DHR), dated January 30, 1992, the Hines Energy Complex is in an area that has been dominated by phosphate mining operations for several decades.

There are no known archaeologically and historically significant sites within five miles of the site.

2.2.7 Socioeconomic and Public Services

2.2.7.1 Socioeconomic

EMPLOYMENT AND INCOME

Polk County's civilian labor force was 204,355 in 2000. Out of this total, 194,695 were employed, resulting in an unemployment rate of 5.5 percent. Major industries in terms of employment were retail trade (22.9 percent), services (25.2 percent), manufacturing (10.7 percent), and government employment (federal, state and local), which accounted for 14.8 percent of total employment (Figure 2.2.7-1). Mining employment accounted for 1.3 percent of total employment. The average annual earnings per job in Polk County in 1999 were $28,426.

Employment in Polk County is projected to increase to 226,203 by the year 2005, according to the Florida Department of Labor and Employment Security's publication on Industry and Occupational Employment Projections. The per capita personal income for Polk County was $23,294 in 1999, or 82 percent of the Florida average and 82 percent of the national average per capita income. The 1999 per capita income for Polk County represented a 5 percent increase over the 1998 per capita income of $22,217 (Table 2.2.7-1).

HOUSING

According to the 2000 census, conventional single family units make up 56 percent of all housing units in the county, mobile homes make up 29 percent, and multi-family units made up 14 percent.

The 2000 census reported that the percentage of occupied housing units occupied by renters was 26.6 percent, while the percentage occupied by owners was 73.4 percent. Vacant units accounted for 17 percent of all units in the county. Housing cost data from the 2000 census indicate that 91 percent of the rental units in the county rented for less than $1,000 per month, with a median monthly rent of $501. Approximately 67 percent of owners with a mortgage had monthly costs of less than $1,000 a month. The median monthly owner costs for units with a mortgage was $839. The median value of owner-occupied units was $83,300. A large majority of these units (87 percent) had a value less than $150,000, while 16 percent of these units were valued at less than $50,000. Table 2.2.7-2 illustrates the trend in building permits issued in Polk County between 1995 and 2000. The total value of residential building permits in Polk County rose from $161.6 million in 1995 to $330.7 million in 2000.

LOCAL GOVERNMENT REVENUES AND EXPENDITURES

Polk County's revenue sources include taxes, permits fees and fines, state and federal grants, charges for services, debt proceeds, interest and other sources. Polk County's total revenues in fiscal year 2000/2001 were approximately $406 million according to the Polk County Budget (Figure 2.2.7-2).

Polk County's expenditure categories include transportation, capital funds, Board of County Commissioners, elected officials, County Attorney, administrative services, community services, Office of Economic Development/Tourism, human services, public safety, county managers, debt service, and transportation. The total operating budget for the 2000/2001 fiscal year was approximately $483 million.

2.2.7.2 Public Services

PARKS AND RECREATION

Polk County contains a total of 4,303 acres of public parkland, which is owned and managed by both the county and municipalities. The Board of County Commissioners owns and manages approximately 2,461 acres of this total parkland acreage. Two county parks are located within 5 miles of the Hines Energy Complex Plant Island. The IMC Peace River Park is located just outside a 5-mile radius of the Plant Island. The IMC Peace River Park is a 640-acre regional park consisting of reclaimed phosphate lands. The partially developed park includes picnic facilities and a boardwalk in a 30-acre area along the Peace River. Bartow and Fort Meade also provide recreation facilities. Recreational facilities located in Bartow include a civic center, parks, ball fields, picnic areas, a recreation center, and a community center. Recreational facilities located in Fort Meade include parks, boat ramps, an outdoor recreation area, a sports complex, a skate park, and a community center.

EDUCATIONAL SERVICES

Several colleges and technical schools are located in Polk County, including Florida Southern College and Polk Community College. The University of South Florida is located in Tampa, 30 miles west of Polk County. USF also has a campus in Lakeland. There are 128 schools in the public school system, including 62 elementary schools, 15 middle schools, 11 high schools and 33 other schools including vocational centers, exceptional student centers and charter schools. Four elementary schools, a middle school, a junior high school, and a high school are located in Bartow. Fort Meade contains two elementary schools, a middle school, and a junior/senior high school. There are nine public libraries and one private library within the county, including public libraries in Bartow and Fort Meade.

PUBLIC SAFETY

Polk County provides public safety services for the entire county. The County's Public Safety offices are located at the Bartow Airbase on Highway 17 between Bartow and Eagle Lake. These offices include the Emergency Management Division, Fire Services, and Emergency Medical Services. The County's Fire Services Division provides fire protection throughout the county through county fire stations and volunteer fire stations. There are 150 full-time firefighters in the county and 350 volunteers. There is also a volunteer fire department located in Fort Meade staffed with 25 volunteers. In addition, there are two fire departments located in the city of Bartow: the Bartow Fire Department, staffed with 15 paid personnel and 35 volunteers; and the Bradley Junction Fire Department (located eight miles from the Hines Energy Complex) staffed with 2 paid personnel and 10 volunteers. The County has a Hazardous Materials Team of 12 persons per shift who are especially trained to handle chemicals and industrial incidents. This team is located in the City of Eagle Lake and throughout the County.

The County Emergency Medical Services has 27 Advanced Life Support units that provide services from response stations in 22 geographically strategic locations throughout the County, including one located in Bartow and one in Fort Meade. There are five hospitals in Polk County, with one major trauma hospital located in Lakeland.

Law enforcement in the area is provided by the Polk County Sheriff's Office located in downtown Bartow, the Highway Patrol, and the Cities of Bartow and Fort Meade, which each have a municipal police force.

UTILITY SERVICES

Central water and wastewater services are not currently available at the proposed site. The closest public water and wastewater systems are in the City of Fort Meade, approximately 4 miles southeast of the Plant Island. The Fort Meade Water Treatment Facility has a capacity of 1.44 million gallons per day (MGD) with current usage at 0.83 MGD or 58% of capacity. The Fort Meade wastewater treatment facility has a capacity of 1.0 MGD and a current usage of 0.68 MGD or 68% of capacity. According to the Fort Meade Comprehensive Plan, the wastewater facility is expected to provide sufficient capacity for the City through the year 2010.

SOLID WASTE SERVICES

Solid waste disposal in Polk County is handled by the County. The County operates three landfills, which are used by municipalities and unincorporated areas of the County. In addition to the County's landfills, the City of Lakeland operates city-owned incinerator. The County does not use this incinerator.

The County's North Central Landfill, located on SR 540 between Lakeland and Winter Haven serves the project site. The North Central Landfill serves 67 percent of the County's population. The landfill began operation in the 1970's and consists of 2,200 acres; 140 acres of which have been filled. The level of service provided by the landfill was 6.3 pounds per capita per day in 1996 and is projected to increase to 6.62 pounds per capita per day by 2010. The landfill is expected to have excess capacity through the year 2020.

TRANSPORTATION

Traffic conditions in the vicinity of the project were quantified in the 1992 SCA. As part of the development of Hines Power Block 1, traffic studies and roadway improvements were completed which addressed and mitigated the total transportation impacts for ultimate site capacity build out (3000 MW).

2.2.7.3 References

BEBR (Bureau of Economic and Business Research). 1996. Florida Statistical Abstract 1995. University Presses of Florida. Gainesville, Florida.

BEBR. 1997. Florida Statistical Abstract 1996. University Presses of Florida. Gainesville, Florida.

BEBR. 1998. Florida Statistical Abstract 1997. University Presses of Florida. Gainesville, Florida.

BEBR. 1999. Florida Statistical Abstract 1998. University Presses of Florida. Gainesville, Florida.

BEBR. 2000. Florida Statistical Abstract 1999. University Presses of Florida. Gainesville, Florida.

BEBR. 2001. Florida Statistical Abstract 2000. University Presses of Florida. Gainesville, Florida.

BEBR. 2002. Florida Statistical Abstract 2001. University Presses of Florida. Gainesville, Florida.

Central Florida Development Council. 2002. Website at www.cfdc.org .

City of Bartow. 2002. Website at www.bartow.govofc.com .

City of Fort Meade. 2002. Website at www.state.fl.us/ftmeade.com

Florida Power Corporation. 1992. Polk County Site. Site Certification Application.

Polk County Board of County Commissioners (BOCC). 2002.
Website at www.Polk-County.net

Polk County Environmental Services Department. 2002. Telephone conversation between L. Battles, Bartow, Florida, and S. Douglas, Consensus Builders, Inc. Tampa, Florida, July 10, 2002.

Polk County School District. 2000. Website at www.pcsb.k12.fl.us

Rufty, Bill. 1991. "Population surging in north Polk." The Ledger, October 27, 1991. Lakeland, Florida.

Southwest Florida Water Management District. 2002. 1999 land use maps. Website at www.swfwmd.state.fl.us.

U.S. Census Bureau. 2002. Website at www.census.gov.

IMAGE QUALITY

AS YOU REVIEW THE NEXT FEW PAGES,
PLEASE NOTE THAT THE ORIGINAL
DOCUMENT WAS OF POOR QUALITY.

Table 2.2.7-1
Per Capita Income Growth
1993 – 1999

LOCATION	1993	1994	1995	1996	1997	1998	1999
United States	21,718	22,581	23,562	24,651	25,874	27,321	28,546
Florida	21,652	22,340	23,512	24,616	245,721	26,931	27,781
Polk	17,437	18,440	19,462	20,428	20,893	22,217	23,294

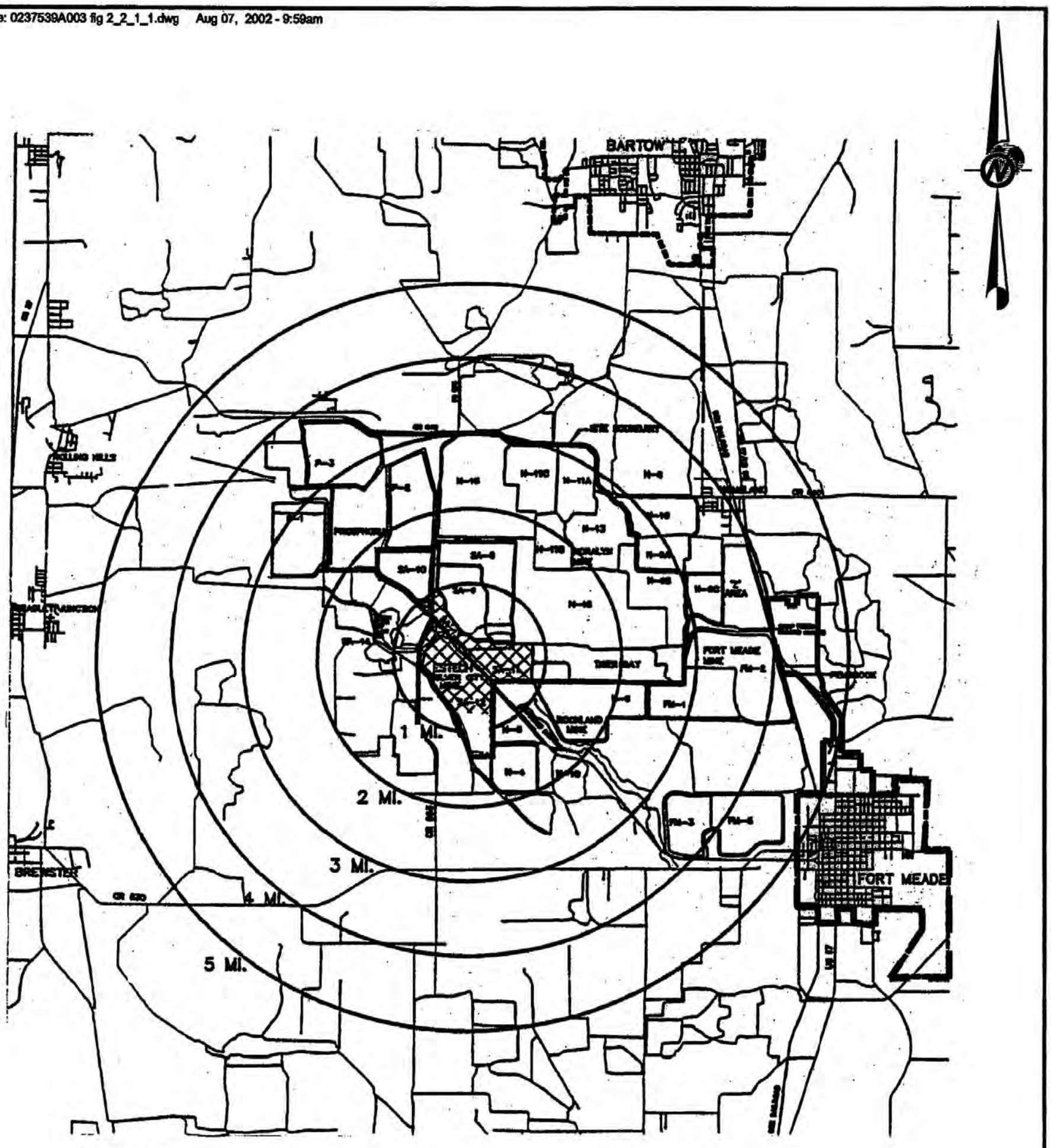
Source: Florida Statistical Abstract 2001.

Table 2.2.7-2
Polk County Building Permits Issued
(Value in Thousands of Dollars)

YEAR	VALUE OF ALL RESIDENTIAL	# OF ONE FAMILY HOUSES	# OF MULTI-FAMILY BUILDINGS
1995	$161,592	2,187	179
1996	$187,822	2,504	122
1997	$222,090	2,648	719
1998	$236,329	2,852	450
1999	$284,806	2,967	912
2000	$330,684	3,520	1,226

Source: Florida Statistical Abstracts 1996 through 2001

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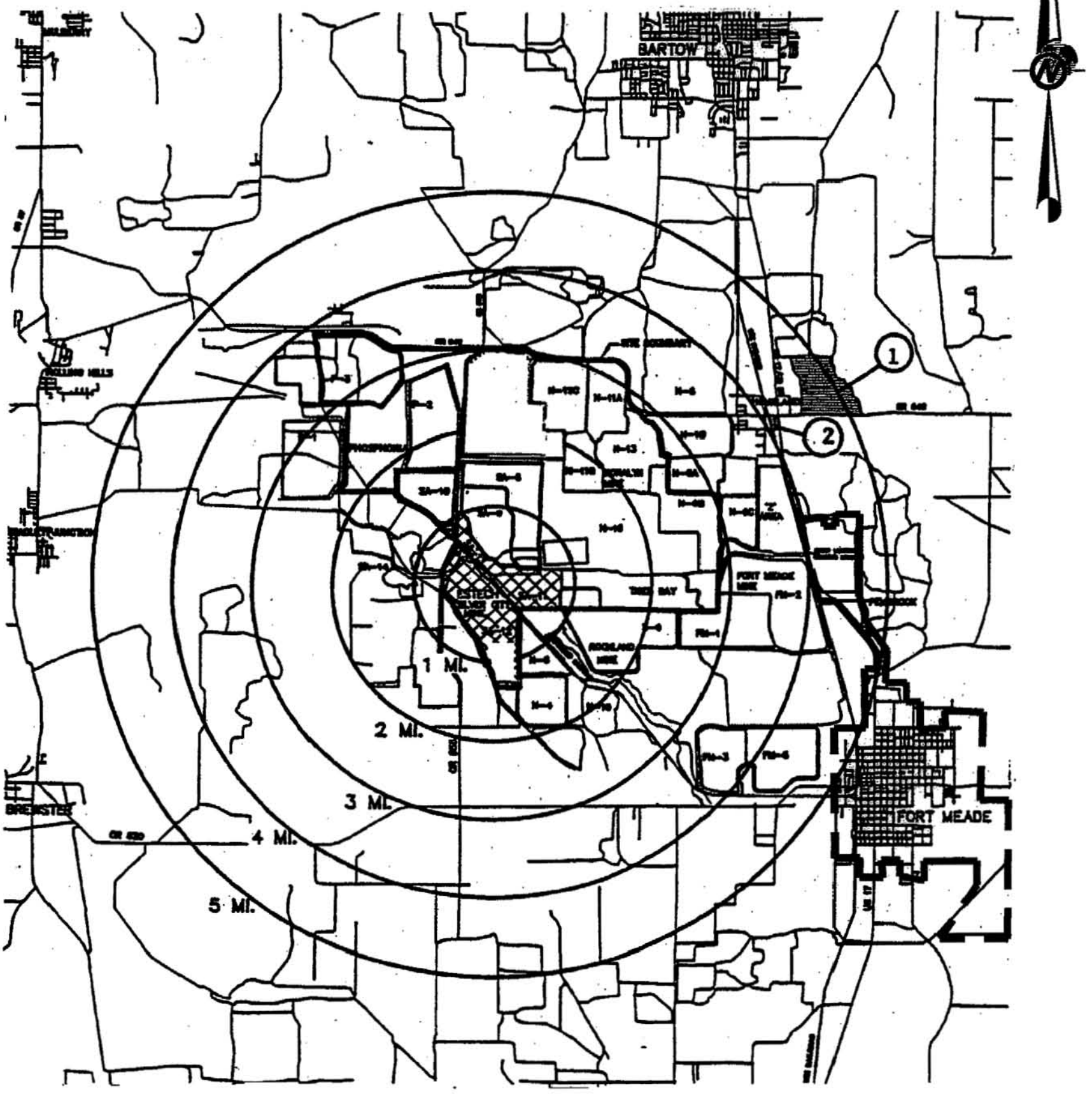
SOURCE: 1992 SCA

Florida Power
A Progress Energy Company

Hines Energy Complex

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

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LEGEND

PLANT ISLAND

(1) IMC PEACE RIVER PARK

(2) HOMELAND HISTORIC AND PIONEER PARK

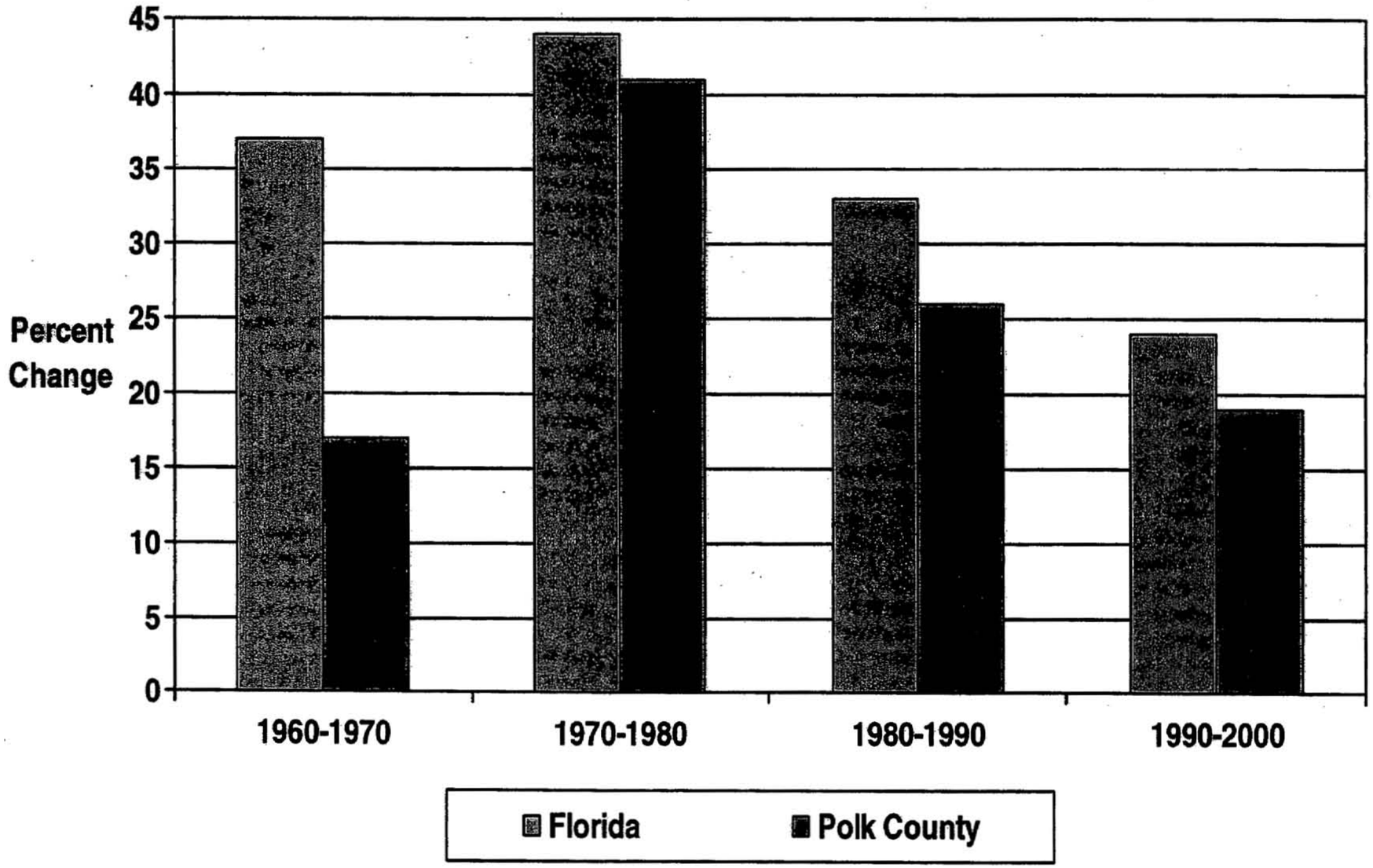
SOURCE: 1992 SCA

Florida Power
A Progress Energy Company

Hines Energy Complex

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

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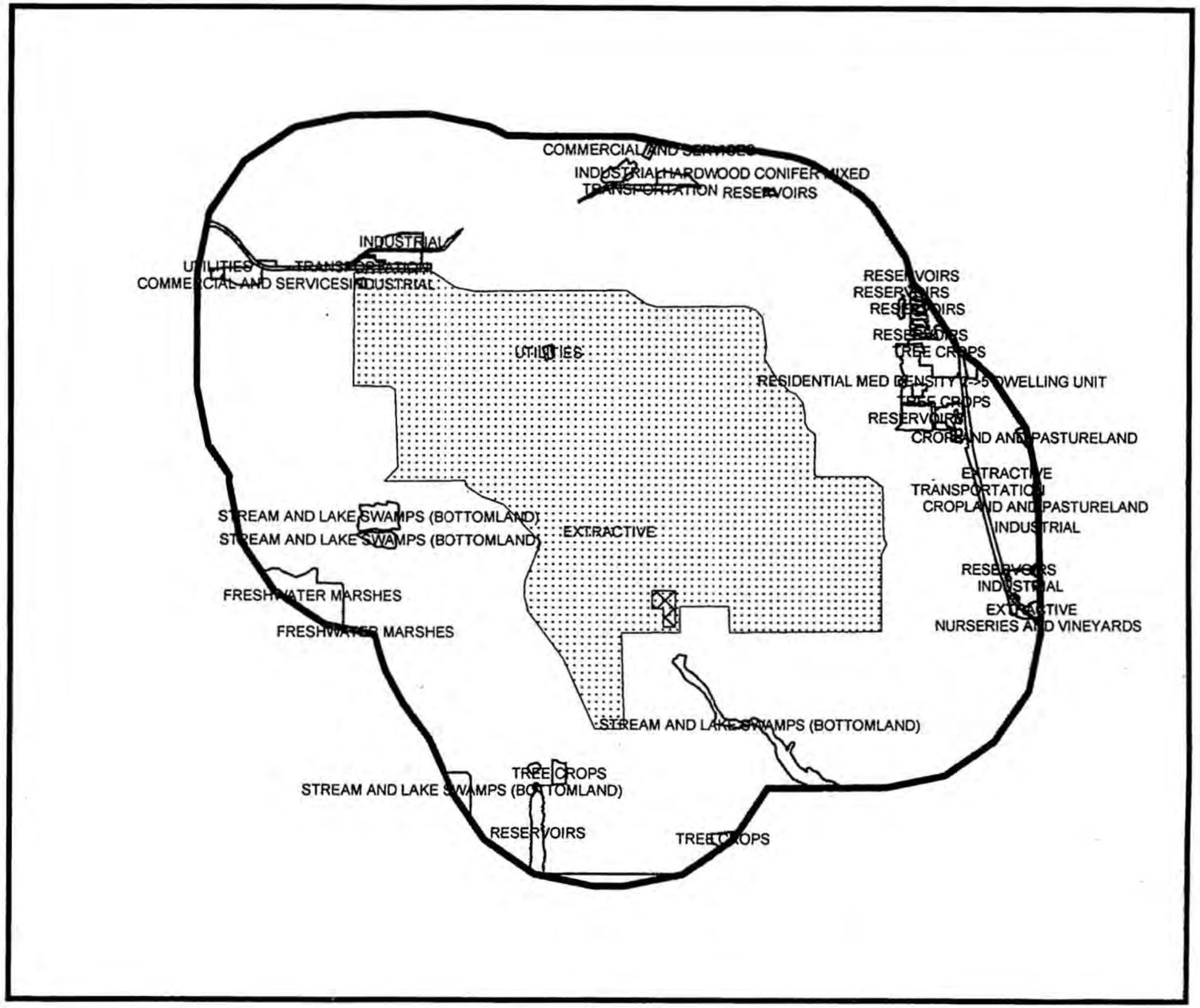


SOURCE: U.S. CENSUS BUREAU, 2002

Florida Power
A Progress Energy Company

Hines Energy Complex

FIGURE 2.2.3-1
POPULATION GROWTH 1960-2000
FLORIDA AND POLK COUNTY



Plant Island
Site Boundary
5 Miles from Boundary

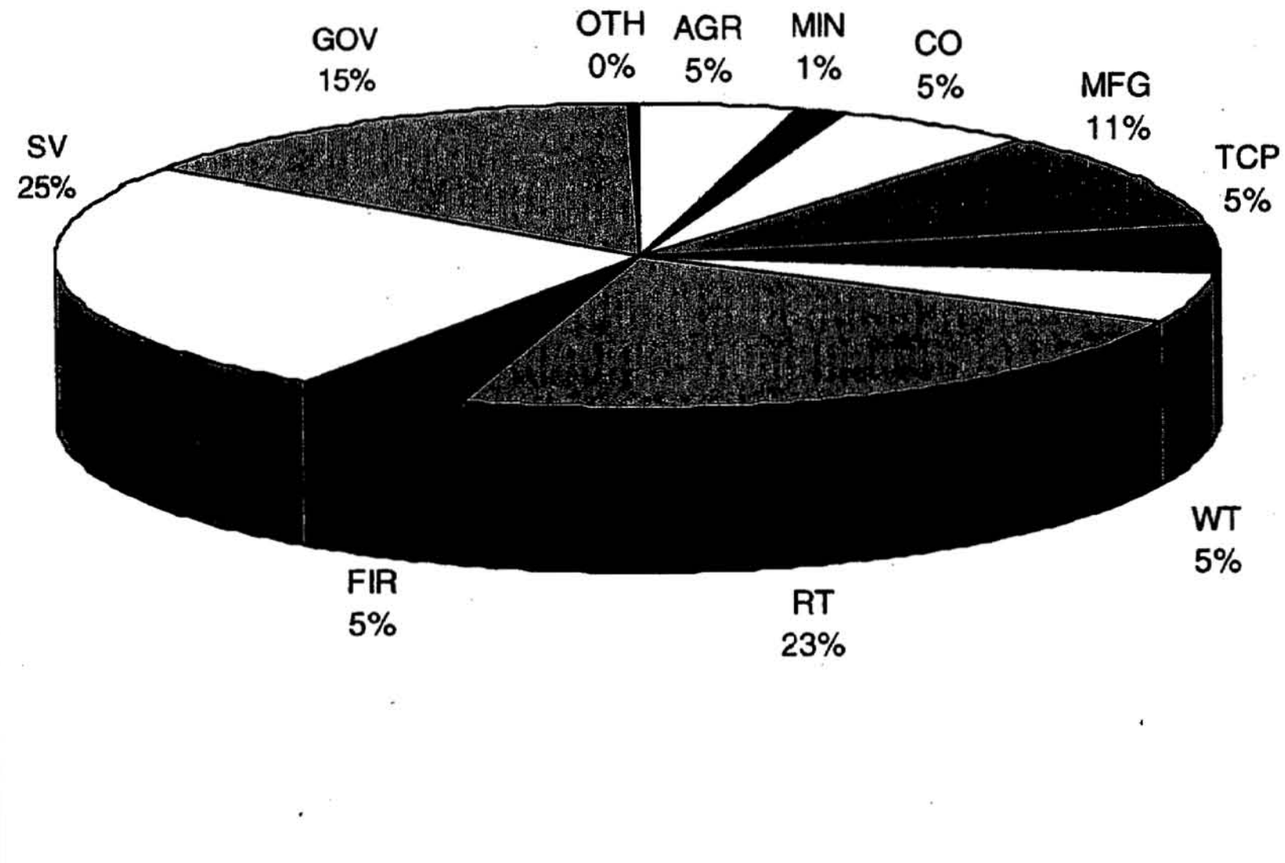
SOURCE: SOUTHWEST FLORIDA WATER MANAGEMENT DISTRACT 1999 LAND USE

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Hines Energy Complex

FIGURE 2.2.3-2
EXISTING LAND USE WITHIN 5 MILES OF THE PLANT

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- AGR - Agriculture, Forestry and Fishing
- MIN - Mining
- CO - Construction
- MFG - Manufacturing
- TCP - Transportation, Communication, Public Utility
- WT - Wholesale Trade
- RT - Retail
- FIR - Finance, Insurance, Real Estate
- SV - Services
- GOV - Government
- OTH - Other

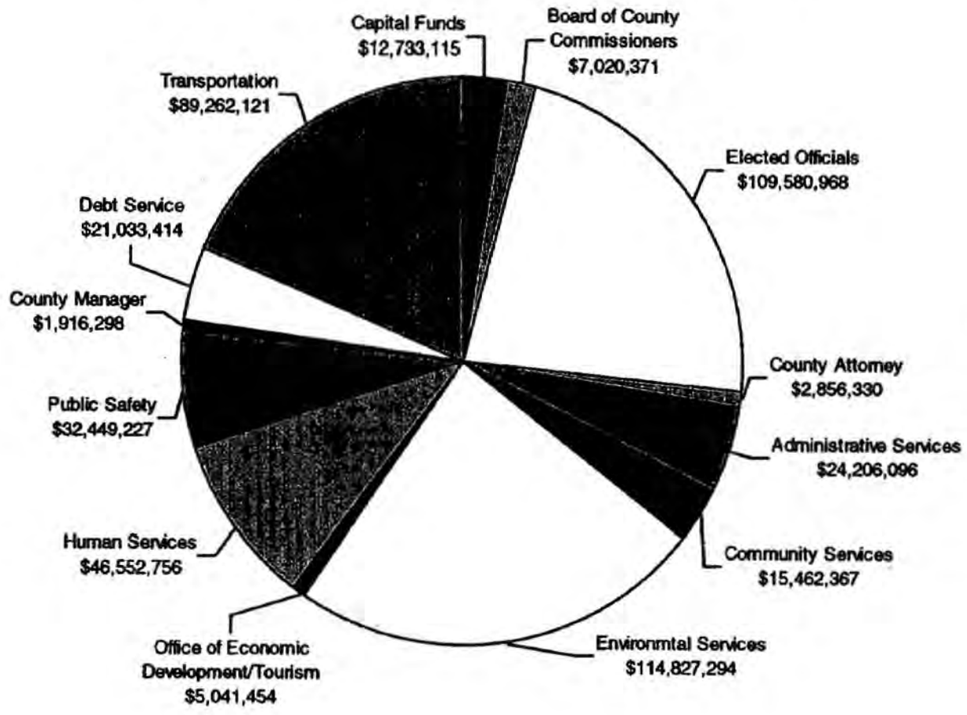
SOURCE: FLORIDA STATISTICAL ABSTRACT 2001

Florida Power
A Progress Energy Company

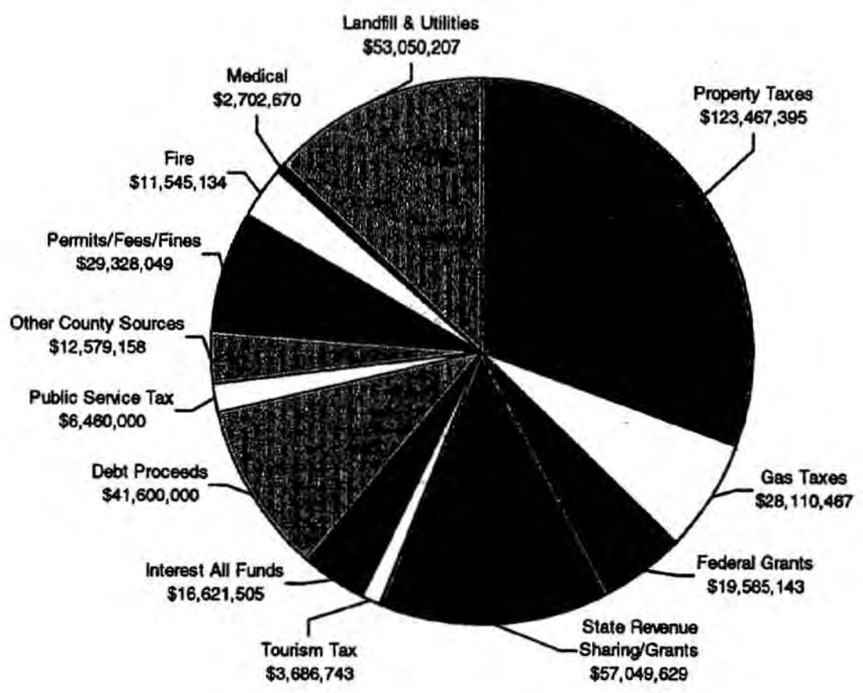
Hines Energy Complex

FIGURE 2.2.7-1
EMPLOYMENT BY INDUSTRY (2002)

Operating Budget by Department



Operating Revenues



SOURCE: POLK COUNTY BOARD OF COUNTY COMMISSIONERS, 2002

Florida Power
A Progress Energy Company

Hines Energy Complex

FIGURE 2.2.7-2
POLK COUNTY OPERATING BUDGET AND REVENUES

2.3 BIOPHYSICAL ENVIRONMENT

Following are descriptions of the general geohydrology, surface and subsurface hydrology, water budget and area uses, vegetation/land use, ecology, meteorology, ambient air quality, noise, and other environmental features that exist at or near the Hines Energy Complex site. It should be noted that the incremental impacts related to the proposed Power Block 3, above those related to the overall development of the site, are expected to be minimal.

2.3.1 General Geohydrology

This section describes the major geohydrologic aspects of the Hines Energy Complex site and discusses these geohydrology features on a regional setting.

2.3.1.1 Geologic Description of the Site-Area

Polk County is divided into nine major physiographic provinces: the Lakeland Ridge, Winter Haven Ridge, Lake Henry Ridge, Lake Wales Ridge, Bombing Range Ridge, Lake Upland, Polk Upland, Osceola Plain, and Western Valley (SWFWMD, 1988). These areas and their topographic relief and sediments were formed when sea levels were much higher than today.

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

REGIONAL GEOLOGY

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

Figure 2.3.1-1 shows the generalized lithostratigraphic units and hydrogeologic framework underlying the site area. Figures 2.3.1-2 and 2.3.1-3 show the distribution of these sediments throughout Polk County in two geologic cross-sections.

POST-MIOCENE SURFACE SEDIMENTS

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

MIOCENE HAWTHORN GROUP

The Miocene Hawthorn Group in South Florida includes the Peace River Formation that overlies the Arcadia Formation. The Bone Valley Member, located in the upper portions of the Peace River Formation, is considered to be the top of the Hawthorn Group. The lower portion of the Hawthorn Group consists of silts, clays and limestone of the Arcadia Formation (Scott, 1988). The Peace River Formation is present throughout Polk County with the exception of the northernmost part of the County. The Arcadia Formation ranges in thickness from 0 feet in the north to approximately 300 feet in the southwest corner of the County. In general, these formations dip to the south and southeast. The Peace River Formation includes the Bone Valley Member that consists of yellowish gray to light olive-green interbedded sands, clays and dolomite with variable phosphate content. The Bone Valley Member is defined as phosphorite pebble or gravel matrix beds with sand-sized phosphorite in a sandy to clayey matrix. At the Hines Energy Complex site, the Bone Valley Member comprises most of the Peace River Formation. The Bone Valley member directly overlies the Arcadia Formation that consists of white to yellowish gray quartz, sandy phosphates and clayey dolomites and clay beds. The thickness of the Hawthorn Group is approximately 260 feet in the site vicinity.

OLIGOCENE SUWANNEE LIMESTONE

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

EOCENE OCALA GROUP

Below the Suwannee Limestone lies the Eocene series of the Ocala Group, the Avon Park Formation and the Oldsmar Formation. The Ocala Group underlies essentially all of Polk County. The Ocala Group

(consisting of the Crystal River, Williston, and Inglis Formations) ranges in thickness from 75 to 335 feet throughout the County. The top of the Ocala Group is near the surface in the northern portion of the County and dips southward.

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

2.3.1.2 Detailed Site Lithologic Descriptions

A description of the drilling of boreholes, collection of samples for lithologic description, and results of downhole geophysical logging performed during the 1991 aquifer pump test program is provided in Appendix 10.5.8 of the 1992 SCA. In addition, hydrogeologic cross-sections were developed from lithology encountered in three 300-foot deep boreholes (SH-1, SH-2, and SH-3) at the site. Generally, the site-specific data obtained during the field activities can be correlated to the overall geologic framework as described for Polk County. Figure 2.3.1-4 shows the hydrogeologic framework of the Hines Energy Complex site as encountered during the field activities. Figure 2.3.1-5 is the cross-section location map for the Hines Energy Complex site. Figures 2.3.1-6 and 2.3.1-7 are hydrogeologic cross-sections underlying the Hines Energy Complex site in relation to the site lithologic data.

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

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

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

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

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

PLANT ISLAND LITHOLOGY

Prior to development of the Hines Energy Complex, the Plant Island areas SA-11, SA-12N and SA-13 were mine pits undergoing reclamation. The Plant Island areas consisted of partially leveled, loose overburden placed on the undisturbed mine pit bottom. Overburden thickness ranged from 22 to 30 feet and typically extended down to elevation 130 to 133 ft MSL in SA-11, and 120 to 130 ft MSL in SA-12N with elevations trending lower to the south. As presented in the 1992 SCA, typically, the overburden soils were classified as either silty or clayey sand (SM or SC). These soils have been leveled in-place and covered with engineered fill as described on the As-Built Drawings for Earthwork Construction filed previously with the Florida Department of Environmental Protection (FDEP).

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

2.3.1.3 Geologic Maps

The geologic map of southwest Polk County adapted from Campell (1992) is shown on Figure 2.3.1-8.

2.3.1.4 Bearing Strength

All Power Block 3 facilities will be constructed within the Plant Island in previous mine areas SA-11 and SA-13. The Plant Island area was developed as approved by the 1994 Certification, by filling the mined areas with overburden obtained from N-16W. Existing overburden piles in the structural power block area were leveled to elevation +154 feet NGVD, and the valleys between piles were filled with loose bulldozed fill after mudwaving and excavation of soft bottom sediments. Engineered fill was subsequently placed above elevation +154 feet NGVD in a controlled manner. Engineered fill was placed in one-foot maximum compacted lift thickness and nominally compacted to in excess of 90% compaction per standard proctor density (ASTM D698). Upon completion of filling, a 10-foot high surcharge was rolled across designated areas of the power block for the purpose of preloading and

consolidating the underlying fill and overburden piles. The entire Power Block 3 area will be surcharged in this fashion. The surcharging is applied to allow lightly loaded plant facilities such as small tanks and other miscellaneous foundations, to be placed on shallow foundations in lieu of deep foundations. For lightly loaded structures and miscellaneous small foundations constructed in surcharged areas, such structures can be placed on shallow footing or mat foundations at a maximum allowable bearing pressure of 1,000 PSF.

Due to the loose nature of the overburden piles and nominally compacted fill, the support of moderately to heavily loaded power plant structures requires that piles be installed down through the fill and seated well into the underlying dense carbonate silts and clays of the Intermediate aquifer.

The fuel oil storage tank put in with Power Block 1 was the only exception to the above criteria. For the heavily loaded tank, the footprint area was surcharged with a 25-foot height of fill placed to a diameter 10 feet larger than the diameter of the tank. Bearing pressures for the tank ring foundation were set at 2500 psf. No additional oil storage tank will be constructed in association with Power Block 3.

The Plant Island, formerly referred to as mining areas SA-11, SA-12N and SA-13, consisted of partially reclaimed mined-out pits with large amounts of loose overburden material. No phosphatic clays have been deposited in these areas. Fine clean sand tailings occupied a large portion of the north section of SA-13 and a smaller area in the north corner of SA-12N.

2.3.1.5 References

Ardaman & Associates, Inc. (1982-1989). Evaluation of Phosphatic Clay Disposal and Reclamation Methods, Volumes 1 to 9. FIPR Research Publications.

Bowles, J.E. 1988. Foundation Analysis and Design, 4th Edition. McGraw Hill Book Company. New York, New York.

Bromwell Engineering, Inc. 1982. Waste Clay Disposal in Mine Cuts. FIPR Publication on 02-006-009. October, 1982.

Campbell, Ken, 1992. Geologic Map of Polk County, Florida. Florida Geological Survey.

FHWA (Federal Highway Administration). 1986. Dynamic Compaction for Highway Construction - Volume 1, Design and Construction Guidelines. Report No. FHWA/RD-86/133. July 1986.

Florida Power Corporation. 1992. Polk County Site. Site Certification Application.

Lambe, T. W. and R. Whitman. 1969. Soil Mechanics. John Wiley & Sons, Inc. New York, New York.

Scott, Thomas M. 1988. The Lithostratigraphy of The Hawthorn Group (Miocene) of Florida. Florida Geological Survey. Bulletin No. 59.

SWFWMD (Southwest Florida Water Management District). 1988. Ground-Water Resource Availability Inventory: Polk County, Florida. March 1988.

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SERIES	LITHOSTRATIGRAPHIC UNIT			MAJOR LITHOLOGIC UNIT	HYDROLOGIC UNIT	
POST-MIOCENE	UNDIFFERENTIATED DEPOSITS			SAND	SURFICIAL AQUIFER SYSTEM	
MIOCENE	HAWTHORN GROUP	PEACE RIVER FORMATION	BONE VALLEY MEMBER	CLASTIC	CONFINING UNITS	INTERMEDIATE AQUIFER SYSTEM
		ARCADIA FORMATION	TAMPA MEMBER	CARBONATE AND CLASTIC	AQUIFER	
					CONFINING UNITS	
OLIGOCENE	SUWANNEE LIMESTONE			CARBONATE	UPPER FLORIDAN AQUIFER	FLORIDAN AQUIFER SYSTEM
EOCENE	OCALA GROUP					
	AVON PARK FORMATION				CONFINING UNITS	
	OLDSMAR FORMATION			CARBONATE WITH EVAPORITES	LOWER FLORIDAN AQUIFER	

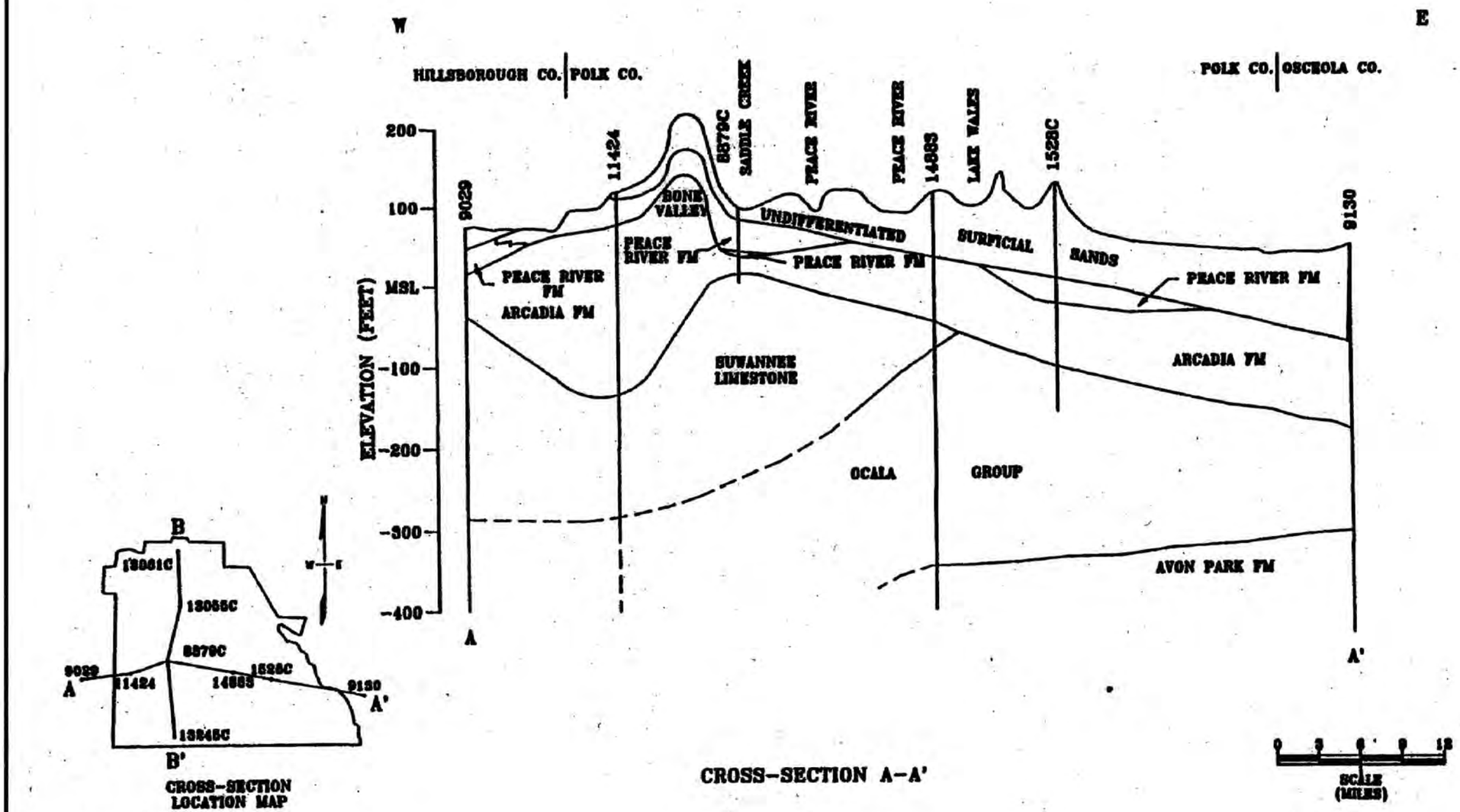
SOURCE: 1992 SCA

Florida Power
A Progress Energy Company

Hines Energy Complex

FIGURE 2.3.1-1
GENERALIZED LITHOSTRATIGRAPHIC
AND HYDROGEOLOGIC FRAMEWORK
POLK COUNTY AREA

Drawing file: 0237[illegible]006 fig 2_3_1_2.dwg Jul 29, 2002 - 2:15pm



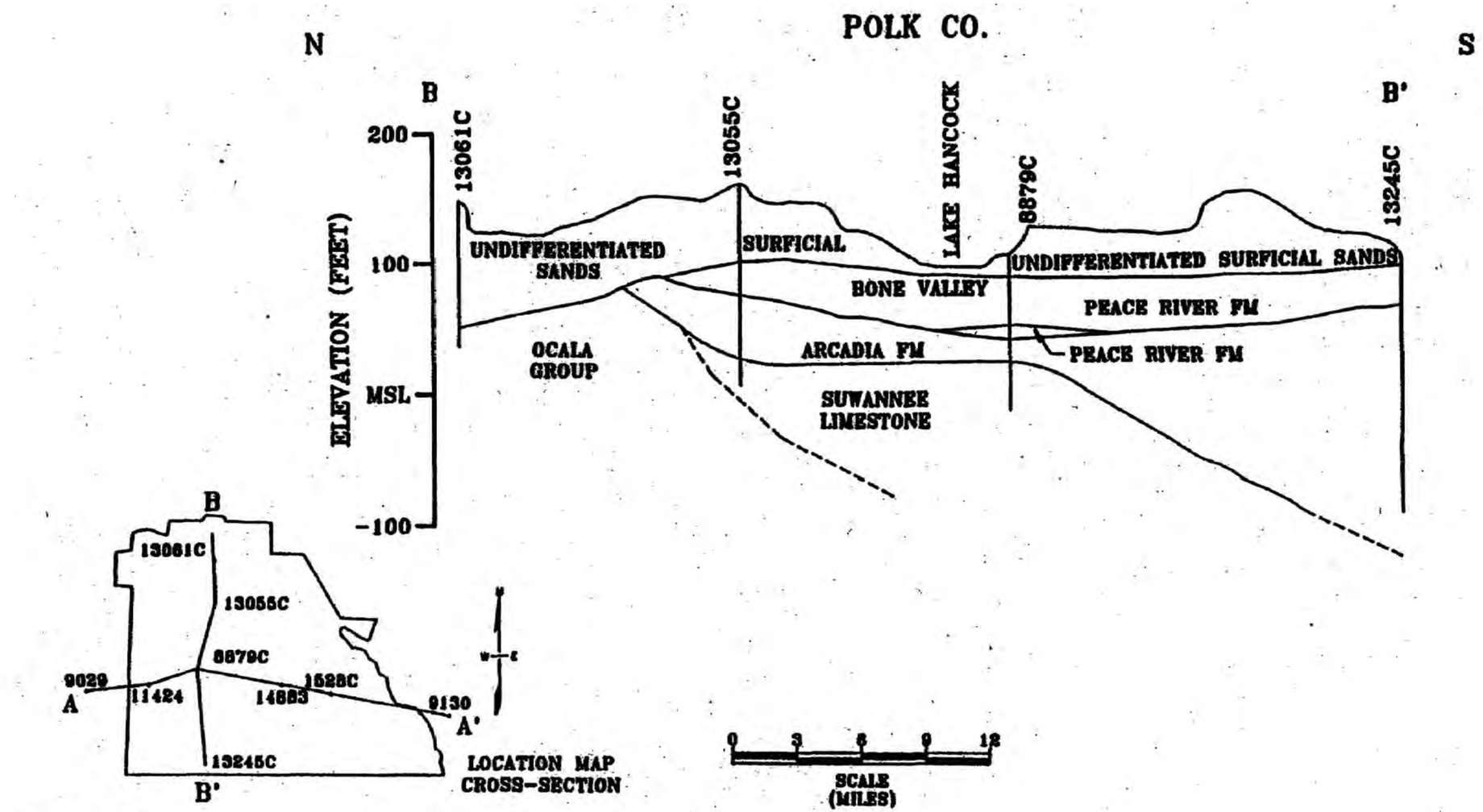
SOURCE: 1992 SCA

Florida Power
A Progress Energy Company

Hines Energy Complex

FIGURE 2.3.1-2
GENERALIZED GEOLOGICAL SECTION OF POLK COUNTY (EAST-WEST)

Drawing file: 023[illegible]007 fig 2_3_1_3.dwg Jul 29, 2002 - 2:19pm



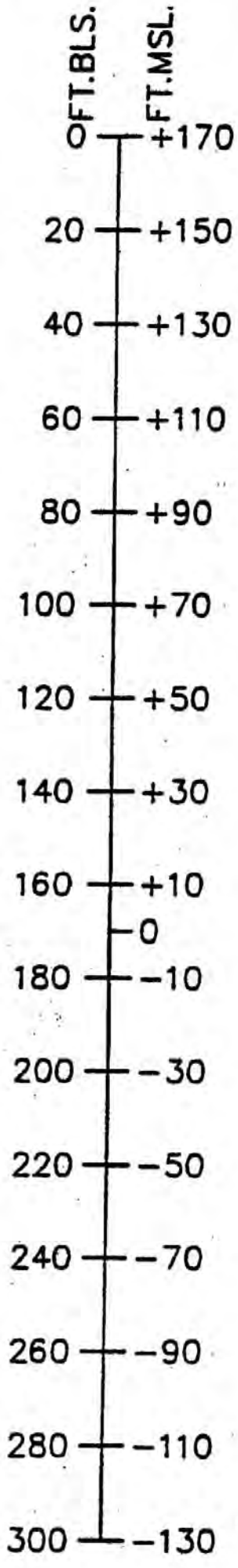
SOURCE: 1992 SCA

Florida Power
A Progress Energy Company

Hines Energy Complex

FIGURE 2.3.1-3
GENERALIZED GEOLOGICAL SECTION OF POLK COUNTY (NORTH-SOUTH)

Drawing file: 0237539A008 fig 2_3_1_4.dwg Aug 30, 2002 - 2:35pm



SERIES	LITHOSTRATIGRAPHIC UNIT		HYDRO-STRATIGRAPHIC UNIT
POST-MIOCENE	UNDIFFERENTIATED CLASTICS (ALTERED)		SURFICIAL AQUIFER SYSTEM
MIOCENE	HAWTHORN GROUP	PEACE RIVER FORMATION / BONE VALLEY MEMBER	ALTERED
		ARCADIA FORMATION	INTERMEDIATE AQUIFER SYSTEM AND CONFINING UNITS: UPPER CONFINING UNITS; CLAYEY LS; SILTY CLAY CLAYEY SILT; LS AQUIFER; CLAYEY SILTS; LS AQUIFER; LOWER CONFINING UNITS
OLIGOCENE	SUWANEE LIMESTONE		UPPER FLORIDAN AQUIFER

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

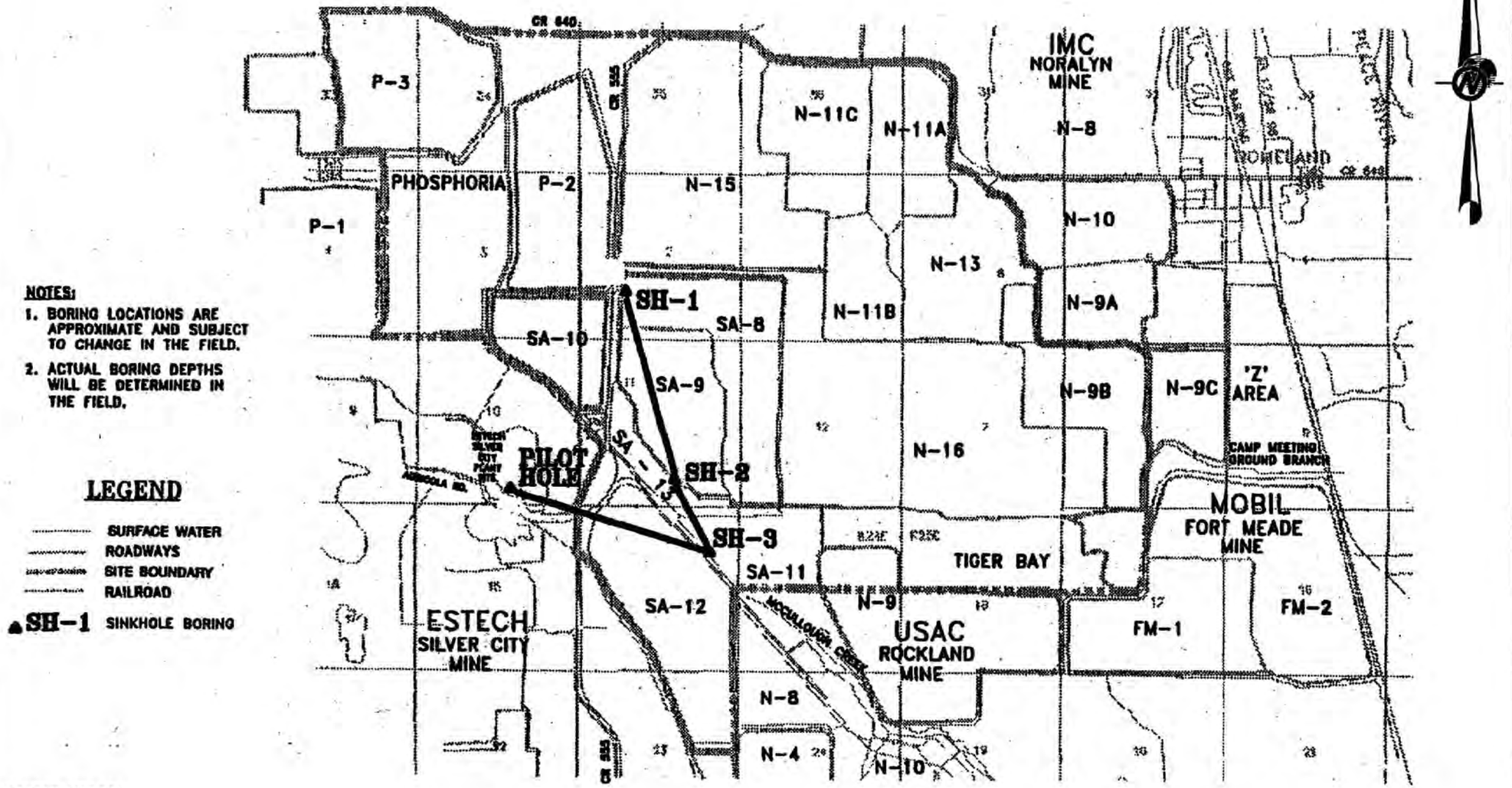
SOURCE: 1992 SCA

Florida Power
A Progress Energy Company

Hines Energy Complex

FIGURE 2.3.1-4
HYDROGEOLOGIC FRAMEWORK
FPC SITE AREA

Drawing file: 0237[illegible]009 fig 2_3_1_5.dwg Jul 29, 2002 - 2:40pm



NOTES:

1. BORING LOCATIONS ARE APPROXIMATE AND SUBJECT TO CHANGE IN THE FIELD.
2. ACTUAL BORING DEPTHS WILL BE DETERMINED IN THE FIELD.

LEGEND

- SURFACE WATER
- ROADWAYS
- SITE BOUNDARY
- RAILROAD
- ▲SH-1 SINKHOLE BORING

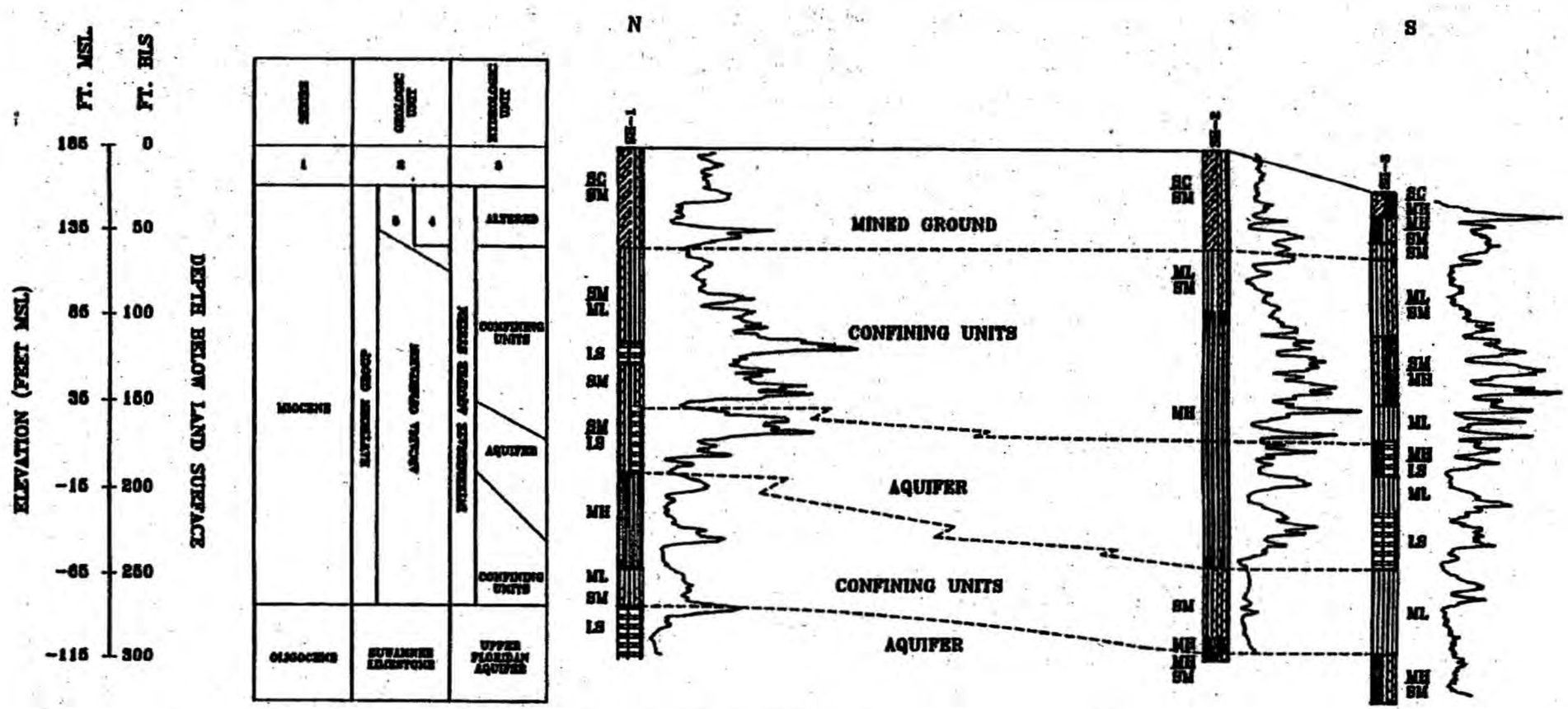
SOURCE: 1992 SCA

Florida Power
A Progress Energy Company

Hines Energy Complex

FIGURE 2.3.1-5
HYDROGEOLOGIC CROSS-SECTION LOCATION MAP
HINES ENERGY COMPLEX SITE AREA

Drawing file: 0237538.010 fig 2_3_1_6.dwg Jul 29, 2002 - 2:56pm



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

① POST-MIOCENE DEPOSITS

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

③ FORMER SURFICIAL AQUIFER SYSTEM

④ BONE VALLEY MEMBER

⑤ PEACE RIVER FORMATION

LEGEND:

FT. MSL = FEET MEAN SEA LEVEL

FT. BLS = FEET BELOW LAND SURFACE

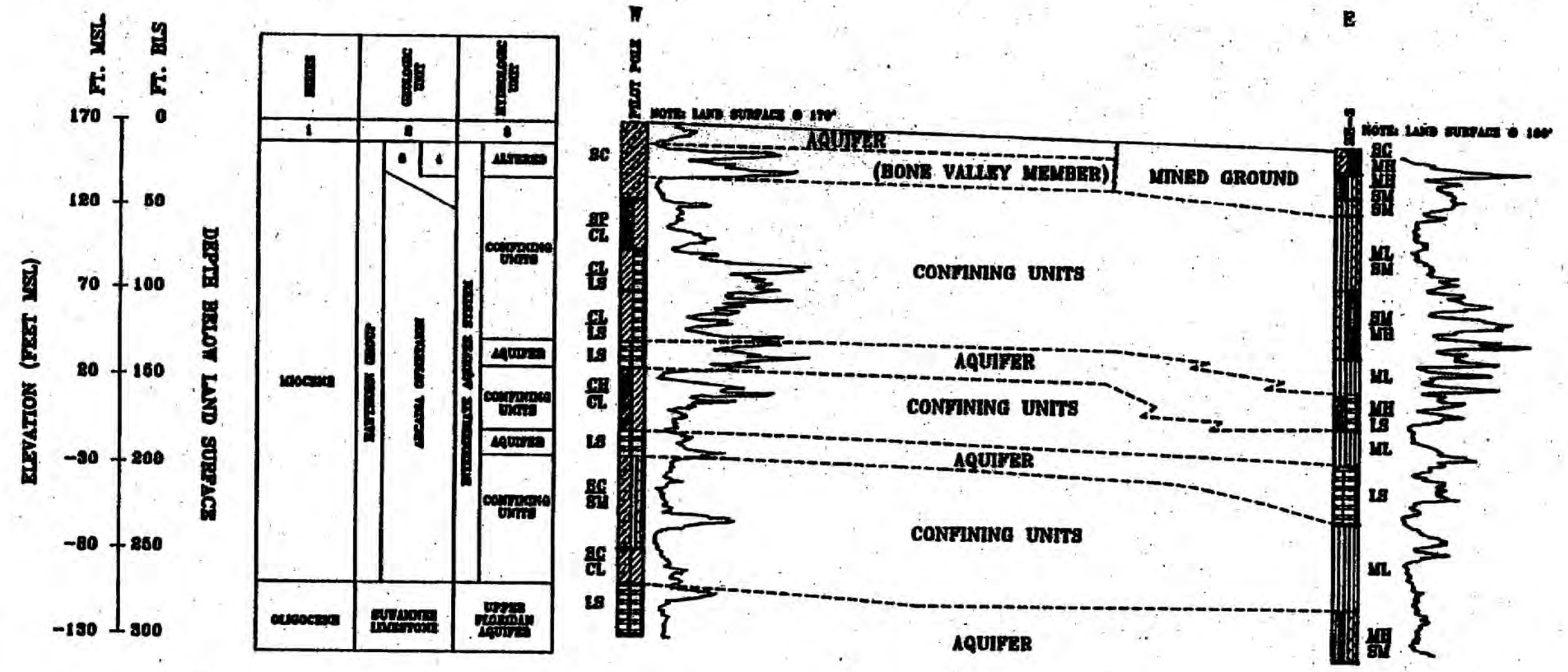
SOURCE: 1992 SCA

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Hines Energy Complex

FIGURE 2.3.1-6
NORTH - SOUTH HYDROGEOLOGIC CROSS-SECTION
HINES ENERGY COMPLEX SITE, DECEMBER 1991

Drawing file: 023753SA011 fig 2_3_1_7.dwg Jul 29, 2002 - 3:02pm



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

① POST-MIOCENE DEPOSITS

④ THIS GEOLOGIC UNIT OR UNITS HAVE BEEN REMOVED/ ALTERED BY MINING ACTIVITIES

⑤ FORMER SURFICIAL AQUIFER SYSTEM

⑦ BONE VALLEY MEMBER

⑧ PEACE RIVER FORMATION

LEGEND:

FT. MSL = FEET MEAN SEA LEVEL

FT. BLS = FEET BELOW LAND SURFACE

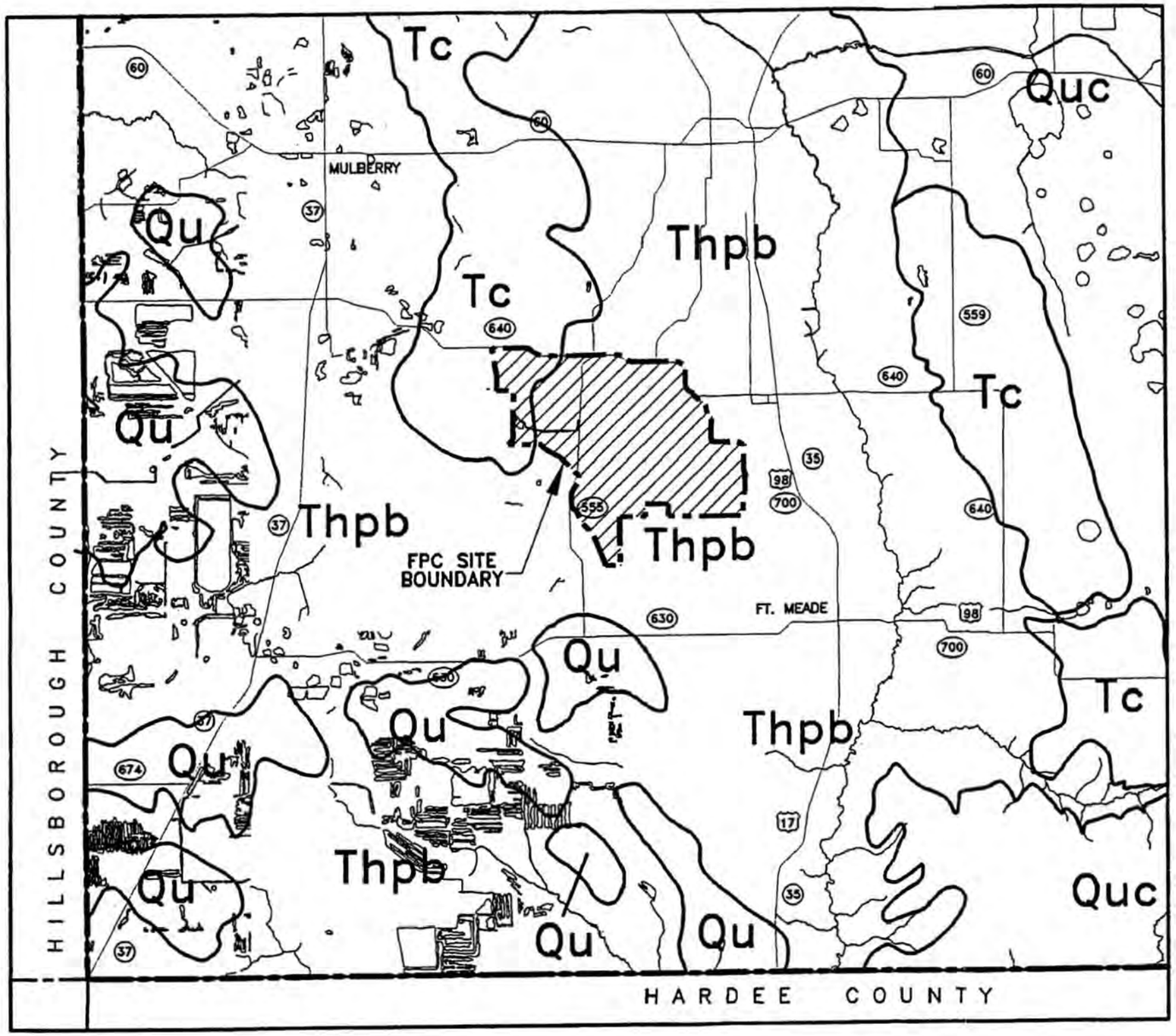
SOURCE: 1992 SCA

Florida Power
A Progress Energy Company

Hines Energy Complex

FIGURE 2.3.1-7
EAST - WEST HYDROGEOLOGIC CROSS-SECTION
HINES ENERGY COMPLEX SITE, DECEMBER 1991

Drawing file: 0237539A012 fig 2_3_1_8.dwg Jul 29, 2002 - 3:14pm



SOURCE: 1992 F.G.S. MAP, CAMPBELL, 1992

EXPLANATION

QUATERNARY

Qu– Undifferentiated surficial sands, clayey sands, clays, marls and peats >20 feet thick. No formations recognized.

Quc– Undifferentiated sands reworked from Cypresshead Fm.. Also isolated occurrences of Cypresshead.

TERTIARY

Tc– Cypresshead Fm. quartz sands with minor clay. Lies on Hawthorn Group.

Thpb–Bone Valley Member of the Peace River Formation, Hawthorn Group. Consists of pebble– or gravel–sized phosphate fragments and sand–sized phosphate grains in a matrix of quartz sand and clay. Percentages of the various components are highly variable.

Florida Power
A Progress Energy Company

Hines Energy Complex

FIGURE 2.3.1-8
GEOLOGIC MAP OF SOUTHWESTERN POLK COUNTY

2.3.2 Subsurface Hydrology

2.3.2.1 Subsurface Hydrological Data for Site Area

Generally, three hydrostratigraphic units underlie the Hines Energy Complex site area: the Surficial aquifer (previously removed/altered at the site); the Intermediate aquifer that includes upper and lower confining units; and the Floridan aquifer. This section provides background water quality data for each unit, aquifer characteristics, historical water level contour maps, and unit thickness. The discussion of aquifer definitions and the relationship of aquifers to geologic units are referenced to the publications by SWFWMD (1988) and Ryder (1985).

Background water quality data for the Surficial, Intermediate, and Upper Floridan aquifers were presented in the 1992 SCA as tabulated from the U.S. Geological Survey (USGS) Water Quality Data Printout dated May 29, 1991. Additional water quality data for the Surficial aquifer were obtained from Hutchinson (1978). Hines Energy Complex site-specific water quality data were obtained from FP's ground water monitoring program.

Historical water level data used to develop contour maps for the Surficial aquifer, as referenced from Hutchinson (1978), were presented in the 1992 SCA. Also presented were potentiometric contour maps for the Intermediate and Upper Floridan aquifers referenced from USGS water resources data reports (USGS, 1980-91). Additional water level data was obtained from FP's construction dewatering ground water level monitoring program conducted between May 1994 and March 1998.

SURFICIAL AQUIFER SYSTEM

Most of the materials that comprise the Surficial aquifer at the Hines Energy Complex site have been altered, or removed, due to mining activities by prior property owners. Where it occurs naturally and before being removed by mining at the Hines Energy Complex site, the Surficial aquifer system typically consists of clastic deposits of sands, silty sands, and clays of eolian and marine origins. In Polk County, the Surficial aquifer is used primarily for domestic and low volume irrigation uses. The Surficial aquifer thickness ranges from a few inches in lowlands to 250 feet in ridge areas. As defined by SWFWMD (1988), the base of the Surficial aquifer system is the clayey, less permeable beds of the Hawthorn Group. As previously discussed in the 1992 SCA, the top of the Hawthorn Group (the Bone Valley Member of the Peace River Formation) is laterally continuous across the Hines Energy Complex site at an elevation of approximately 150 ft NGVD. The bottom of the Surficial aquifer, to an elevation of about 150 ft NGVD, has been removed/altered during mining operations.

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

During the field activities at the Estech Plant site in November and December 1991, the elevation of the water table of the Surficial aquifer in an adjacent unmined area was measured to range from 153 to 163 ft NGVD. As reported in the Aquifer Characteristics Program (ACP) Summary Report (Appendix 10.5.8 of the 1992 SCA), the ground water flow direction at the Estech Plant site is to the southwest. Water level measurements were not collected at the Hines Energy Complex site itself, because of the lack of aquifer thickness or continuity. However, published data by Hutchinson (1978) provided water table elevations for the Surficial aquifer in September 1975. Figure 2.3.2-1 is a generalized water table contour map of the Surficial aquifer in the Hines Energy Complex site area before mining. These data show water level elevations of 150 ft NGVD near the Hines Energy Complex site with a ground water flow direction to the east along the east half of the site and to the southwest along the west half of the site. However, it is noted that these water levels are no longer indicative of present day flow conditions due to the extensive mining operations in the Hines Energy Complex site area. This information is provided solely as historical data on pre-mining ground water flow and elevation.

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

Hines Energy Complex site construction activities and mine reclamation activities have, in places, reconstructed the Surficial aquifer. Cast overburden placed during mining operations was excavated for construction of the Cooling Pond area. The Surficial aquifer framework at the Cooling Pond has therefore been removed. Cast overburden from the Cooling Pond excavation was placed as engineered fill within the Plant Island. The Surficial aquifer at the Plant Island is, therefore, engineered (compacted) fill. The engineered fill is described in the As-Built Drawings for Earthwork Construction on file with the DEP. Elsewhere on the property, the Surficial aquifer has been either reconstructed with recontoured overburden as part of the mine reclamation activities or replaced with waste clay in the waste clay settling areas.

Surficial aquifer ground water levels at the Hines Energy Complex site were monitored from April 1, 1993 through March 16, 1998. Ground water level monitoring was conducted as required under Condition XXVI.A.24.e of the Conditions of Certification for Power Block 1. The levels were monitored in 15 upper Surficial aquifer monitor wells and six lower Surficial aquifer monitor wells. Except during construction dewatering, the monitor wells constructed in the upper portion of the Surficial aquifer had ground water levels generally ranging from 145 to 165 feet NGVD. Monitor wells constructed in the

lower portion of the Surficial aquifer had ground water levels typically one to three feet lower than the water levels in the shallower wells.

The background water quality of the Surficial aquifer system near the Hines Energy Complex site is tabulated from published data by the USGS (1991). The Surficial aquifer baseline water quality data sampling locations are shown on Figure 2.3.2-2. Water quality data at nine sampling locations near the Hines Energy Complex site are provided in Table 10.5.3-3 of the 1992 SCA. The minimum, maximum, and mean Surficial aquifer water quality data are presented in Table 10.5.3-4 of the 1992 SCA.

INTERMEDIATE AQUIFER SYSTEM

As shown on Figures 2.3.1-1 through 4, the Intermediate aquifer system is present in the Arcadia and Peace River Formations of the Miocene Age Hawthorn Group. The Intermediate aquifer system includes all water bearing units and confining units between the overlying Surficial aquifer system and the underlying Upper Floridan aquifer system (SWFWMD, 1988). The Intermediate aquifer system includes the upper confining units below the Surficial aquifer, the middle unit of limestone and clayey silts, and the lower confining units above the Suwannee Limestone, which corresponds to the upper sections of the Upper Floridan aquifer. Water withdrawals from the middle units of the Intermediate aquifer system are used primarily for domestic supply in Polk County. Large diameter wells (6 inches or larger) open to the Intermediate aquifer system generally can provide yields of 200 gpm or more. The aquifer is most productive in the central and southern parts of Polk County.

The upper confining layers of the Intermediate aquifer system consist of the clayey and silty sediments of the Bone Valley Member of the Peace River Formation. Mining activities have removed/altered the sediments of the Bone Valley Member, which were typically 15 to 25 feet thick. The geophysical logs taken at the Hines Energy Complex site in 1991 (FP 1992), show the bottom of the Bone Valley Member to be approximately 130 ft NGVD. Therefore, the remaining upper confining units of the Arcadia Formation are about 100 feet thick, beginning at approximately 130 ft NGVD and extending downward to the first production zones, consisting of limestone at an elevation of 30 ft NGVD. The lithologic data obtained from a 300-foot deep pilot hole at the adjacent Estech Plant site and the three 300-foot deep borings near the Plant Island area at the Hines Energy Complex show two limestone aquifer zones in the Arcadia Formation. As shown in the hydrogeologic cross-section and framework, the aquifer zones of the Intermediate aquifer range in elevation from 30 ft NGVD at the top to about -30 ft NGVD at the bottom. The units appear to be laterally extensive throughout the Hines Energy Complex site area as extrapolated from the boring locations.

The lower confining units of the Intermediate aquifer consist of gray clayey silts of the Arcadia Formation. The lower confining units are approximately 75 feet thick with the bottom at an elevation

ranging from -110 ft NGVD at the Estech pilot hole, to -85 ft NGVD at SH-1, and to -115 ft NGVD at SH-3. (See Figures 2.3.1-6 and 2.3.1-7.)

Hutchinson (1978) discusses the hydraulic properties of the Intermediate aquifer system. The transmissivity for the Intermediate aquifer averaged 5,185 ft^2/day for six tests conducted in Polk County, and storage coefficients ranged between 1.0×10^{-4} and 4.2×10^{-5} for seven tests. One leakance coefficient value of 2×10^{-4} feet per day per foot (ft/day/ft) was reported (SWFWMD, 1988). Model-derived leakance values of the lowermost intermediate confining beds are estimated to range from 3×10^{-5} to 7×10^{-5} ft/day/ft (Ryder, 1985). A leakance value for the lower confining units evaluated from data generated during the aquifer performance testing at the adjacent Estech Plant site (Appendix 10.5.8 of the 1992 SCA) was calculated to be 2.4×10^{-4} gallons per day per cubic foot (gpd/ft^3). The leakance values are greatly affected by the variability in thickness of the confining beds, which is most likely the main reason for the observed differences.

Historical potentiometric surface contour maps of the Intermediate aquifer during wet and dry seasons were developed from USGS data files, as shown on Figures 2.3.2-3 and 2.3.2-4 during the months of May and September, for the year 2001. The potentiometric maps suggest variable flow directions influenced by pumping from water wells in Bartow, Fort Meade, and Homeland. The potentiometric level in the Hines Energy Complex site area ranged from approximately 60 ft NGVD to 75 ft NGVD during the May measurements with ground water flow to the southeast and east, and 75 ft NGVD to 90 ft NGVD during the September measurements with ground water flow to the east. As shown in Appendix 10.5.8 of the 1992 SCA, the potentiometric surface contours suggest a northwest ground water flow direction. Metz and Stelman (1995) reported potentiometric levels in the Hines Energy Complex site area to be between 90 and 110 feet NGVD in May 1995 with ground water flow direction ranging from northwest to northeast. In September 1995, Metz, Swenson, and Stelman (1996) reported potentiometric levels between 80 and 110 feet NGVD with ground water flow directions generally northeast. Figure 2.3.2-4 shows that the groundwater flow direction is southward at the Hines site.

Intermediate aquifer potentiometric levels at the Hines Energy Complex site were monitored from April 1, 1993 through March 16, 1998. The monitoring was conducted as required under Condition XXVI.A.24.e of the Conditions of Certification for Power Block 1. The levels were monitored in two Intermediate aquifer monitor wells DMWP-1D and DMWP-6D. The Intermediate aquifer potentiometric levels generally ranged from 70 to 92 feet NGVD.

The background water quality of the Intermediate aquifer is provided by data published by the USGS. The Intermediate aquifer baseline water quality data sampling locations are shown on Figure 2.3.2-5. Water quality data at six locations near the Hines Energy Complex are provided in Table 10.5.3-5 of the 1992 SCA. The minimum, maximum, and mean values of the water quality data are presented in Table 10.5.3-6

of the 1992 SCA. Overall, the water quality of the Intermediate aquifer system in Polk County is within FDEP primary and secondary drinking water standards (SWFWMD, 1988).

FP has conducted ground water sampling and analysis as part of the ground water monitoring program required by the 1994 certification. Six Intermediate aquifer monitor wells (IMW1, IMW-2, IMW-3, IMW-4, IMW-5, and IMW-6) were sampled on April 4, 2000. The samples were analyzed for Primary Drinking Water Standard parameters (inorganics and volatile organic compounds), Secondary Drinking Water Standard parameters, purgeable halocarbons, purgeable aromatics, phenols, phthalate esters, and PCB's. The water quality of the Intermediate aquifer system at the Hines Energy Complex is within FDEP primary and secondary drinking water standards. In addition, purgeable halocarbons, purgeable aromatics, phenols, phthalate esters, and PCB's were not present in detectable concentrations in any of the samples except one sample where cis-1,2-Dichloroethene was detected at a concentration fifty times lower than the drinking water standard contained in Chapter 62-550, F.A.C.

FLORIDAN AQUIFER SYSTEM

As shown in the generalized lithostratographic and hydrogeologic framework (Figure 2.3.1-1), the Floridan aquifer system near the Hines Energy Complex site consists of vertically persistent permeable carbonates of the Avon Park Formation, the Ocala Group, and the Suwannee Limestone.

As shown on Figure 2.3.1-4, the Upper Floridan aquifer begins at the encounter of the sandy carbonates of the Suwannee Limestone, followed by the limestones of the Ocala Group and consists of units below the bottom of the clayey silts of the Arcadia Formation of the Hawthorn Group, from which most of the potable water supplies are provided. The contact between the Suwannee Limestone and the Ocala Group could not be identified from the field activities performed at the Estech Plant site; however, the bottom of the Suwannee is estimated to be at approximately -200 ft NGVD (Ryder, 1985).

The 300-foot deep pilot hole at the Estech Plant site and the three 300-foot borings (SH-1, 2, and 3) at the FP Hines Energy Complex show the top of the Upper Floridan aquifer to range from -85 ft NGVD (SH-1) to -115 ft NGVD (SH-3). (See Figures 2.3.1-6 and 2.3.1-7.) Estimates of the aquifer's base elevation range from higher than -1,000 ft NGVD in central Polk County to deeper than -1,200 ft NGVD in southern Polk County (SWFWMD, 1988). The deepest well from which downhole geophysical data were obtained on the Estech Plant site was SC-1, to a bottom elevation of approximately -650 ft NGVD. During the field activities at the Estech Plant site, between October and December 1991, the potentiometric level of the Upper Floridan ranged in elevation from +57 ft NGVD to +58 ft NGVD as shown in the ACP Summary Report contained in Appendix 10.5.8 of the 1992 SCA.

Historical water level data from USGS files led to the potentiometric surface contour maps for the Upper Floridan during the wet and dry seasons shown on Figures 2.3.2-6 and 2.3.2-7 during the months of May and September for the year 2001. In the Hines Energy Complex site area, the potentiometric levels ranged from 40 ft NGVD to 50 ft NGVD during the May measurements and 55 ft NGVD to 65 ft NGVD during the September measurements. Based on USGS data, the ground water flow direction of the Upper Floridan aquifer is toward the southwest. Figure 2.3.2-8 shows a hydrograph of the water levels in Floridan Aquifer well ROMP 59, which is maintained by the Southwest Florida Water Management District. This well is located in Section 12, Township 30S, Range 24E and is about four miles north of the Hines Energy Complex site. Floridan Aquifer water levels vary from a low of 43 feet in April 1990 to a high of 83 feet in February 1998.

The hydraulic properties of the Upper Floridan aquifer are documented throughout Polk County. The areal variation in the Upper Floridan transmissivity is controlled primarily by the occurrence of solution features and fractures. The aquifer storage coefficient is controlled by thickness, and confining bed lithology and thickness control leakance (SWFWMD, 1988). Transmissivity values from four aquifer performance tests performed near the Hines Energy Complex ranged from 119,000 gpd/ft to 69,800,000 gpd/ft as shown on Table 1 of ACP Summary Report contained in Appendix 10.5.8 of the 1992 SCA. The upper range was reported for a well that most probably encountered a fracture system (SWFWMD, 1987). Storage coefficients ranged from 1.0×10^{-4} to 4.4×10^{-4}. An average transmissivity value of 552,000 gpd/ft was measured during the aquifer performance test performed on well SC-1 at the adjacent Estech Plant site. The average storage coefficient was 7.92×10^{-3} for the test at the adjacent Estech Plant site.

Background water quality data of the Upper Floridan aquifer was provided by the USGS. The Upper Floridan aquifer baseline water quality data sampling locations are shown on Figure 2.3.2-9. Water quality data for thirteen locations near the FP Hines Energy Complex are provided in Table 10.5.3-7 of the 1992 SCA. The minimum, maximum, and mean values of the water quality data are presented in Table 10.5.3-8 of the 1992 SCA.

One Floridan Aquifer monitor well (FMW-1) was sampled on September 23, 1998. The sample was analyzed for Primary Drinking Water Standard parameters (inorganic and volatile organic compounds), Secondary Drinking Water Standard parameters, purgeable halocarbons, purgeable aromatics, phenols, phthalate esters, and PCB's. The water quality of the Floridan aquifer system underlying the Hines Energy Complex site is within DEP primary and secondary drinking water standards. In addition, purgeable halocarbons, purgeable aromatics, phenols, phthalate esters, and PCB's were not present in detectable concentrations.

RECHARGE TO AQUIFER SYSTEMS

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

The highest value of recharge occurs in a linear band directly associated with the upland sandy ridge areas, where recharge rates are estimated between 10 and 20 inches per year (SWFWMD, 1988). Estimates of recharge by SWFWMD (1988), Ryder (1985), and Stewart (1980), near the Hines Energy Complex site area range from no recharge to 2 inches, 3 to 6 inches, and 0 to 2 inches per year, respectively.

Recharge rates to the Intermediate aquifer system were evaluated by SWFWMD (1988). This publication indicates a very low to moderate recharge rate to the Intermediate aquifer for September 1986 and May 1987, ranging from 0 to 10 inches per year in the Hines Energy Complex site area.

2.3.2.2 Karst Hydrogeology

The Karst hydrogeology review and Hines Energy Complex site sinkhole evaluation was presented in the 1992 SCA. The review and evaluation included the following:

1) A study of topographic maps and aerial photographs (both pre-mining and post-mining) of the Hines Energy Complex site and vicinity;

2) A review of the available literature on the geology of the region of Polk County;

3) A review of USGS and Florida Geological Survey (FGS) documents related to sinkhole occurrences as reported by the Florida Sinkhole Research Institute (FSRI) and SWFWMD;

4) A review of available newspaper articles regarding reported sinkholes in the Polk County area;

5) A Surficial lineament analysis to evaluate the regional potential for sinkhole solution activity; and;

6) A field investigation program consisting of deep borings in three depressed areas identified on pre-mining aerial photographs.

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

- The overall assessment of sinkhole potential at the Hines Energy Complex site is that the occurrence of a catastrophic sinkhole is highly unlikely. See Figure 2.3.2-10.

- No evidence of historic sinkholes at the Hines Energy Complex site exists, and there were no reported incidents of sinkhole problems during mining operations nor during Hines Energy Complex site development activities.

A sinkhole occurred approximately eight miles to the west of the Hines Energy Complex in 1996 beneath the IMC gypsum stack at the New Wales facility. The facility is located just south of County Road 640 near the Polk and Hillsborough County line. Due to the distance (approximately 8 miles) between the IMC sinkhole site and the Hines Energy Complex, this sinkhole activity does not impact the Hines Energy Complex site.

The Florida Geological Survey maintains records of sinkholes reported to the Florida Department of Community Affairs and the Florida Geological Survey. A review of the sinkhole files of the Florida Geological Survey reveals that no sinkholes in the vicinity of the Hines Energy Complex were reported since the submittal of the 1992 SCA.

2.3.2.3 References

Ardaman & Associates. 1978. Soil Exploration Analyses and Design Recommendations, Silver City Settling Area No. 8, Report to Swift Agricultural Chemicals Corporation. June 16, 1978.

Ardaman & Associates. 1979. Soil Exploration Analyses and Design Recommendations, Silver City Settling Area No. 9, Report to Swift Agricultural Chemicals Corporation. March 9, 1979.

Ardaman & Associates 1981. Subsurface Investigation, Analysis, and Design Recommendations or Silver City Settling Area No. 10, Report to Swift Agricultural Chemicals Corporation. October 21, 1981.

Beck, B.F., and W.C. Sinclair. 1985. Sinkholes in Florida: An Introduction, Florida Sinkhole Research Institute, Report 86-86-3. University of Central Florida. Orlando, Florida.

Beggs, T.F., and B. Ruth. 1984. Factors Affecting the Collapse of Cavities; Sinkholes Their Geology, Engineering and Environmental Impact. Beck, B.F. (ed.), A.A. Balkema Publishers. Rotterdam, Netherlands.

Florida Power Corporation. 1992. Polk County Site. Site Certification Application.

Hutchinson, C.B. 1978. Appraisal of Shallow Ground-Water Resources and Management Alternatives in the Upper Peace and Eastern Alafia River Basins, Florida. U.S. Geological Survey, Water Resources Investigation 77-124.

Metz, P.A., and Stelman, K.A., 1995, Potentiometric Surfaces of the Intermediate Aquifer System, West-Central Florida, May, 1995, USGS Open-File Report 95-707.

Metz, P.A., Swenson, E.S., and Stelman, K.A., 1996, Potentiometric Surfaces of the Intermediate Aquifer System, West-Central Florida, September, 1995, USGS Open-File Report 96-136.

Pittsburg Testing Laboratory, 1973. IMC Noralyn No. 15 Slimes Dam – Design Recommendations. Report to IMC Corp. PTL Ref. TA-6974. June 4, 1973.

Ryder, P.D. 1985. Hydrogeology of the Floridan Aquifer System in West-Central Florida. U.S.G.S. Open-File Report 84-611.

Sinclair, W.C. et al. 1985. Types, Features and Occurrence of Sinkholes in the Karst of West-Central Florida. U.S. Geological Survey. Water Resources Investigations Report 85-4126.

Sinclair, W.C. and J.W. Stewart. 1985. Sinkhole Type, Development, and Distribution in Florida. U.S. Geological Survey. Map Series No. 110.

Stewart, H.H. 1966. Ground-Water Resources of Polk County. Florida Geological Survey. Report of Investigations No. 44.

Stewart, J.W., 1980. Areas of Natural Recharge to the Floridan Aquifer in Florida, Map Series 98.

SWFWMD (Southwest Florida Water Management District). 1987. Aquifer Characteristics within the SWFWMD. February 1987.

SWFWMD. 1988. Ground-Water Resources Availability Inventory: Polk County, Florida. SWFWMD.

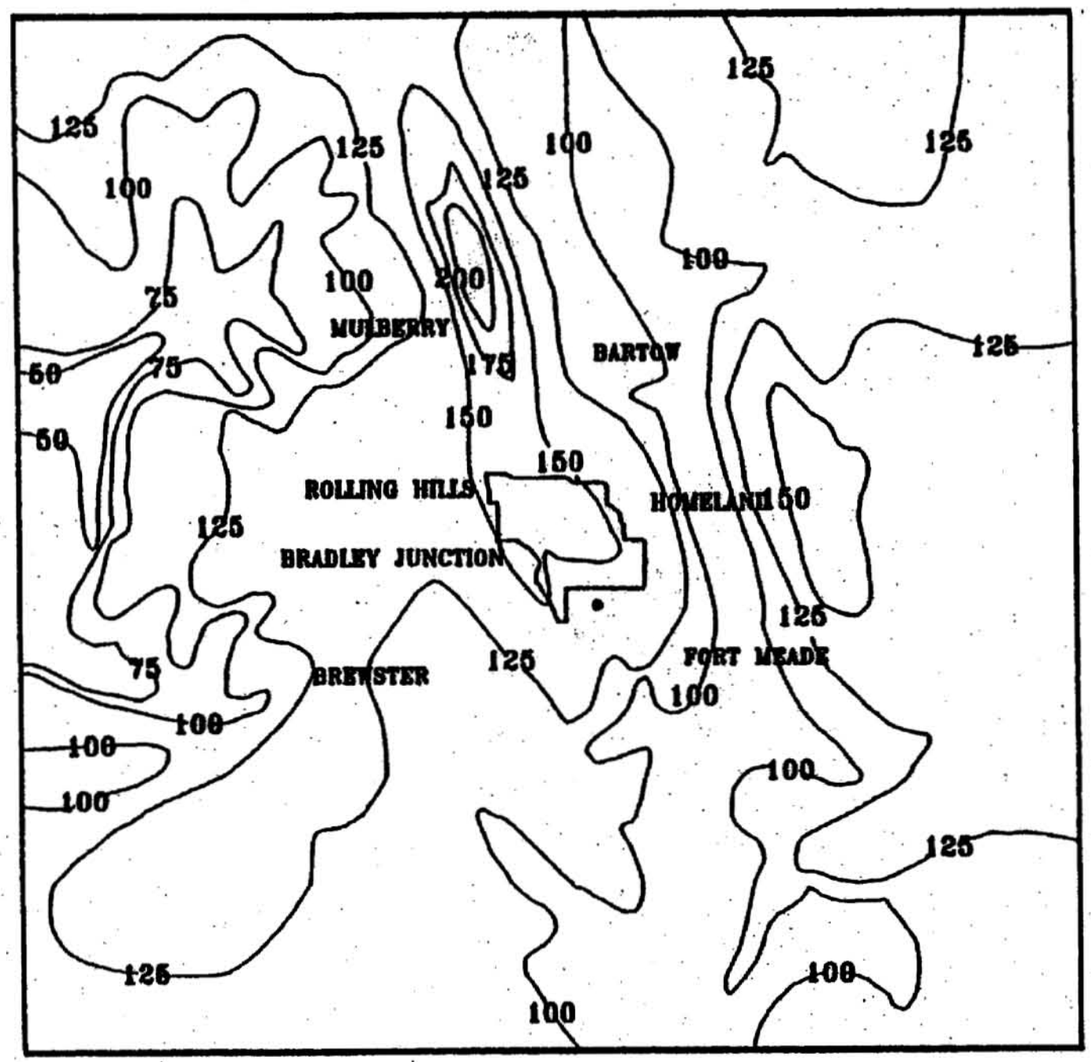
USGS (U.S. Geological Survey). 1999. Potentiometric Surface Maps for the Intermediate and Floridan Aquifers. West-Central Florida. September 1998.

USGS. 1980-1991. Water Resources Data, Florida. Southwest Florida Groundwater. USGS Water Resources Division. Tampa, Florida.

Vernon, R.O. 1951. Geology of Citrus and Levy Counties. Florida Geological Survey. Bulletin No. 31.

White, W.A. 1970. The Geomorphology of the Florida Peninsula. State of Florida Department of Natural Resources, Bureau of Geology. Geological Bulletin No. 51.

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CONTOUR INTERVAL = 25 FEET (NGVD)

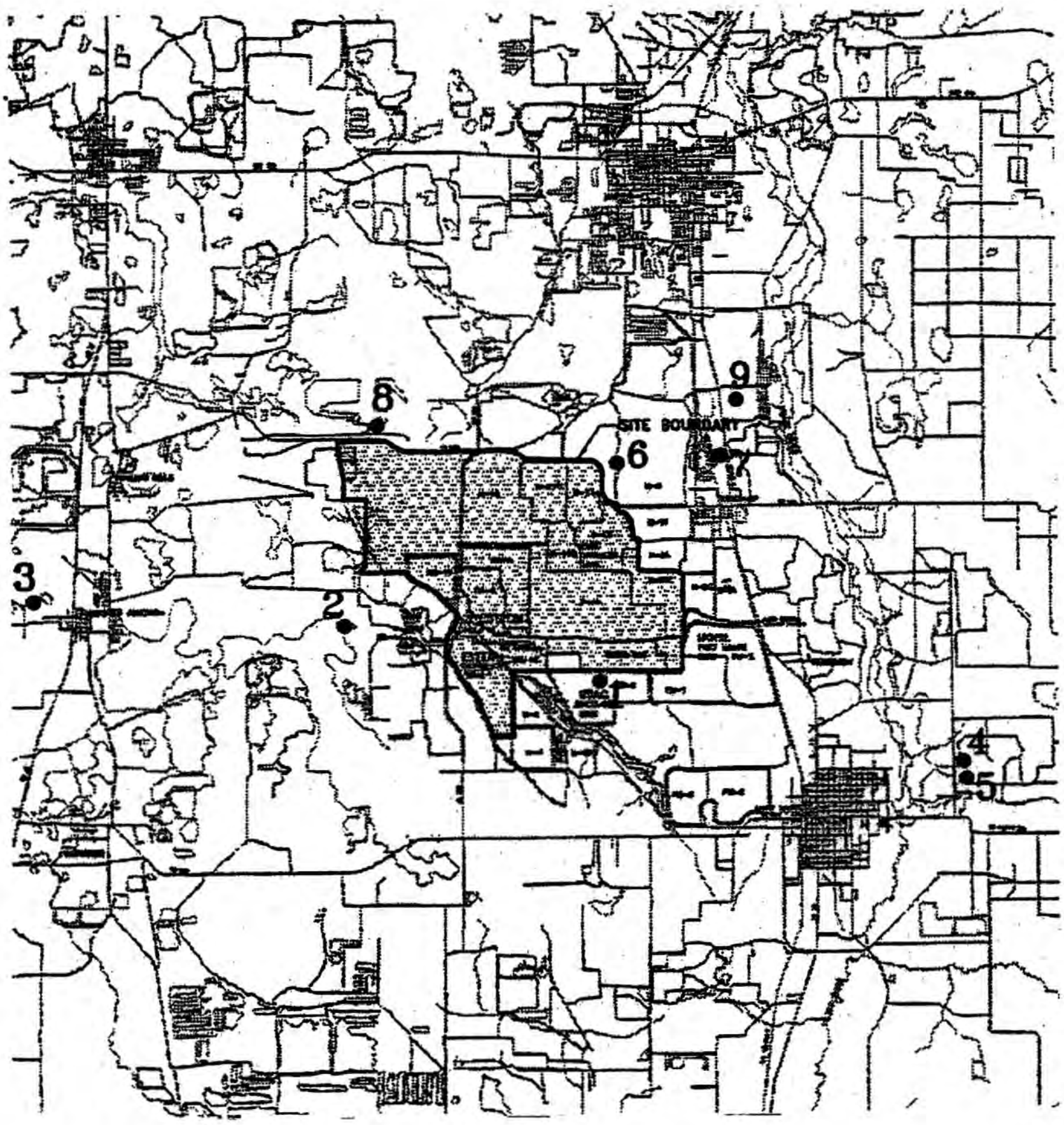
SOURCE: 1992 SCA

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

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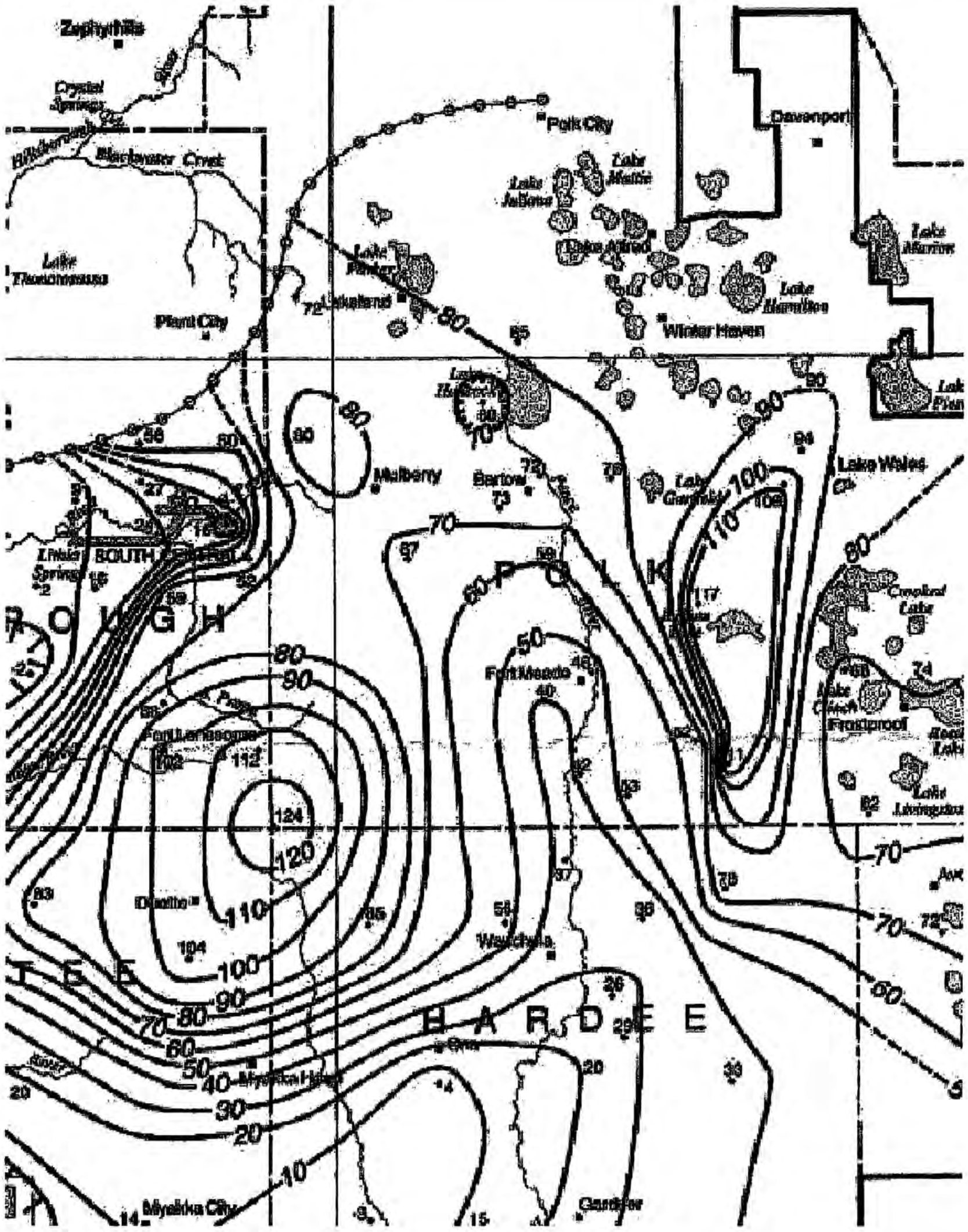
SOURCE: 1992 SCA

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

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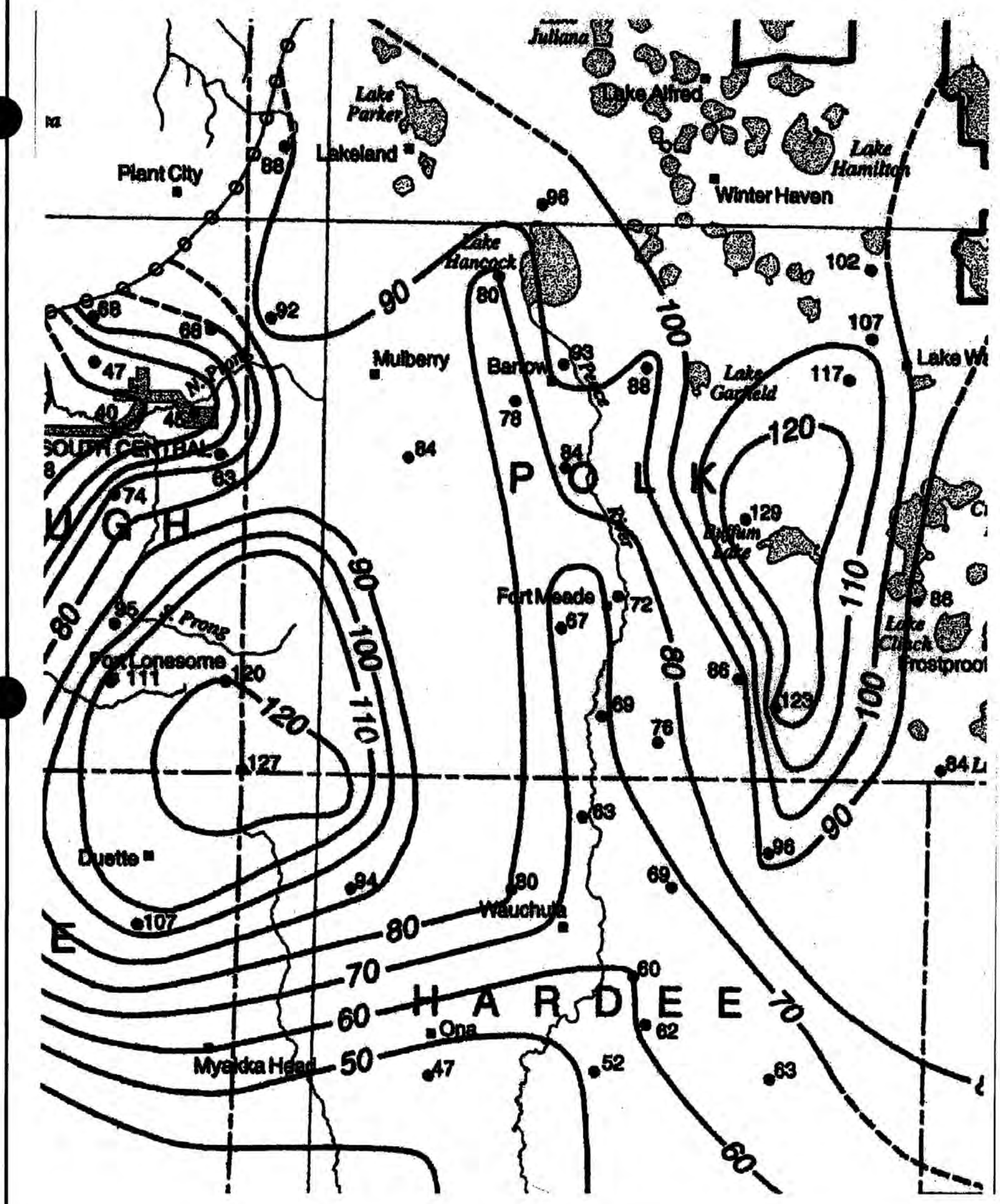


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FIGURE 2.3.2-3
POTENTIOMETRIC SURFACE INTERMEDIATE AQUIFER
MAY 2001

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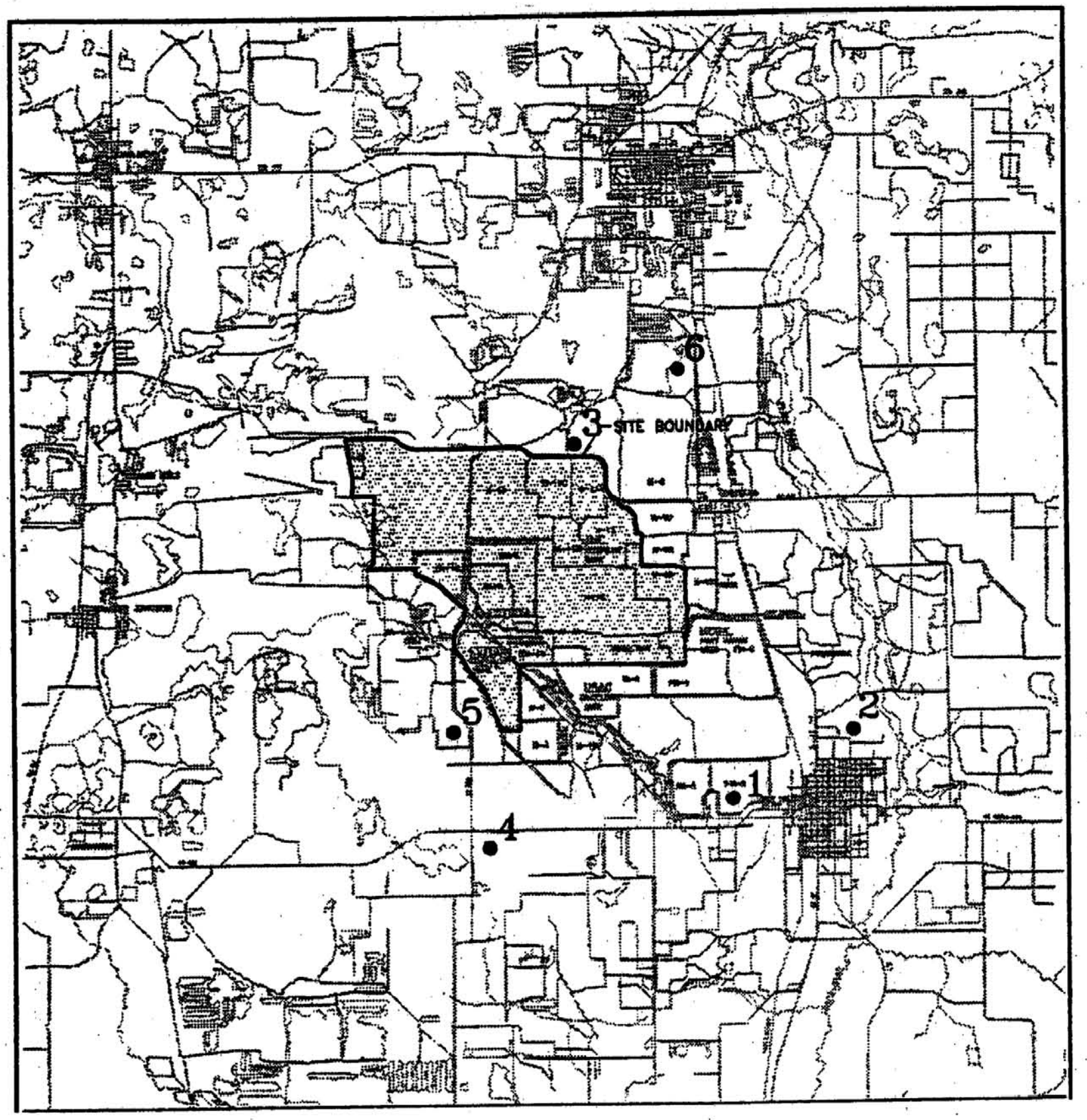


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FIGURE 2.3.2-4
POTENTIOMETRIC SURFACE INTERMEDIATE AQUIFER
SEPTEMBER 2001

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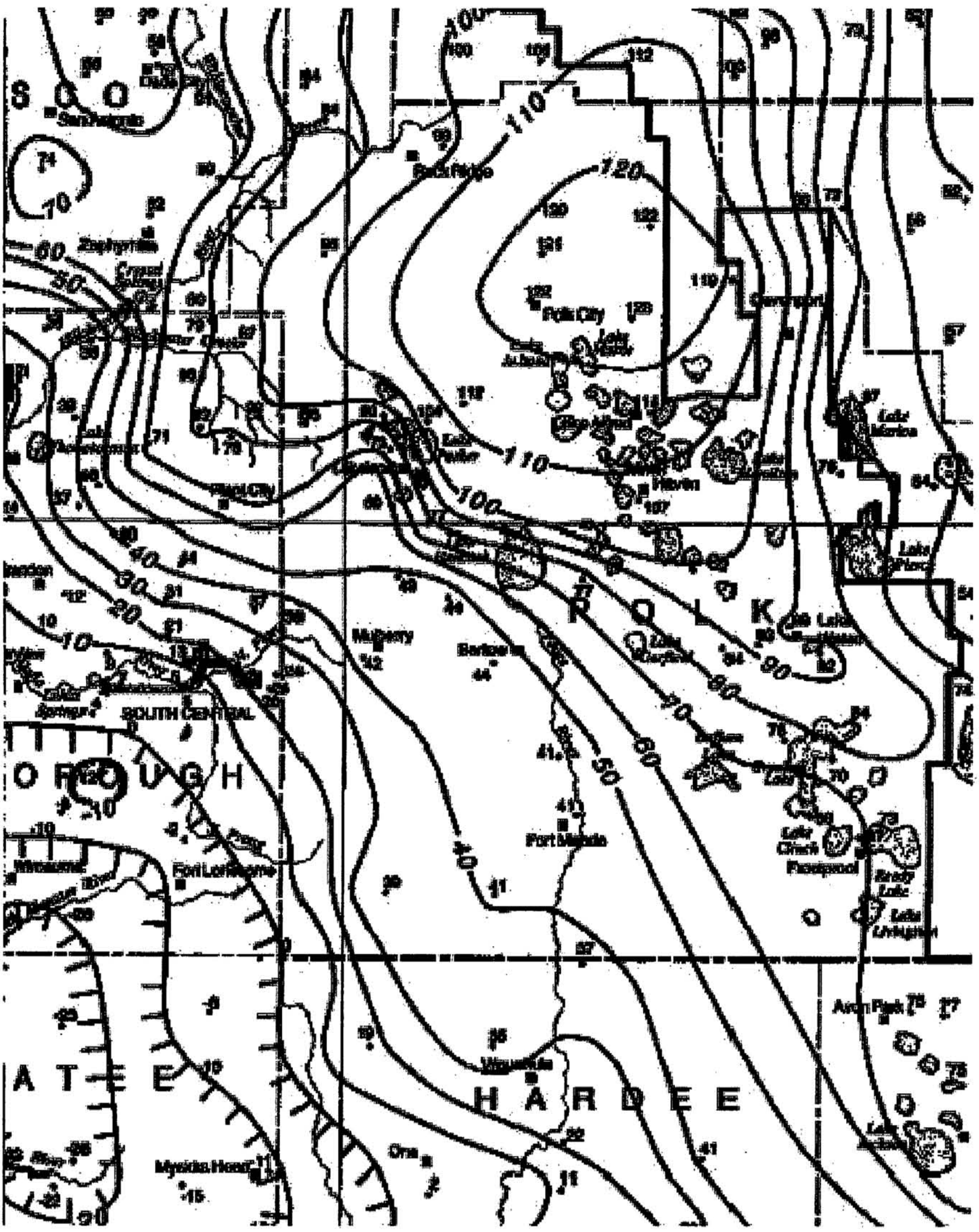
SOURCE: 1992 SCA

Florida Power
A Progress Energy Company

Hines Energy Complex

FIGURE 2.3.2-5
INTERMEDIATE AQUIFER BASELINE
WATER QUALITY DATA SAMPLING
LOCATION MAP

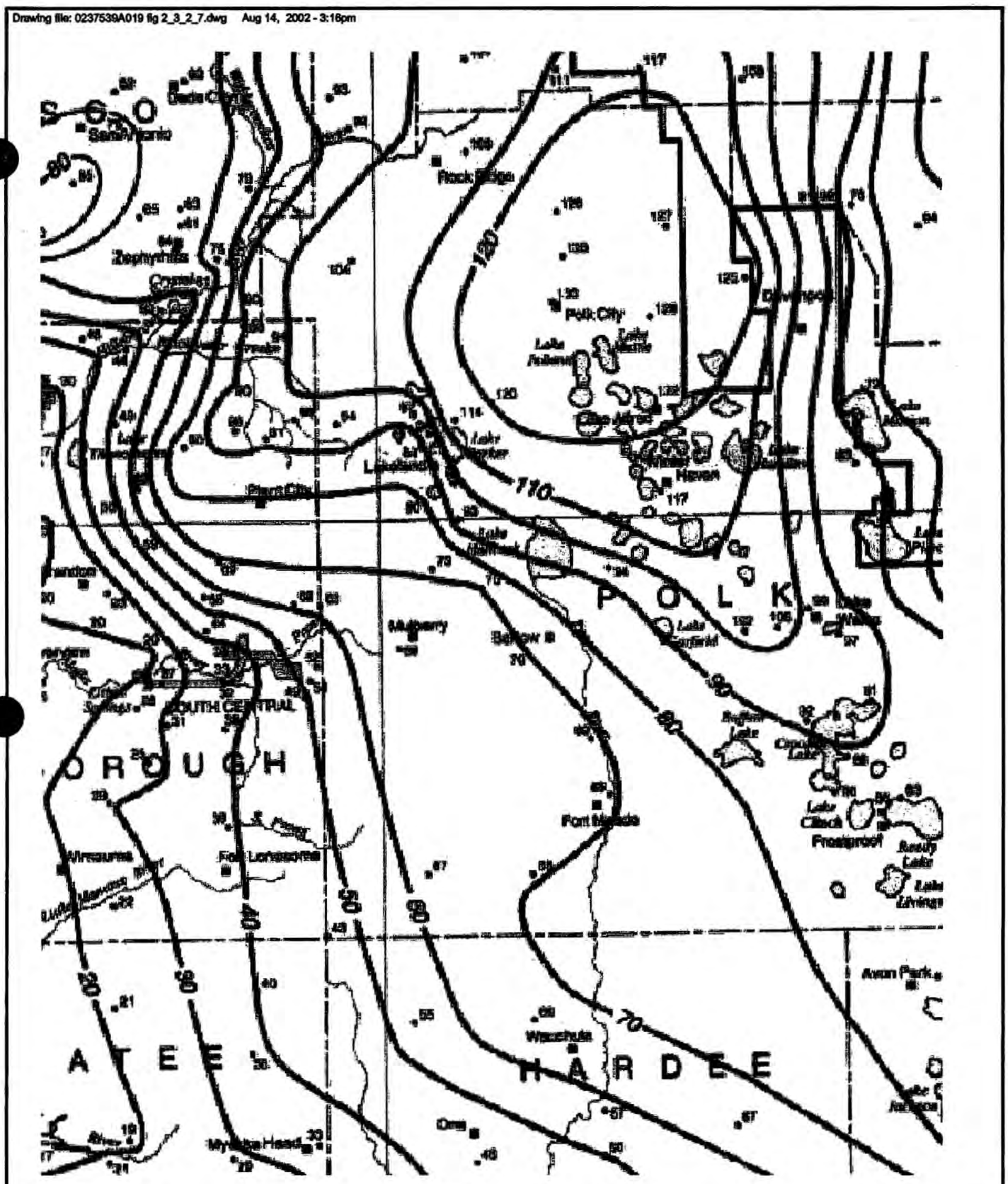
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Florida Power
A Progress Energy Company

Hines Energy Complex

FIGURE 2.3.2-6
POTENTIOMETRIC SURFACE FLORIDAN AQUIFER
MAY 2001

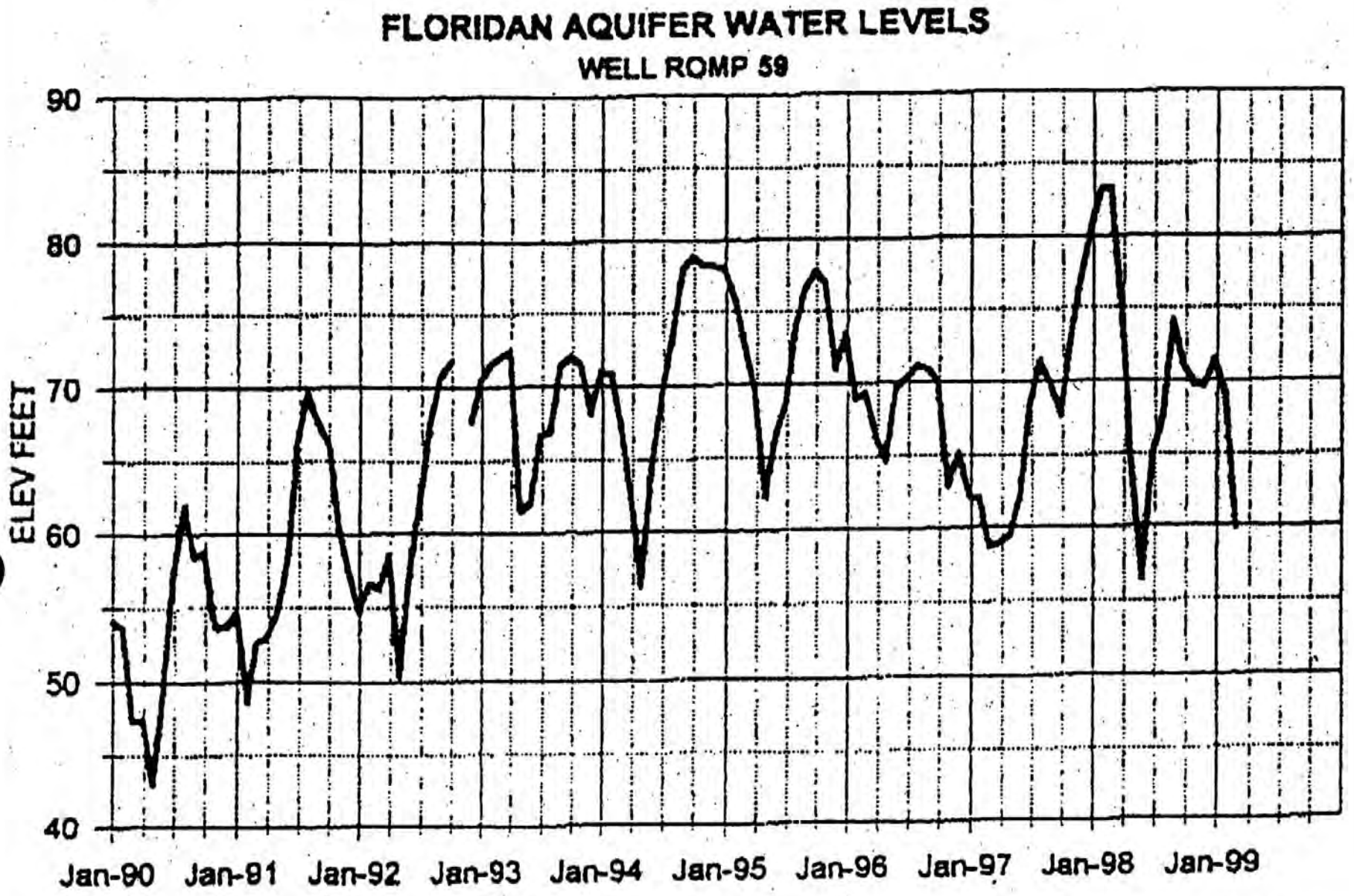


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Hines Energy Complex

FIGURE 2.3.2-7
POTENTIOMETRIC SURFACE FLORIDAN AQUIFER
SEPTEMBER 2001

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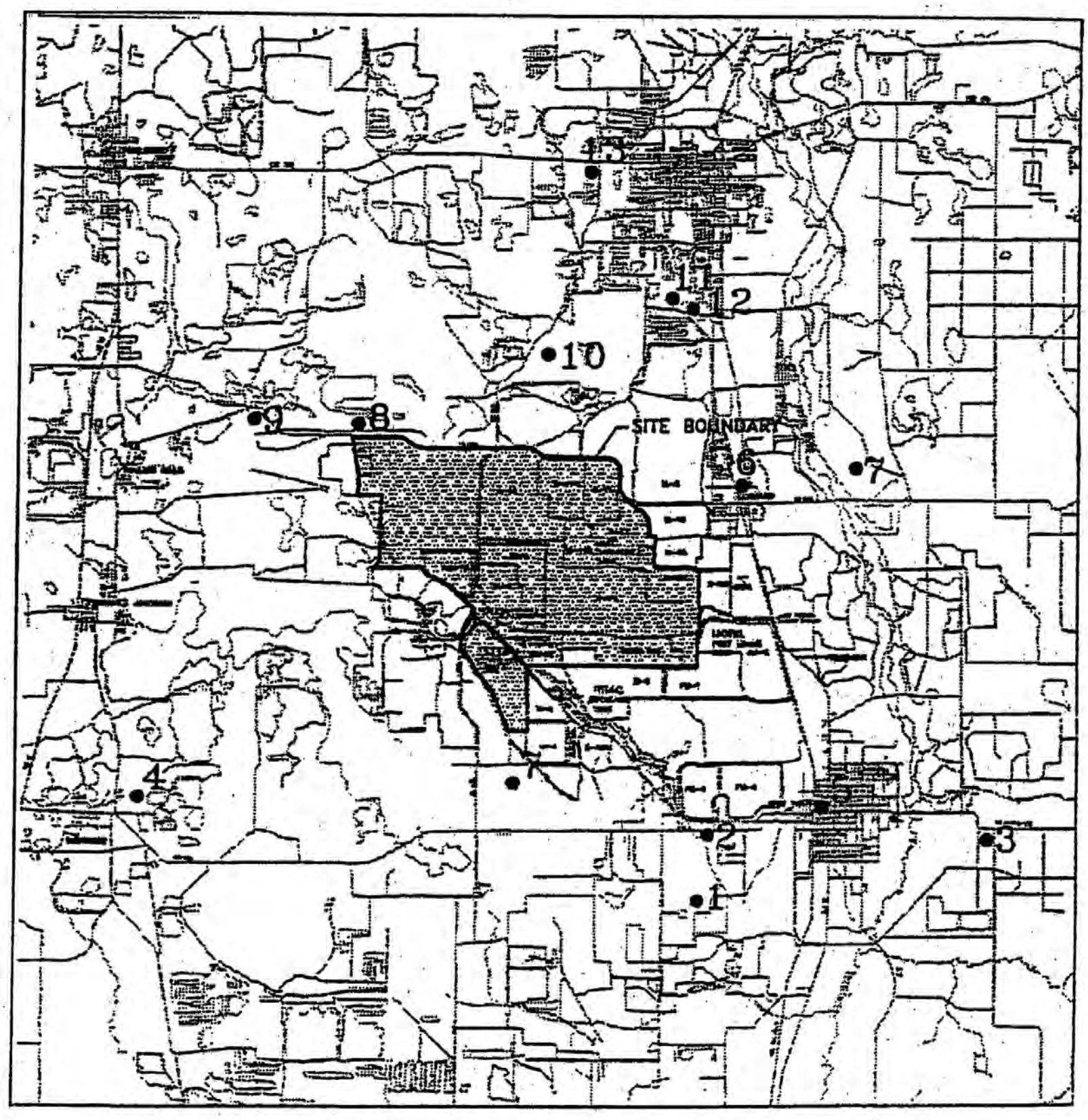


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Hines Energy Complex

FIGURE 2.3.2-8
FLORIDAN AQUIFER WATER LEVELS
AT WELL ROMP 59
1990 TO 1999

Drawing file: 0237539A021 fig 2_3_2_9.dwg Jul 30, 2002 - 8:23am



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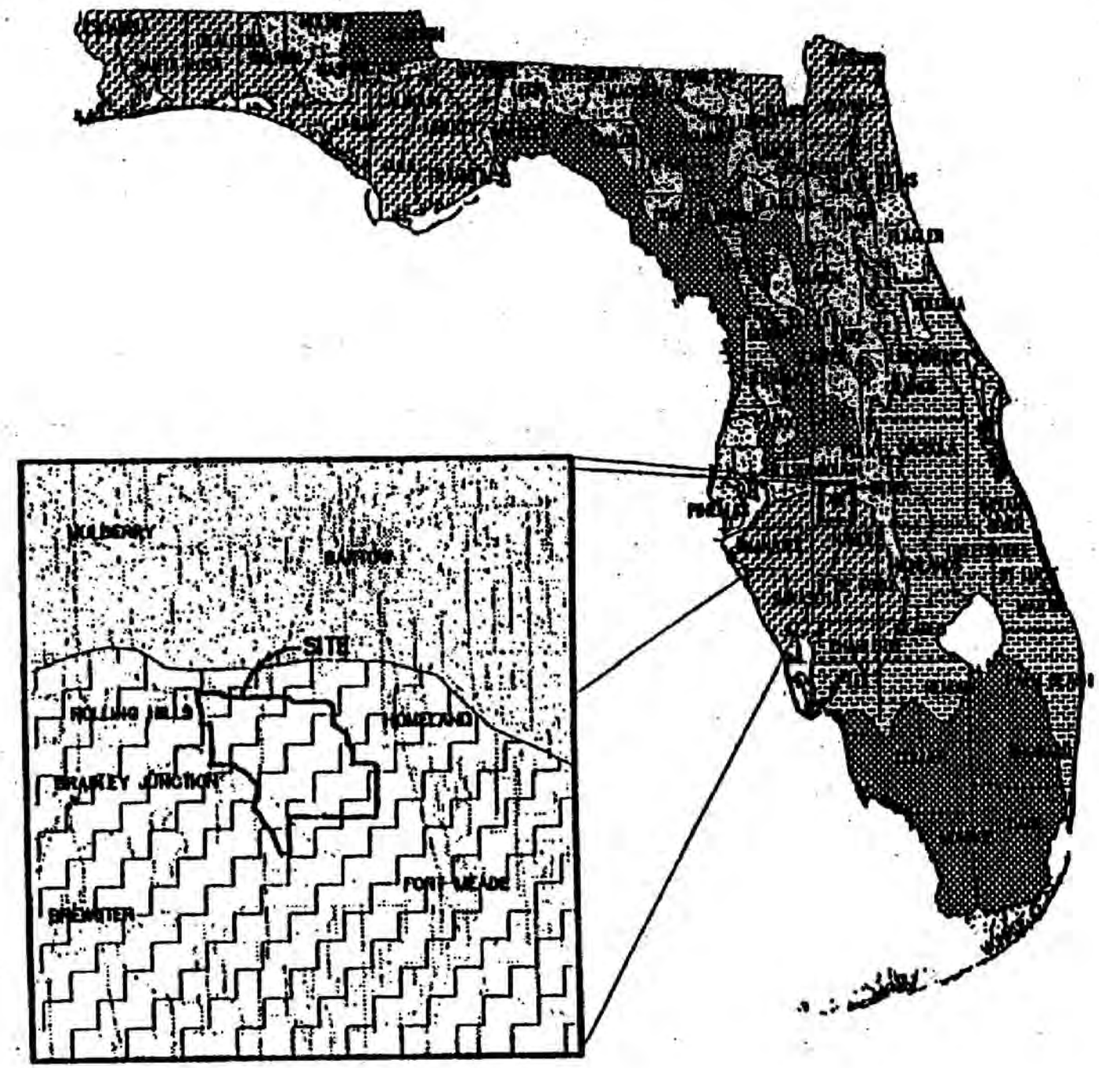
SOURCE: 1992 SCA

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Hines Energy Complex

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

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SINKHOLE TYPE, DEVELOPMENT AND DISTRIBUTION IN FLORIDA

AREA I. BARE OR THINLY COVERED LIMESTONE
Sinkholes are few, generally shallow and broad, and develop gradually. Solution sinkholes dominate.

AREA II. COVER IS 30 TO 200 FEET THICK
Consists mainly of incohesive and permeable sand. Sinkholes are few, shallow, of small diameter, and develop gradually. Cover-subsidence sinkholes dominate.

AREA III. COVER IS 30 TO 200 FEET THICK
Consists mainly of cohesive clayey sediments of low permeability. Sinkholes are most numerous, of varying size, and develop abruptly. Cover-collapse sinkholes dominate.

AREA IV. COVER IS MORE THAN 200 FEET THICK
Consists of cohesive sediments interlayered with discontinuous carbonate beds. Sinkholes are very few, but several large diameter, deep sinkholes occur. Cover-collapse sinkholes dominate.

SOURCE: 1992 SCA

Florida Power
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Hines Energy Complex

FIGURE 2.3.2-10
AREAS OF SINKHOLE OCCURENCE IN FLORIDA

2.3.3 Site Water Budget and Area Uses

This section presents a general site water budget based on regional information. In addition, area uses of water are presented in the following discussion.

2.3.3.1 General Site Water Budget

CLIMATOLOGY AND METEOROLOGY

The Hines Energy Complex is located in the south central Florida peninsula, which has a climate characterized as subtropical. The two National Weather Service stations nearest the Hines Energy Complex with long-term (30-year) periods of record are located at Bartow and Wauchula, Florida. Bartow lies approximately 3.5 miles north-northeast of the Hines Energy Complex site and Wauchula is approximately 19 miles south-southeast of the site. As shown in the 1992 SCA, temperatures in the vicinity of the Hines Energy Complex, as measured at Bartow and Wauchula, range from a combined average low of 61.2° F in January to a combined average high of 82.0° F in August, with a combined average of approximately 72.4° F. The highest temperature recorded nearby was 103° F and the lowest was 18° F, both recorded at the Bartow location.

Average total annual rainfall measured at Bartow and Wauchula, as shown in the 1992 SCA, is 53.43 inches. Normal monthly averages range from 2.00 inches in December to 8.42 inches in July. Generally, the wet season, when the majority of the rainfall occurs, is May through September.

Figure 2.3.3-1 shows the monthly rainfall pattern at the Noralyn Mine site, just to the north of the Hines site. The Southwest Florida Water Management District (SWFWMD) maintains this database.

No direct measurements of evaporation and evapotranspiration near the Hines Energy Complex site are available. Pan evaporation has been recorded monthly by National Oceanic and Atmospheric Administration (NOAA) since 1965 at Lake Alfred, which is approximately 23.5 miles north-northeast of the Hines Energy Complex site. SWFWMD analyzed NOAA's monthly measurements of pan evaporation data from Lake Alfred and presented a rationale for the method used to convert pan evaporation to estimated evapotranspiration rates (Keller, 1988). The 1992 SCA presented a summary of the measured precipitation and pan evaporation data along with calculated evapotranspiration, runoff, and recharge rates for the southwest Polk County area. Average yearly precipitation is approximately 53.43 inches and the average pan evaporation is 71.29 inches. Pan evaporation is converted to estimated evapotranspiration, using SWFWMD's formula, by multiplying the pan evaporation by 0.6 to obtain an estimated annual total evapotranspiration of 42.78 inches (Keller, 1988).

The Hines Energy Complex is located within the Peace River Basin. Based upon U.S.G.S. streamflow data for the Peace River Station at Zolfo Springs, Florida, Gauge No. 02295637, the average annual runoff for this area of west-central Florida is 10.25 inches.

GROUND WATER RESOURCES

Generally, the Hines Energy Complex site area is underlain by three hydrostratigraphic units: the Surficial aquifer (removed/altered at the Hines Energy Complex site); the Intermediate aquifer that includes upper and lower confining units; and the Floridan aquifer. Most of the materials that comprise the Surficial aquifer at the Hines Energy Complex site have been altered, or removed, due to mining activities by prior property owners. Where it occurs naturally and before being removed by mining at the Hines Energy Complex site, the Surficial aquifer system typically consists of clastic deposits of sands, silty sands, and clays of eolian and marine origins. In Polk County, the Surficial aquifer is used primarily for domestic and low volume irrigation uses. The bulk of recharge to the Surficial aquifer occurs directly by infiltration of rainfall. The Intermediate aquifer system includes all water bearing units and confining units between the overlying Surficial aquifer system and the underlying Upper Floridan aquifer system. Water withdrawals from the middle units of the Intermediate aquifer system are used primarily for domestic supply in Polk County. Recharge to the Intermediate aquifer system occurs through leakance from the Surficial aquifer through the overlying confining unit. The Upper Floridan aquifer of the Floridan aquifer system underlies the Intermediate aquifer. Primarily vertical hydraulic conductivity and thickness of overlying confining units control the recharge to the Upper Floridan aquifer in Polk County. Recharge occurs from the Intermediate aquifer through confining units separating the Intermediate aquifer from the Upper Floridan aquifer. The Floridan aquifer underlies the Upper Floridan aquifer and receives recharge principally from leakance through semi-confining units separating the Upper Floridan aquifer from the Floridan aquifer. More detailed information concerning ground water resources is presented in Section 2.3.2 of this SSCA.

SURFACE WATER RESOURCES

The Hines Energy Complex site is located completely within areas that were formerly mined for the severance of phosphate ore. This area was comprised principally of waste clay settling areas, with some mined-out areas also present. These mine land forms possess a significant quantity of storage volume which has altered the rate and volume of surface water discharging from the site compared to natural (pre-mining) condition.

As authorized in the 1994 and 2001 Certifications, the Hines Energy Complex site has been developed to support power plant operations. Surface waters within the site are being managed in accordance with the approved plans. Areas within the site which are being managed as closed basin systems include the Cooling

Pond and the Brine Pond. These areas are designed to retain all runoff that is generated within them. The Plant Island is served by a stormwater management system that presently drains to the Cooling Pond.

Areas of the Hines Energy Complex site that are being managed as externally drained watershed areas include the McCullough Creek and Camp Branch drainage enhancement project, composed of SA-10 and SA-12S, N-11A, N-13, N-9B and Tiger Bay. These systems are designed to collect, and convey runoff to McCullough Creek and Camp Branch respectively.

Surface waters within the remaining areas of the site drain are collected and incorporated into the on-site water cropping system.

2.3.3.2 Area Water Uses

The Southwest Florida Water Management District (SWFWMD) through the issuance of water use permits and well construction permits regulates surface and ground water use in the vicinity of the Hines Energy Complex site. Information gathered primarily from SWFWMD permit records was used to develop a summary of water uses near the Hines Energy Complex site. Polk County does not maintain any separate records of surface and ground water usage or well construction.

The unincorporated community of Homeland lies approximately one mile northeast of the Hines Energy Complex site. Homeland residents use ground water from individual wells for drinking water. Water use permits are not required for these individual, domestic ground water users.

Ground water is withdrawn regionally from the Surficial, Intermediate, and Upper Floridan aquifers for four principal purposes: phosphate mining operations, chemical manufacturing and processing, citrus and agricultural irrigation, and public supply. Essentially, all of the large water users withdraw ground water from the Floridan aquifer system. Some public supplies and citrus irrigation water is supplied from the Intermediate and Upper Floridan aquifers. Surface water withdrawal from a mining pit is the only surface water withdrawal permit listed.

Table 2.3.3-1 provides details concerning each water use permit within a five-mile radius of the Plant Island. The table lists ownership, location of property, number of permitted wells, source (aquifer or surface water), use, and permitted capacity.

Table 2.3.3-2 lists all the known wells identified in SWFWMD permit files within one mile of the Hines Energy Complex site. Additionally, the table lists the ownership, location, well depth, diameter, and permitted use of each well. Of the 70 known wells within one mile of the Hines Energy Complex site, 35 are listed as domestic use, 14 industrial use, 5 public supply, and 16 miscellaneous industrial

categories. Few, if any, of these wells produce from the Surficial aquifer and many produce completely or partially from the Intermediate aquifer system. The majority produces from the Upper Floridan aquifer. Since most of these well owners are not required to obtain a water use permit, it is assumed that the overall usage is relatively low.

The above information has been provided fro reference purposes. The 1994 Site Certification authorized up to 17.5 mgd of groundwater withdrawal as not impacting existing legal users. FP is a superior user as it relates to wells installed after 1994.

2.3.3.3 References

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

Florida Power Corporation. 1992. Polk County Site. Site Certification Application.

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

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

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

SWFWMD. Well Construction and Permitting Section. SWFWMD. Brooksville, Florida. 2000. Computer Records.

USGS. 1980-1990, 1995, 1998. Water Resources Data - Florida, Southwest Florida Surface Water. USGS. Tampa, Florida.

IMAGE QUALITY

AS YOU REVIEW THE NEXT FEW PAGES,
PLEASE NOTE THAT THE ORIGINAL
DOCUMENT WAS OF POOR QUALITY.

TABLE 2.3.3-1

CONSUMPTIVE USE PERMITS WITHIN A FIVE MILE RADIUS OF THE HINES ENERGY COMPLEX PLANT ISLAND

Consumptive Use Permit No.	OWNER	Location			# Wells	Gallons Per Day (GPD)	
		SECTION	TOWNSHIP	RANGE		Permit Peak	Permit Average
20. 341.04	CITY OF BARTOW	35,36	29	24	17	5,130,000	4,100,000
		12,13,23,24	30	24			
		14,23,31,32,35	29	25			
		2,4,5,6,7,8,9,16,17,18	30	25			
20. 610.05	CF INDUSTRIES, INC.	24	30	23	27	3,821,800	3,302,300
		8,9,13,17,18,19,20,24,25,30	30	24			
20. 2224.06	CARGILL FERTILIZER	26,27,28,29,32,33,34,35	29	24	8	6,420,000	5,200,000
		3,4,5,9,10,11,14,15,16,21,22	30	24			
20. 8751.01	IMC-AGRICO CO/IMC- FERTILIZER	32,33	30	24	1	33,000	5,000
20. 10035.00	UNC RECLAMATION	30	30	24	1	90,000	30,000
20. 10700.00	POLK POWER PARTNERS LTD	23,25,26	30	24	2	1,010,000	761,000
20.3841.07	C & G CITRUS LIMITED PARTNER	2,9,10,11,13,14,15,16,21,22,23	31	24	44	576,000	132,000
20. 11436.00	CARPENTER, INC. D/B/A VADCON	29	30	25	2	8,400	4,200
20. 11600.01	POLK COUNTY BOCC DEPT. OF PARKS	33,34	30	25	2	3,100	1,700
20. 29.07	CARGILL FERTILIZER INC.	13,23,24,36	31	23	35	13,527,000	11,491,000
20. 438.04	U.S. AGRI-CHEMICALS CO.	13,24,25,26,35,36	31	24	56	18,913,300	9,673,400
		2,11	32	24			
		1,2,3,11,12	33	24			
		18,19,29,30,31,32,33	31	25			
		5,6,7,8	32	25			
20. 2297.06	CARGILL FERTILIZER INC.	1,2,11,12,13,14,23,24,36	32	24	30	20,800,000	15,300,000
		1,9,10,11,12,13,15,16,21,23,24	33	24			
		6,7,9,10,15,16,17,18,19,20,21,22,27 28,29,30,31,32,33,34	32	25			
		5,7,8,17,18,19	33	25			
20. 10638.00	CARGILL FERTILIZER INC.	12	32	24	1	1,000,000	186,000
20. 1255.03	MARY SNELL	5	31	25	1	26,800	13,400

TABLE 2.3.3-1
CONSUMPTIVE USE PERMITS WITHIN A FIVE MILE RADIUS OF THE HINES ENERGY COMPLEX PLANT ISLAND

Consumptive Use Permit No.	OWNER	Location			# Wells	Gallons Per Day (GPD)	
		SECTION	TOWNSHIP	RANGE		Permit Peak	Permit Average
20.11400.04	IMC-AGRICO CO.	32,33	30	25	228	66,500,000	52,000,000
		33	30	25			
		32	30	25			
		28,29	30	25			
		32,33	30	25			
		33	30	25			
		33	30	25			
		20	30	25			
		25,26,27,28,33,34,35,36	31	21			
		26,27,28,32,33,34,35	29	22			
		2,3,4,9,13,24,25,26,35	30	22			
		1,2,3,4,9,10,11,12,13,14,19,22,23	31	22			
		24,25,27,28,29,31,32,33,34,36,					
		3,4,5,6,7,11,27,34,35	32	22			
		2,8,12,17,23,24,25,26,27,29,30,31	30	23			
		32,33,34,35,36					
		1,2,3,4,5,6,7,8,9,10,11,12,14,15,16	31	23			
		17,18,20,21,22,26,27,28,29,36					
		1,9,10,11,12,13,14,17,20,21,24,27	32	23			
		28,29,30,32,33,34					
		2,3,5,6,7,19,30,31	33	23			
		3,6,20	34	23			
		7,12,13,14,15,16,17,20,21,22,23,24	30	24			
		25,26,27,28,29,30,31,32,33,34,35,36					
		1,2,3,4,5,6,7,8,9,12,13,17,20,21,28,29	31	24			
		30,31					

TABLE 2.3.3-1
CONSUMPTIVE USE PERMITS WITHIN A FIVE MILE RADIUS OF THE HINES ENERGY COMPLEX PLANT ISLAND

Consumptive Use Permit No.	OWNER	Location			# Wells	Gallons Per Day (GPD)	
		SECTION	TOWNSHIP	RANGE		Permit Peak	Permit Average
20. 1467.02	GOOCHLAND NURSERIES INC.	15	31	25	5	216,000	166,600
20. 2318.03	MOBIL MINING & MINERALS COMPANY	1,2,3,4,8,9,10,11,12,13,14,15,16,17 19,20,21,22,23,24,25,28,29,33,34	31	25	88	1,620,000	1,360,000
		3,4	32	25			
		7,17,18,19,20,29,30	31	26			
20. 2596.02	WAYNE R. SNELL	4	31	25	1	19, ,000	5,000
20. 7226.01	PEMBROKE LABORATORIES INC	15	31	25	1		16,100
20. 8615.01	MARTHA L. SNELL	4	31	25	1	48,700	8,300
20. 10757.00	CENTRAL FLORIDA HUMAN SERVICES	2,3,11	31	25	2	6,000	2,000
20.11470.00	FLORIDA DEPT. OF ENV. PROTECTION	3,4,9,10	31	25	3	2,800	1,400
20. 261.02	ALUMINUM COMPANY OF AMERICA	30	31	25	2	340,000	200,000
20. 438.04	U.S. AGRI-CHEMICALS CORPORATION	13,24,25,26,35,36	31	24	56	7,878,300	9,673,400
		2,11	32	24			
		1,2,3,11,12	33	24			
		18,19,29,30,31,32,33	31	25			
		5,6,7,8	32	25			
		27	31	25			
20. 645.03	CITY OF FORT MEADE	1,2,3,4,8,9,10,11,12,13,14,15,16,17,19	31	25	3	1,534,000	1,264,000
		20,21,22,23,24,25,28,29,33,34	31	25			
20. 2318.03	MOBIL MINING & MINERALS COMPANY	7,17,18,19,20,29,30	31	26	88	1,620,000	1,360,000
		25,30,31,32,35,36	31	25			
20. 3842.11	C & G CITRUS	1,2,3,4,5,9,10,11,12	32	25			
		31,32	31	26	64	7,878,300	1,758,500
20. 8300.01	ANNIE B. WALKER	4,5,6,7,8,9	32	26			
20. 8586.01	JOHN C. BARNETT	33	31	25	1	132,200	22,600
		32	31	25	2	102,600	17,600

TABLE 2.3.3-1
CONSUMPTIVE USE PERMITS WITHIN A FIVE MILE RADIUS OF THE HINES ENERGY COMPLEX PLANT ISLAND

Consumptive Use Permit No.	OWNER	Location			# Wells	Gallons Per Day (GPD)	
		SECTION	TOWNSHIP	RANGE		Permit Peak	Permit Average
20. 8594.01	VIOLET SHEFFIELD TRUST	29	31	25	1	69,600	18,000
20. 9637.00	JOHN C. BARNETT, JR.	28	31	25	1		15,000
20. 10718.00	THE OAKS NURSERY	27	31	25	1	46,300	22,800
20. 10775.00	BARNETT-SUNBELT, INC.	27	31	25	1	56,200	27,700
20. 10840.00	U.S. AGRI-CHEMICALS CO	31	31	25	3	2,100,000	1,700,000
20. 438.04	U.S. AGRI-CHEMICALS CO	13,24,25,26,35,36	31	24	56	18,913,300	9,673,400
		2,11	32	24	30	20,800,000	15,300,000
		1,2,3,11,12	33	24			
		18,19,29,30,31,32,33	31	25			
		5,6,7,8	32	25			
20. 2297.06	CARGILL FERTILIZER INC.	1,2,11,12,13,14,23,24,36	32	24			
		1,9,10,11,12,13,15,16,21,23,24	33	24			
		6,7,9,10,15,16,17,18,19,20,21, 22,27,28,29,30,31,32,33,34	32	25			
		5,7,8,17,18,19	33	25			
20. 2318.03	MOBIL MINING & MINERALS CO	1,2,3,4,8,9,10,11,12,13,14,15,16			88	1,620,000	1,360,000
		17,19,20,21,22,23,24,25,28,29,33,34	31	25			
		3,4	32	25			
		7,17,18,19,20,29,30	31	26			
20. 3842.11	C & G CITRUS	25,30,31,32,35,36	31	25	64	7,878,300	7,758,500
		1,2,3,4,5,9,10,11,12	32	25			
		31,32	31	26			
		4,5,6,7,8,9	32	26			
20. 7948.01	JOHN C. & IRIS JEAN BARNETT	7	32	25	1	125,200	21,400
20. 29.07	CARGILL FERTILIZER INC.	13,23,24,36	31	23	35	13,527,000	11,491,000
		1,12	32	23			
		7,8,9,16,17,18,19,21,22,27,28,29 30,31,32,33,34	31	24			
		3,4,5,6,7,8,9,10,16,17,18	32	24			

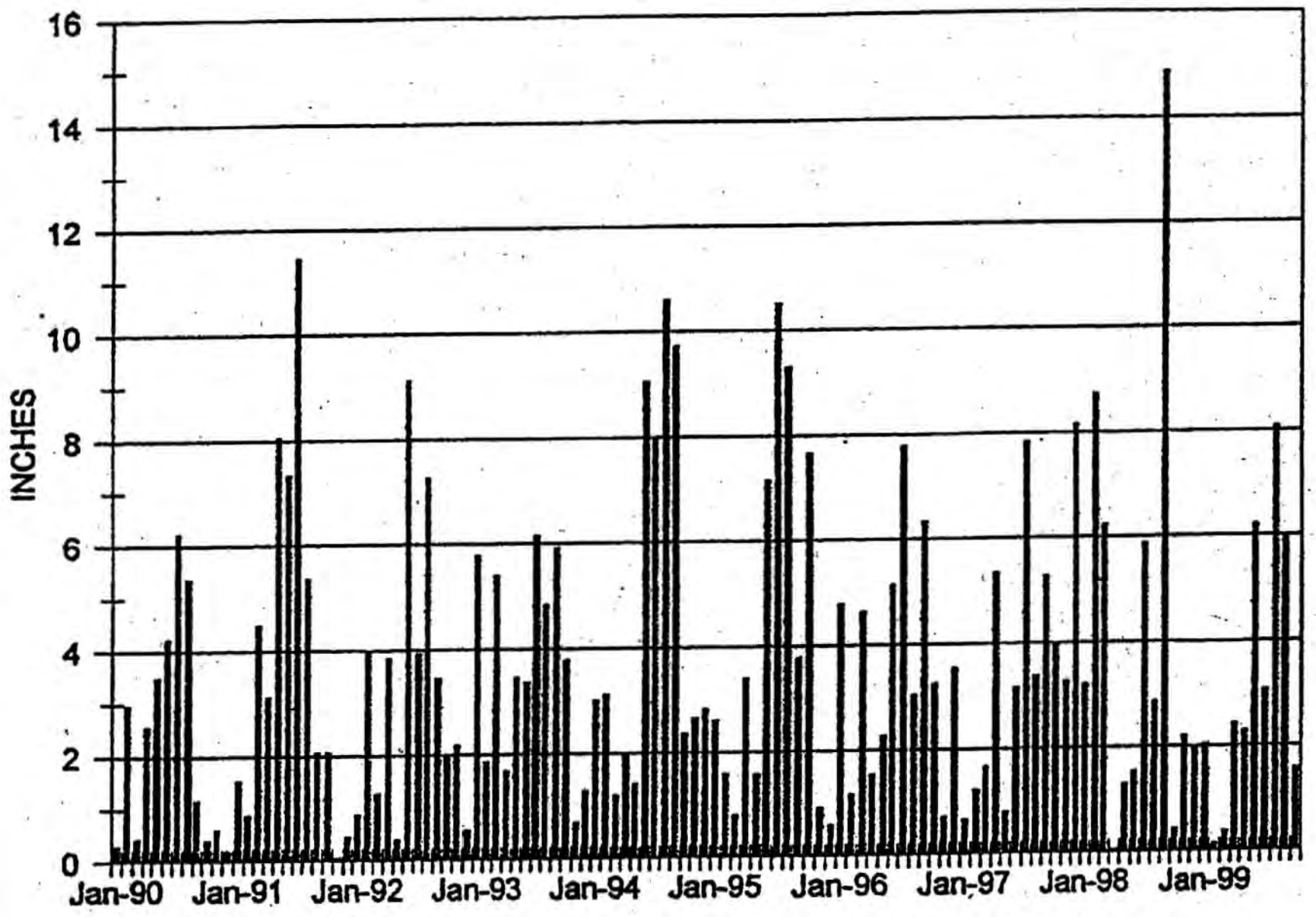
Table 2.3.3-2

WELLS WITHIN ONE MILE OF THE HINES ENERGY COMPLEX

Well Owner	Location S T R	Well Diameter	Well Depth	Casing Depth	Well Usage
A. Smith	11-31-24	4	200	83	Domestic
J. Haney	11-31-24	4	201	81	Domestic
Portable Dredging Corp.	11-31-24	4	160	84	Domestic
IMC	12-31-24	8	250	65	Industrial
Swift Agri Chemicals Corp.	14-31-24	4	220	40	Dewatering
Estech Inc	14-31-24	2	822	188	Public Supply
Swift & Company	15-31-24	8	795	325	Industrial
Estech Inc	15-31-24	4	822	333	Public Supply
IMC	25-30-24	0	125	43	Industrial
Intl. Min &	25-30-24	8	105	25	Mining
Intl. Min Ch	25-30-24	8	291	136	Irrigation
Farmland Industries, Inc	25-30-24	34	250	105	Industrial
Farmland Industries, Inc	25-30-24	24	460	105	Industrial
Intl Min Ch	26-30-24	8	291	85	Mining
L. Mason	26-30-24	3	18	7	Livestock
IMC	26-30-24	8	105	64	Monitoring
Polk Co Board of Co Comm Eng	26-30-24	6	375	98	Essential Services
IMC	26-30-24	8	340	72	Industrial
CSW Development One, Inc	26-30-24	12	800	260	Industrial
CSW Development One, Inc	26-30-24	12	800	261	Industrial
Polk Power Partners Limited	26-30-24	4	305	220	Public Supply
IMC - Agrico Company	27-30-24	4	150	84	Domestic
Maria Tenorio	27-30-24	4	140	65	Domestic
J. Douglas	34-30-24	3	170	91	Domestic
Carlton Whitaker	35-30-24	4	131	52	Domestic
W. R. Broderi	35-30-24	4	132	42	Domestic
W. Geohagan	35-30-24	4	145	50	Domestic
I. Stricklan	35-30-24	4	142	96	Domestic
IMC	35-30-24	8	186	66	Mining
IMC	35-30-24	8	256	67	Mining
D. G. Hagg	35-30-24	4	157	120	Domestic
R. M. Spivey	35-30-24	4	135	84	Domestic
IMC	35-30-24	8	205	126	Industrial
D. Gay	35-30-24	4	135	67	Domestic
B. Register	35-30-24	4	220	126	Domestic
IMC - Agrico Company	35-30-24	4			Domestic
John Desmidt	35-30-24	2	100	90	Domestic
Donald G. Haag	35-30-24	4	195	105	Domestic

WELLS WITHIN ONE MILE OF THE HINES ENERGY COMPLEX					
Well Owner	**Location S T R**	**Well Diameter**	**Well Depth**	**Casing Depth**	**Well Usage**
IMC	36-30-24	8	383	91	Mining
IMC	36-30-24	8	245	49	Mining
IMC	36-30-24	8	300	126	Domestic
R. Fountain	29-30-25	8	200	71	Mining
Kaplan Fd Y	29-30-25	12	885	82	Industrial
IMC	29-30-25	8	90	64	Mining
K. Planfeed	29-30-25	4	185	95	Livestock
Homeland Ind Complex	29-30-25	4	190	78	Public Supply
IMC	30-30-25	8	250	62	Industrial
International Mineral & Chemical	30-30-25	8	300	105	Industrial
Alcoa	32-30-25	10	823	397	Industrial
Alcoa	32-30-25	10	835	390	Industrial
P. Wilson	32-30-25	4	110	63	Domestic
R. Helms Sr.	32-30-25	4	--	--	Domestic
Paul Goss	32-30-25	4	155	63	Domestic
H. Gray	32-30-25	4	182	105	Domestic
IMC - Agrico Company	32-30-25	3	40	20	Recharge
Lloyd Leach	32-30-25	4	180	83	Domestic
Thomas Jarosek	32-30-25	4	--	--	Domestic
William Marvin Lanier	32-30-25	4	163	86	Domestic
Thomas Jarosek	32-30-25	4	120	60	Domestic
Lamar Sellers	32-30-25	4	180	84	Domestic
Ray Bodeen	32-30-25	4	125	50	Domestic
Hugh C. Davis Jr.	32-30-25	4	245	147	Public Supply
Earl Peterman	32-30-25	4	137	59	Domestic
Isabell Lawhorn	32-30-25	4	90	60	Domestic
Gas Kwick	32-30-25	6	35	10	Recovery Well
Dan Kauffman	32-30-25	4	185	54	Domestic
John Moon	32-30-25	4	98	54	Domestic
Edward Winberley	32-30-25	4	125	76	Domestic
Louise Helms	32-30-25	4	112	75	Domestic
Carlos A Salcedo	32-30-25	4	150	84	Domestic
Source: SWFWMD, 2002					

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Hines Energy Complex

FIGURE 2.3.3-1
MONTHLY RAINFALL AT NORALYN MINE
1990-1999

2.3.4 Surficial Hydrology

2.3.4.1 Hydrologic Characterization

GENERAL DESCRIPTION

The Hines Energy Complex site is located within SWFWMD's boundaries, along the divide between the Peace River Basin and the Alafia River Basin (see Figure 2.3.4-1).

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

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

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

Streamflow in Polk County does not fluctuate as rapidly or as much as in many other counties in Florida because of the buffer effect of the many lakes in the County. The lakes store water in times of excess rainfall, thus reducing flood peaks. Conversely, they release water to streams in times of deficiency and thereby sustain streamflow. Each stream is stabilized by lakes to a greater or lesser extent, depending upon the size and number of lakes to which it may be connected. This factor, as well as climatic and geologic factors, causes flow characteristics to be different from stream to stream and even from place to place on the same stream.

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

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

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

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

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

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

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

plants nearby. Water quality has typically been best in the South Prong of the river and is of intermediate quality in the main stem downstream of the confluence of the two prongs.

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

A portion of the Hines Energy Complex, as it existed prior to the start of mining activities, was within the drainage basin of the Alafia River. These areas, which are identified on Figure 2.3.4-2 represented approximately 0.14 percent of Alafia River's drainage basin. The three areas as they are presently identified include a small portion of land at the northwest corner of the Estech SA-12 parcel, the western portion of the IMC Phosphoria parcel and the western portion of the IMC P-3 parcel. These areas were altered by mining pre-1971, pre-1984, and during 1974 respectively. The P-2 and P-3 parcels, which were previously reclaimed, no longer drain to the Alafia River system. Reclamation plans for the Phosphoria parcel indicate that this area will drain to the Peace River system. Since none of these areas have contributed to the Alafia River basin since the start of mining and will not following reclamation, no further discussion of the Alafia River basin will be presented in this SSCA.

MORPHOMETRY, BATHYMETRY, AND STAGES

PEACE RIVER. Figure 2.3.4-3 shows the profile of the Peace River, from Punta Gorda to Lake Hancock. Figure 2.3.4-4 shows the USGS flow and water quality monitoring stations on the Peace River in the vicinity of the Hines Energy Complex. The Bartow station is located at the SR 60 Bridge in Bartow, 105 miles upstream from the mouth of the River (USGS, 1998). It is also shown at Milepost 101 on Figure 2.3.4-3. The Peace River station near Homeland is 97 miles upstream from the mouth, or at Milepost 93 as shown on Figure 2.3.4-3. The Peace River station at Fort Meade is 92 miles upstream of the mouth, or at Milepost 88 as shown on Figure 2.3.4-3.

Morphometry and bathymetry for the Peace River were not measured. However, data from the USGS gauging stations at Bartow, Homeland, and Fort Meade indicate that during the dry season, river widths are typically 20 to 50 feet at each of these stations, with maximum depths on the order of 1.5 to 4 feet. During the wet season, river widths are more typically 200 to 600 feet, and maximum depth ranges from 4 to 8 feet. The stage-discharge curve for the Bartow gauging station indicates a flow of 3,000 cfs would occur at a depth (gauge height) of about 7.5 feet. The same depth at the Fort Meade station would coincide with a flow of under 1,000 cfs. The maximum high water surface stages shown on Figure 2.3.4-3 were estimated for a design storm of 9.6 inches over a 5-day period (Johnson, 1960). This storm has a recurrence interval of about 15 years. Maximum stages, and the associated flows, are presented in Table 2.3.4-2 for the Peace

River USGS stations in the vicinity of the Hines Energy Complex. The peak stage at Fort Meade is 78.43 ft-NGVD and the peak stage at Bartow is 96.35 ft-NGVD. The coinciding peak flow rates are 2,020 cfs and 1,550 cfs, respectively. The 100-year flood stages at Bartow, Homeland, and Fort Meade are reported to be about 99.0, 90.6, and 85.1 ft-NGVD, respectively (FEMA, 1983).

McCULLOUGH CREEK. McCullough Creek presently arises from a small lake (approximately 10 acres) just south of the Hines Energy Complex property line. The Creek runs approximately south-southeast for about 5 miles and then empties into Whidden Creek. In the upper reaches, the Creek bank elevation is about 150 ft-NGVD. At the Whidden Creek confluence, the McCullough Creek bank elevations are on the order of 50 feet. The 100-year flood stage in the vicinity of the Hines Energy Complex site is expected to be within the channel banks due to the limited drainage area and the large detention storage volume within SA-12S. Presently, the only permitted discharge from the site to McCullough Creek is the weir outfall from SA-12S.

The pre-mining drainage basin for McCullough Creek was 14.5 square miles (Partney, et al., 1990), while in 1990 FDNR reported it contained 16.6 square miles at that time (see Figure 2.3.4-5). The increase in area is a result of phosphate mining changes to the topography. The area within the Hines Energy Complex, which was in the pre-mining drainage basin, is estimated at 1,526 acres, or about 2.4 square miles. As authorized by the 1994 Certification, approximately 500 acres of the site, known as the McCullough Creek drainage enhancement project, presently drains to McCullough Creek.

CAMP BRANCH. The source of Camp Branch is Tiger Bay. The Branch continues eastward about 3,500 feet and crosses under U.S. Highway 17. In 1971, the Branch traveled generally northward about a mile and then joined a ditch that entered the Peace River, as shown on Figure 2.3.4-6 (EPA, 1985). Since that time, the portion of the Branch east of U.S. Highway 17 has been mined. Its actual channel location is still more or less as described. A determination of total drainage area of the Branch has not been made. As indicated in the 1992 SCA, a portion of the Buffer/Mitigation Area (N-11A, N-13, and N-9B) has been reclaimed and reconnected to Camp Branch.

BARBER BRANCH. Barber Branch is a former stream that drained a portion of the Hines Energy Complex to the east and eventually discharged to the Peace River. Virtually no traces of this stream are left as a result of mining activities.

SIX-MILE CREEK. The former Six Mile Creek Basin is now part of the IMC Noralyn and Phosphoria mine areas. Much of the area is presently part of the mine water recirculation system for these mines. Portions of the area are presently being restored. After reclamation is complete, the Six Mile Creek Basin will be reconnected to the Peace River.

FLOWS

PEACE RIVER. Streamflow records in the vicinity of the Hines Energy Complex are available only for the Peace River. Figure 2.3.4-4 shows the three Peace River USGS monitoring locations at Bartow, Homeland, and Fort Meade. For the Bartow and Fort Meade stations, flows have been recorded daily since 1939 and 1974 respectively.

The Peace River Valley Water Conservation and Drainage District developed a unit hydrograph for the Peace River at Bartow in 1960 (Johnson, 1960). It is reproduced in this SCA as Figure 2.3.4-7, and it shows a peak of about 1,150 cfs at 3.5 hours with a duration of about 15 days. The maximum discharge recorded at the Bartow station was 4,100 cfs on September 24, 1947. The average discharge from 1939 to 2000 is 225 cfs. The maximum discharge recorded at Fort Meade since 1974 was 2,250 cfs on February 23, 1998. The minimum daily discharges recorded were 0 cfs at Bartow and 0.22 cfs at Fort Meade.

Heath and Wimberly (USGS, 1971) calculated the 7 consecutive day 10-year low flow (7Q10) from October 1939 through September 1964 for the Peace River at Bartow was 11.1 cfs, and the average flow was 308 cfs. Based on the period 1966 through 1991, the 7Q10 has dropped to about 3.0 cfs. Based on the period of record (water years 1940 to 1991), the 7Q10 is 4.6 cfs. Based on the period from 1974 to 1991, the 7Q10 is 3.3 cfs at Bartow, and only 0.9 cfs at Fort Meade. The average flow at Fort Meade is 181 cfs (water years 1974 to 1996); for the same period at Bartow, the average is 154 cfs.

TEMPERATURE

Heath (USGS, 1981) reports an average annual temperature range of streams in south central and southwestern Florida of 72 to 76° F. All of the USGS data for the Peace River at Bartow, near Homeland, and at Fort Meade have been plotted over the period of temperature record, and are shown on Figures 2.3.4-8 through 2.3.4-10. Based on the USGS data, water temperatures in the Peace River in the vicinity of the Hines Energy Complex range from a low of 50°F in the winter to a high of 94.1°F in the summer. There are no published temperature data for other water bodies in the site vicinity.

As part of the surface water hydrology studies in support of the 1992 SCA, water quality data were monitored at seven surface water locations during both the wet and dry season (see Figure 2.3.4-11). These monitoring results are tabulated in Table 2.3.4-3. They indicate that the temperatures in McCullough Creek and Camp Branch are, for all practical purposes, the same as in the Peace River. For SA-11, N-15, and N-16, water temperatures during the wet season (June to September) were 3 to 6° F higher than those in McCullough Creek, Camp Branch, and the Peace River, but were indistinguishable

from them in the dry season (October to May). Water temperatures measured in Tiger Bay were similar to those measured in the other on-site areas.

WATER QUALITY

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

Water quality data have been taken continuously at the Bartow station since February 1963; and at the Fort Meade Station since January 1965. Water quality data are available for the Homeland station from January 1965 to August 1994, however these data are not continuous. These water quality data for the Bartow, Homeland, and Fort Meade stations are voluminous and will be made available upon request.

As part of baseline Surficial hydrology studies conducted in support of the 1992 SCA, water quality samples were taken during the wet (September 1991) and dry (February 1992) seasons at seven locations (see Figure 2.3.4-11). The complete results of that monitoring program are shown in Table 2.3.4-4 of the 1992 SCA. Table 2.3.4-5 presents the results of that monitoring program showing only those constituents that were detected.

Heath and Conover (USGS, 1981) indicate that streams in southwest Polk County are of the calcium and magnesium sulfate type (see Figures 2.3.4-12 and 2.3.4-13). This information indicates that the dominant cations for streams in the site vicinity are calcium, magnesium, and sodium, and the dominant anions are sulfate, bicarbonate, and chloride.

ON-SITE WATER BODIES

There is one existing on-site natural water body, Tiger Bay, which contains numerous surface water bodies and is not part of Plant operations. Tiger Bay is located east of the Plant Island area and consists of about 524 acres of reclaimed land and lakes mine area. Tiger Bay drains to the remnant Camp Branch system located on its east side. Tiger Bay receives water input from direct precipitation, groundwater seepage through the cooling pond southern dam and minimally from adjacent upland areas.

SITE DRAINAGE

Stormwater runoff is being managed for all areas within the Hines Energy Complex site. Areas that are in contact with plant process waters or industrial wastewater will be managed as closed basins. Several areas within the Hines Energy Complex are designed to drain freely, so as to enhance the flows in adjacent drainage systems. This has been done to intentionally provide flows to the McCullough Creek and Camp

Branch drainages. Those areas within the Hines Energy Complex that are not specified as closed systems or that are not designated as off-site drainage enhancement areas are used for water cropping purposes.

2.3.4.2 References

Florida Bureau of Geology, 1975. River Basin and Hydrologic Unit Map of Florida, Map Series 72.

Florida Power Corporation. 1992. Polk County Site. Site Certification Application.

Johnson, L. 1960. A Report on a Plan of Improvement for Peace River Valley. Peace River Valley Water Conservation and Drainage District.

Partney, S. H., W. R. Murphy, and G. L. Henderson. 1990. FDNR. A Comparative Hydrological Study of the McCullough Creek Basin --- YESTERDAY & TOMORROW. (Preliminary) November 5, 1990.

SWFWMD (Southwest Florida Water Management District). 1991. Water Supply Needs and Sources, 1990-2020 (Draft). April 29, 1991.

USGS (United States Geological Survey). 1961. Surface Water Resources of Polk County, Florida. Information Circular No. 15. Richard C. Heath. Tallahassee, Florida.

USGS. 1971. Selected Flow Characteristics of Florida Streams. Information Circular No. 69. R. C. Heath and E. T. Wimberly. Tallahassee, Florida.

USGS. 1981. Hydrologic Almanac of Florida. USGS Open File Report 81-1107. R. C. Heath and C. S. Conover, Tallahassee, Florida.

USGS. 1996. Water Resources Data, Florida, Water Year 1996, Volume 3A
Southwest Florida Surface Water. USGS Report FL-96- 3A. Tallahassee, Florida.

USGS. Website at www.USGS.gov/water.com 1998.

Table 2.3.4-1
Pre-Mining Drainage Basins

Pre-mining Basin	% of Site Acreage
Peace River Basin	
McCullough Creek	18.5%
Six Mile Creek	52.5%
Barber Branch	11.5%
Camp Branch[1]	12.3%
Peace River Basins Subtotal	94.7%
Alafia River Basin	
In SA-12	0.6%
In Phosphoria	2.5%
In P-3	2.1%
Alafia River Basin Subtotal	5.2%

1. Also know as Camp Meeting Ground Branch.
Source: 1992 SCA.

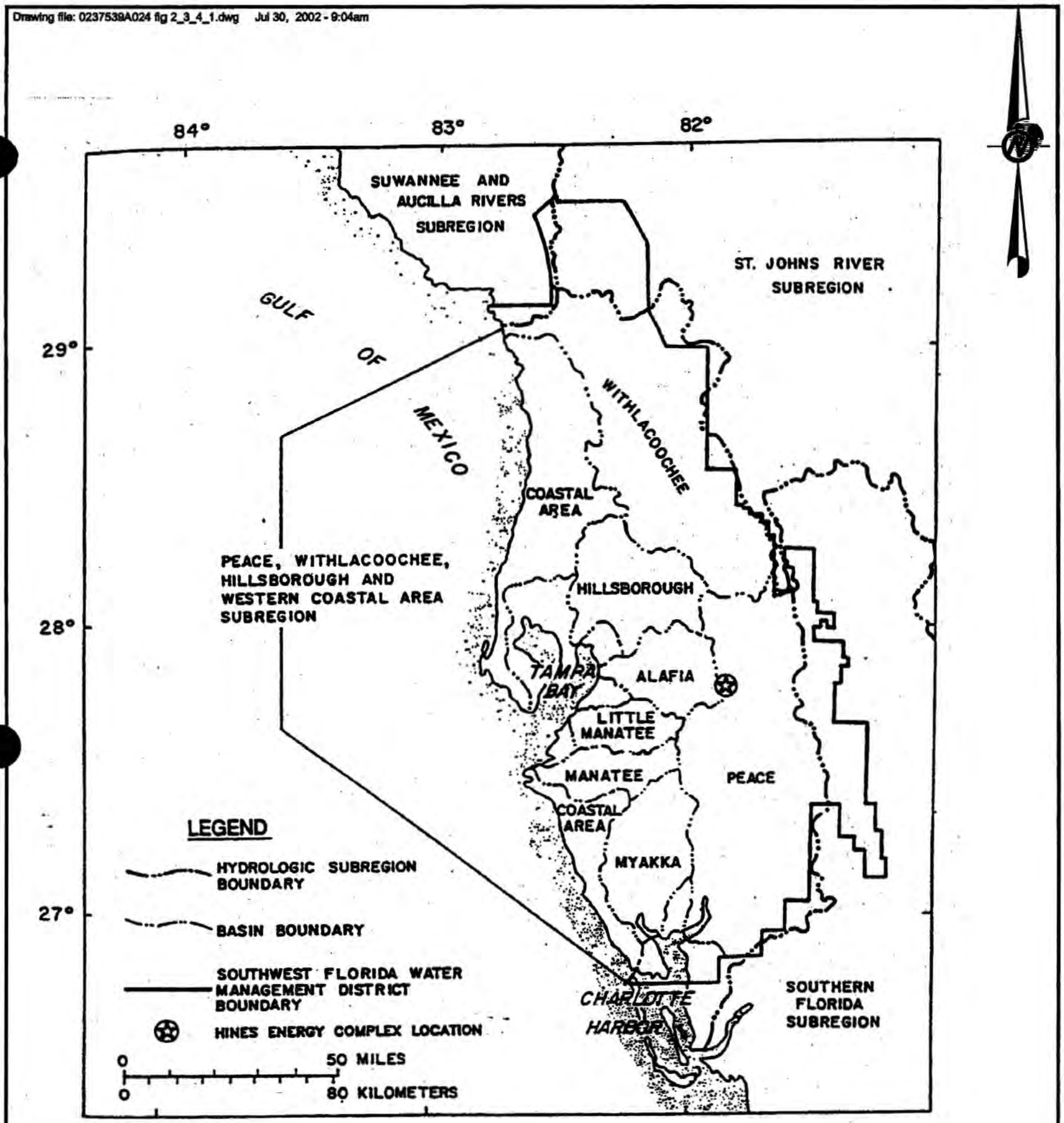
Table 2.3.4-2 Maximum Stages - Peace River					
Station Location	At Bartow		Near Homeland	At Fort Meade	
Years of Complete Record	Flow 57	Stage 29	N/A	Flow 23	Stage 21
Peak Stage ft. NGVD	96.35		N/A	78.43	
Flow at Peak Stage, cfs	1,550		N/A	2,020	
N/A = Not Available Source: USGS Website at www.USGS.gov/water. 1998.					

Table 2.3.4-3 Measured Water Temperatures[1]		
Location	Wet Season	Dry Season
N-15	86.7	71.2
N-16	89.4	71.8
SA-11	86.0	72.1
Tiger Bay	87.1	72.5
Camp Branch[2]	82.4	71.6
McCullough Creek	83.7	69.6
Peace River	83.3	70.3

1. Temperature expressed in °F.
2. Also know as Camp Meeting Ground Branch.

Source: 1992 SCA

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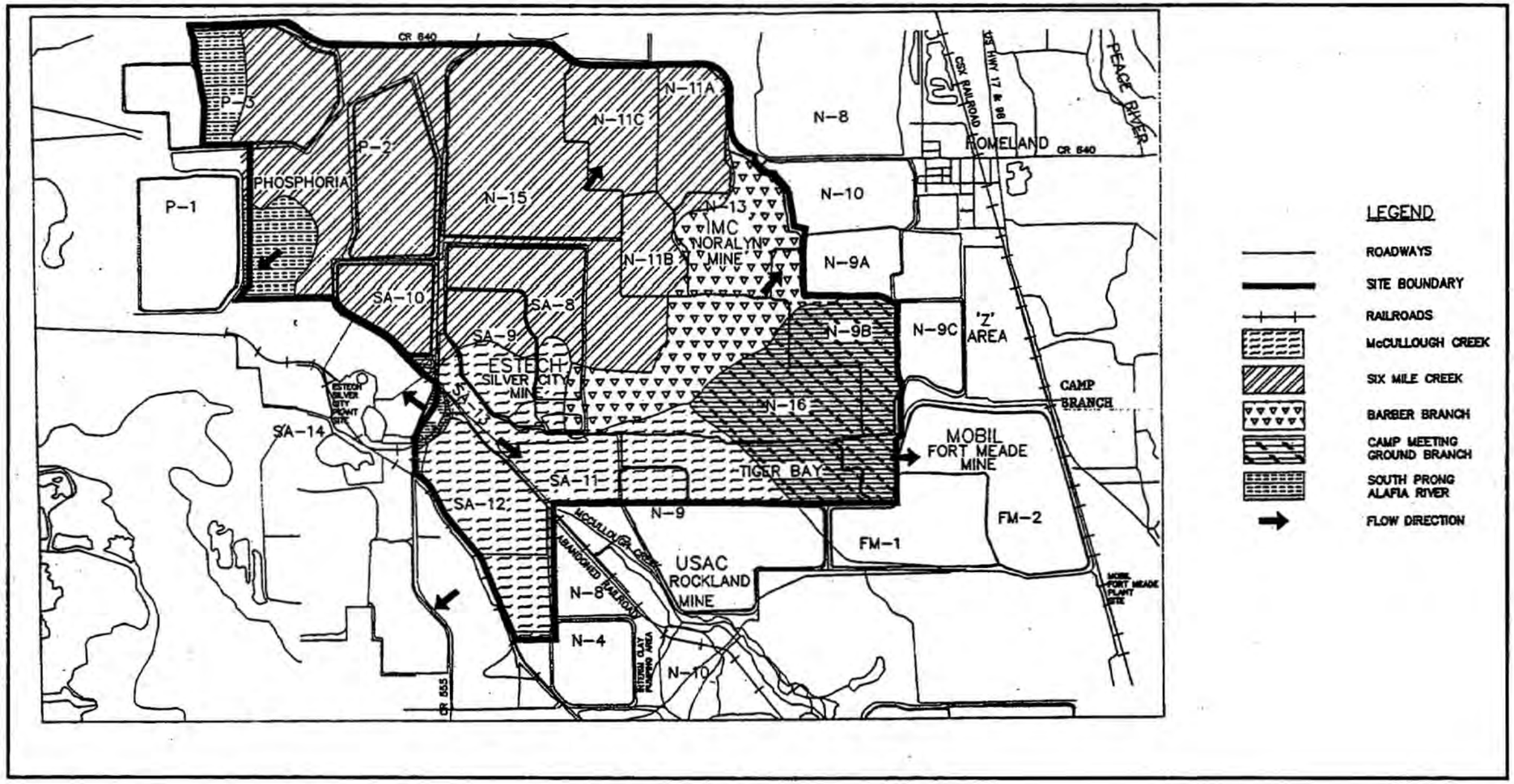
SOURCE: 1992 SCA

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FIGURE 2.3.4-1
MAJOR RIVER BASINS IN VICINITY OF SITE

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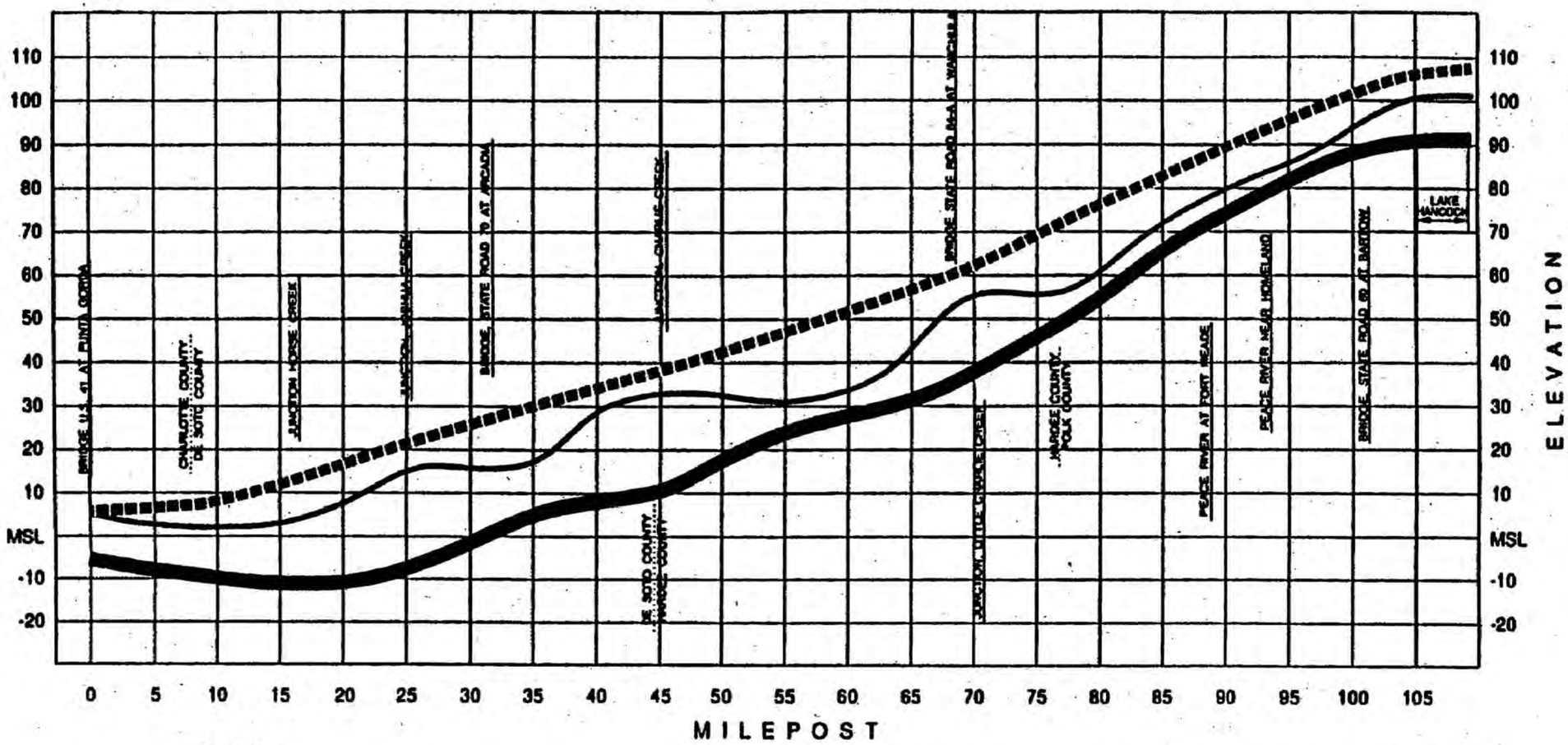
SOURCE: 1992 SCA

Florida Power
A Progress Energy Company

Hines Energy Complex

FIGURE 2.3.4-2
PRE-MINING DRAINAGE BASIN BOUNDARIES

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

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

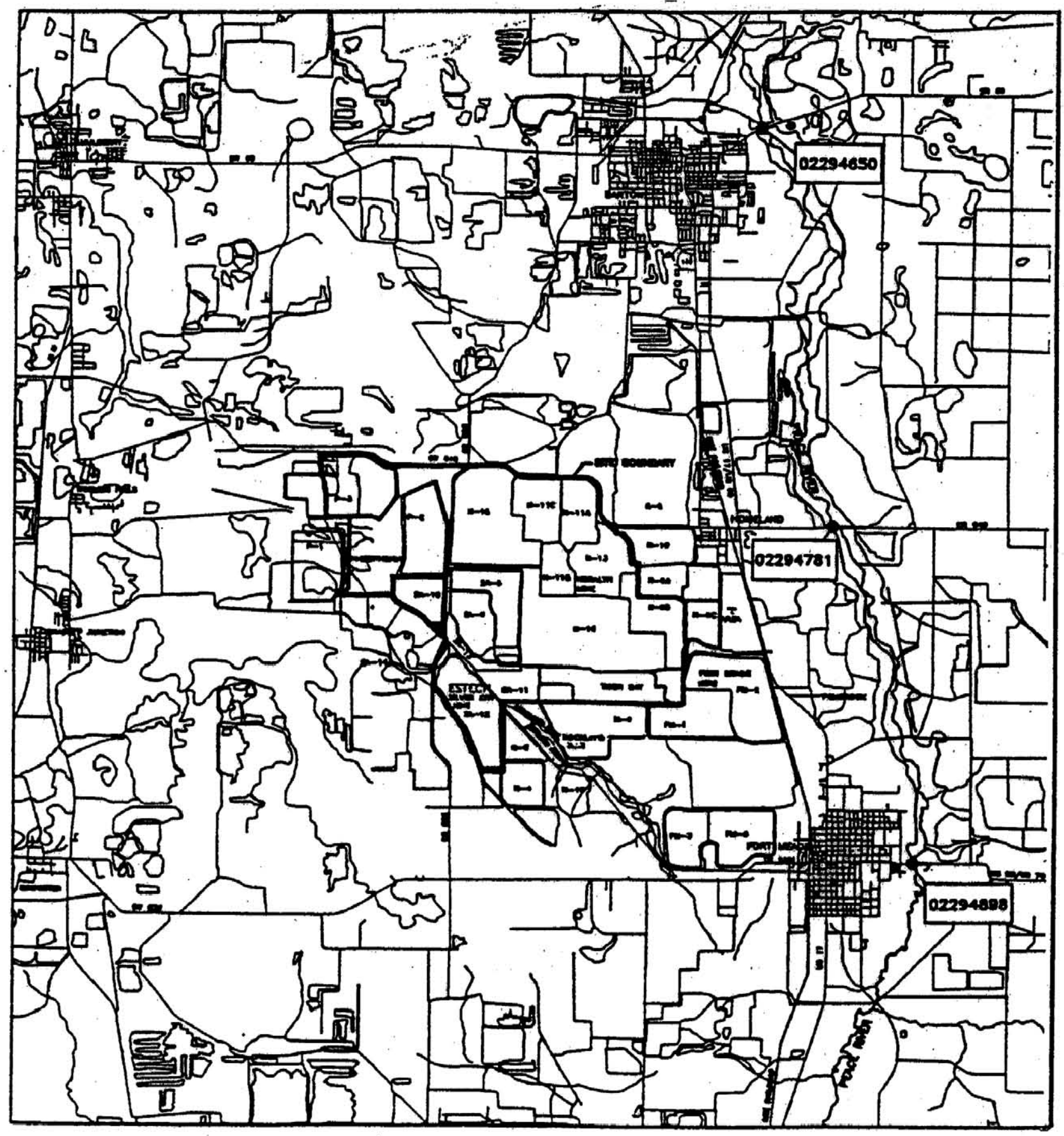
SOURCE: 1992 SCA

Florida Power
A Progress Energy Company

Hines Energy Complex

FIGURE 2.3.4-3
PROFILE OF PEACE RIVER

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LEGEND

SITE BOUNDARY

02294898 USGS STREAM GAGING STATION

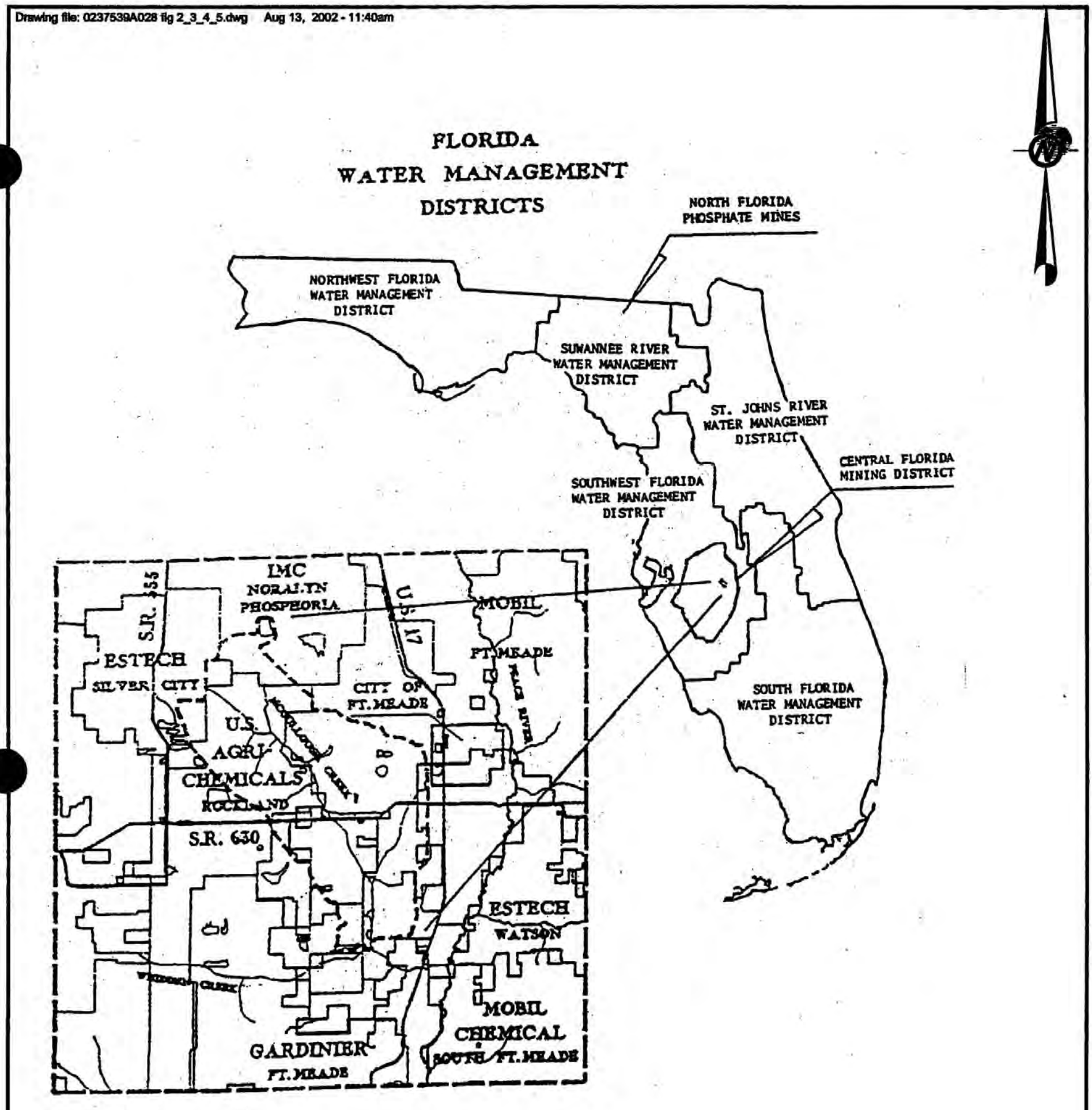
SOURCE: 1992 SCA

Florida Power
A Progress Energy Company

Hines Energy Complex

FIGURE 2.3.4-4
USGS STATION LOCATIONS

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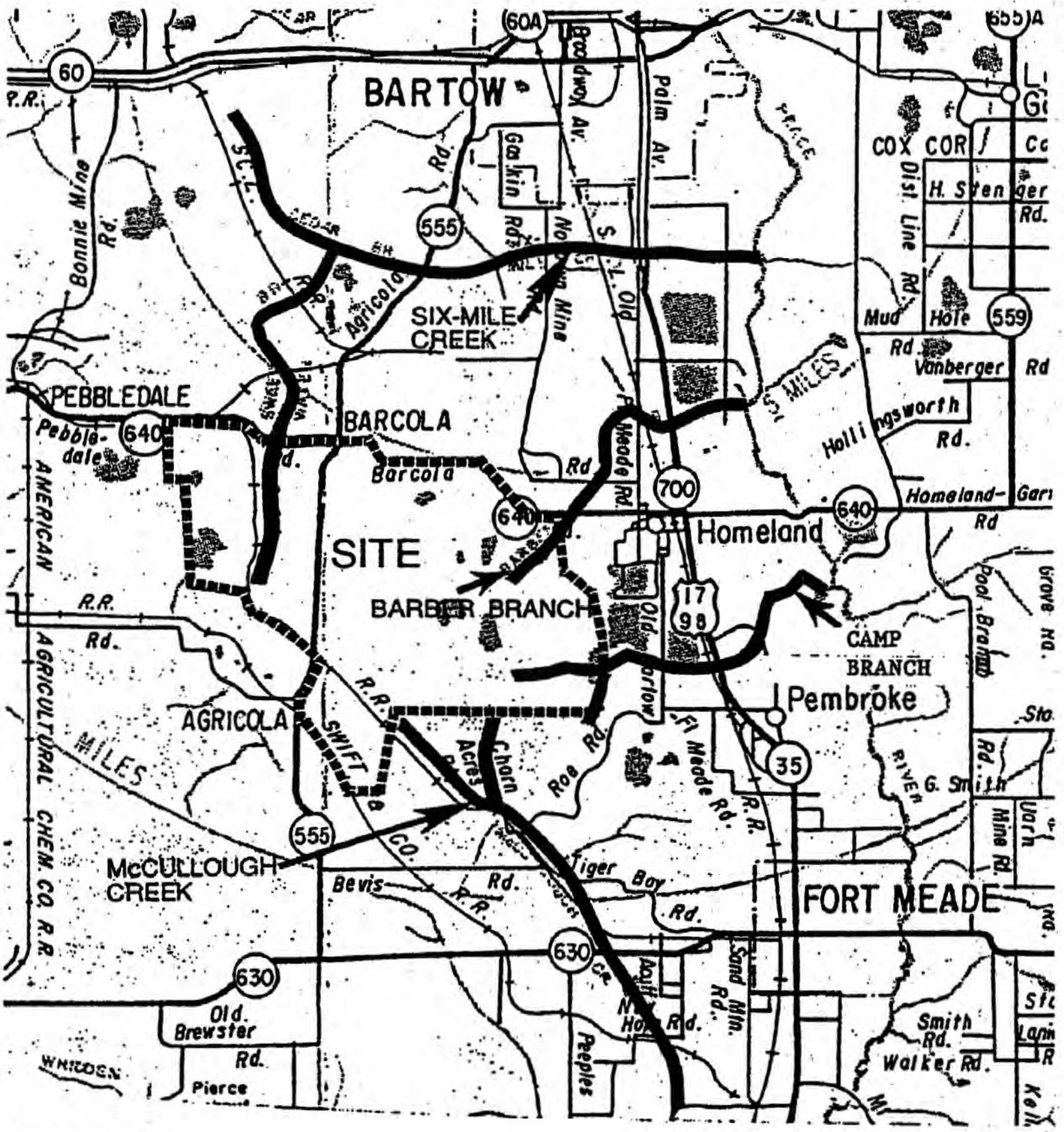
SOURCE: 1992 SCA

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

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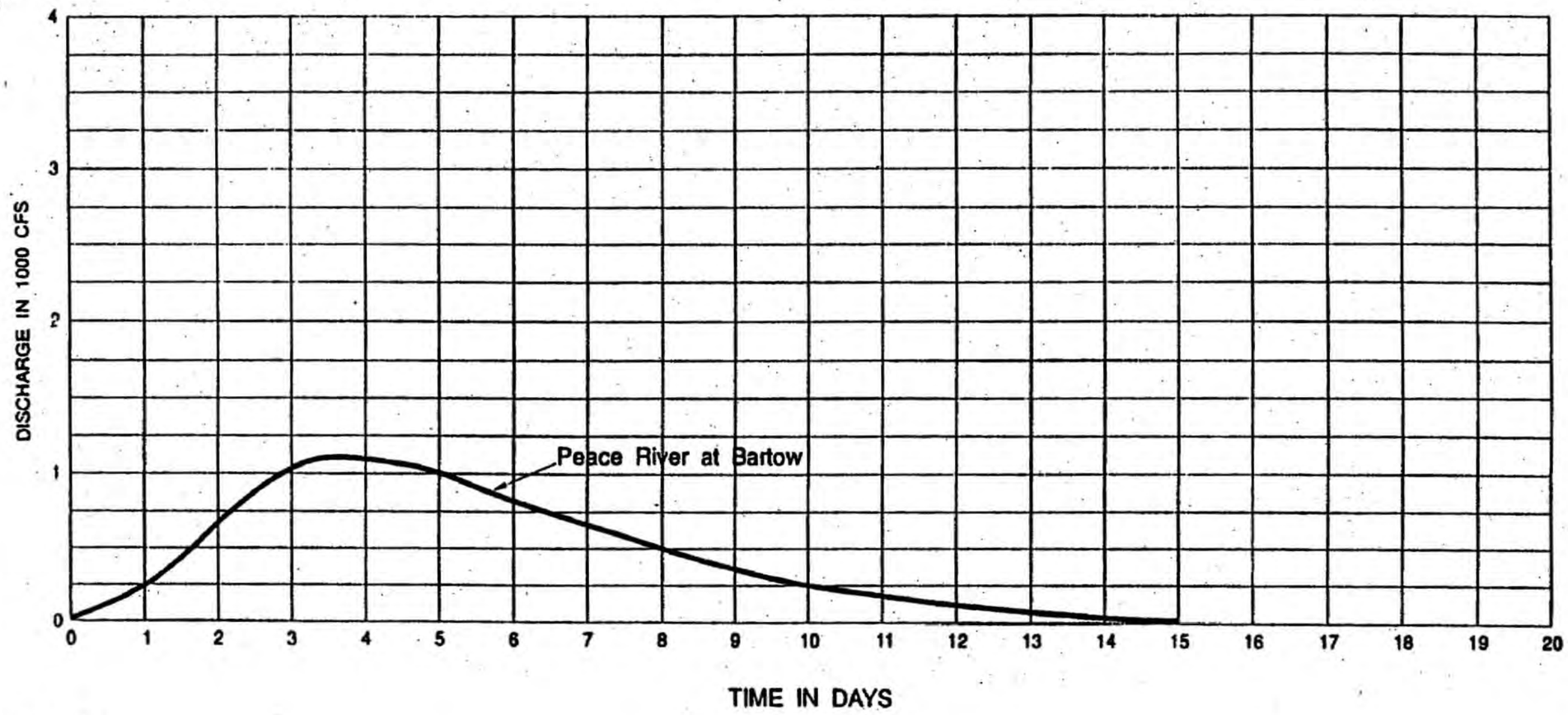
SOURCE: 1992 SCA

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

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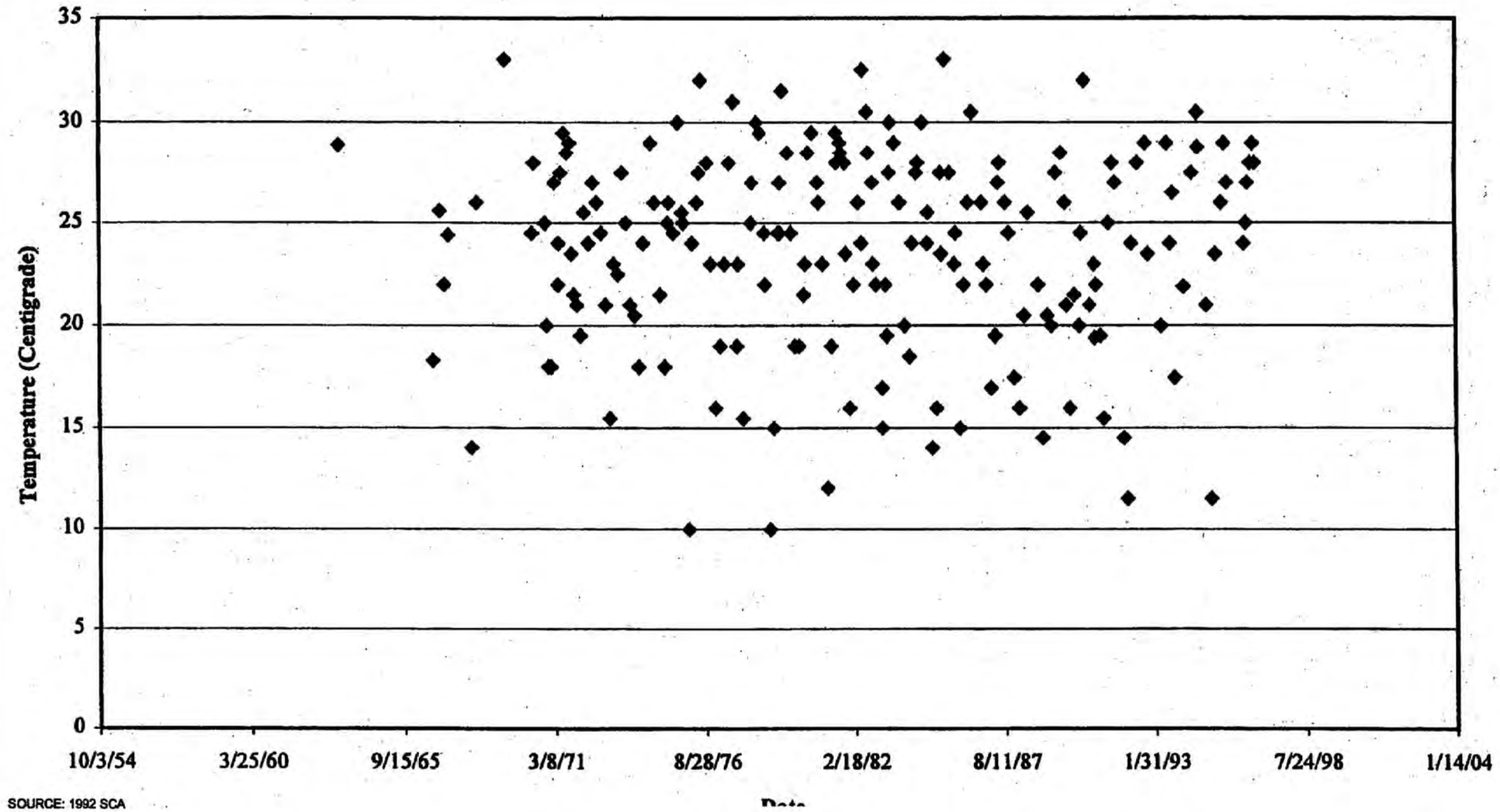
SOURCE: 1992 SCA

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

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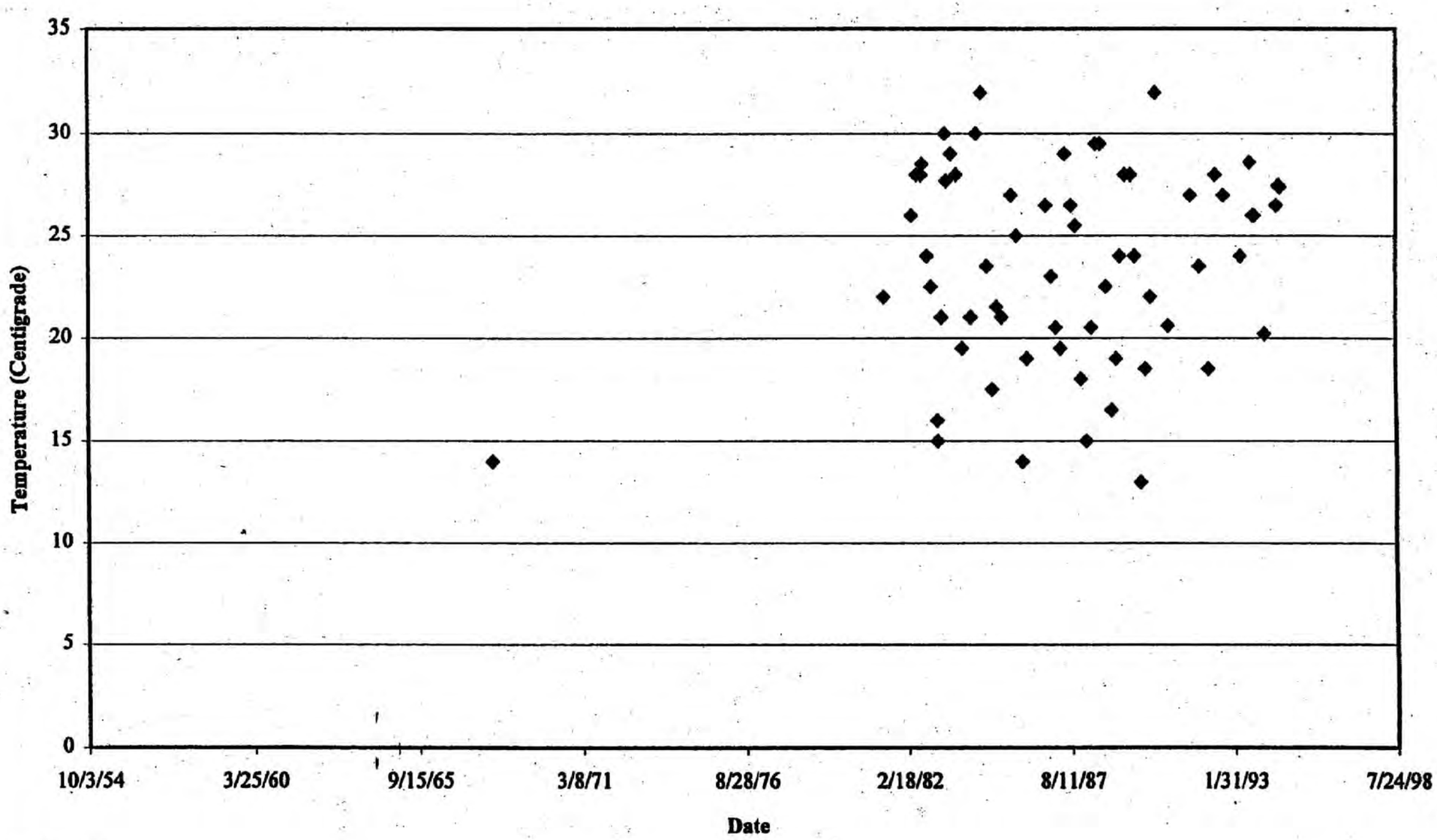
SOURCE: 1992 SCA

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FIGURE 2.3.4-8
WATER TEMPERATURE
PEACE RIVER - BARTOW STATION No. 02294650

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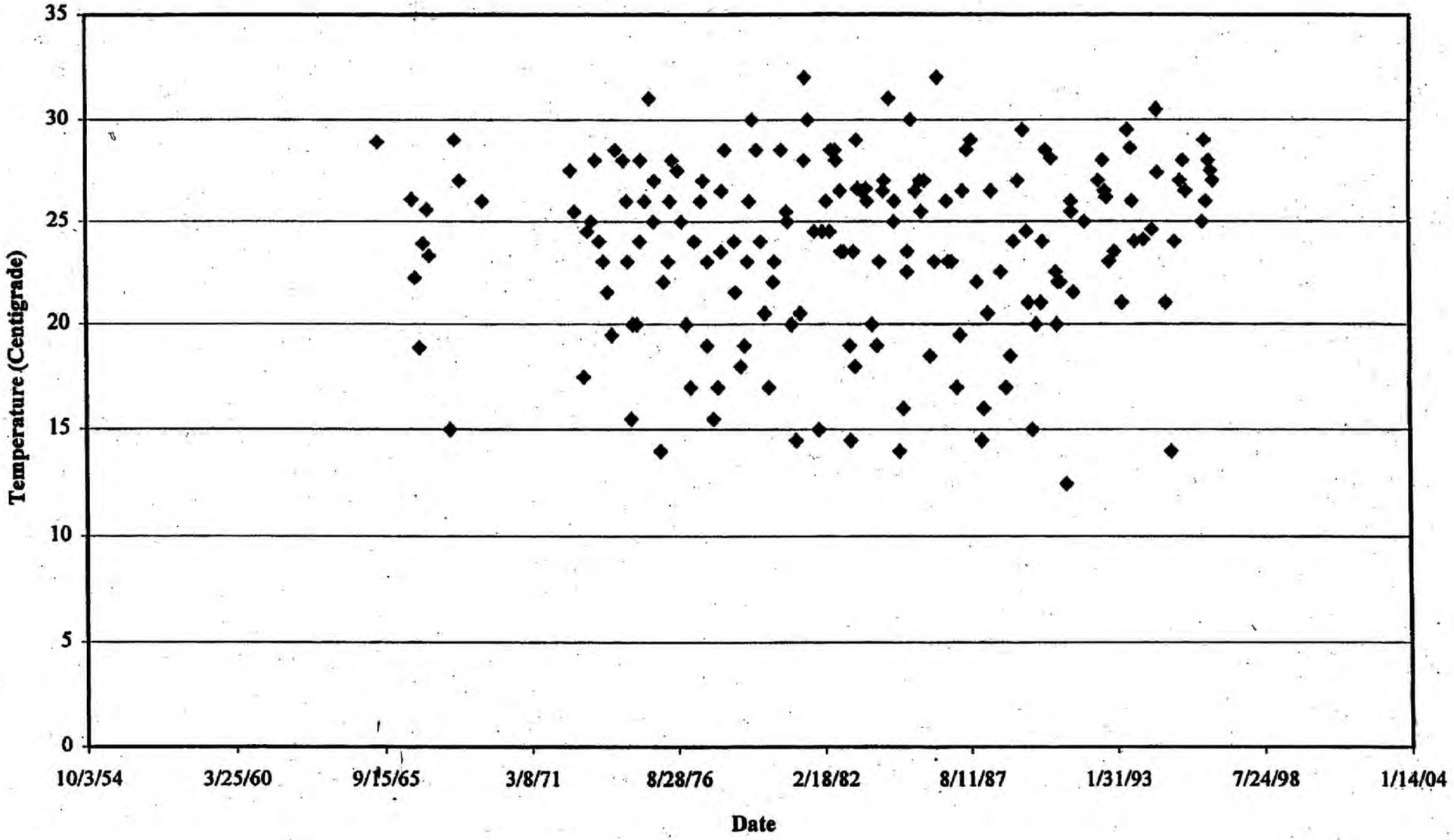
SOURCE: 1992 SCA

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FIGURE 2.3.4-9
WATER TEMPERATURE
PEACE RIVER - HOMELAND STATION No. 02294781

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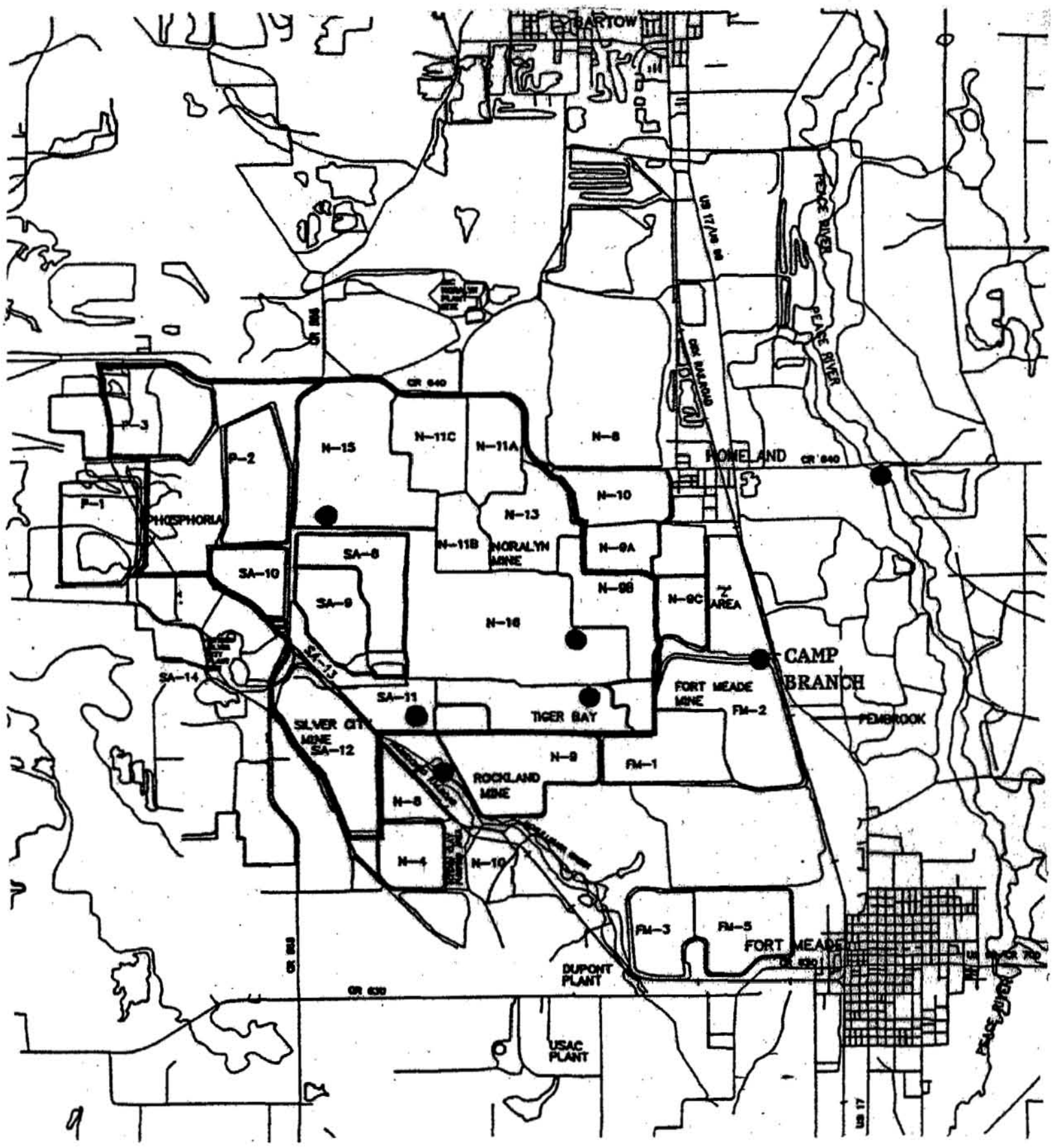
SOURCE: 1992 SCA

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FIGURE 2.3.4-10
WATER TEMPERATURE
PEACE RIVER - FORT MEADE STATION No. 02294898

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LEGEND

- SURFACE WATER SAMPLING LOCATIONS
- ROADWAYS
- SITE BOUNDARY
- RAILROAD

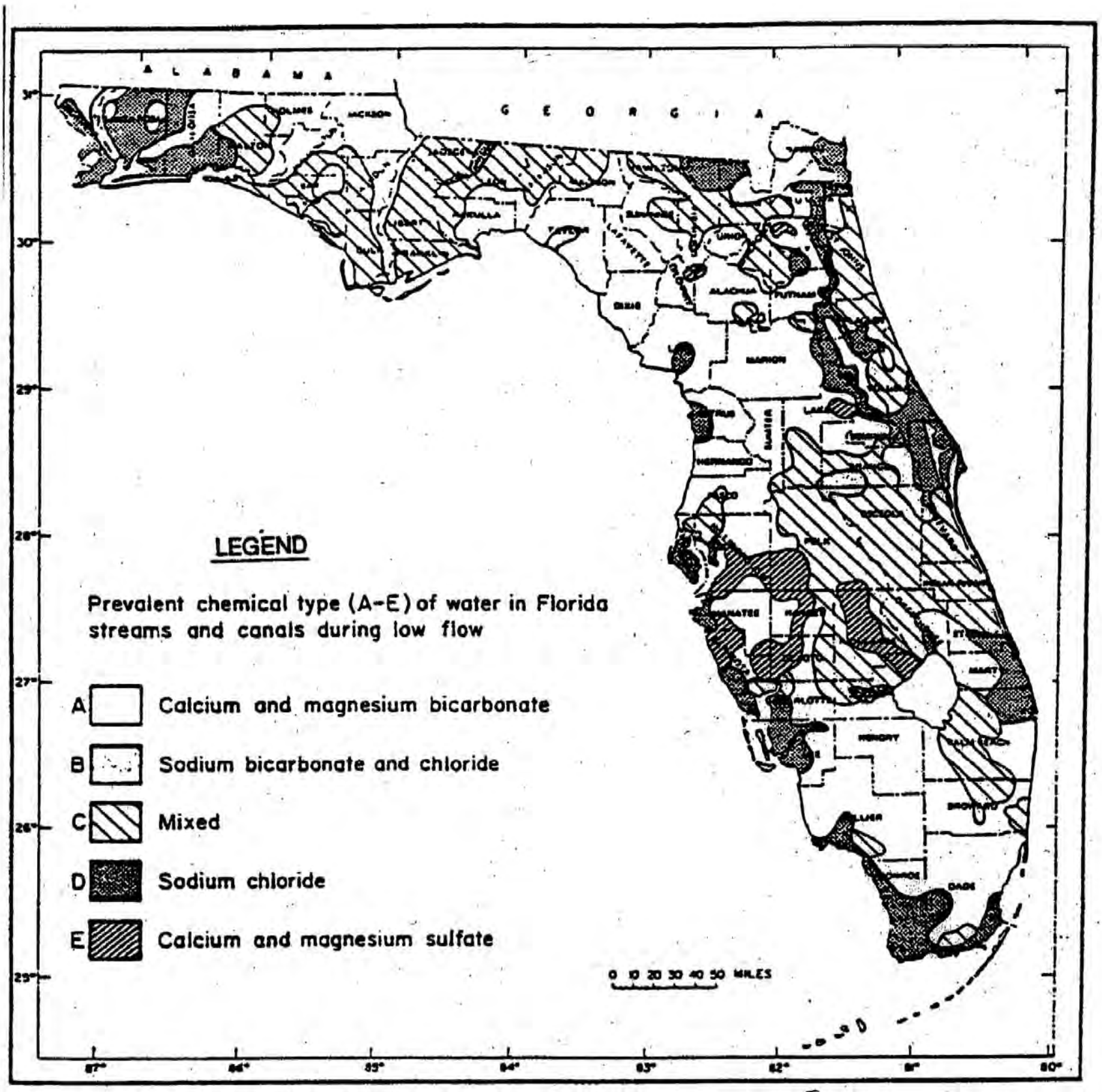
SOURCE: 1992 SCA

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FIGURE 2.3.4-11
SURFACE WATER SAMPLING SITE LOCATIONS

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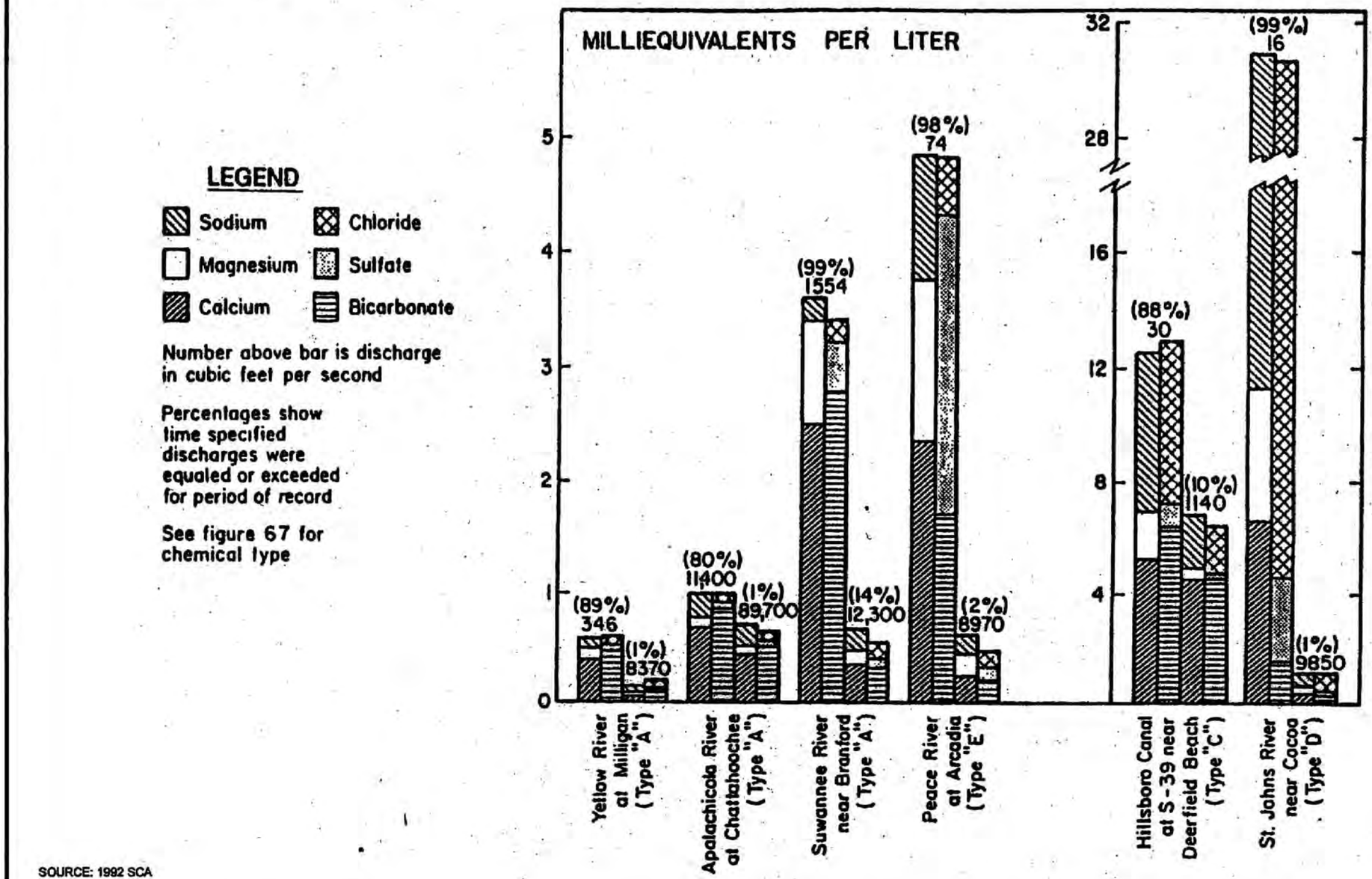
SOURCE: 1992 SCA

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FIGURE 2.3.4-12
CHEMICAL TYPES OF WATER IN FLORIDA STREAMS

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SOURCE: 1992 SCA

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FIGURE 2.3.4-13
RELATIONS AMONG CHEMICAL COMPOSITION, CONSTITUENT CONCENTRATION AND DISCHARGE FOR SIX FLORIDA STREAMS AND CANALS DURING LOW VERSUS HIGH STREAM FLOW

2.3.5 Vegetation/Land Use

The Hines Energy Complex site consists of land developed for placement of electrical generation facilities and of mandatory mined lands (where mining began on or after July 1, 1975) and non-mandatory mined lands (where mining began prior to July 1, 1975). Mandatory lands on the site were subject to reclamation plans that were approved by the FDEP, prior to approval of the Site Certification. The 1994 Site Certification granted variances from certain reclamation requirements for mandatory areas which were to be developed as the Plant Island or as support facilities for power generation, such as the Cooling Pond and Brine Pond.

The baseline conditions used for impact assessment purposes in this document are those land conditions as authorized by the 1994 Certification and as permitted by the U. S. Army Corps of Engineers. For reference purposes only, a summary discussion of existing conditions is presented in this section along with the discussion of baseline conditions. These conditions are described in full in the original SCA.

2.3.5.1 Baseline Conditions

The baseline condition for SCA purposes is the projected condition of the site at the conclusion of site buildout and includes electrical generation facilities, buffer lands, including the wetland mitigation areas on the eastern and western portions of the site. Use of pre-certification conditions as the baseline is not appropriate for most of the site because of the significant alterations to the property that have occurred due to phosphate mining activities. Exceptions to this scenario are Tiger Bay, which is a reclaimed and released area, and Tiger Bay East, which was mined and revegetated naturally without reclamation and the P2 area that was previously reclaimed and released by the FDEP-BOMR. The Tiger Bay area currently makes up a portion of the site buffer area and conservation easements over these areas were conveyed to the State of Florida as a permanent conservation easement in 2002, pursuant to a non-mandatory funding contract between the State of Florida and FP.

SITE DESCRIPTION

Figures 2.3.5-1A and 2.3.5-1B are land cover maps of the Hines Energy Complex site. Land cover types shown on these maps are consistent with the site's stage of development as authorized in the 1994 Certification and subsequent modifications. The following vegetation/land use types would be present in the site area under the full site buildout condition. Classification is based on Levels I and II Florida Land Use, Cover and Forms Classification System.

- Electrical generation facilities

- Native uplands
- Wetlands
- Lakes

DOMINANT INDICATOR VEGETATION

Final site buildout, as authorized in the 1994 Certification, will include native upland and wetland vegetation communities created as part of the Buffer Area and SA-10 reclamation projects and the Tiger Bay area Enhancement Program. These programs have been initiated, plantings have occurred and progress toward ecological success is being monitored, as described in Section 2.3.5.2 below.

VEGETATION COMMUNITY QUALITY AND CONDITION

Tiger Bay is composed of 417 acres of uplands, wetlands, and open water lakes. It is currently a mix of forested wetlands, uplands and small lakes. Tiger Bay was considered to be low to medium in ecological quality at the time of Certification in 1994. The planting of over 30 wetland and transitional species during reclamation has increased the plant species diversity of Tiger Bay. Some of the planted tree and shrub species are well established and form narrow bands along lake margins. Cattail, Carolina willow, and hydrilla clearly dominated the majority of the wetlands as late as Year 2000 at the time of preparation of the SSCA for Hines Energy Complex Power Block No. 2. As a result of FP's nuisance plant eradication program in Tiger Bay, much of the dominance of these species has now given way to dominance of higher quality native vegetation such as cypress and with a decline in cattails, Brazilian pepper and aquatic pest species.

Tiger Bay East was also considered low to medium in ecological quality at the time of Site Certification in 1994. It is an unreclaimed mining area which has revegetated naturally and contains some relatively mature second growth upland forests in addition to some of the same invasive exotic and nuisance species found in Tiger Bay. In fact, the small (102 acres) area contains the majority of the upland forest community types on-site. Tiger Bay East has relatively high plant species diversity and exhibits some plant community types at intermediate stages of successional development. A non-mandatory reclamation program to enhance the ecological condition of Tiger Bay East is being proposed to the FDEP Bureau of Mine Reclamation. If approved for non-mandatory reclamation funding, this program is proposed to begin in 2003.

2.3.5.2 Reclamation Activities

GENERAL

The Hines Energy Complex Site is comprised entirely of lands which have been previously disturbed by phosphate mining and processing activities. Subsequent to these disturbances, some of the property has been reclaimed, either by the previous owners or by FP; in accordance with state reclamation standards. Additionally, FP has developed some of the site parcels as power plant facilities and some of the property still remains to be reclaimed. The site parcels can be further classified according to their status, under state reclamation law, as either Non-Mandatory Lands or Mandatory Lands. The Non-Mandatory Lands are those that were mined by the phosphate companies prior to July 1, 1975, which comprise approximately half of the Hines Energy Complex site. A trust fund was established by the State to encourage the voluntary reclamation of these lands. The Mandatory Lands are those that were mined on or after July 1, 1975 and must either be reclaimed in accordance with the standards of Chapter 62C-16 F.A.C. or must be granted variances from these standards by the FDEP. The Mandatory Lands that have been or will be developed as power plant facilities were granted the necessary variances from these standards through the approval of the 1994 Certification. Figure 2.3.5-1 is a map of the site illustrating the site parcels, which are discussed below.

PHOSPHORIA, P-2, P-3 AND TRIANGLE LAKES

These areas, which are west of CR 555, comprise approximately 1,700 acres. They are entirely Mandatory Lands, as defined above, and must be reclaimed by IMC-Agrico (IMC) in accordance with the standards of Chapter 62C-16 FAC. When purchased by FP from IMC, the P-2 clay settling area, had already been mined and reclaimed. Mining of Phosphoria concluded in late 1999, and IMC has initiated early stage reclamation activities on the area. Triangle Lakes continues to operate as a portion of the IMC mine water recirculation system. A modified Conceptual Reclamation Plan has been submitted for all of these areas and is under review by the FDEP Bureau of Mine Reclamation. In general, IMC's current reclamation plans call for re-establishment of the pre-mining habitat and drainage characteristics of the area. FP will utilize the final discharge of runoff from these areas for power plant water needs, as previously authorized in the 1994 Certification.

BUFFER AREA (N-11A, N-11C, N-13, N-9B AND TIGER BAY)

The Buffer Area of the site is located on its southern and eastern boundaries, encompassing approximately 1,800 acres. Subsequent to the Post-Certification Amendment filed April 17, 2000, N-11A, N-13 and N-9B were determined to be eligible for participation in the Non-Mandatory Lands Reclamation Program of the state. Upon execution of the contract between the State of Florida and FP, funding of the non-mandatory

reclamation of these parcels has taken place, and a conservation easement over Tiger Bay has been conveyed to the State as additional support for the variances previously granted in the 1994 Certification. Following is a discussion of the current status of areas within the Buffer Area.

N-11A

N-11A is a non-mandatory clay settling area located in the northeastern corner of the site. Active consolidation of the clays in this area has been completed. In accordance with the non-mandatory reclamation requirements of Chapter 62C-17 FAC, and the approved reclamation design plans. Reclamation of this parcel was completed in October 2001. In general, this parcel was reclaimed as wildlife habitat consisting of various land use and cover classifications (FLUCCS). This area will also serve as watershed for the parcels to the south and ultimately to the Peace River.

N-11C

N-11C is a non-mandatory clay settling area that also contains large amounts of phosphatic sand tailings which were disposed of by IMC-Agrico. These sand tailings may be used by FP as backfill material to support site construction activities. The western portion of the parcel will be developed as part of the cooling pond. However, the remainder of the parcel will ultimately be reclaimed by FP in accordance with the standards of Chapter 62C-17 FAC. Specific design plans for this reclamation will be submitted to FDEP for review and approval prior to commencement of reclamation activities.

N-13

N-13 is a former IMC-Agrico non-mandatory waste clay settling area in which clay consolidation has also been completed. In accordance with the Post-Certification Amendment filed April 17, 2000, FP has reclaimed this area as primarily upland wildlife habitat, consisting of various land use and cover classifications. This area will also serve as watershed for the N-9B parcel to the south and ultimately to the Peace River.

N-9B AND SA-10 - CORPS OF ENGINEERS MITIGATION AREAS

In addition to meeting the requirements of applicable state reclamation rules, the N-9B and SA-10 Parcels have been reclaimed to contain wetland areas which will fulfill the requirements of U.S. Army Corps of Engineers Dredge and Fill Permit No. 199302169 (IP-MN). These wetlands are to serve as mitigation for impacts to spoil pile wetlands which existed in the N-16 Cooling Pond at the time the Hines Energy Complex site was acquired by FP. The habitat created in these areas consists of herbaceous and forested wetlands and their associated upland watersheds. The upland portions of the mitigation areas are shrub,

brush, rangeland and forested habitat. SA-10 will serve as watershed for McCullough Creek and N-9B will serve as watershed for Camp Branch and ultimately to the Peace River. *Note:* Originally, the N-13 parcel was proposed as a mitigation area for the N-16 impacts. However, a modification of the Site Certification was approved in 1996 to allow FP to transfer the requirement for palmetto prairie reclamation from SA-10 into N-13 and to transfer the N-13 mitigation requirements to the SA-10 parcel. Concurrence from the U.S. Army Corps of Engineers is conditioned in the above permit upon meeting the review criteria and obtaining the final approval of the reclamation plan and schedule from the FDEP Bureau of Mine Reclamation.

TIGER BAY AND TIGER BAY EAST

These areas form the portion of the Buffer Area located south of the N-16 cooling pond. Tiger Bay is a previously reclaimed mandatory mining parcel, while Tiger Bay East is an unreclaimed non-mandatory area. These areas collectively form the headwaters of Camp Branch, to the east, which is a tributary to the Peace River. Additionally, these areas represent a link in the wildlife corridor connecting Hookers Prairie, in the Alafia River drainage basin, to the Peace River basin via Camp Branch. In accordance with the post-Certification Amendment filed April 17, 2000, a conservation easement over the Tiger Bay and Tiger Bay East parcels was donated to the State of Florida in 2000. This donation was completed following the signing of the non-mandatory funding contracts for the reclamation of Parcels N-11A, N-13 and N-9B, as alternative mitigation for the variances from mandatory reclamation requirements that were granted in the 1994 Certification.

SA-12 SOUTH – McCULLOUGH CREEK DRAINGAGE ENHANCEMENT PROJECT

This area was constructed by FP as the watershed detention area which discharges runoff from this project to the McCullough Creek headwaters located on the US Agri-Chemicals property to the east. As required by the 1994 Certification, this detention area was designed by FP to receive runoff from the offsite Silver City Drainage Area to the northwest and from the SA-10 reclamation area, also to the northwest, and then gradually discharge this water as an enhancement to the downstream McCullough Creek hydrology.

N-16 (Cooling Pond), SA-9 (Brine Pond), SA-12 North, SA-11 and SA-13

These areas were mandatory lands that have been developed by FP for their respective uses as power plant generation and support facilities. The construction and operation of these facilities is described in the 1992 SCA, the 1994 Certification and in subsequent modifications.

SA-8, N-15, N-11B, N-16E (Clay Storage and Reclaimed Water Storage Areas)

These areas, which are either clay settling areas or unreclaimed mined areas, are designated for construction and operation as future power plant support facilities. SA-8 was designated the Phase I Solid Waste Disposal Area for use when FP implements coal gasification as the fuel option for on-site generation. The remainder of the areas are proposed as future additions to the cooling pond. All of these areas, with the exception of the clay storage area of N-16E, are classified as non-mndatory Lands.

2.3.5.3 References

FDOT (Florida Department of Transportation). 1985. Florida Land Use, Cover and Forms Classification System. 2nd Ed. Proc. No. 550-010-001-A. FDOT, State Topography Bureau. Tallahassee, Florida.

Florida Power Corporation. 1992. Polk County Site. Site Certification Application.

Florida Power Corporation. 2000. Post-Certification Amendment.

Siting Board. 1994. Final Order Approving Certification. In Re: Application for Power Plant Certification of Florida Power Corporation Polk County Site PA 92-33. DOAH Case no. 92-5308 EPP.

FDEP. 1997. Final Order Modifying Conditions of Certification. In Re: Application for Power Plant Certification of Florida Power Corporation Polk County Site. DEP Case No. PA 92-33B.

FDEP. 1997. Final Order Modifying Conditions of Certification. In Re: Application for Power Plant Certification of Florida Power Corporation Polk County Site. DEP Case No. PA 92-33C. OGC Case No. 92-1494.

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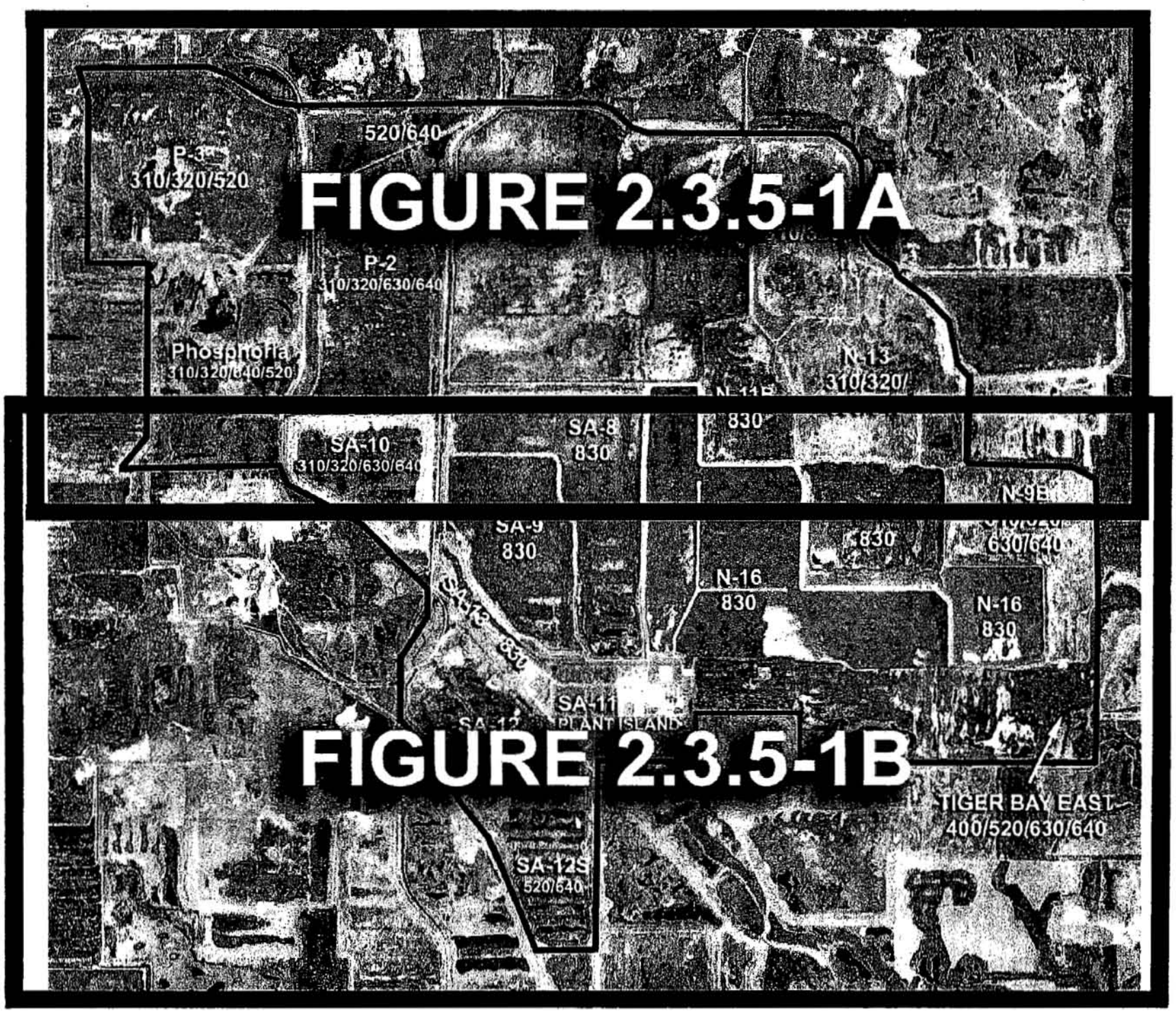


FIGURE 2.3.5-1A

FIGURE 2.3.5-1B

FLUCCS CODE LEGEND

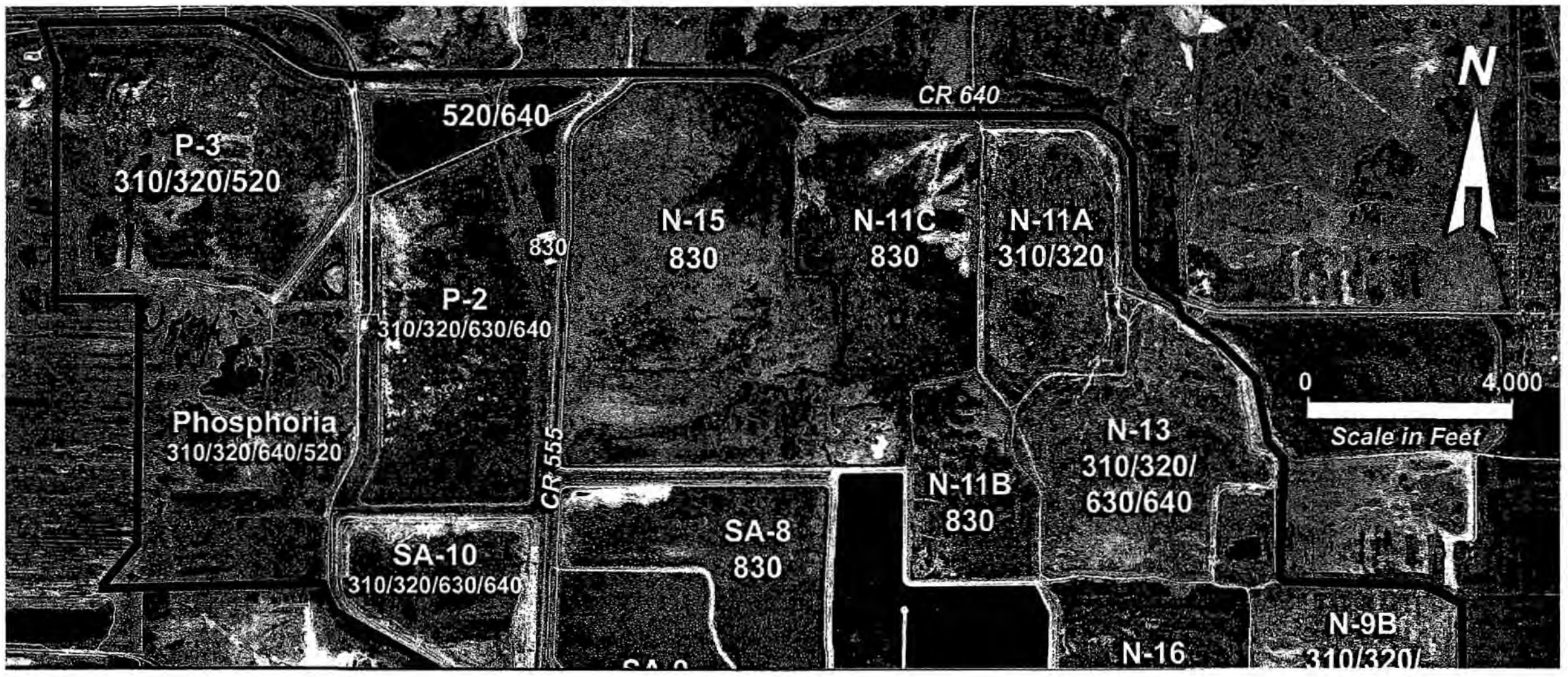
210	CROPLAND AND PASTURELAND
310	UPLAND HERBACEOUS
320	UPLAND SHRUB AND BRUSHLAND
400	UPLAND FORESTS
520	LAKES
630	WETLAND FORESTS
640	VEGETATED NON-FORESTED WETLANDS
830	UTILITIES

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FIGURE 2.3.5-1
VEGETATION / LAND USE MAP KEY

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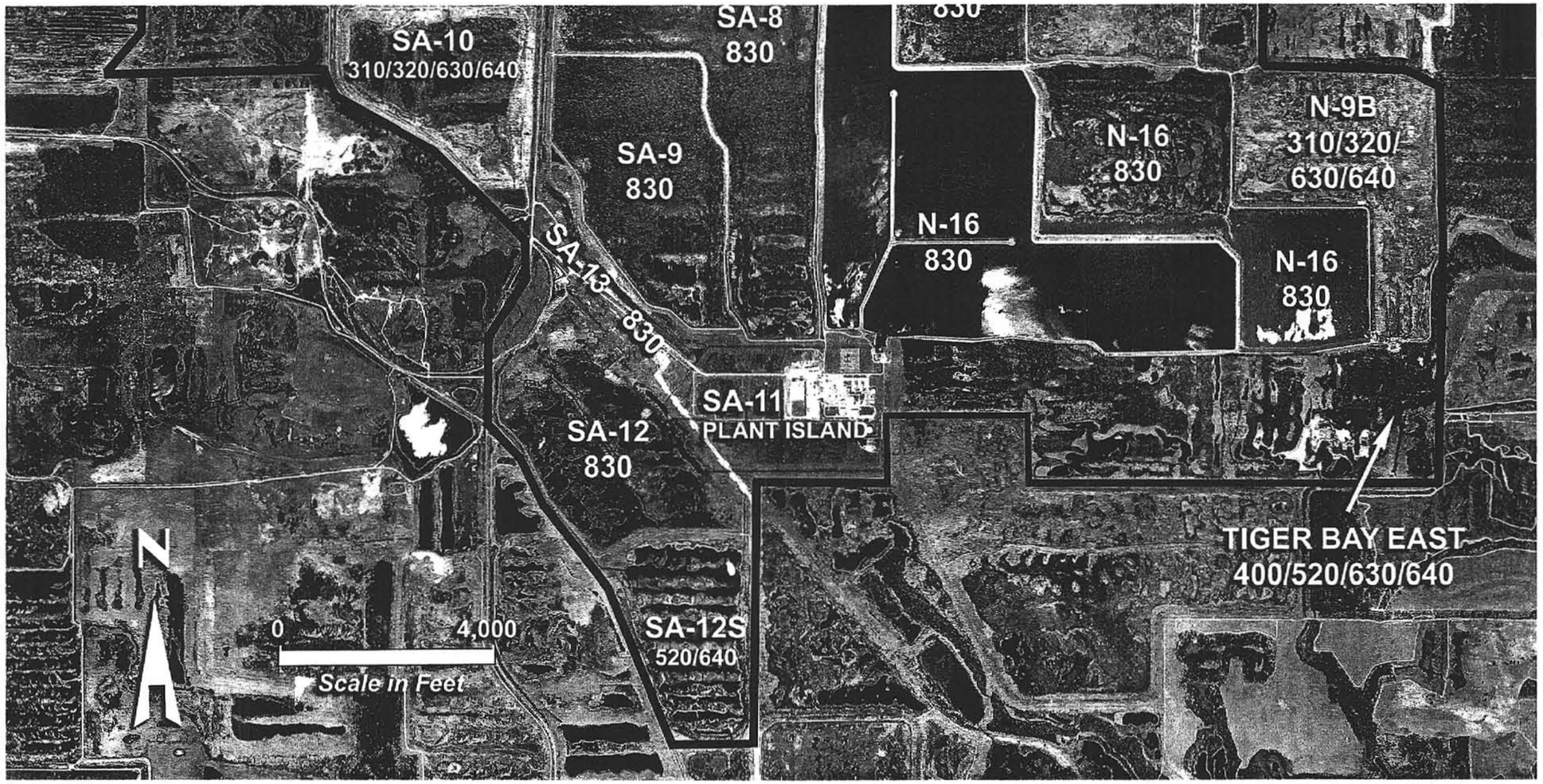


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FIGURE 2.3.5-1A
VEGETATION / LAND USE MAP
EXISTING CONDITIONS

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FIGURE 2.3.5-1B
VEGETATION / LAND USE MAP
EXISTING CONDITIONS

2.3.6 Ecology

As part of the 1994 Certification, vegetation and land use impacts for full site buildout were reviewed and approved. The permitted reclamation plans for unreclaimed portions of the Hines, as well as the condition of areas which were already reclaimed and released at the time, were set forth as the pre-development baseline to which project impacts would be compared. The overall Hines site development plan was then reviewed and approved on the basis of this analysis.

The status of important flora and fauna is highlighted in this section. Importance status is based upon species or assemblages of species which are:

- Threatened or endangered species by the U.S. Fish and Wildlife Service (FWS)
- Threatened or endangered species or species of special concern by the Florida Fish and Wildlife Conservation Commission (FFWCC) and Department of Agriculture and Consumer Services (DACS)

Game, furbearers, or fishery resources by the FFWCC

- Indicators of species that are endemic or unique to specific plant communities or habitat types
- Functionally dominant species in their vegetation communities or habitat types

The potential status of important species at the full build out has not changed from that described in the 1992 SCA.

2.3.6.1 Species - Environmental Relationships

AQUATIC SYSTEMS

BASELINE CONDITIONS. At full build out, the aquatic systems on the site will include Tiger Bay and the Buffer/Mitigation Areas N-9B and SA-10 as developed for mitigation. The Tiger Bay aquatic system was not involved in construction of Power Blocks 1 or 2 and a conservation easement over the Tiger Bay parcel has been deeded to the State. The aquatic systems in N-9B and SA-10 have been created and are progressing toward ecological success as designed.

Threatened and Endangered Species and Species of Special Concern. No state or federally threatened or endangered species, or species of special concern, are known to occur in the aquatic habitats associated with the Hines Energy Complex (50 CFR 17).

Freshwater Game or Commercial Fish. Sport and commercial hunting and fishing are currently not allowed on the Hines Energy Complex site.

Indicator and Endemic Species. There are no indicator species existing on the Plant Island because of a lack of aquatic habitat in that area. Indicator species likely occur in other areas of the site where naturally occurring vegetation communities occur. No endemic species likely occur on the site.

Species Significant to Local Ecological Systems. As discussed in Section 2.3-5, various areas of the Hines Energy Complex site have been developed or reclaimed to have aquatic habitats. These areas contain wetlands and species that are typical of central Florida ecological systems.

BASELINE TERRESTRIAL AND WETLAND CONDITIONS

SPECIES IMPORTANCE CRITERIA. Descriptions of expected vegetation community structure are presented in Section 2.3.5. Within these communities is the potential for occurrence of faunal and floral species which are of special importance. This special importance arises from species status as being either:

- Threatened, endangered, or species of special concern
- Indicator and endemic species
- Vertebrate species significant to local ecological systems

Threatened or Endangered Plant Species. Endangered, or federally threatened plants, whose ranges include the Hines Energy Complex, are listed in Table 2.3.6-1. For conservative evaluation purposes, consideration was given to species whose known occurrence is within a one county radius of Polk County. None of the species described in Table 2.3.6-1 have been found at the Hines Energy Complex. When ecological succession has progressed in the Buffer/Mitigation Areas, habitat for many of these species will develop in those areas.

Protected species importance is based on species lists of the U.S. FWS (50 CFR 17.11-12), the FFWCC (Section 39-27.003-005 F.A.C.), and the Florida Department of Agriculture and Consumer Services (DACS) (Preservation of Native Flora Act, Section 581.185-187, F.S.).

The summary status of protected plant species potentially occurring in the Polk County area and, therefore, at the Hines Energy Complex, is presented in Table 2.3.6-1. Review of the literature resulted in a total of 107 species that could potentially be present. Florida Natural Areas Inventory has documented the presence

of 38 protected species in Polk County. Suitable habitat as well as marginal habitat exists in the Hines Energy Complex site for 33 of the species listed.

Threatened, Endangered, or Species of Special Concern (Animals). Terrestrial vertebrate protected species status for the Hines Energy Complex based on habitats expected to exist following full buildout in the eastern Buffer/Mitigation Area is summarized in Table 2.3.6-2. Descriptions of habitat requirements, species range and other life history characteristics of protected vertebrate species potentially occurring at the Hines Energy Complex with existing certified baseline reclamation are given below. As the Buffer/Mitigation area fully develops and ecological succession progresses, habitat for many of these species is occurring. Habitats associated with the construction of Power Block 3 (i.e. cleared and graded land) are not suitable for occupation by protected species.

FLORIDA GOPHER FROG (*Rana capito*) has been recorded throughout most of Florida. Its most common habitat association is in and around gopher tortoise burrows. The preferred habitat is dry but near enough to grassy ponds for breeding. The gopher frog feeds upon insects and toads. Marginal habitat for the species currently exists on the Hines Energy Complex.

GOPHER TORTOISE (*Gopherus polyphemus*), a species of special concern in Florida, has large populations within the state. Species habitat includes dry, well-drained soils covered with a variety of upland pine and oak species, as well as old field vegetation communities. Vegetation cover is usually a habitat requirement. Gopher tortoises feed on grasses, leaves, and other herbaceous matter. This species excavates long burrows for its own use; however, a variety of other species also use these burrows for shelter such as the eastern indigo snake *(Drymarchon corais couperi*) and gopher frog. Some species use only tortoise burrows for life history needs (McDiarmid, 1978). Potential habitat for the gopher tortoise could develop in reclaimed upland areas of the Buffer/Mitigation Area of the Hines Energy Complex. Areas with flat topography and high wet season water table would limit burrowing habitat. Sandy soils versus soils with rock and solidified hard clays on the site will be preferred by the tortoise. The gopher tortoise was recorded on the site area prior to mining (FNAI files, Tallahassee, FL), but has not been observed during field inspections.

AMERICAN ALLIGATOR (*Alligator mississippiensis*), federally classified as threatened through its similarity in appearance to the American crocodile (*Crocodylus acutus*), and a species of special concern in Florida, has populations existing throughout the state and over much of the southeastern United States coastal plain. This species is found in nearly all wetland and aquatic habitat types in Florida. Food for the alligator includes aquatic and wetland vertebrates and larger invertebrates (McDiarmid, 1978). Potential habitat for this species following baseline reclamation in the area ranges from drainage canals to freshwater depression type wetlands, and ponds. Alligators were observed to be very common in former clay settling ponds on the site and should be expected in mitigation area aquatic and wetland systems.

SHORT-TAILED SNAKE (*Stilosoma extenuatum*) is found in Florida from the northeastern portion of the state south to Highlands County. This species is associated with xeric conditions of longleaf pine-turkey oak communities and in oak hammocks. Its natural history is poorly known (Ashton and Ashton, 1988). Habitat loss from timber operations and development are the primary reasons for its threatened status (McDiarmid, 1978). Habitat is not present on the Hines Energy Complex but will be of limited occurrence in the Buffer/Mitigation Area as ecological succession proceeds.

FLORIDA PINE SNAKE (*Pituophis melanoleucus mugitus*) is found throughout most of northern and eastern Florida. It occupies sandy habitats such as longleaf pine and turkey oak communities. The pine snake feeds upon small mammals, birds, and other small vertebrates (Ashton and Ashton, 1988). Habitat loss is the primary reason for its population decline and listing as a species of special concern. No habitat for this species is currently on the Hines Energy Complex. The Buffer/Mitigation Area will contain limited appropriate habitat as ecological succession proceeds.

EASTERN INDIGO SNAKE (*Drymarchon corais couperi*), classified as threatened by Florida and the federal government, is generally found in Florida and southeastern Georgia. Species habitat includes dry sandy areas, as well as moist vegetation communities. The indigo snake frequently uses gopher tortoise burrows as shelter in xeric habitats, in part to avoid desiccation. Food for this species includes a wide range of small upland vertebrates including other snakes (McDiarmid, 1978). Potential habitat for the indigo snake in the Hines Energy Complex area exists in pine flatwoods and pine and wet prairies and would be present following the Buffer/Mitigation Area reclamation. No indigo snakes were observed at the Hines Energy Complex. The indigo snake has been observed in several areas of Polk County prior to mining (FNAI, 1992). Habitat in the mitigation areas should be suitable for this species.

BLUE-TAILED MOLE SKINK (*Eumeces egregius lividus*) occurs on the Lake Wales Ridge in Polk and Highlands Counties. Its habitat is sand pine and scrub where it burrows in the St. Lucie Fine Sand. Occasionally, it is found in the turkey oak vegetation community. This species consumes small invertebrates such as roaches, spiders, and crickets. Habitat loss is reason for its threatened status (McDiarmid, 1978). The Hines Energy Complex currently lacks habitat for this species. The Buffer/Mitigation Areas include limited and marginal habitat that might be suitable for the species.

WOOD STORK (*Mycteria americana*) is considered endangered in Florida with nesting colonies occurring in South Carolina, southeastern Georgia and Florida. Nesting and feeding occur in freshwater wetlands and brackish mangrove swamps. Food for this species includes small fish usually obtained from shallow water. Inland nesting is frequently in large cypress trees while mangrove islands provide nesting habitat in estuarine and marine environments (Kale, 1978). Shallow open water and isolated marshlands represent potential feeding habitat for the wood stork in the Hines Energy Complex area,

particularly under low water conditions when fish are concentrated. This habitat exists along ditches, in depressions and in shallow areas on clay settling ponds. Wood storks have been observed feeding in these habitats on the Hines Energy Complex. No suitable freshwater swamp-nesting habitat was found to occur at or near the Hines Energy Complex. Wood storks were observed feeding in off-site reclaimed wetlands and adjacent ponds. The Buffer/Mitigation Areas include limited feeding habitat that should be suitable for the species.

SOUTHERN BALD EAGLE (*Haliaeetus leucocephalus*), considered threatened by the State of Florida and endangered by the federal government, occurs throughout the state; however, nesting is concentrated in north central counties and along coastal portions of Charlotte, Lee, Collier, Monroe, and Dade Counties. Nesting usually occurs near feeding areas along shorelines and over shallow water bodies. Nests are solitary and are usually in tall pine or cypress trees often with good visibility over the surrounding countryside. Although fish are this species' primary food source, other vertebrate prey may be captured (Kale, 1978). Feeding habitat for this species includes clay settling ponds and marshlands that occur now and will occur following reclamation. The potential for nesting at the Hines Energy Complex is low now but increases ecological succession in of the Buffer/Mitigation Area reclamation.

SOUTHEASTERN AMERICAN KESTREL (*Falco sparverius paulus*), considered threatened by the State of Florida, is an open habitat bird preferring open pine forest and clearings with dead trees. However, it can also be found along the open edges of river bottoms, coastal regions, suburban areas, and even in large cities. Large insects are the primary food item with small rodents and reptiles also being important prey items. *Falco sparverius paulus* ranges from South Carolina south to southern Alabama and Florida with recent observations indicating that the Florida population is declining (Kale, 1978). Kestrels were observed occasionally at the Hines Energy Complex during the winter surveys, but not during the breeding season surveys. Habitat for this species will be present with Buffer/Mitigation Area as ecological succession occurs.

OSPREY (*Pandion haliaetus*) occurs at and near rivers, lakes and wetlands throughout the state. The population in the Keys is listed as a species of special concern. It has received consideration here because of its protected status elsewhere in the state, its previous decline due to chlorinated insecticides, and its high level position in the food chain. The osprey nests on tall structures near feeding areas or near the ground on islands with low predator populations (Kale, 1978). The species feeds upon fish. Osprey occupies the Hines Energy Complex during all seasons. Nesting pairs have occupied nest platforms in Tiger Bay regularly during the breeding season.

FLORIDA SANDHILL CRANE (*Grus canadensis pratensis*) is classified as threatened in Florida and ranges from extreme southeastern Georgia (Okefenokee Swamp) southward through peninsular Florida, becoming scarce in Monroe and Dade Counties. The preferred habitat includes wet prairies, marshy lake

margins, and low-lying improved cattle pastures. Nesting activity is related to water level with eggs hatching normally in March and April. Sandhill cranes feed on a wide range of plants. Besides eating various grains, they consume herbaceous foliage, underground stems, tubers, and roots. Invertebrates such as grasshoppers, beetles, caterpillars and snails along with certain amphibians and mammals make up the bulk of the animal portion of its diet (Kale, 1978). Suitable feeding habitat exists in Tiger Bay and in the mitigation areas. No sandhill cranes were observed on the Hines Energy Complex.

LIMPKIN (*Aramus guarauna*), a species of special concern in Florida, can be found throughout peninsular Florida where they favor slow-moving freshwater rivers and streams, marshes and lakeshores. Nesting in Florida probably occurs year round and corresponds with the availability of foods. Various snails along with other freshwater mussels are the limpkin's primary foods. Lizards, insects, frogs and worms are eaten in lesser amounts (Kale, 1978). Suitable limpkin habitat was present at the Hines Energy Complex, however, this species was not observed. The lack of slow moving open watercourses now and within Buffer/Mitigation Area reclamation limits the opportunity for limpkin usage.

LITTLE BLUE HERON (*Egretta caerulea*), a Florida species of special concern, breeds along much of the Atlantic and Gulf coasts. In Florida, they range from the panhandle south to the Florida Keys. Cypress (*Taxodium distichum*), southern willow (*Salix caroliniana*), red mangrove, black mangrove, cabbage palm (*Sabal palmetto*), and Brazilian pepper are among the more common trees used during the breeding season which, in Florida, spans the months of February to September. These tree species occur in habitats ranging from fresh to saltwater. Little blue herons prefer to forage in freshwater habitats for the crustaceans, insects, small fish, frogs and lizards, which form the major portion of their diet (Kale, 1978). Suitable nesting and feeding habitat occurs in the Buffer/Mitigation Area.

SNOWY EGRET (*Egretta thula*), a Florida species of special concern, is typically restricted to coastal areas. It is found from Maine to Florida along the Atlantic Coast and to Texas along the Gulf. This small white egret nests in both inland and coastal colonies throughout peninsular Florida, but only rarely in western Florida. The largest nesting colonies occur in coastal estuarine habitats often in association with tricolor heron. Woody species typically chosen for nest sites include mangroves, willow, buttonbush, and wax myrtle stands. Small fish and various invertebrates are among the more common food items. Feeding habitat and nesting for the snowy egret exists in the Hines Energy Complex Buffer/Mitigation Area.

TRICOLORED HERON (*Egretta tricolor*) is classified as a species of special concern in Florida. In peninsular Florida, this large wader is most commonly found in estuarine colonies and only occasionally in freshwater habitats. Mangroves, willow, buttonbush, marsh elder, and wax myrtle are among the more common woody species used for nesting. Small fish are the primary food source while a variety of invertebrates are also consumed to a lesser extent. Nesting habitat for the tricolored heron occurs within

the Hines Energy Complex as noted for the little blue heron above. Suitable feeding habitat is present in the Buffer/Mitigation Area.

LEAST TERN (*Sterna albifrons*) occurs in coastal areas throughout the state. Nesting colonies have occurred at widely scattered inland locations. The tern has nested near Polk County in both Lake and Highlands Counties. Nesting generally occurs on open flat sandy areas. Feeding habitat includes aquatic areas where they feed upon small fish (Kale, 1978). The Hines Energy Complex may be sparingly used by this species for feeding. It could be used in a similar fashion in the Buffer/Mitigation Area until sand deposits and open water habitats revegetate. Habitat loss and human disturbance are the reasons for its listing as a threatened species. Habitat for this species is limited on the site.

WHITE IBIS (*Eudocimus albus*), is a species of special concern as listed by the FFWCC. It nests along with other medium-sized wading birds in forest and shrub areas standing in water or in the same vegetation structure on small islands surrounded by relatively large distances of open water. The species feeds in wetlands and on moist grasslands. The white ibis feeds in the Hines Complex mitigation wetlands.

FLORIDA PANTHER (*Felis concolor coryi*), is a species considered endangered by both the State of Florida and the FWS. In Florida, this species is generally found in large undeveloped lands in the central parts of the state southward. It feeds primarily on large mammals, such as deer, rabbits, raccoons, etc. It may be diurnally active. The Florida panther has a large home range and may travel extensively up to 25 miles in a given night (Whitaker, 1980). Unofficial observations of the species were historically reported at the Hines Energy Complex in the area between N-15 and SA-8. No tracks of the species could be found in either instance. Several subsequent trips to the Hines Energy Complex, to locate tracks and scat of this species, did not result in any panther evidence. The FNAI files show no records of the panther in the region.

SHERMAN'S FOX SQUIRREL (*Sciurus niger shermani*), a Florida species of special concern, prefers the longleaf pine-turkey oak vegetation association of the sandhills. However, smaller numbers are known to occupy certain ecotonol situations. Among these transition areas are areas where range includes much of peninsular Florida east of the Suwannee River and north of Lake Okeechobee. Pine seeds and acorns along with a few insects are the primary food items (Layne, 1978). Suitable habitat does not exist on the Hines Energy Complex. However, it could possibly exist in the Buffer/Mitigation Area as mature forestlands develop.

Indicator and Endemic Vertebrate Species. No animal species endemic to Florida are likely to require habitats associated with the electrical generation facilities on the Hines Energy Complex. With ecological succession in the Buffer/Mitigation Area, indicator species are likely to be in the reclaimed native

vegetation communities. The following indicator species characteristic of a given habitat type may use this are in the future:

- Eastern Meadowlark - Pasture and Rangeland
- Marsh Rice Rat – Herbaceous/Shrub Wetlands
- Bullfrog - Open Water, Herbaceous Wetlands
- Pig Frog - Open Water, Herbaceous Wetlands
- Southern Leopard Frog - Open Water, Herbaceous Wetlands
- Southern Cricket Frog - Ponds, Herbaceous Wetlands
- American Alligator - Ponds, Herbaceous Wetlands, and Forested Wetlands

Vertebrate Species Important to Local Ecological Systems. The importance of vertebrate species to ecological systems on the Hines Energy Complex will be based upon roles species play in the local food chains and their ability to impact this energy flow by virtue of their numbers present.

Seasonal shifts in faunal ecosystem roles can complicate site food chain characteristics. For example, breeding, migratory and wintering birds differ seasonally in their food requirements and use of site habitats. Additionally, during the dry season, when many site wetland areas dry out for several months, these areas take on terrestrial characteristics. Consequently, habitat availability for species changes during the course of a year.

Reptilian species that may be most prominent at the Hines Energy Complex could include the following: black racer, skinks (Genus *Eumeces*), common garter snake and eastern diamondback rattlesnake in upland areas. In site wetlands, the American alligator, cooters, and water snakes (*Nerodia* spp.) are expected to be most abundant.

The following discussion of avian species important to local ecological systems focuses on winter and breeding season populations. During these periods of time, species populations are, at least in part, directly dependent on site habitats for food, cover and other life history requirements. During migratory seasons avian populations have less of a dependence upon site resources. The ecological effects of all species of migratory birds likely influence populations of most site biota.

Birds significant to local ecological systems are generally those with larger population densities or those considered being upper and top carnivore species. Upper and top carnivore species include raptors, shrikes, and large wading birds. For most of the smaller migratory bird species, dietary shifts occur in preparation for migration and winter occupation (when high energy content foods such as grains are required) and for nesting (when higher protein content foods are required for egg production and nestling growth). During the breeding season, therefore, many of these migratory species, position in the food

chain will rise with more carnivorous diets and in the other seasons fall at times when more herbivorous or graniverous diets are required.

Large wading bird use of the Hines Energy Complex with baseline reclamation conditions would be restricted generally to shallow ditches and open isolated wetlands with standing water. Red-tailed and red-shouldered hawks would be observed throughout the open and forested portions of the Hines Energy Complex respectively. Red-shouldered hawks would be observed more often in and near forested habitats. Red-tailed hawks would be more often observed foraging in open pine flatwoods and pastureland and rangelands. The northern harrier would occur, foraging over open low vegetation in large dry wet prairies, rangelands and pasturelands, as they are present. Loggerhead shrikes would most frequently be observed in pastures and pine flatwoods. In the larger open water habitats in the Buffer/Mitigation Area, waterfowl including ducks, coots, common moorhens, double-crested cormorants, white and brown pelicans and anhingas would dominate the food chain systems at the upper trophic levels.

Confirmed indications of top or upper carnivore species presence at the Hines Energy Complex have been that of the bobcat and fox. These species are likely to be present at the Hines Energy Complex with future ecological succession in the Buffer/Mitigation Area. The occurrence and food chain status of mammals at the site are presented in the 1992 SCA.

In wetlands, streams, and open water habitats, river otters would likely be the most prominent mammals. Elsewhere, where there is adequate cover, an assortment of medium-sized mammals occurs at the Hines Energy Complex and is likely to occur in the Buffer/Mitigation Area with ecological succession. These include raccoons, opossum, armadillos, and bobcats. The white-tailed deer should also be present. In addition to the bobcat as a top carnivore, the gray and red fox could be present in adequate numbers to significantly influence the food chain. Other species that could be present include the eastern cottontail and marsh rabbits, and striped skunks. Small mammals that could be present include several rodents and shrews.

2.3.6.2 Pre-existing Stresses

Pre-existing stresses for this discussion consist of environmental disturbances that would occur under full build out conditions as approved in the 1994 Certification. Generally, stresses that would be expected at the Hines Energy Complex result from the effects of human activity associated with certified electrical generation.

Effects of human activity will result from certified electrical generation and will be generally restricted to site areas outside of the Buffer/Mitigation Area. These activities will include noise generated from the

facility and the movement of vehicles and machinery used in the operation of the facility. The primary area on the Hines Energy Complex where human activity will occur is in the Plant Island.

2.3.6.3 Measurement Program

Methods associated with the 1992 SCA aquatic ecology studies and terrestrial and wetlands ecological studies are described in Section 2.3.6.3 of the 1992 SCA. Two types of data are addressed in these studies: a general characterization of existing conditions and a more detailed evaluation of site conditions proposed with conclusion of mining operations and implementation of existing approved (pre-1992) reclamation plans. Because the Buffer/Mitigation Area reclamation process is on schedule and land to be used for development of Power Block 3 has already been cleared, no special ecological surveys were needed for this SSCA.

2.3.6.4 References

Ashton, R. E. Jr. and P. S. Ashton. 1985. Handbook of Reptiles and Amphibians of Florida - Part Two- Lizards, Turtles and Crocodilians. Windward Publishing, Inc. Miami, Florida.

Ashton, R. E. Jr. and P. S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida - Part One- The Snakes. Windward Publishing, Inc. Miami, Florida

Ashton, R. E. Jr. and P. S. Ashton. 1988. Handbook of Reptiles and Amphibians of Florida - Part Three- The Amphibians. Windward Publishing, Inc. Miami, Florida

Behler, J. L., and F. W. King. 1979. The Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf. New York, New York.

Borror, D. J., D. M. De Long, C. A. Triplehorn. 1981. An Introduction to the Study of Insects. Saunders College Publishing: Philadelphia, Pennsylvania.

Brigham, A. R., W. V. Brigham, and A. Gnilka, eds. 1982. Aquatic Insects and Oligochaetes of North and South Carolina. Midwest Aquatic Enterprises. Mahomet, Illinois.

Brinkhurst R. O. 1986. Guide to the Freshwater Aquatic Microdile Oligochaetes of North America. Canadian Special Publication of Fisheries and Aquatic Sciences.

Brown, H. P. 1972, Aquatic Dryopoid Beetles of the U.S. Biota of Freshwater Ecosystems. Identification Manual No. 6. USEPA EP 2.10:18050 ELD04/76(6).

Burch, J. B. 1982. Freshwater Snails (Mollusca) Gastropoda of North America. EPA 600/3-82-026

Carlander, K. D. 1969. Handbook of Freshwater Fishery Biology. Volume One: Iowa State: University Press. Ames, Iowa.

Carlander, K. D. 1977. Handbook of Freshwater Fishery Biology. Volume Two. Iowa State University Press. Ames, Iowa.

Carr, A., and C. J. Goin. 1959. Guide to the Reptiles, Amphibians and Freshwater Fishes of Florida. University of Florida Press., Gainesville, Florida.

Conard, H. S. 1969. Plants of Central Florida. Ridge Audubon Society. Lake Wales, Florida.

Crowder, J.P. 1974. The Freshwater Fishes and Fisheries of South Florida. U.S. Fish and Wildlife Service. NTIS PB-231-631.

Duncan, W. H., and M. B. Duncan. 1988. Trees of the Southeastern United States. University of Georgia Press. Athens, Georgia.

Duncan, W. H., and L. E. Foote. 1975. Wildflowers of the Southeastern United States. University of Georgia Press. Athens, Georgia.

Edelson, N. A. and M. W. Collopy. 1990. Foraging Ecology of Wading Birds Using an Altered Landscape in Central Florida. Publication No. 04-039-087. Florida Institute of Phosphate Research. Bartow, Florida.

Fisher, A. K. 1983. Hawks and Owls of the United States. U.S. Department Agriculture. Bull. No. 3.

Florida Fish and Wildlife Conservation Commission. 1997. Florida's endangered species, threatened species and species of special concern. Gainesville, Florida.

Florida Natural Areas Inventory. 1997. Species and Natural Community Summary for Polk County. www.fnai.org

Florida Power Corporation. 1992. Polk County Site. Site Certification Application.

Godfrey, R. K., and J. W. Wooten. 1979. Aquatic and Wetland Plants of the Southeastern United States - Monocotyledons. University of Georgia Press. Athens, Georgia.

Godfrey, R. K., and J. W. Wooten. 1981. Aquatic and Wetland Plants of the Southeastern United States - Dicotyledons. University of Georgia Press. Athens, Georgia.

Hobbs, H. 1942. Crayfishes of Florida. University of Florida Biota Sciences Series. 3(2):1-17.

Kahl, M. P., Jr. 1964. Food Ecology of the Wood Stork (Mycteria americana) in Florida, Ecol. Monogr. 34:97-117.

Kale, H. W. III, ed. 1978. Rare and Endangered Biota of Florida. In: P.C.H. Pritchard, series ed. Vol. II - Birds. University Presses of Florida. Gainesville, Florida.

Kale, H. W. III, and D. S. Maehr. 1990. Florida's Birds. Pineapple Press. Sarasota, Florida.

Lakela, O., and R. W. Long. 1976. Ferns of Florida. Banyan Books. Miami, Florida.

Lakela, O., and R. P. Wunderlin. 1980. Trees of Central Florida. Banyan Books: Miami, Florida.

Layne, J. N., ed. 1978. Rare and Endangered Biota of Florida. In: P.C.H Pritchard, series ed. Vol. I - Mammals. University Presses of Florida Gainesville, Florida.

Lee, D. S., C. R. Gilbert, C. H. Hocutt, R. E. Jenkins, D. E. McAllister, and J. R Stauffer, Jr. 1980. Atlas of North American Freshwater Fishes. North Carolina State Museum of Natural History. Raleigh, North Carolina.

Lellinger, D. 1985. A Field Manual of the Ferns and Fern Allies. Smithsonian Institution Press. Washington, D.C.

Loftus, W. F. and J. A. Kushlan. 1987. Freshwater Fishes of Southern Florida. Bulletin of the Florida State Museum, Biological Sciences 31(4):147-344.

Long, R. W., and O. Lakela. 1978. Flora of Tropical Florida. Banyan Books. Miami, Florida.

Martin, A. C., H. S. Zim, and A. L. Nelson. 1961. American Wildlife and Plants, A Guide to Wildlife Food Habits. Dover Publications. New York, New York.

Merritt, R. W., and K. W. Cummins. 1984. An Introduction to the Aquatic Insects of North America. 2nd ed. Kendal/Hunt Publishing Company. Dubuque, Iowa.

Pennak, R. W. 1978. Freshwater Invertebrates of the United States. John Wiley and Sons. New York, New York.

Radford, A. E., H. E. Ahles, and C. Ritchie Bell. 1968. Manual of the Vascular Flora of the Carolinas. The University of North Carolina Press. Chapel Hill, North Carolina.

Whitaker, J. O. 1980. The Audubon Society Field Guide to North American Mammals. Alfred A. Knopf. New York, New York.

Wunderlin, R. P. 1982. Guide to the Vascular Plants of Central Florida University Presses of Florida. Gainesville, Florida.

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Table 2.3.6-1

PROTECTED PLANT SPECIES POTENTIALLY OCCURRING IN THE HINES ENERGY COMPLEX

Scientific Name	Common Name	Designated Status FDAC	Designated Status USFWS	Habitat	Hines Energy Complex
Adiantum tenerum	Brittle maidenhair fern	E		Sinkholes, grottos, limestone ledges	Habitat not present
Andropogon arctatus	Pinewood bluestem	T		Flatwoods	Habitat not present
Aristida simpliciflora	Southern three-awn	E		Moist pine woods and fields	Habitat marginal, species not found
Asclepias curtissii *	Curtiss milkweed	E		Dry hammocks, scrub, flatwoods	Habitat not present
Asplenium auritum	Auricled spleenwort	E		Trunks of large trees in hammocks and strand swamps	Habitat marginal, species not found
Asplenium verecundum	Delicate spleenwort	E		Limestone in grottos and boulders in shaded woods	Habitat not present
Blechnum occidentale	Sinkhole fern	E		Sinkholes in forests	Habitat not present
Bonamia grandiflora *	Florida bonamia	E	T	Sandy soil and scrub	Habitat not present
*Calamintha ashei**	Ashe's calaminth	T		Dry pinelands and sand pine scrub	
Calopogon mutliflorus	Many-flowered grass pink	E	T	Pine flatwoods	Habitat not present
Carex chapmanii	Chapman's sedge	E		Hammocks and woodlands	Habitat marginal, species not found
*Centrosema arenicola**	Sand butterfly pea	E		Mixed woodlands, pine or oak palmetto thickets	Habitat marginal, species not found
Chionanthus pygmaeus *	Pigmy fringetree	E	E	Scrub	Habitat not present
Chrysopsis floridana	Florida golden aster	E	E	Sand pine scrub on bare sand	Habitat not present
Cladonia perforata	Florida perforate	E		Rosemary sandhills	Habitat not present
*Clitoria fragrans**	Pigeon wings	E	T	Sandhills, scrub, scrubby flatwoods, roadsides	Habitat marginal, species not found
Coelorachis tuberculosa	Florida jointtail	T		Marshes and margins of ponds	Habitat present, species not found
*Conradina brevifolia**	Short-leaved rosemary	E	E	Sand pine scrub of the Lake Wales Ridge	Habitat not present
*Crotalaria avonensis**	Avon Park harebells	E	E	Bare white sand of the Lake Wales Ridge	Habitat not present
Ctenitis sloanei syn. Dryopteris ampla	Red-hair comb fern	E		Limestone ledges and rockland hammocks, cypress swamps	Habitat not present
Ctenitis submarginalis syn. Thelypteris submarginalis	Brown-hair comb fern	E		Cypress swamps, rockland hammocks, spoil banks	Habitat marginal, species not found
Dicerandra christmanii	Christmas mint	E	E	Yellow sand and oak scrub	Habitat not present
*Dicerandra frutescens**	Scrub mint	E	E	Yellow sand in sand pine scrub	Habitat not present
*Drosera intermedia**	Water sundew	T		Wet flatwoods and depression marshes	Habitat marginal, species not found
Eltroplectris calcarata syn. Centrogenium setaceum	Spurred neottia	E		Dense hammocks	Habitat not present
Epidendrum difforme syn. Neolehmannia difformis	Umbelled epidendrum	E		Hammocks	Habitat not present
Eriogonum floridanum	Scrub buckwheat	E		Sandhills, scrub, long leaf pine, Lake Wales Ridge	Habitat not present
*Eryngium cuneifolium**	Scrub celery	E	E	Sand pine scrub	Habitat not present
Eulophia ecristata syn. Pteroglossaspis ecristata*	Non-crested eulophia	T		Sand pine scrub, sandhills	Habitat not present
Garberia heterophylla	Garberia	T		Scrub and prairies	Habitat marginal, species not found
Gossypium hirsutum	Wild cotton	E		Coastal hammocks, shell mounds,	Habitat not present

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Scientific Name	Common Name	Designated Status FDAC	USFWS	Habitat	Hines Energy Complex
Habenaria distans	Distans habenaria	E		Hydric hammocks, strand swamps	Habitat marginal, species not found
Harrisella filiformis	Threadroot orchid	T		Orange groves, strand swamp, hardwood swamps, hammocks	Habitat present, species not found
*Hartwrightia floridana**	Hartwrightia	T		Wet flatwoods, bogs, pine woods	Habitat not present
*Hypericum cumulicola**	Highland's scrub	E	E	Sand pine scrub	Habitat not present
*Hypericum edisonianum**	Edison ascyrum	E		Marsh, wet prairie, wet flatwoods	Habitat present, species not found
Hexalectris spicata	Crested coralroot (orchid)	E		Hammock	Habitat marginal, species not found
*Illicium parviflorum**	Star anise	E		Bottomland forest, wet hammocks	Habitat not present
Justicia cooleyi	Cooley's water willow	E	E	Moist hammock, rocky woods	Habitat marginal, species not found
Lantana depressa	Pineland lantana	E		Pine rockland, coastal strand, marl prairies	Habitat not present
*Lechea cernua **	Nodding pinweed	T		Scrub	Habitat not present
*L. divaricata**	Pine pinweed	E		Pinelands	Habitat marginal, species not found
*Liatris ohlingerae **	Scrub blazing star	E	E	Sand pine scrub, Lake Wales Ridge	Habitat not present
Lilium catesbaei	Catesby lily	T		Wet flatwoods	Habitat not present
Liparis nervosa	Tall twayblade orchid	E		Cypress swamps, hammocks	Habitat not present
Listera australis	Southern twayblade	T		Moist woods, stream banks	Habitat present, species not found
Litsea aestivalis	Pond-spice	E		Margins of ponds, bayheads, hammocks in cypress swamps	Habitat present, species not found
Lobelia cardinalis	Cardinal flower	T		Springs, coastal hammocks	Habitat not present
*Lupinus aridorum **	Scrub lupine	E	E	Sand pine scrub	Habitat not present
Matelea floridana syn. Odontostephana floridana*	Florida spiny pod	E		Bluffs, pine-oak-hickory woods	Habitat not present
Matelea gonocarpus	Angle-pod	T		Floodplains	Habitat not present
Matelea pubiflora	Sandhill spiny pod	E		Sandhills, scrub	Habitat not present
Maytenus phyllanthoides	Mayten	T		Hammocks	Habitat not present
Monotropa hypopitys syn. Hypopitys monotropa	Pine-sap	E		Upland woods	Habitat marginal, species not found
Monotropa reynoldsiae	Pygmy-pipes	E		Grows on *Cornus florida* roots	Habitat not present
Najas filifolia	Slender naiad	T		Submerged in water	Habitat present, species not found
*Nemastylis floridana**	Celestial lily	E		Marshes, wet pine flatwoods	Habitat present, species not found
*Nolina brittoniana **	Scrub beargrass	E	E	Sand pine scrub, dry pine	Habitat not present
*Ophioglossum palmatum * syn. Cheiroglossa palmatum*	Hand fern	E		Epiphyte on Sabal palm in hydric hammocks and strand swamps	Habitat not present
*Panicum abscissum**	Cut throat grass	E		Wet pinelands	Habitat not present
*Paronychia chartacea **	Paper nailwort	E	T	Scrub	Habitat not present
Peperomia humilis	Peperomia	E		Maritime hammocks, upland hardwood, swamp	Habitat present, species not found
Pharus glaber	Creeping leafstalk grass	E		Dry woods and rocky hammocks	Habitat marginal, species not found
Pinguicula caerulea	Blue butterwort	T		Pine flatwoods, roadsides	Habitat marginal, species not found
Pinguicula lutea	Yellow butterwort	T		Pine flatwoods, roadsides	Habitat marginal, species not found
Platanthera integra syn. Habenaria integra*	Orange rein orchid	E		Boggy depressions in wet woods	Habitat not present
Platanthera blephariglottis, P. ciliaris, P. cristata, P. flava, P. nivea	Orchids	T		Marshes, meadows, pine savannahs, wet prairies	Habitat present, species not found

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PROTECTED PLANT SPECIES POTENTIALLY OCCURRING IN THE HINES ENERGY COMPLEX

Scientific Name	Common Name	Designated Status FDAC	Designated Status USFWS	Habitat	Hines Energy Complex
Pogonia ophioglossoides	Rose pogonia	T		Meadows, swamps, flatwoods	Habitat present, species not found
Polygala lewtonii *	Scrub milkwort	E		Dry oak, sand pine scrub	Habitat not present
*Polygonella. basiramia * syn. P. ciliata*	Wireweed	E	E	Sand pine and rosemary scrub	Habitat not present
*Polygonella myriophylla**	Sand lace	E	E	Scrub	Habitat not present
Polypodium dispersum, P. plumula, P. ptilodon	Polypodies	E		Hammocks	Habitat not present
Polystachya concreta syn. P. flavescens	Pale-flowered polystachya	E		Strand swamps	Habitat marginal, species not found
*Prunus geniculata**	Scrub plum	E	E	Sand pine scrub	Habitat not present
Sarracenia minor	Hooded pitcher plant	T		Flatwoods, bogs, ditches	Habitat marginal, species not found
*Salix floridana**	Florida willow	E		Wet hammocks, dense bottomland forest, swamps	Habitat present, species not found
*Schizachyrium niveum**	Scrub bluestem	E		Rosemary scrub	Habitat not present
Schwalbaca americana	Chaffseed	E	E	Pinelands, savannahs	Habitat marginal, species not found
Spigelia loganioides syn. Coelostylis loganioides	Levy pinkroot	E		Swamps, wet woods	Habitat present, species not found
Spiranthes brevilabris syn. S. gracilis	Small ladies' tresses	E		Pine flatwoods	Habitat not present
Spiranthes laciniata, S. longilabris, S. tuberosa	Ladies' tresses	T		Swamp, marshes, flatwoods	Habitat present, species not found
Spiranthes ovalis syn. Ibidium ovale	Lesser ladies' tresses	E		Moist shady wood thickets, swamp margins	Habitat present, species not found
Stenorrhynchos lanceolatus	Leafless beaked orchid	T		Pastures, pine flatwoods	Habitat not present
*Stylisma abdita**	Hidden stylisma	E		Dry pinelands, scrub	Habitat not present
Thelypteris serrata	Dentate lattice fern	E		Pond apple and popash hammocks, guava groves, cypress swamps	Habitat not present
Tillandsia balbisiana, T. flexuosa	Wild pine (airplants)	T		Hammocks, cypress swamps, scrub	Habitat not present
Tillandsia utriculata	Giant wild pine	E		Hammocks, cypress swamps, pinelands	Habitat not present
Triphora craigheadii, T. latifolia	Orchids	E		Hammocks	Habitat not present
Triphora trianthophora	Three-birds orchid	T		Hammocks	Habitat not present
Verbena tampensis	Tampa vervain	E		Flatwoods, hammocks	Habitat not present
Vicia ocalensis	Ocala vetch	E		Banks of thickets and marshes	Habitat present, species not found
*Warea amplexifolia**	Clasping warea	E	E	Dry pine, sandhills	Habitat not present
*Warea carteri**	Carter's mustard	E	E	Scrub, sandhills, pinelands	Habitat not present
Zephynanthes atamasco, Z. simpsonii, Z. treatiae*	Zephyr lilies	T		Moist woods, pastures, meadows	Habitat marginal, species not found
*Ziziphus celata**	Scrub ziziphus	E	E	Sand pine scrub, long leaf pine	Habitat not present

FDAC = Florida Department of Agriculture and Consumer Services
USFWS = U.S. Fish and Wildlife Service
E = Endangered
T = Threatened
* = Recorded as present in Polk County by Florida Natural Areas Inventory. December 1997.

Table 2.3.6-2

PROTECTED ANIMAL SPECIES POTENTIALLY OCCURRING IN THE HINES ENERGY COMPLEX

Common Name	Scientific Name	Designated Status FDAC	USFWS	Habitat	Hines Energy Complex
GOPHER FROG	*Rana capito*	SSC		Dry areas near grassy ponds	Habitat present, species not found
GOPHER TORTOISE	*Gopherus polyphemus*	SSC		Dry well-drained soils suitable for burrow construction	Habitat present, species not found
AMERICAN ALLIGATOR	*Alligator mississippiensis*	SSC	T(S/A)	Aquatic and wetland habitats	Habitat present in Complex including mitigation area
SHORT-TAILED SNAKE	*Stilosoma extenuatum*	T		Xeric hammocks	Habitat marginal, species not found
EASTERN INDIGO SNAKE	*Drymarchon corais couperi*	T	T	Dry to wetland conditions	Habitat present, species not found
SAND SKINK	*Neoseps reynoldsi*	T	T		
BLUE-TAILED MOLE SKINK	*Eumeces egregius lividus*	T	T	Sand pine scrub	Habitat marginal, species not found
WOOD STORK	*Mycteria americana*	E	E	Fresh-water wetlands	Habitat present onsite including mitigation area; species present in Complex
FLORIDA GRASSHOPPER SPARROW	*Ammodramus savannarum*	E	E	Palmetto prairie	Habitat not present
SOUTHERN BALD EAGLE	*Haliaeetus leucocephalus*	T		Open water bodies and wetlands	Habitat present onsite including mitigation area; species present in Complex
SOUTHEASTERN AMERICAN KESTREL	*Falco sparverius paulus*	T		Open upland habitats with perches	Habitat marginal, species not found
PEREGRINE FALCON	*Falco peregrinus*	T		Open water bodies and wetlands	Habitat present, species not found
OSPREY	*Pandion haliaetus*	SSC		Open water bodies and wetlands	Habitat present onsite including mitigation area; species present in Complex
FLORIDA SANDHILL CRANE	*Grus canadensis pratensis*	T		Wetlands, open habitats	Habitat present, species not found
LIMPKIN	*Aramus guarauna*	SSC		Wetlands and riverine systems	Habitat present, species not found
WHITE IBIS	*Eudocimus albus*	SSC		Wetlands, open moist habitats	Habitat present onsite including mitigation area; species present in Complex
LITTLE BLUE HERON	*Egretta caerulea*	SSC		Wetlands	Habitat present onsite including mitigation area; species present in Complex
SNOWY EGRET	*Egretta thula*	SSC		Wetlands	Habitat present onsite including mitigation area; species present in Complex
TRICOLORED HERON	*Egretta tricolor*	SSC		Wetlands	Habitat present onsite including mitigation area; species present in Complex
LEAST TERN	*Sterna albifrons*	SSC		Open calm waters, protected sandy areas with little vegetation	Nesting habitat not present, species not observed
SNAIL KITE	*Rhynchops niger*	E	E	Open wetlands with apple snail	Habitat not present

Table 2.3.6-2

PROTECTED ANIMAL SPECIES POTENTIALLY OCCURRING IN THE HINES ENERGY COMPLEX

Common Name	Scientific Name	Designated Status FDAC	USFWS	Habitat	Hines Energy Complex
				population present	
RED-COCKADED WOODPECKER	*Picoides borealis*	T	E	Mature pine forests	Habitat not present
SHERMAN'S FOX SQUIRREL	*Sciurus niger shermani*	SSC		Well-drained mixed forests	Habitat not present
FLORIDA BLACK BEAR	*Ursus americanus floridanus*	T		Uplands and wetlands with ample cover	Habitat not present
FLORIDA MOUSE	*Podomys floridanus*	SSC		Flatwoods and forests	Habitat marginal, species not found
FLORIDA PANTHER	*Felis concolor coryi*	E	E	Large undeveloped lands	Habitat present onsite including mitigation area; species possibly present in Complex in early 1990's

FFWCC = Florida Fish and Wildlife Conservation Commission
USFWS = U.S. Fish and Wildlife Service
E = Endangered
T = Threatened
T = Threatened due to similarity in appearance to crocodile
SSC = Species of Special Concern
Sources: 1992 SCA; Florida Fish and Wildlife Conservation Commission, 1997; Florida Natural Areas Inventory, 1997

2.3.7 Meteorological and Ambient Air Quality

2.3.7.1 Meteorology

Meteorological data collected at existing monitoring stations were used to describe the local and regional climatology in the vicinity of the Hines Energy Complex (Hines). The closest existing meteorological station to the facility with complete data is the National Weather Service (NWS) station located at the Tampa International Airport, situated approximately 68 kilometers (km) (42 miles) northwest of the Hines Energy Center. The NWS has recorded weather observations for more than 50 years at this site. These data are the most complete for, and representative of, the region surrounding the Project. FDEP has approved the use of these meteorological data in previous air permit applications for this area and recommended that these data be used for this Project.

The climate in the Hines area is subtropical with a marine influence from the Gulf of Mexico. The monthly and annual average temperatures for this area are presented in Table 2.3.7-1. The annual average temperature is approximately 72°F with monthly average temperatures varying from a maximum of 90°F to a minimum of 50°F. Record extreme temperatures range from a low of 18°F to a record high of 99°F. During the summertime, temperatures rarely exceed 99°F due to the high relative humidities with subsequent cloud cover formation and the abundant convective-type (e.g., thunderstorms) precipitation.

The monthly and annual average precipitation data are presented in Table 2.3.7-2. Approximately 70 percent of the annual precipitation falls during the six warmest months, May through October. The average annual precipitation is approximately 44 inches, but this has varied from as little as 30 inches to 68 inches in the past 30 years. The majority of rain is in the form of short-lived convection showers (e.g., thunderstorms). Large amounts of rain are also produced during the late summer or fall when tropical storms or hurricanes may pass near the Tampa region. These events may result in heavy downpours that reach torrential proportions; 24-hour amounts of about 12 inches have been associated with hurricanes.

Monthly and annual average relative humidities, which indicate the amount of moisture in the air at a given temperature, are also presented in Table 2.3.7-2 for the morning hours of 1:00 A.M. and 7:00 A.M. and early afternoon and evening hours of 1:00 P.M. and 7:00 P.M. The highest humidities are coincident with the coolest ambient temperatures, which generally occur at 7:00 A.M., or near dawn. The lowest humidities coincide with the highest ambient temperatures.

The project area lies entirely within the trade wind belt (i.e., below 30°N latitude), resulting in predominant winds from the east. Because of the location of the Gulf of Mexico, moderate to strong late afternoon sea breezes occur on days with strong land heating and produce localized onshore winds to reinforce the westerly winds. A wind rose for the 5-year period from 1991 through 1995 is given in Figure 2.3.7-1. A summary of the seasonal and annual average wind direction and wind speed, including calm conditions, is

presented in Table 2.3.7-3. The data for this period were also used in the air quality impact analyses for the project.

Except during the passage of tropical storms or hurricanes, wind speeds greater than 25 mph in the area are not common.

Atmospheric stability is a measure of the atmosphere's capability to disperse pollutants and potentially reduce ground-level concentrations. During the daytime with strong solar heating, the atmosphere can disperse pollutants very quickly for a relatively short period. This condition is considered unstable and generally occurs more frequently during the summer. During the nighttime under clear skies and light wind speeds, the atmosphere is considered stable with minimal potential to disperse pollutants. During the day or night when wind speeds are moderate to high, pollutants are dispersed at moderate rates (i.e., dispersion rates that are lesser than those during unstable conditions but greater than those during stable conditions). This condition is considered neutral and occurs frequently throughout the year. The seasonal and annual average occurrences of atmospheric stability classes for this area for 1991 to 1995 are shown in Table 2.3.7-4.

During the summer months, unstable conditions occur about 35 percent of the time due to strong solar heating, whereas unstable conditions occurs only 16 percent of the time in the winter months. Neutral stability occurs most frequently during the winter months due to the higher wind speeds that occur in this season. The occurrence of stable conditions is nearly uniform throughout the year.

The mixing height is a parameter used to define the vertical height to which pollutants can disperse and, therefore, is used in estimating the volume of air in which pollutants are emitted and can be dispersed. In general, the higher the mixing height, the greater the potential for pollutants to be dispersed and for ground-level concentrations to be reduced.

The seasonal and annual average morning and afternoon mixing heights for the Hines area for 1991 to 1995 determined using the Holzworth method are listed in Table 2.3.7-5. The highest afternoon mixing heights occur in the spring and the lowest morning mixing heights occur in winter.

Thunderstorms are the most frequent of severe storms, occurring an average of 83 days per year as reported by the NWS at Tampa International Airport. These storms occur throughout the year, but about 73 percent occur from May through October.

Hurricanes and tornadoes are other types of severe weather that can occur in the project area, but the probability of a hurricane or tornado passing over the Hines Energy Complex is low.

In the 80-km (50-mile) coastal strip from Pinellas County to Tampa Bay, there is about a 10 percent chance that a tropical storm will pass over the Bay area during any given year (Gale Research Co., 1980). For storms of hurricane strength [i.e., wind speeds exceeding 73 miles per hour (mph)], the chance decreases to

about 6 percent with a 1-percent chance that the winds will be greater than 124 mph (i.e., wind speeds of a great hurricane).

Statistics compiled by the severe local storms branch of the national severe storms forecast center (Pautz, 1969) show that 42 tornadoes were spotted within the 1 degree latitude by 1 degree longitude square centered just south of the Tampa area from 1955 to 1967. This averages about two tornadoes per year. The tornado recurrence interval for any specific point location within the 1 degree square was estimated by the Methodology of Thom (1963). The recurrence interval, r, is equal to 1/p where p is the probability of a tornado striking within the 1 degree square area and is estimated as follows:

$$p = (2.8209 \times t)/A$$

where: t = mean annual frequency of tornadoes occurring
A = of the 1 square (mi^2)

In this analysis, t was assumed to be 1.4 based on data collected from 1953 to 1962 and A was estimated to be 4,200 mi^2. Therefore, the mean recurrence interval for a tornado striking a point within this square is about 1,000 years.

2.3.7.2 Ambient Air Quality

AMBIENT STANDARDS

The National and Florida Ambient Air Quality Standards (AAQS) are presented in Table 2.3.7-6. Primary National AAQS were promulgated to protect the public health, and secondary National AAQS were promulgated to protect the public welfare from any known or anticipated adverse effects associated with the presence of pollutants in the ambient air. Areas of the country in violation of AAQS are designated as nonattainment areas, and new sources to be located in or near these areas may be subject to more stringent air permitting requirements. Pollutants for which AAQS have been established are referred to as criteria pollutants. These pollutants include particulate matter (PM) with an aerodynamic particle size of 10 micrometers (μm) or less (PM_{10}), sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), and lead (Pb).

Polk County is classified as an attainment area for all criteria pollutants (Rule 62-204.340, F.A.C.).

In promulgating the 1977 Clean Air Act (CAA) Amendments, Congress specified that certain increases above an air quality *baseline concentration* level of SO_2 and PM concentrations would constitute *significant deterioration* for sources located in attainment areas. The magnitudes of the allowable increases, or prevention of significant deterioration (PSD) increments, depend on the classification of the area in which a new source (or modification) will be located or have an impact. Three PSD increment classifications were designated based on criteria established in the 1977 CAA amendments. Initially, Congress promulgated areas as either Class I (national parks, national wilderness areas, and memorial parks

larger than 5,000 acres, and national parks larger than 6,000 acres) or as Class II (all areas not designated as Class I). No Class III areas, which would be allowed greater deterioration than Class II areas, were designated. EPA then promulgated as regulations the requirements for classifications and area designations.

On October 17, 1988, EPA promulgated regulations to prevent significant deterioration due to nitrogen oxide (NO_x) emissions and established PSD increments for NO_2 concentrations. The EPA class designations and allowable PSD increments are presented in Table 2.3.7-6. Florida has adopted the EPA allowable increments for PM_{10}, SO_2, and NO_2.

Polk County is classified as a Class II area (Rule 62-204.340, F.A.C.) since it is an attainment area for all pollutants. The nearest Class I area to the Hines Energy Complex is the Chassahowitzka National Wilderness Area located about 118 km (73 miles) to the north-northwest.

AMBIENT AIR QUALITY DATA

The Hines Energy Center is located in a rural area of Polk County, which has a minimal number of air pollution sources. Air monitoring data are collected in the county for SO_2, PM_{10}, O_3, and NO_2.

A summary of the maximum pollutant concentrations measured in Polk County from 1998 through 2001 is presented in Table 2.3.7-7. These data indicate that the maximum air quality concentrations measured in the region are well below applicable standards.

Given the lack of industrial development in the vicinity of the plant, existing concentrations of other criteria pollutants, i.e., CO and Pb, which are usually associated with an urban environment, are expected to be well below the AAQS.

2.3.7.3 Measurement Programs

All information (i.e., meteorology and air quality data) was compiled from offsite monitoring stations maintained and operated by FDEP, Polk County, or cooperating governmental agencies (i.e., NWS). No significant changes in these programs are anticipated after the construction and operation of the Project.

Meteorological data were obtained from the NWS surface and upper-air station at the Tampa International Airport. These data were obtained for a 5-year period from 1991 through 1995 from which the joint frequency of wind direction, wind speed, and atmospheric stability and a 5-year average of mixing heights were developed. The wind sensors at the Tampa International Airport have been located 22 ft above grade. Regular surface observations are taken just before each hour, 7 days per week. Upper-air soundings are conducted twice per day at 0700 and 1900 Eastern Standard Time.

A PSD preconstruction ambient air monitoring analysis was developed as part of the licensing planning to satisfy PSD requirements. For all pollutants, an exemption from monitoring is provided by FDEP rules since the impacts of these pollutants are less than *de minimis* impact levels [Rule 62-212.400(3)(e), F.A.C.].

Table 2.3.7-1
Monthly and Annual Average Temperatures Measured at Tampa International Airport

Month	Daily Temperatures (°F)[a]			Extremes (°F)[b]	
	Average	Maximum	Minimum	Maximum	Minimum
January	59.9	69.8	50.0	86	21
February	61.5	71.4	51.6	88	24
March	66.4	76.6	56.5	91	29
April	71.2	81.7	60.8	93	40
May	77.2	87.2	67.5	98	49
June	81.0	89.5	72.9	99	53
July	82.1	90.2	74.5	97	63
August	82.1	90.2	74.5	98	67
September	81.0	89.0	72.8	96	57
October	74.9	84.3	65.2	94	40
November	67.6	77.7	57.2	90	23
December	62.2	72.1	52.3	86	18
Annual	72.3	81.6	63.0	99	18

[a] 30-year period of record, climatological normal, 1961 to 1990.

[b] 54-year period of record, 1947 to 2000.

Source: National Oceanic and Atmospheric Administration (NOAA), 2000.

Table 2.3.7-2
Monthly and Annual Average Precipitation and Relative Humidity Measured at Tampa International Airport

Month	Precipitation (inches)			Humidity (%) hour (LT) [a]			
	Average[a]	Maximum[b]	Minimum[b]	1 a.m.	7 a.m.	1 p.m.	7 p.m.
January	1.99	8.02	< 0.01	84	86	58	73
February	3.08	10.82	0.21	83	86	56	69
March	3.01	12.64	0.06	82	87	54	67
April	1.15	10.71	<0.01	82	86	50	62
May	3.10	17.64	0.02	82	86	52	62
June	5.48	13.75	1.46	84	87	60	69
July	6.58	20.59	1.65	85	88	63	73
August	7.61	18.59	2.35	87	90	64	75
September	5.98	13.98	1.28	86	91	62	75
October	2.02	7.36	0.06	85	89	56	71
November	1.77	6.12	<0.01	86	88	57	74
December	2.15	15.57	0.07	84	87	58	74
Annual	43.92	20.59	<0.01	84	88	58	70

[a] 30-year period of record, climatological normal, 1961 to 1990.
[b] 54-year period of record, 1947 to 2000.

Note: LT = local time.

Source: NOAA, 2000.

Table 2.3.7-3
Seasonal and Annual Average Wind Direction and Wind Speed Measured at Tampa International Airport

Season	Average Wind Speed (mph)	Calm (Percent)	Prevailing Wind Direction	Prevailing Wind Average Wind Speed (mph)
Winter	7.8	6.4	Northeast	7.8
Spring	8.3	6.1	East-northeast	7.5
Summer	6.1	14.2	Southeast	6.8
Fall	6.8	10.6	Northeast	7.6
Annual	7.2	9.3	East-northeast	6.9

[a]5-year period of record, 1991 to 1995. The data for this period were also used in the air quality impact analyses for the project.
Source: NOAA, 1995.

Table 2.3.7-4
Seasonal and Annual Average Atmospheric Stability Classes Determined at Tampa Int'l Airport

Occurrence (Percent) of Stability Class

Season	Very Unstable	Moderately Unstable	Moderately Unstable	Slightly Neutral	Slightly Stable	Slightly Stable
Winter	0.0	3.5	12.2	41.7	18.4	24.2
Spring	0.5	8.6	17.1	33.1	18.0	22.8
Summer	2.6	13.4	19.0	20.8	14.7	29.6
Fall	0.6	7.5	15.4	30.3	17.5	28.8
Annual	0.9	8.3	15.9	31.4	17.1	26.3

[a] 5-year period of record, 1991 to 1995. The data for this period were also used in the air quality impact analyses for the project.

Source: NOAA, 1995.

Table 2.3.7-5
Seasonal and Annual Average Morning and Afternoon Mixing Heights Determined at Tampa International Airport [a]

Season	Mixing Height (m) Morning	Afternoon
Winter	475	1,032
Spring	691	1,531
Summer	657	1,398
Fall	481	1,132
Annual	577	1,275

[a]5-year period of record, 1991 to 1995. The data for this period were also used in the air quality impact analyses for the project. Mixing heights based on surface temperatures and upper-air data from the NWS stations at Tampa International Airport and Ruskin, respectively.

Source: NOAA, 1995.

Table 2.3.7.6
National and State AAQS, Allowable PSD Increments, and Significant Impact Levels

Pollutant	Averaging Time	National Primary Standard	AAQS ($\mu g/m^3$) Secondary Standard	Florida AAQS [a] ($\mu g/m^3$)	PSD Increments ($\mu g/m^3$) [a] Class I	Class II	Significant Impact Levels [b] ($\mu g/m^3$)
Particulate Matter [c] (PM_{10})	Annual Arithmetic Mean	50	50	50	4	17	1
	24-Hour Maximum	150	150	150	8	30	5
Sulfur Dioxide	Annual Arithmetic Mean	80	NA	60	2	20	1
	24-Hour Maximum	365	NA	260	5	91	5
	3-Hour Maximum	NA	1,300	1,300	25	512	25
Carbon Monoxide	8-Hour Maximum	10,000	10,000	10,000	NA	NA	500
	1-Hour Maximum	40,000	40,000	40,000	NA	NA	2,000
Nitrogen Dioxide	Annual Arithmetic Mean	100	100	100	2.5	25	1
Ozone [c]	1-Hour Maximum [d]	235	235	235	NA	NA	NA
Lead	Calendar Quarter Arithmetic Mean	1.5	1.5	15	NA	NA	NA

Note: Particulate matter (PM_{10}) = particulate matter with aerodynamic diameter less than or equal to 10 micrometers.
NA = Not applicable, i.e., no standard exists.
[a] Short-term maximum concentrations are not to be exceeded more than once per year, except for PM_{10} and O_3 AAQS which are based on expected exceedances.
[b] Maximum concentrations are not to be exceeded.
[c] On July 18, 1997, EPA promulgated revised AAQS for particulate matter and ozone. For particulate matter, $PM_{2.5}$ standards were introduced with a 24-hour average standard of 65 $\mu g/m^3$ (based on the 3-year averages of the 98th percentile values) and an annual standard of 15 $\mu g/m^3$ (3-year averages at community monitors). The form of the 24-hour PM_{10} standard was changed; compliance is based on 3-year average of 99th percentile concentrations that is 150$\mu g/m^3$ or less. The O_3 standard was modified to be 0.08 ppm for the 8-hour average; achieved when the 3-year average of 99th percentile values is 0.08 ppm or less. Florida DEP has not yet adopted the revised standards.

[d] 0.12 ppm; achieved when the expected number of days per year with concentrations above the standard is fewer than 1.

Sources: Federal Register, Vol. 43, No. 118, June 19, 1978, 40 Code of Federal Regulations (CFR) 50; 40 CFR 52.21, Florida Chapter 62.204, A.C.

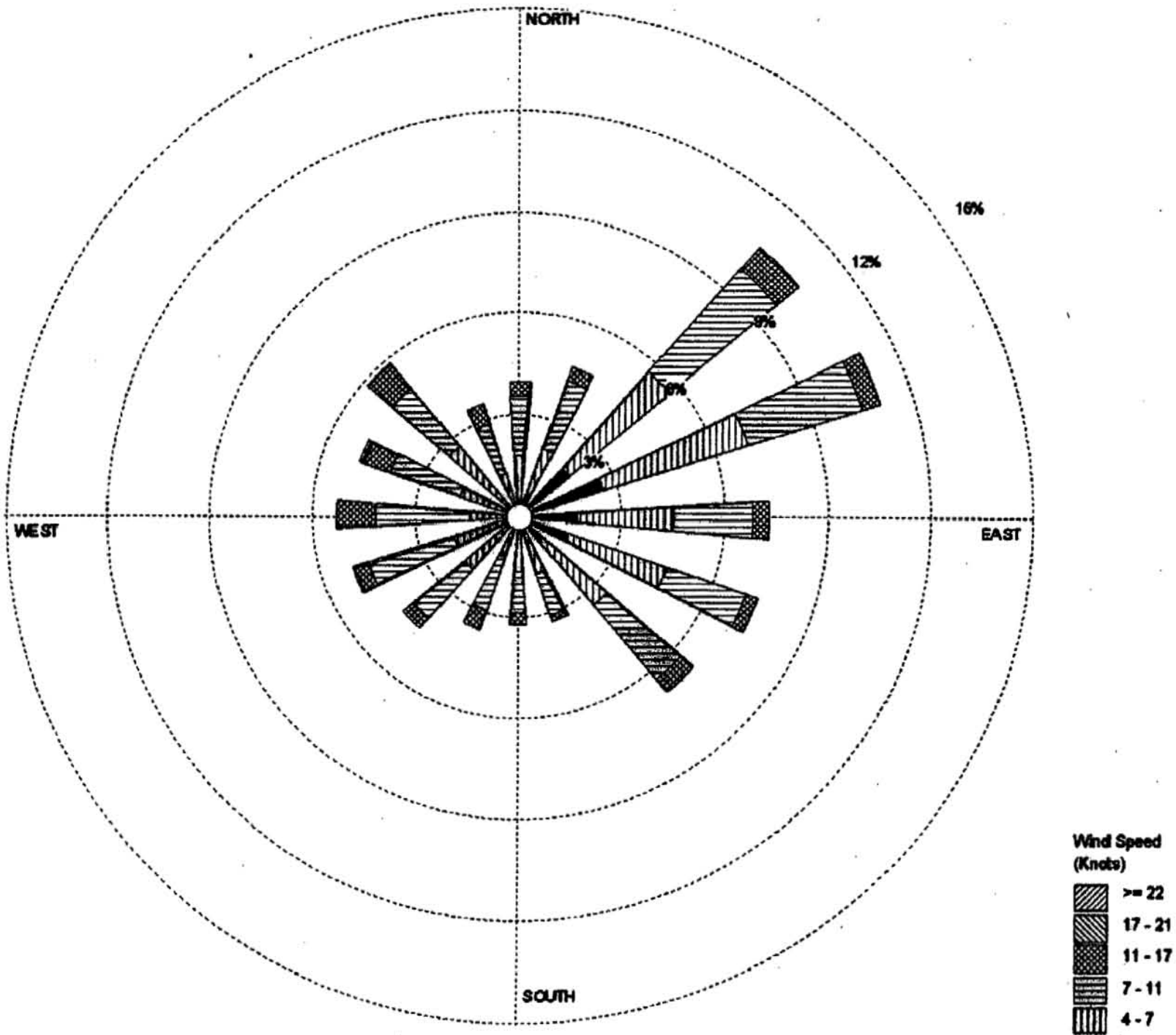
Table 2.3.7-7. Summary of Maximum Measured SO_2, PM_{10}, O_3, and NO_2 Concentrations Representative of the Hines Energy Complex, 1998 to 2001

AIRS/ Saroad Site No.	Operator	Location	Measurement Period		Concentration 1-Hour		3-Hour		8-Hour 3-year Average	24-Hour		Annual
			Year	Months	Highest	2nd Highest	Highest	2nd Highest	4th Highest	Highest	2nd Highest	Average
Sulfur dioxide		**Florida AAQS**			**NA**	**NA**	**NA**	**0.5 ppm**	**NA**	**NA**	**0.1 ppm**	**0.02 ppm**
2860006F02	Polk County	Mulberry	1998	Jan-Dec	NA	NA	0.078	0.069	NA	0.029	0.027	0.006
			1999	Jan-Dec	NA	NA	0.070	0.052	NA	0.019	0.019	0.006
			2000	Jan-Dec	NA	NA	0.074	0.062	NA	0.022	0.018	0.005
			2001	Jan-Dec	NA	NA	0.059	0.048	NA	0.018	0.017	0.005
PM_{10} [a]		**Florida AAQS**			**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**150 µg/m³**	**50 µg/m³**
121052006-1	Polk County	Mulberry	1998	Jan-Dec	NA	NA	NA	NA	NA	108	91	22.2
			1999	Jan-Dec	NA	NA	NA	NA	NA	50	50	20.8
			2000	Jan-Dec	NA	NA	NA	NA	NA	46	45	25.4
			2001	Jan-Dec	NA	NA	NA	NA	NA	74	59	22.6
Ozone [a]		**Florida AAQS**			**NA**	**0.12 ppm**	**NA**	**NA**	**0.08 ppm**	**NA**	**NA**	**NA**
121056006-1	Polk County	Lakeland	1998	Jan-Dec	0.119	0.106	NA	NA	NA	NA	NA	NA
			1999	Jan-Dec	0.103	0.101	NA	NA	NA	NA	NA	NA
			2000	Jan-Dec	0.106	0.102	NA	NA	NA	NA	NA	NA
			2001	Jan-Dec	0.113	0.106	NA	NA	NA	NA	NA	NA
Nitrogen dioxide		**Florida AAQS**			**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.053 ppm**
120570081-1	Hillsborough	Tampa	1998	Jan-Dec	NA	NA	NA	NA	NA	NA	NA	0.006
			1999	Jan-Dec	NA	NA	NA	NA	NA	NA	NA	0.007
			2000	Jan-Dec	NA	NA	NA	NA	NA	NA	NA	0.008
			2001	Jan-Dec	NA	NA	NA	NA	NA	NA	NA	0.007

Note: NA = not applicable.
AAQS = ambient air quality standard.

[a] On July 18, 1997, EPA promulgated revised AAQS for particulate matter and ozone. For particulate matter, $PM_{2.5}$ standards were introduced with a 24-hour average standard of 65 µg/m³ (based on the 3-year averages of the 98th percentile values) and an annual standard of 15 µg/m³ (3-year averages at community monitors). The form of the 24-hour PM_{10} standard was changed; compliance is based on 3-year average of 99th percentile concentrations that is 150 µg/m³ or less. The O_3 standard was modified to be 0.08 ppm for the 8-hour average; achieved when the 3-year average of 99th percentile values is 0.08 ppm or less. The courts have stayed these standards. Florida DEP has not yet adopted the revised standards.

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FIGURE 2.3.7-1
1991 - 1995 TAMPA WIND ROSE

2.3.8 Noise

2.3.8.1 Introduction

A comprehensive noise monitoring program was conducted in January 1992 and presented in the 1992 SCA. The monitoring program characterized the existing noise levels at the nearest noise-sensitive receptor locations, as well as the Plant Island. On May 8, 2000, an additional survey was conducted by Golder Associates, Inc. at the same sites that were used in the noise survey conducted in 1992. The purpose of the second survey was to determine the noise levels associated with Power Block 1 in operation. The Noise Survey performed in 2000 included the operation of Power Block 1 and representative of 2002, since Power Block 2 is under construction and not yet operational. The results of these surveys are summarized in this Section and are used to evaluate the noise impacts for construction and operation of Power Block 3.

2.3.8.2 Study Area Description

Noise levels were monitored in 1992 at five locations in the vicinity of the Hines Energy Complex (see Figure 2.3.8-1). Four of the monitoring locations (Locations 1-4) were near areas considered to be noise-sensitive receptors; the fifth (Location 5) was in the approximate location of the Plant Island.

The highly industrialized nature of this mining region has limited residential development, primarily to existing nearby communities of Homeland and Fort Meade. Thus, there are only a few isolated rural residences in the land areas surrounding the Hines Energy Complex. No residences exist within about 2.5 miles of the Plant Island where all of the plant generating equipment, which is the primary source of noise, will be located. Three or four isolated residences are located on the south side of CR 630 near the intersection of CR 555 about 2.9 miles south (Location 1), and one residence is located at the intersection of CR 640 and CR 555 about 3 miles to the north-northwest (Location 2). The communities of Homeland (Location 3) and Fort Meade (Location 4) are located about 3.5 miles northeast and 4.5 miles southeast from Plant Island, respectively.

Other potential noise-sensitive receptors in the area include one cemetery located on CR 555 south-southwest of the site (referred to as the Trinity Cemetery after the previous church at this location) (Location 7) and a church adjacent to Watson Cemetery at the intersection of CR 555 and CR 630 (Location 6). These receptors are about 1.5 miles and 2.5 miles from Plant Island, respectively.

Existing sources of noise in the area include heavy truck traffic on all the roads, mining activities and several large agri-chemical processing plants. The agri-chemical processing plants were only audible at Locations 1, 2 and 5 late at night during brief lulls in truck traffic. Truck traffic, even late at night, was a significant source of noise at monitoring locations.

2.3.8.3 Noise Standards or Guidelines

Noise resulting from power plant activities can impact the health and welfare of both workers and the general public. The level of impact is related to the magnitude of noise, which is referred to as sound pressure level (SPL) with units in decibels (dB). Decibels are calculated as a logarithmic function of SPL in air to a reference effective pressure, which is considered the hearing threshold, or:

$SPL = 20 \log_{10} (Pe/Po)$

where: Pe = measured effective pressure of sound wave in micropascals (μPa),

and

Po = reference effective pressure of 20 μPa.

To account for the effect of how the human ear perceives sound pressure, sound pressure level is adjusted for frequency. This is referred to as A-weighting (dBA), which adjusts measurements for the approximated response of the human ear to low-frequency SPLs [i.e., below 1,000 hertz (Hz)] and high-frequency SPLs (i.e., above 1,000 Hz).

There are no federal, state, or local noise standards applicable to the Hines Energy Complex site. The city of Fort Meade has a nuisance ordinance that prohibits unnecessary noise, but it is not applicable to the project site, which is about four miles outside Fort Meade. The EPA has developed guidelines for noise levels to protect the public health and welfare with an adequate margin of safety (EPA, 1974). These criteria relate to short-term and day-night average SPLs. The L_{eq} is the equivalent constant SPL that would be equal in sound energy to the varying SPL over the same time period. The L_{dn} is the 24-hour average SPL calculated for two daily time periods, i.e., day and night, but has 10 dBA added to nighttime SPL. The equation for L_{dn} is:

Where:

- $L_{dn} = 10 \log 1/24 (15x10^{(Ld/10)} + 9 x10^{(Ln+10/10)})$
- Ld = daytime l_{eq} for the period 0701 to 2200 hours
- Ln = nighttime L_{eq} for the period 2201 to 0700 hours.

For residential and farming areas, an outdoor L_{dn} of 55 dBA is recommended. For industrial areas, an L_{eq} of 70 is recommended.

2.3.8.4 Noise Monitoring Methodology

During the 1992 noise survey, both A-weighted and octave band sound levels were obtained at the five monitoring locations. The A-weighted scale was designed to account for the manner in which the human auditory system responds to sounds of different frequencies. Very low and very high frequency sounds are attenuated electronically by the meter to produce an instrument response proportional to the subjective

response of an average person. Octave band sound level measurements are taken at different frequencies to show the tonal characteristics of the overall sound.

The A-weighted sound level was measured continuously and simultaneously at the five locations over a complete 24-hour period using five Larson-Davis Laboratories Model LDL 700 precision sound level analyzers (LDL 700) with integral data loggers. The microphones were equipped with 3.5-inch diameter foam windscreens to reduce wind effects and they were mounted at a height of 5 feet above the ground.

The analyzer was set to the A-weighted scale such that the level measured in each band already contained the A-weighting adjustment. Use of this technique generally ensures that the most audible frequencies will also be those with the highest peaks on the plotted graph. This is seldom the case with non-weighted octave band data where low frequency sounds are generally high in level but low in audibility.

During the May 2000 noise survey, both A-weighted and octave band sound pressure levels were collected at the four off-site locations (Sites 1-4) evaluated during 1992 using measurement techniques set forth by American National Standard Institute (ANSI) S12.9-1993/Part 3.

The noise monitoring equipment used during the 2000 noise study included:

1. Continuous Noise Monitoring Equipment
   a. Larson Davis Model 824 Precision Integrating Sound Level Meter with Real Time Frequency Analyzer
   b. Larson Davis Model PRM902 Microphone Preamplifier
   c. Larson Davis Model 2560 Prepolarized 1/2" Condenser Microphone
   d. Windscreen, tripod, and various cables

2. Sound Level Meter Calibration Unit
   a. Larson Davis Model CAL200 Sound Level Calibrator, 94/114 dB at 1,000 Hz.

The Larson Davis sound level meter complies with Type I--Precision requirements set forth by ANSI S1.4-1983 for sound level meters.

The equipment used to monitor the noise levels operated in the slow response mode to obtain accurate, integrated, A-weighted sound pressure levels. A windscreen was used because all measurements were taken outdoors. The microphone was positioned so that a random incidence response, as specified by the ANSI, was achieved. The sound level meter and octave band analyzer were calibrated immediately prior to and just after the sampling period to provide a quality control check of the sound level meter's operation during monitoring. Integrated sound pressure level (SPL) data consisting of the following noise parameters were collected at each location:

L_{eq} The sound pressure level averaged over the measurement period; this parameter is the continuous steady sound pressure level that would have the same total acoustic energy as the real fluctuating noise over the same time period;

Max The maximum sound pressure level for the sampling period, and;
Min The minimum sound pressure level for the sampling period.

Monitoring was conducted using the sound level meter mounted on a tripod at a height of 1.2 m (4 ft) above grade. Local meteorological conditions (wind speed, wind direction and temperature) were measured during the monitoring periods. The operator recorded detailed field notes during monitoring and including major noise sources in the area. Daytime and nighttime SPLs were measured at each of the four sites, for a minimum of 30 consecutive minutes. During the May 2000 noise survey, Power Block 1 was in operation, which would provide information on the potential noise contribution at each monitoring location from the existing plant. Since Power Blocks 2 and 3 are principally identical to Power Block 1, their noise potential impacts can be assessed.

2.3.8.5 Data Analysis

During the 1992 noise survey, the LDL 700 continuous analyzers were programmed to start automatically at 1600 on January 20, 1992, and to stop 24 hours later at 1600 on January 21, 1992. The analyzers were further programmed to compute and store the equivalent sound level (L_{eq}) occurring during each minute and each hour of the 24-hour period. The equivalent sound level is the energy averaged sound level occurring during the specified averaging period. Other hourly parameters computed and stored were the statistical sound levels exceeding 10, 50 and 90 percent of each 1-hour sample period (L_{10}, L_{50} and L_{90}, respectively). The L_{10} represents the sound level where only 10 percent of the time the observed noise level is greater than or equal to that sound level. This sound level would closely correspond to the noise levels where truck traffic is occurring on nearby roads. The L_{90} represents the sound level where 90 percent of the time the observed noise level is greater than or equal to that sound level. This sound level would closely correspond to the noise levels in absence of truck traffic and would be the "background" or "baseline" noise level. Any noise impacts from a power plant would be most noticeable during "baseline" noise levels. The baseline noise level at each monitoring location was calculated using the L_{90} data provided in the 1992 SCA.

At the end of the sample period in 1992, the analyzers were connected to a computer to which the data were downloaded, stored and computations performed. The day/night sound levels (L_{dn}) and the 24-hour L_{eq} levels were computed from the hourly L_{eq} data. The L_{dn} computation, as noted in Section 2.3.8.3, requires the addition of a 10 dBA penalty to hourly L_{eq} levels occurring between the hours of 10 p.m. and 7 a.m. to account for the increased noise sensitivity during normal sleep hours. Adjusted nighttime levels were then energy averaged with unadjusted daytime hourly levels to compute resulting L_{dn} levels. The 24-hour L_{eq} level was computed by energy averaging actual hourly L_{eq} levels.

For the May 2000 noise survey, the L_{eq} (equivalent sound pressure level averaged for the sampling period) as well as the maximum and minimum SPLs during each monitoring episode were recorded. The minimum, maximum, and L_{eq} SPLs for each site were calculated using 15 hours to represent the daytime

conditions and 9 hours to represent nighttime conditions. This provided calculated 24-hour L_{eq} levels. The L_{dn} was also calculated using the same daytime and nighttime hours, but adding 10 dBA to the nighttime readings. Since the monitoring conducted in May 2000 was for a shorter duration, the minimum SPLs represent baseline noise levels at the sites. The minimum SPLs do not include transient noise, such as traffic, but include continuous noise sources such as Power Block 1.

2.3.8.6 Survey Results

For the 1992 noise survey, the 24-hour L_{eq} and L_{dn} levels and the L_{90} levels for each of the five monitored locations were:

Monitoring Location	24 Hour L_{eq} (dBA)	24 Hour L_{dn} (dBA)	Baseline L_{eq} (dBA)	Baseline L_{dn} (dBA)
1	56.6	62.7	43.4	46.4
2	58.3	64.5	46.4	48.9
3	50.0	53.2	46.2	48.0
4	53.7	57.5	48.2	50.0
5	49.9	51.2	38.7	42.6

A comparison of the 24-hour L_{dn} levels with the EPA guideline level of 55 dBA indicates that Locations 1, 2 and 4 already exceed the recommended EPA criteria. In the three cases, the noise levels are due to heavy truck traffic. Location 2, about 150 feet from the intersection of CR 555 and CR 640, had the highest L_{dn} level at 64.5 dBA. The lowest measured levels were at Location 5, which was on-site and well away from any roads. When the effect of trucks are removed from the observed noise levels, as represented by the L_{90} or what has been referred to as "Baseline" in the above table, all noise levels are within the EPA criteria.

During the May 2000 noise survey, the minimum, maximum, and L_{eq} SPLs for each site observed were:

Monitoring Location	Time of Monitoring	Minimum (dBA)	Maximum (dBA)	L_{eq} (dBA)
1	Day	41.0	58.5	49.2
1	Night	40.3	48.5	43.2
2	Day	44.5	61.6	52.9
2	Night	45.6	63.9	55.2
3	Day	45.4	58.8	50.7
3	Night	44.2	56.5	48.0
4	Day	43.5	54.4	48.9
4	Night	54.8	62.2	57.9

The results at monitoring location 1 and 3 observed lower nighttime noise levels than daytime levels, which would be expected given the rural nature of the site. Noise levels at monitoring location 2 were similar during both the daytime and nighttime periods. This was due to the truck traffic near this monitoring location. This observation was similar to that observed during the 1992 noise survey. The nighttime noise levels observed at the monitoring location 4 were considerably higher than the daytime observations. This was primarily due to a nearby thunderstorm that traversed the area.

Based on the results of the May 2000 noise survey, the calculated 24-hour L_{eq} and L_{dn} levels and baseline levels for each of the four off-site monitoring locations are:

Monitoring Location	24 Hour L_{eq} (dBA)	24 Hour L_{dn} (dBA)	Baseline L_{eq} (dBA)	Baseline L_{dn} (dBA)
1	47.8	51.2	40.8	46.8
2	53.9	61.4	45.0	51.9
3	49.9	54.9	45.0	50.8
4	54.5	63.7	51.1	60.6

A comparison of the calculated 24-hour L_{dn} levels with the EPA guideline level of 55 dBA indicates that locations 2 and 4 exceed the recommended EPA criteria. For monitoring location 2, the calculated L_{dn} noise level was due to the localized traffic, which was observed during the 1992 noise survey. The calculated L_{dn} noise levels observed at monitoring location 4 during the 2000 noise survey were due to the localized thunderstorm. The calculated baseline L_{dn} at monitoring locations were either less than or about equal to the results observed in 1992. This strongly suggests that the operation of Power Block 1 does not have a significant noise level impact on the noise levels observed at the sites.

2.3.8.7 Summary

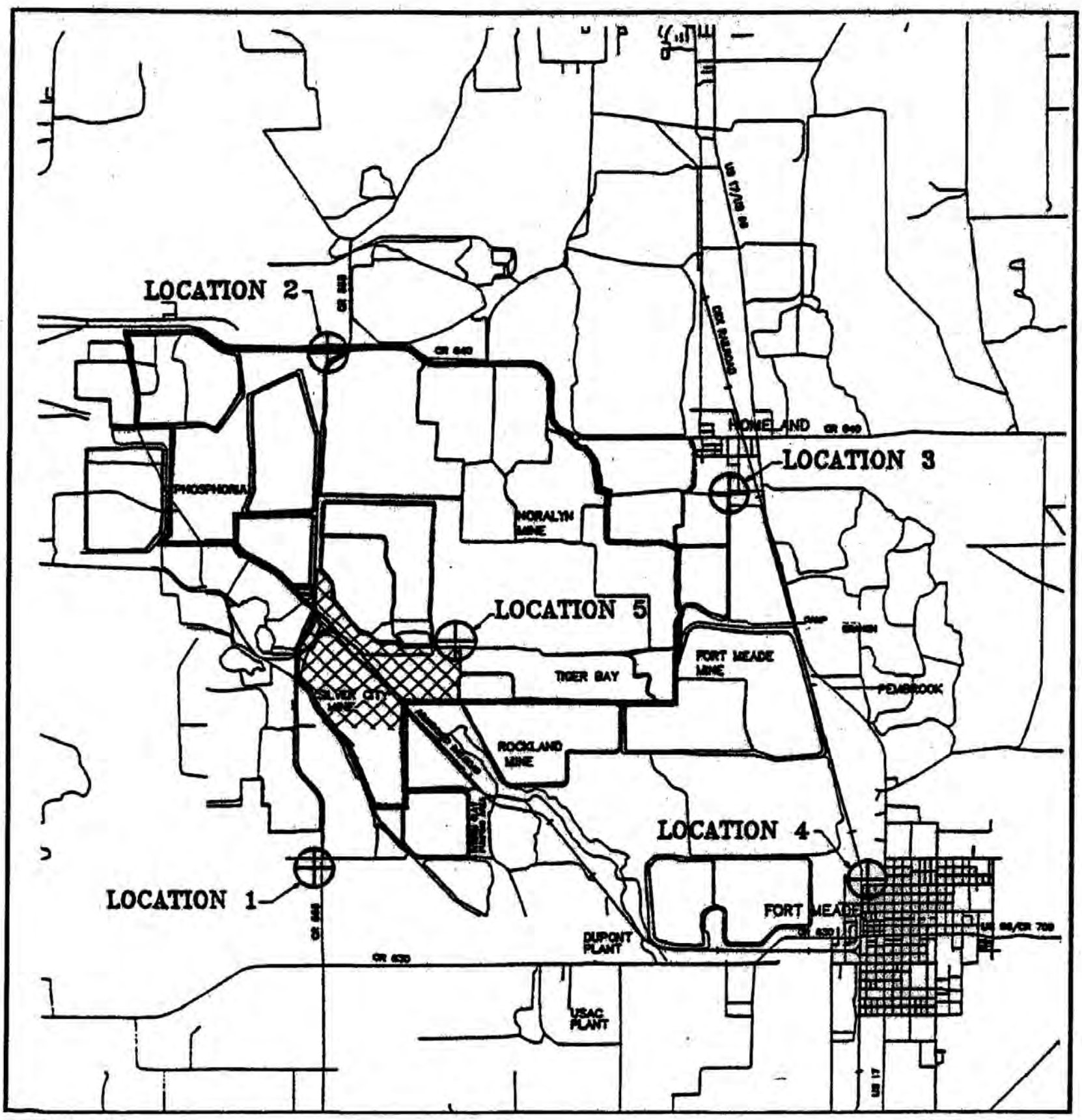
Noise levels at existing noise-sensitive receptors around the site are dominated by heavy trucks on the state and county roads. The truck traffic is associated with the industrial plants in the area that operates 24 hours a day. Thus, the truck traffic also exists throughout the day and night. The noise environment at all of the land uses normally considered to be noise-sensitive (residences and churches) that exist adjacent to these roads around the site, while higher than the EPA guideline level, are dominated by traffic noise. During times when traffic is not occurring or at locations that are removed from the heavily traveled roads, noise levels would be within the EPA criteria. During the 1992 survey, existing industries were not audible in Homeland and Fort Meade but were audible at night at a very low level at the other three locations when there was a lull in truck traffic. During the May 2000 noise survey, these industries were not noted as a source of the noise and noise from the operation of Power Block 1 was not observed at the offsite monitoring locations.

2.3.8.8 References

EPA (U.S. Environmental Protection Agency). 1974. Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.
550/9-74-004. Washington, D.C.

Florida Power Corporation. 1992. Polk County Site. Site Certification Application.

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SOURCE: 1992 SCA

LEGEND

- PLANT ISLAND
- MONITORING LOCATION
- ROADWAYS
- SITE BOUNDARY
- RAILROAD

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FIGURE 2.3.8-1
NOISE MONITORING LOCATIONS

2.3.9 Other Environmental Features

Several regulatory agencies, including the DEP Bureau of Mine Reclamation, and environmental organizations promote the concept of regional wildlife corridors to form an integrated habitat network (IHN). During the preparation of the 1992 SCA, FP agreed to participate in this effort by assisting with the establishment of a wildlife corridor system in Polk County (FGFWFC, 1992). FP followed through on this commitment in December 1994 by funding the acquisition of a 442-acre offsite Conservation Easement on behalf of the State of Florida (See Figure 2.3.9-1). Additionally, pursuant to the post-Certification Amendment filed April 17, 2000, FP has donated a Conservation Easement on the reclaimed Buffer Area parcels (N-11A, N-13, and N-9B) and the Tiger Bay parcel to the State of Florida. These donations, together with the Conservation Easement described above, constitute a major portion of the IHN for the region.

2.3.9.1 References

FGFWFC (Florida Game and Fresh Water Fish Commission). 1992. Letter from T. King, FGFWFC, to K. Small, Florida Power Corporation, St. Petersburg, Florida. February 18, 1992.

Florida Power Corporation. 1992. Polk County Site. Site Certification Application.

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FIGURE 2.3.9-1
ENVIRONMENTAL FEATURES

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3.1 BACKGROUND

FP proposes to install and operate multiple generating units at the Hines Energy Complex over a twenty-year period. The units will be brought on-line sequentially, with the scheduling of units to match the estimated growth of demand through the ultimate site capacity. The Siting Board granted ultimate site capacity certification in 1994 for the Hines Energy Complex based on the assumption that the ultimate installation could include 12 CTs with associated HRSGs, STs, and coal gasification units for a total site capacity of 3,000 MW. The filing of this SCA is consistent with FP's original schedule proposed for the Hines Energy Complex. The actual sequence and timing of future units may vary somewhat, depending on need, as determined by the PSC.

The addition of Power Block 3 at the Hines Energy Complex as a 530 MW (nominal) natural gas-fired combined cycle (CC) unit with distillate oil as back-up fuel is consistent with the expected development of the total site capacity.

By this application, FP is seeking approval for the construction and operation of Power Block 3. All construction activities will occur within an approximate 5-acre portion of the Plant Island adjacent to Power Block 2.

Associated facilities that have been certified and constructed to support the Hines Energy Complex include transmission lines, a gas pipeline within the site's boundaries and a reclaimed water pipeline from the Bartow city limits to the Cooling Pond on site. These facilities, already authorized by the 1994 Certification, are sufficient to support the addition of Power Block 3.

The existing on-site Cooling Pond provides circulating water for cooling of the plant auxiliary systems and steam turbine condensers. The addition of Power Block 3 will not require any expansion of the Cooling Pond. The 722-acre portion of the ultimate 2250-acre Cooling Pond has been constructed and is sufficient to support Power Blocks 1, 2 and 3.

The existing site stormwater management system located within the Plant Island area is adequate for Power Blocks 1, 2 and 3 and provides overflow to the on-site Cooling Pond.

Air emission control will be achieved using the best available control technology. In addition to dry low NO_x burners in the CTs, selective catalytic reduction (SCR) technology will be used to further control nitrogen oxide (NO_x) emission levels while firing natural gas. While firing fuel oil as a back-up, water injection will be used to limit NO_x levels, along with the SCR technology. The combustion of clean fuels to minmize sulfur dioxide (SO_2) and particulate mater emissions is accomplished by burning fuels low in ash

and sulfur content in conjunction with good combustion practices to ensure complete combustion. These technologies will ensure compliance with applicable air quality standards.

Noise impacts from the full 3000 MW site were assessed for several residential receptors around the Hines Energy Complex site as part of the 1994 Certification. Fractional noise increases observed at any nearby residential receptor will not be noticeable or significant. (See Section 2.3.8.) The isolated location and buffer area around the Hines Energy Complex site results in the lack of a significant noise impact.

Vehicular access is provided by County Road 555 (CR 555), with rail access provided by existing CSX rail lines, including an on-site rail spur. A traffic impact analysis was completed to assess traffic impacts for the construction and operation of the full build out of the site (3000 MW) on Polk County roadways. Conditions of Certification addressing those impacts were included in the 1994 Certification. Area roadways have capacity to accommodate traffic from construction and operation of Power Block 3 as previously demonstrated.

All on-site fuel oil delivery, storage and handling facilities, including unloading areas, piping, storage tank systems and containment structures are in place and adequate for Power Blocks 1, 2 and 3.

3.2 SITE LAYOUT

The Hines Energy Complex site contains a Plant Island and several ancillary areas that make up the balance of the site. The arrangement consists of two existing combined cycle units with a third combined cycle unit being proposed adjacent to the second. This section provides a description of existing and future plant arrangements of the power generating facilities and associated facilities on-site.

3.2.1 Plant Island

The overall plant arrangement, shown on Figure 3.2.1-1, utilizes a Plant Island that is located in the southern portion of the site, east of CR 555. The Plant Island consists of areas that were previously part of the phosphate mining company parcels designated as SA-11, SA-12N and SA-13, for a total of 704-acres. These parcels were selected for the Plant Island because, although originally intended to be waste clay settling areas, they were never so utilized. Thus, there are no waste clays in these areas that could complicate the structural foundation design. Figure 3.2.1-1 shows the location of Power Blocks 1 and 2, as well as indicating the space reserved for Power Block 3.

Figure 3.2.1-2 shows the general arrangement of the power block area, including Power Block 3.

Figure 3.2.1-3 is a schematic of a typical combined cycle unit illustrating the type of equipment associated with Power Block 3.

3.2.2 Balance of Site

The additional areas of the Hines Energy Complex site that may be minimally impacted by the addition of Power Block 3 are described below.

COOLING POND

One of the requirements for combined cycle power plants is a reliable supply of process water and cooling water to allow condensation of the steam. A cost-effective device to achieve that supply, while minimizing the consumptive use of water, is a cooling pond. The existing 722-acre Cooling Pond, which was constructed within mine area N-16W as shown on Figure 3.2.2-1, is a varying level Cooling Pond capable of supporting Power Blocks 1, 2 and 3. Other than new intake/discharge structures, no changes to the Cooling Pond will be needed to accommodate Power Block 3.

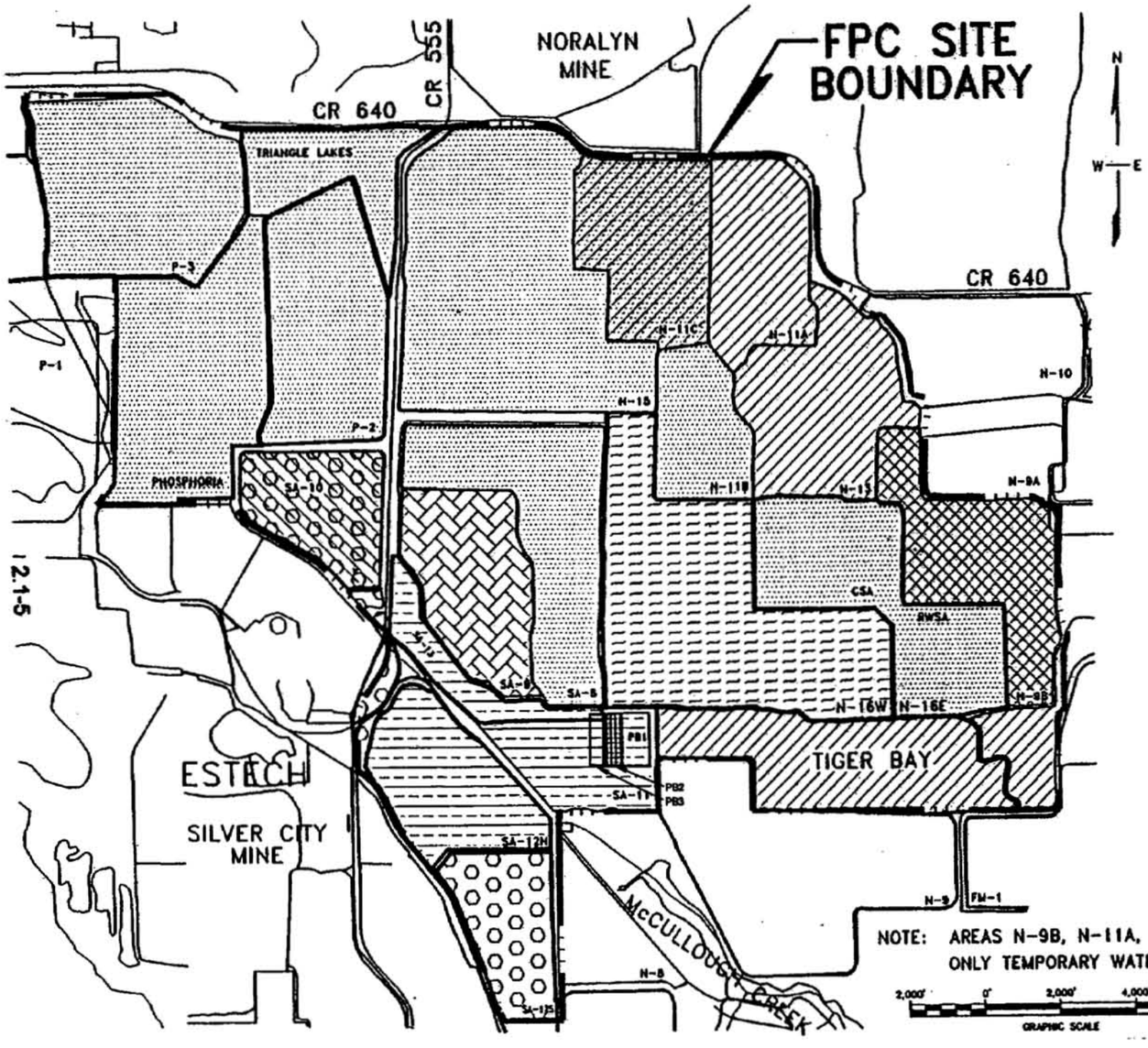
BRINE POND

Two unique features of the Hines Energy Complex site are the availability of waste clays, and the presence of structurally sound dams remaining from the previous phosphate mining activities. These features accommodate the use of an evaporative Brine Pond to receive concentrated wastewaters from the reverse osmosis treatment process. The area designated as SA-9, comprising about 311 acres of the site area, is utilized as the Brine Pond. Waste clays serve as an impermeable liner along the bottom of this area. The Brine Pond location is shown on Figure 3.2.2-1. This pond will not need to be altered for Power Block 3.

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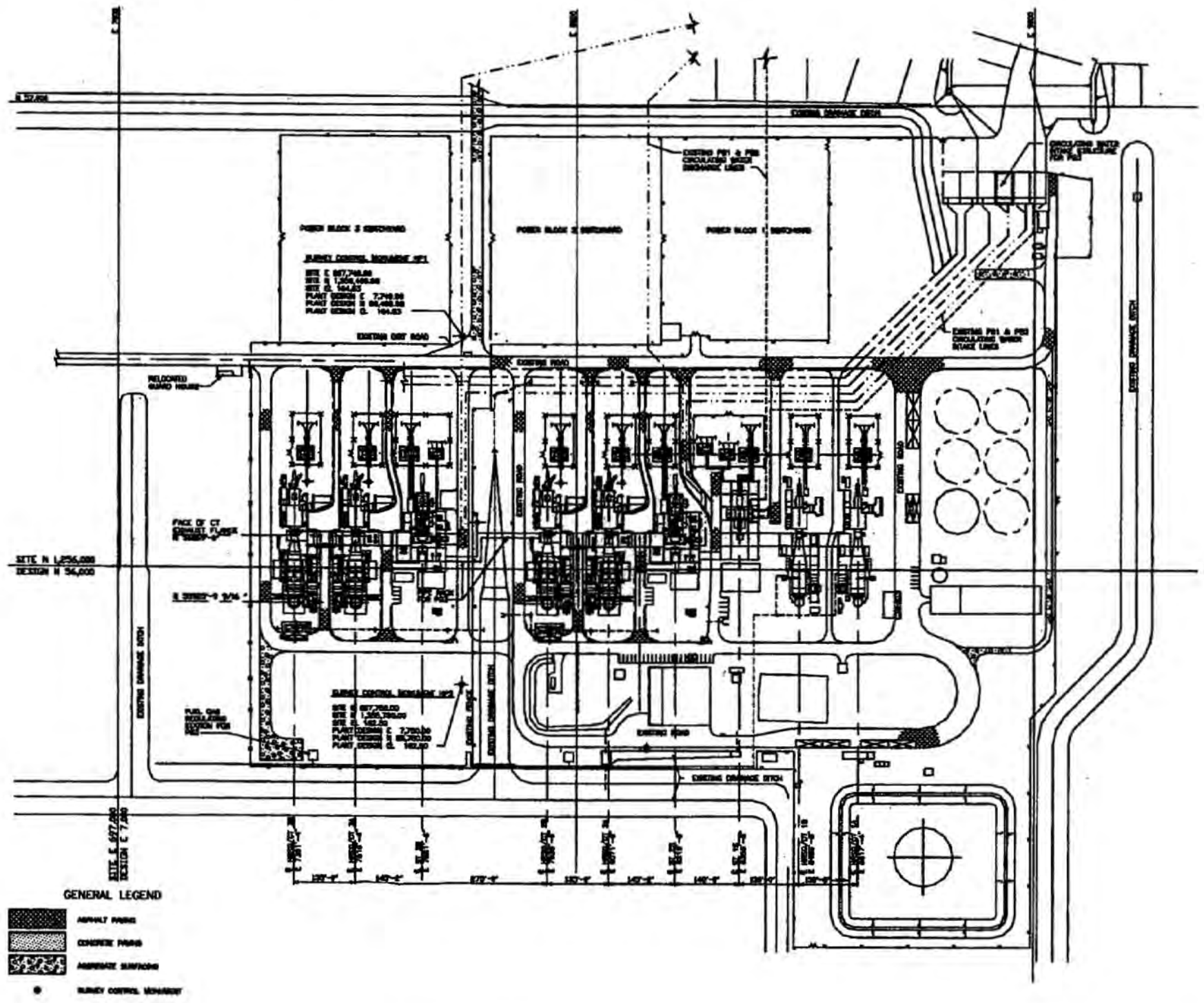
BUFFER AREA		
	N-11C	347 AC.
	N-11A	295 AC.
	TIGER BAY	524 AC.
	N-13	388 AC.
	N-9B	362 AC.
	TOTAL	1,916 AC.
COE MITIGATION AREA		
	N-9B	362 AC.
	SA-10	220 AC.
	TOTAL	582 AC.
COOLING POND		
	N-16(WEST)	722 AC.
	TOTAL	722 AC.
BRINE POND		
	SA-9	311 AC.
	TOTAL	311 AC.
PLANT ISLAND		
	SA-11	210 AC.
	SA-12(NORTH)	383 AC.
	SA-13	111 AC.
	TOTAL	704 AC.
McCULLOUGH CREEK WATER SHED		
	SA-12S	250 AC.
	SA-10	220 AC.
	TOTAL	470 AC.
WATER CROP		
	SA-8	429 AC.
	N-11C	347 AC.
	N-15	850 AC.
	N-16 EAST (RWSA/CSA)	495 AC.
	N-11B	199 AC.
	P-2	414 AC.
	P-3	490 AC.
	PHOSPHORIA/TRI LAKES	795 AC.
	TOTAL	4,019 AC.

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FIGURE 3.2.1-1
HINES ENERGY COMPLEX POWER BLOCK 3 SITE PLAN

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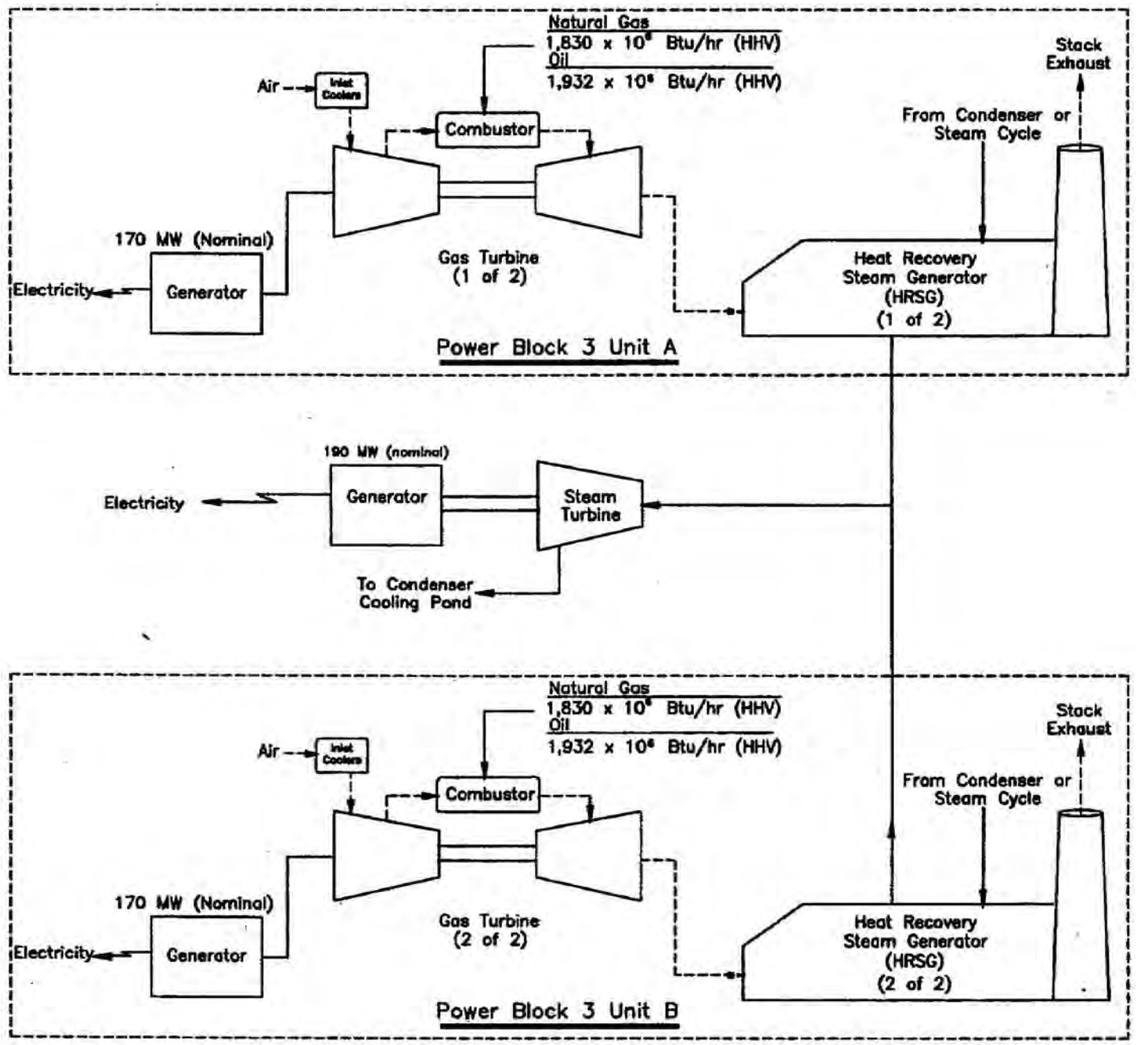
Hines Energy Complex

FIGURE 3.2.1-2
SITE ARRANGEMENT MAP

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Baseload Operation
Turbine Inlet Temperature of 59° F

Natural Gas–Firing	Oil firing
1,009,500 ACFM	1,139,394 ACFM
59.2 ft/sec	67.0 ft/sec
190°F	270° F



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FIGURE 3.2.1-3
PROCESS FLOW DIAGRAM

3.3 FUEL AND FUEL HANDLING CHARACTERISTICS

Power Block 3 will utilize natural gas as the primary fuel and low sulfur distillate fuel oil as backup fuel.

Following is a description of the fuel characteristics, supply considerations, and storage concepts associated with each of the fuels.

3.3.1 Natural Gas

Natural gas will be supplied via two separate existing pipelines to the Hines Energy Complex. Both the Florida Gas Transmission (FGT) and Gulf Stream pipelines currently supply natural gas to the site.

FP constructed the on-site pipeline from the FGT and Gulf Stream metering stations to the Plant Island area. This line was sized for three Power Blocks and ranges in size from 16" at the on-site metering station to 8" at the combustion turbines.

3.3.2 Fuel Oil

Low sulfur (0.05 % by weight) distillate fuel oil will be used as a backup fuel for the Power Block 3 at the Hines Energy Complex.

The fuel oil unloading system and storage tank existing at the site is adequate to serve the requirements of Power Block 3. This system consists of four truck unloading stations and one 3.7 million-gallon storage tank.

3.4 AIR EMISSIONS AND CONTROLS

Power Block 3 will consist of a natural gas-fired CC unit capable of producing approximately 530 MW (nominal). Specific information about this unit is presented in the Prevention of Significant Deterioration (PSD) application included as Appendix 10.1.5.

The remainder of this section will address the air emissions and controls for the proposed development.

3.4.1 Air Emission Types and Sources

Following is a description of the sources and types of air emissions at the Hines Energy Complex.

3.4.1.1 Sources

The primary sources of air emissions for this proposed development are the two Siemens Westinghouse combustion turbine (CT) units. The best available control technology (BACT) for these sources is presented in Section 3.4.3.

3.4.1.2 Emissions

Estimated maximum emissions from each of the air emission point sources noted in Section 3.4.1.1 are tabulated in Table 3.4.1-1. The estimated emissions represent full load operating conditions and are not inclusive of background ambient concentrations introduced into the particular processes. It is anticipated that higher emission rates will occur for short periods of time when a unit is started from a cold start or possibly during a malfunction. A comparison of the significant emission rate thresholds given in the table demonstrates that the project is subject to PSD BACT review for nitrogen oxides (NO_x), sulfur dioxide (SO_2), sulfuric acid mist (SAM), carbon monoxide (CO), particulate matter (TSP and PM_{10}) and volatile organic compounds (VOCs).

3.4.1.3 Emissions Inventory

For source specific emissions, DEP Form 62-210.900(1), "Application For Air Permit - Long Form", has been completed for Power Block 3, a copy of which is included in Appendix 10.1.5. These emissions are based on a 100 percent capacity factor at full load.

3.4.2 Air Emission Controls

The proposed control technologies and associated emission rates for the regulated pollutants emitted from each of the primary sources on the site are tabulated in Table 3.4.2-1. A detailed BACT analysis, including an economic evaluation, was performed and is presented in Appendix 10.1.5, Section 4.0.

3.4.3 Best Available Control Technology (BACT)

This BACT discussion provides a preliminary "worst case" scenario of generation alternatives and the corresponding analysis of the air quality control alternatives for controlling pollutant emissions from the Hines Energy Complex.

Under the federal Clean Air Act (CAA), BACT represents an emission limitation based on the maximum degree of pollutant reduction determined on a case-by-case basis considering technical, economic, energy, and environmental considerations. However, BACT cannot be less stringent than the emission limits established by the applicable New Source Performance Standards (NSPS) for stationary sources.

This BACT analysis follows the general requirements of the EPA's draft "top down" BACT guidance document, which requires that the BACT analysis start by assuming the use of the most stringent control alternative. Other less efficient emission control technologies are evaluated if this most stringent alternative is determined to be technologically infeasible or unreasonable considering economic, energy, and environmental factors.

As discussed in Section 3.4.1, the following regulated pollutants exceed the PSD significant emission rate thresholds and are, therefore, subject to PSD review:

- Carbon Monoxide (CO)
- Nitrogen oxides (NO_x)
- Sulfur dioxide (SO_2)
- Particulate (TSP and PM_{10})
- Volatile organic compounds (VOC)
- Sulfuric acid mist (SAM)

Consequently, the BACT analysis for Power Block 3 presented in Appendix 10.1.5, Section 4.0, addresses the control of emissions of these pollutants. Also included are discussions of the effects of the BACT systems selected on the emissions of other regulated pollutants.

3.4.4 Design Data for Control Equipment

Control equipment design information is included as part of the BACT analyses discussed in Section 3.4.3. Pollutant emission rates and specific control technologies are summarized in Table 3.4.2-1.

The CC units will be designed to minimize NO_x formation by the use of combustion controls, low NO_x burners and selective catalytic reduction (SCR). Water will be injected into the combustion zones to lower combustion temperatures and limit NO_x formation during oil firing. The annual emissions of other regulated pollutants which might be emitted from the CC units in quantities subject to PSD review (SO_2, CO, particulate matter [TSP/PM_{10}], VOCs and SAM) will be controlled by limiting the amount of fuel oil burned annually, limiting the sulfur content of the fuel, efficient operation of the CC facility, and utilizing good combustion control of the units.

3.4.5 Design Philosophy

Air quality control system designs are determined based on conservative design parameters. The parameters are developed to ensure that the air quality control system performance meets or exceeds the requirements specified by state and federal regulatory NSPS. Critical equipment that may affect the overall system reliability will have spare units in place to assure continuous operation. In addition, the application of top-down BACT (i.e., the evaluation of technical/engineering, economic, and environmental considerations) is used to determine appropriate air emission control technologies. The BACT analysis, discussed in Section 3.4.3, results in the selection of the best air quality control system for the particular site.

Table 3.4.1-1.

Maximum Potential Annual Emissions (530 MW) and PSD Significant Values

Pollutant	Emissions (TPY) *	PSD Significant Emission Rate (TPY)	PSD Review Required (Yes/No)
Carbon Monoxide	744	100	Yes
Nitrogen Oxides	267	40	Yes
Sulfur Dioxide	137	40	Yes
Particulate Matter (PM_{10})	121	15	Yes
Total Suspended Particulates (TSP)	121	25	Yes
Volatile Organic Compounds	57	40	Yes
Lead	0.02	0.6	No
Sulfuric Acid Mist (SAM)	21	7	Yes

* TPY = Tons per year for the proposed Power Block 3 project.

Basis:

	Load	Ambient Temp.	Annual Hours of Operation / CT: Gas	Annual Hours of Operation / CT: Oil
NO_x	100%	59° F	7,760	1,000
SO_2	100%	59° F	7,760	1,000
TSP/PM_{10}	100%	59° F	7,760	1,000
Lead	100%	59° F	7,760	1,000
SAM	100%	59° F	7,760	1,000
CO	100%	59° F	4,760	1,000
	60%	59° F	3,000	--
VOC	100%	59° F	4,760	1,000
	60%	59° F	3,000	--

Source: Golder Associates, 2002.

Table 3.4.2-1.
Summary of Proposed BACT Control Technologies and Emission Limits
Hines Energy Complex Power Block 3
(Siemens Westinghouse 501FD CTs)

Pollutant	Fuel	Load (%)	Control Technology	Proposed BACT Emission Limits[a] Concentration (ppm)	Mass (lb/hr)
TSP/PM_{10}	Gas	All	Natural gas and limited use of low-sulfur fuel oil	10%[b]	NA
	Oil	All	Efficient and complete combustion	20%[b]	NA
CO	Gas	100-65	Efficient and complete combustion	10	42
	Oil	100-65	Efficient and complete combustion	30	106
	Gas	60	Efficient and complete combustion	50	146
VOC	Gas	100	Efficient and complete combustion	1.8	4.4
	Oil	100-65	Efficient and complete combustion	10	21
	Gas	80-60	Efficient and complete combustion	3.0	7.5
NO_x	Gas	100-60	Use of dry low-NO_x burners and SCR	3.5[c]	23
	Oil	100-60	Water injection and SCR	12	87.5
$S0_2$/SAM	Gas/Oil	All	Natural gas and limited use of low-sulfur fuel oil	NA	NA

[a] NO_x is ppmvd at 15% O_2 gas and oil; CO is ppmvd at 15% O_2 for gas and ppmvd for oil; VOC is ppmvd at 15% O_2 for gas and ppmvw for oil. Max emissions at 59°F compressor inlet.

[b] Percent opacity, a surrogate for TSP/PM_{10} limits.

[c] Based on a 24-hr block (midnight. to midnight) average

Source: Golder Associates, 2002.

3.5 PROJECT WATER USE

The 1994 Site Certification authorized an ultimate site buildout (3000 MW) for the Hines Energy Complex site that will require a total of 32 MGD of water from a combination of sources, including reclaimed water, internal reuse of wastewater, water cropping, offsite non-potable water sources and ground water. Water will be needed for makeup requirements of the Cooling Pond, personal and sanitary needs of employees and visitors, and various plant processes associated with 3000 MW of power generation and ancillary facilities. With the exception of quantities needed to support potable and sanitary needs of the proposed facility, the 1994 Certification disallows use of ground water in support of the first 940 MW of generation capacity, except as approved by SWFWMD under circumstances constituting an emergency. Beyond the first 940 MW, the 1994 Site Certification authorizes the withdrawal of up to 17.5 MGD Annual Average Daily of Upper Floridan aquifer water. Power Block 3 represents the first major phase of development in excess of 940 MW and requires the first use of ground water as a source of cooling and process water makeup.

The HEC site is designed as a zero surface water discharge facility for industrial wastewaters. The key feature of this design is the Cooling Pond, which serves not only as the heat dissipation sink but also as a water storage impoundment. The existing 722-acre Cooling Pond in place is adequate to support Power Blocks 1, 2 and 3.

The following summarizes FP's efforts to minimize the use of ground water through the use of water conservation practices consistent with those outlined in Condition XXVI.A.14.b.ii.1) of the 1994 Site Certification.

- Power Block 3's combined-cycle combustion turbine design uses water-conserving electric generation and pollution control technologies;
- Any dewatering that may take place as part of the construction of Power Block 3 will be maintained on site;
- On-site rainwater and stormwater are captured and managed in the on-site water cropping system as cooling pond makeup;
- Internal wastewater streams are returned to the cooling pond for reuse;
- Reuse of treated wastewater from sewage treatment facilities is currently used to the maximum amount available (see addition information below); and,
- There are no other sources of non-potable water currently available for use.

As noted above, and as required by Conditions XXVI.A.15 and XXX.21 of the 1994 Site Certification, FP evaluated the availability of alternative water resources (e.g., reclaimed water) for this SSCA. A summary of potential reclaimed water sources located in Polk County is provided in Table 3.5-1. The locations of these potential sources are shown on Figure 3.5-1.

An evaluation of those facilities which might potentially provide reclaimed water of sufficient quantity and quality for the Cooling Pond follows:

The City of Bartow Wastewater Treatment Facility has a permitted design capacity of 4.0 MGD. An agreement between FP and the City of Bartow allows FP to receive up to 3.5 MGD of reclaimed water, with a provision which allows the City of Bartow to use up to .6 MGD for irrigation of its own facilities, if needed. Presently, measured average daily flows to the Hines Energy Complex from Bartow are approximately 1.77 MGD. Monthly Operating Reports (MORs) filed by Bartow with DEP indicate that average daily flows from its Wastewater Treatment Facility are approximately 2.0 MGD. This level of total flows indicates that additional reclaimed water is not available for use at this time.

The City of Lakeland W. Carl Dicks Wastewater Treatment Facility, located approximately 15 miles from the Hines Energy Complex, currently has a permitted design capacity of 10.8 MGD. DEP MOR data indicate that average daily flows of 9.8 MGD are currently reused by Lakeland Electric. Flows of sufficient quantity are therefore not available at this time.

The City of Lakeland Northside reclaimed effluent outfall, which is located approximately 8 miles from the Hines Energy Complex, has a permitted design capacity of 6.25 MGD. DEP MOR data indicate that average daily flows are 2.9 MGD, with reuse by Lakeland Electric. Flows of sufficient quantity are therefore not available at this time.

The City of Winter Haven #3 Wastewater Treatment Facility, located approximately 20 miles from the Hines Energy Complex, has a permitted design capacity of 5.0 MGD with discharge via overland flow. DEP MOR data indicate that average daily flows are approximately 2.9 MGD. Although quantities of reclaimed effluent are potentially available, this water is currently committed to another proposed power generation facility.

No other domestic wastewater treatment facilities in the vicinity of the Hines Energy Complex have adequate capacity to generate reclaimed effluent of sufficient quantity and quality to be feasible.

Currently anticipated total actual water-needs for the operation of Power Blocks 1, 2 and 3 will be approximately 10.6 MGD. An agreement with the City of Bartow allows FP to receive up to 3.5 MGD of reclaimed water, although measured average daily flows are only approximately 1.77 MGD. Additional sources of makeup to the Cooling Pond currently include direct precipitation (2.87 MGD), runoff from the

Plant Island stormwater retention pond SA-12N (0.67 MGD), reuse of process water (0.13 MGD), and the on-site water cropping system (2.77 MGD). In addition, the 1994 Site Certification authorized up to 17.5 MGD of Floridan Aquifer groundwater to support generation capacity in excess of the initial 940 MW of generating capacity. For reference, the current water budget for Power Blocks 1 and 2 is included on Figure 3.5-2. Figure 3.5-3 indicates the detailed water budget that illustrates the annual average flows for water uses for Power Blocks 1, 2 and 3. Figure 3.5-4 addresses the annual average flows expected during a one-in-ten year drought condition. In such a drought condition, up to 5.14 MGD of groundwater may be required to maintain the Cooling Pond at an adequate level necessary to ensure continued reliable operation of the facility.

3.5.1 Heat Dissipation System

As described above, the key feature of the plant water and wastewater systems is the Cooling Pond system. Following is a description of that system.

3.5.1.1 System Design

HEAT DISSIPATED

Based on data from Power Block 1, the estimated heat rejection rate for Power Blocks 1 and 2 is 2,550 mmBtu/hr. Power Block 3 will add an additional 1275 mmBtu/hr. The existing Cooling Pond will provide sufficient heat sink capacity for Power Blocks 1, 2 and 3 at the Hines Energy Complex.

SIZE AND LOCATION

The existing 722-acre Cooling Pond was approved in the 1994 Site Certification to provide a heat sink for heat rejection at the HEC and was constructed within mine area N-16W as shown on Figure 3.5.1-1. The existing Cooling Pond is capable of supporting the generating capacities of Power Blocks 1, 2 and 3. The Cooling Pond was constructed during initial site development and the As-Built drawings, dated November 1, 1996, were submitted to the appropriate agencies following completion of construction. The perimeter impoundment dam crest elevations are constructed to elevation 172 ft NGVD and the interior Cooling Pond phasing and dividing dams are constructed to a crest elevation of 167 feet NGVD. The interior phasing dams were constructed to create the initial phase 722-acre Cooling Pond, which falls entirely within the larger 1200-acre N-16 mine area.

RATE OF EVAPORATION OF WATER

Total evaporation from the Cooling Pond includes both natural and forced evaporation. Forced evaporation is that extra evaporation above and beyond natural evaporation that is caused by the heat rejected from the plant. The total annual average evaporation rate from the Cooling Pond is estimated to be 9,300,000 gallons per day for Power Blocks 1, 2 and 3. This evaporation rate is included in Figures 3.5-3 and 3.5-4, which illustrate the water budget for three power blocks under average and drought conditions.

DESIGN OF DAMS

Design of the Cooling Pond dams was addressed in the 1992 SCA. As-Built drawings of completed and accepted designs are currently on file with DEP. No new Cooling Pond dam construction is proposed for the Power Block 3 construction.

CONCEPTUAL DESIGN/LOCATION OF INTAKE STRUCTURES

The Hines Energy Complex will have no intake structures within any waters of the state or U.S. A new cooling water intake structure for Power Block 3 will be installed adjacent to the existing Power Block 1 and 2 cooling water intake structure within the Cooling Pond bank. Each of the three Power Blocks will have two vertical circulating water pumps. Design intake velocity will be a maximum of 2 feet per second at a design circulating water flow of approximately 120,000 gallons per minute.

MAXIMUM PREDICTED DISCHARGE TEMPERATURE AT POD

The project does not have a Point of Discharge (POD) to the waters of the state or U.S.

TRAVEL TIME FROM CONDENSER INLET TO POD

The project does not have a POD to the waters of the state or U.S.

3.5.1.2 Source of Cooling Water

The source of plant cooling water for Power Blocks 1, 2 and 3 will be the existing Cooling Pond. The Cooling Pond level will be maintained by using makeup from the following sources:

- Direct precipitation
- Reclaimed treated municipal effluent
- Plant Islant stormwater runoff
- Recycle of blowdown
- Treated low volume wastewaters
- Water cropping

- Groundwater

3.5.1.3 Dilution System

Power Blocks 1, 2 and 3 have no dilution systems.

3.5.1.4 Blowdown, Screened Organisms, and Trash Disposal

The project does not have a blowdown system with an off-site discharge. Disposal of debris and trash from coarse bar screens at the circulating water intake is described in Section 3.7. There are no off-site makeup water pumps.

3.5.1.5 Injection Wells

Like Power Blocks 1 and 2, Power Block 3 does not have any injection wells for waste disposal.

3.5.2 Domestic/Sanitary Wastewater

Showers, lavatories, sinks, toilets, urinals, and drinking fountains generate plant domestic/sanitary wastewater. These wastewaters are collected and treated in on-site domestic/sanitary waste treatment facilities. The effluent from the sanitary waste treatment system is used as makeup water for the Cooling Pond.

As authorized by the 1994 Certification, FP currently operates a 0.010 MGD Type III domestic wastewater treatment plant consisting of aeration, secondary clarification and chlorination at the Hines Energy Complex. Chlorinated effluent is directed to the 722-acre Cooling Pond.

3.5.3 Potable Water Systems

Potable water uses at the plant will include water for drinking, washing, showers, urinals, and toilets. Potable water for the plant is provided from the on-site service water system, supplied by well water. The well water is being treated using the lime softening pretreatment and filtration in the service water pretreatment system, and chlorination.

Condition No. XVI of the 1994 Site Certification authorizes potable water for the Hines Energy Complex. The system is a non-transient non-community water system. The permitted capacity of the plant (0.005 MGD) is adequate for Power Blocks 1,2 and 3.

3.5.4 Process Water Systems

The major process water uses for Power Blocks 1, 2 and 3 are as follows:

DEMINERALIZED WATER. Demineralized water is required for use as makeup to the steam-condensate-feedwater cycle associated with the heat recovery steam generators in Power Blocks 1, 2 and 3. The makeup is required to replace steam cycle losses and boiler blowdown. In addition, demineralized water will be used when firing the combustion turbines on fuel oil to control NO_x emissions, as well as for demineralizer regeneration.

Demineralized water treatment consists of reverse osmosis (RO) equipment and mobile ion exchange demineralizer units that are regenerated off-site. The source of demineralized water is the Cooling Pond water that is filtered and pumped as needed through the RO unit. RO permeate is transferred to the demineralizer inlet. As the water passes through the RO and demineralizer exchangers, it will be progressively demineralized until the effluent contains essentially no dissolved solids. RO brine reject is routed to the existing on-site Brine Pond. The mobile demineralizer vessels are regenerated off-site; therefore no regeneration wastes require on-site neutralization and disposal.

SERVICE WATER. Service water is provided throughout the plant for washdown purposes and for pump and equipment seal water and flushing as necessary. Service water may also be used to supplement the fire water supply described below. Service water is obtained from the Cooling Pond and is filtered and chlorinated before storage.

FIRE WATER. A dedicated supply of water from the existing Cooling Pond is treated by filtration and provided to the existing service/fire water storage tank. Backup fire water is supplied from the Cooling Pond via diesel-driven fire pumps located at the cooling water intake structure.

PROCESS WASTEWATER. Process wastewater potentially contaminated with oil is treated by the existing oil/water separator prior to being recycled to the Cooling Pond.

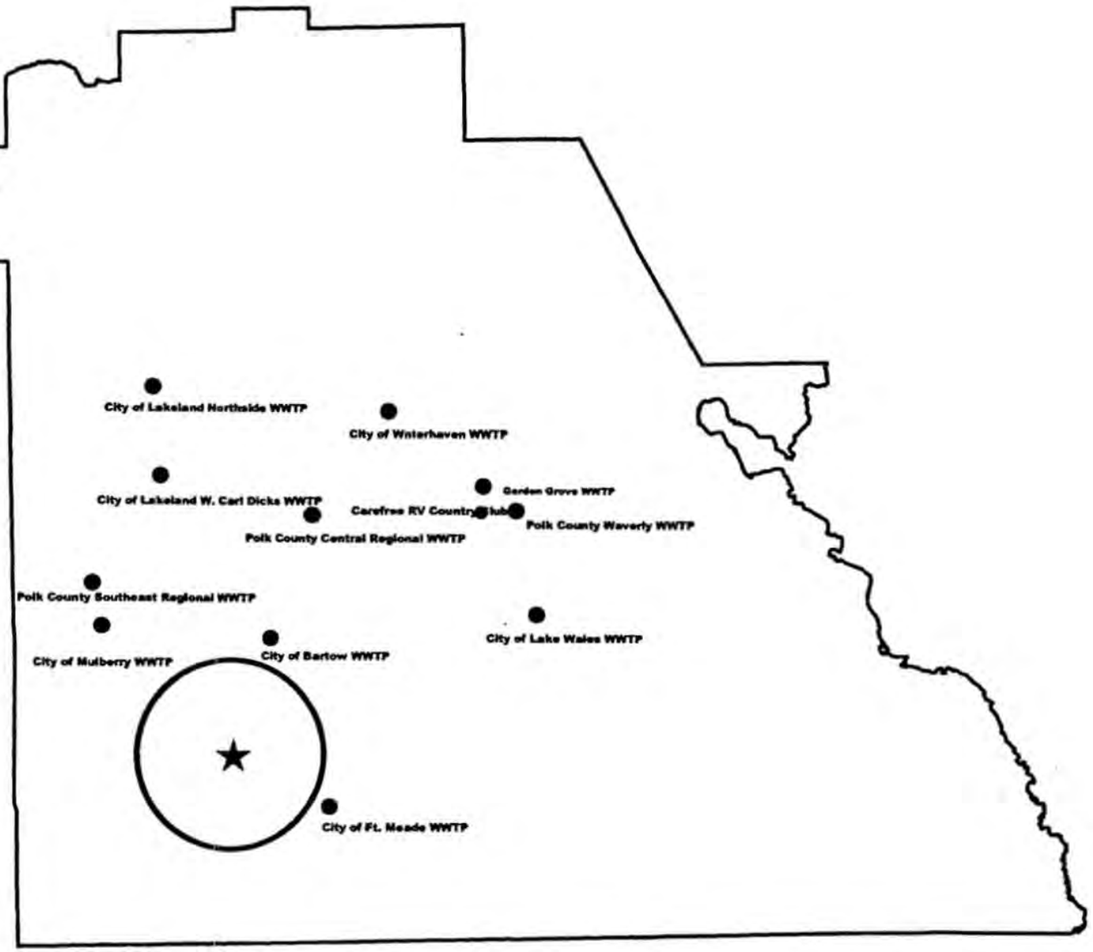
3.5.5 References

Florida Power Corporation. 1992. Polk County Site. Site Certification Application.

1994. Power Block 2 Site Certification Application

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- **WASTEWATER TREATMENT PLANTS**
- ★ **HINES ENERGY COMPLEX**
- **5 MILE RADIUS**



5 2.5 0 5 10 Miles

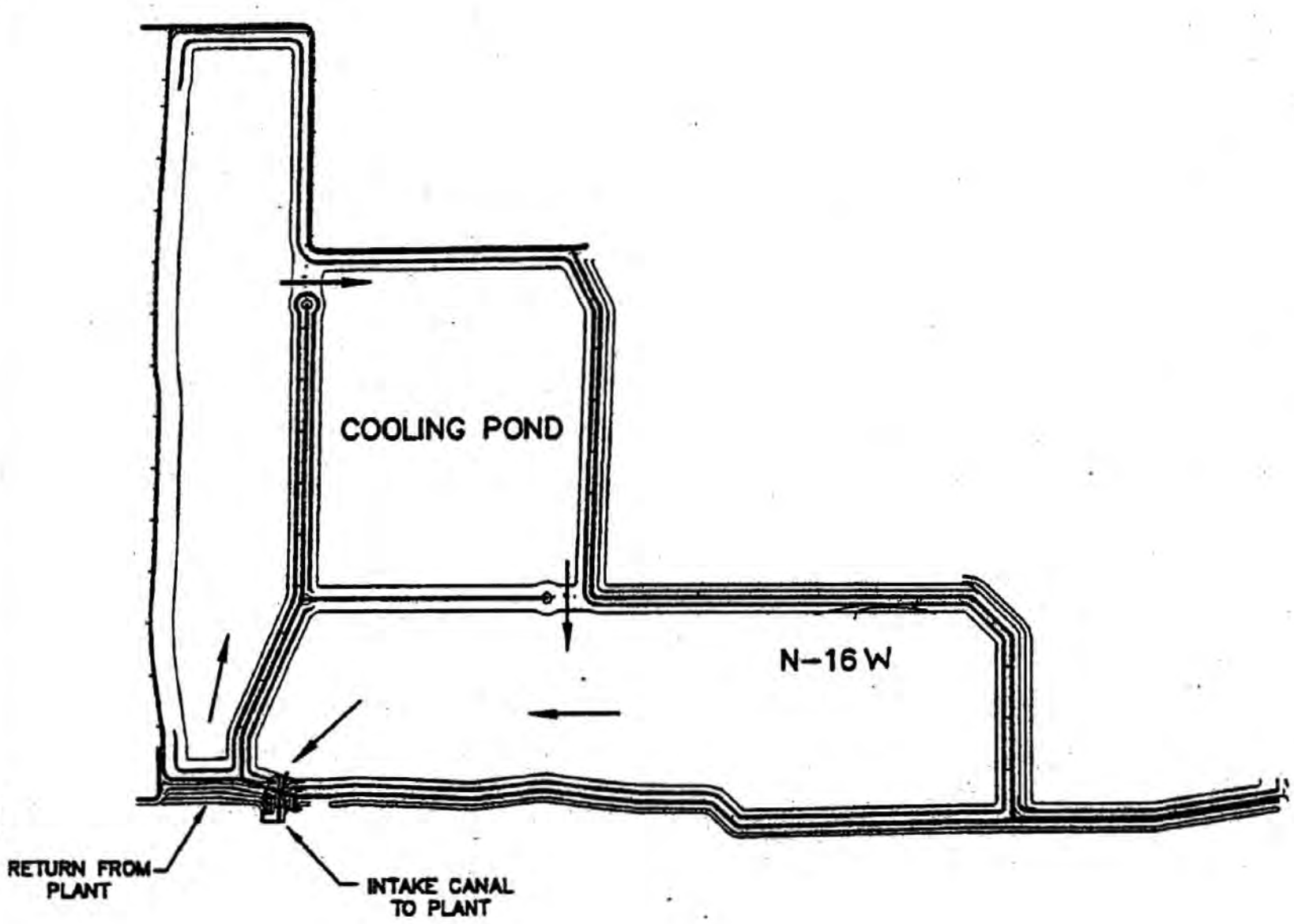
SOURCE: 1992 SCA

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FIGURE 3.5-1
POLK COUNTY WASTE WATER
TREATMENT PLANT LOCATIONS

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LEGEND

——— COOLING POND BOUNDARY

←——— DIRECTION OF WATER FLOW

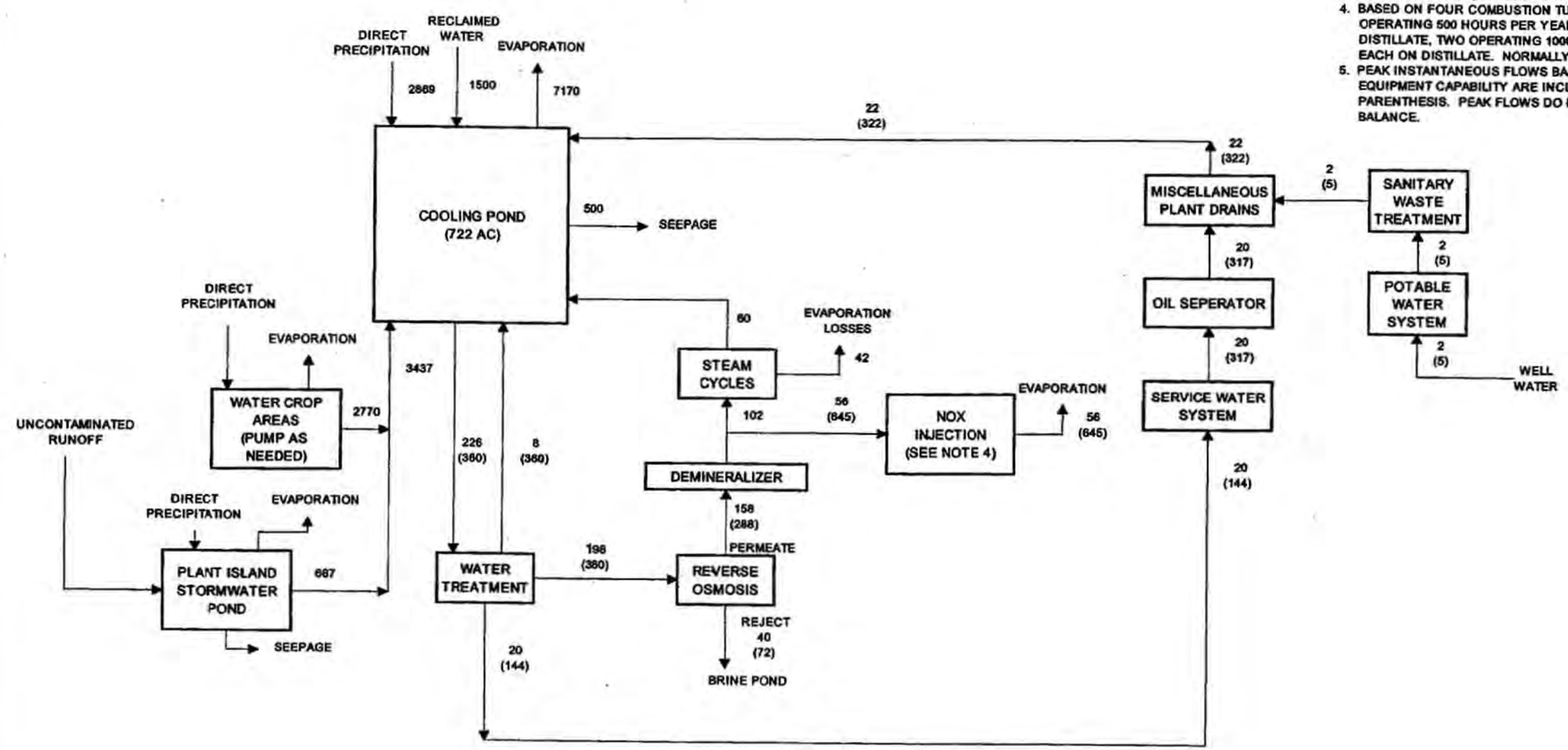
SOURCE: 1992 SCA

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FIGURE 3.5.1-1
COOLING POND CONFIGURATION

NOTES:
1. ALL FLOWS IN 1000's of GAL/DAY.
2. BASED ON 85% LOAD AND ANNUAL AVERAGE PRECIPITATION AND EVAPORATION.
3. 1000 MW NOMINAL, BLOCKS 1 AND 2.
4. BASED ON FOUR COMBUSTION TURBINES, TWO OPERATING 500 HOURS PER YEAR EACH ON DISTILLATE, TWO OPERATING 1000 HOURS PER YEAR EACH ON DISTILLATE. NORMALLY NO FLOW.
5. PEAK INSTANTANEOUS FLOWS BASED ON EQUIPMENT CAPABILITY ARE INCLUDED IN PARENTHESIS. PEAK FLOWS DO NOT NECESSARILY BALANCE.



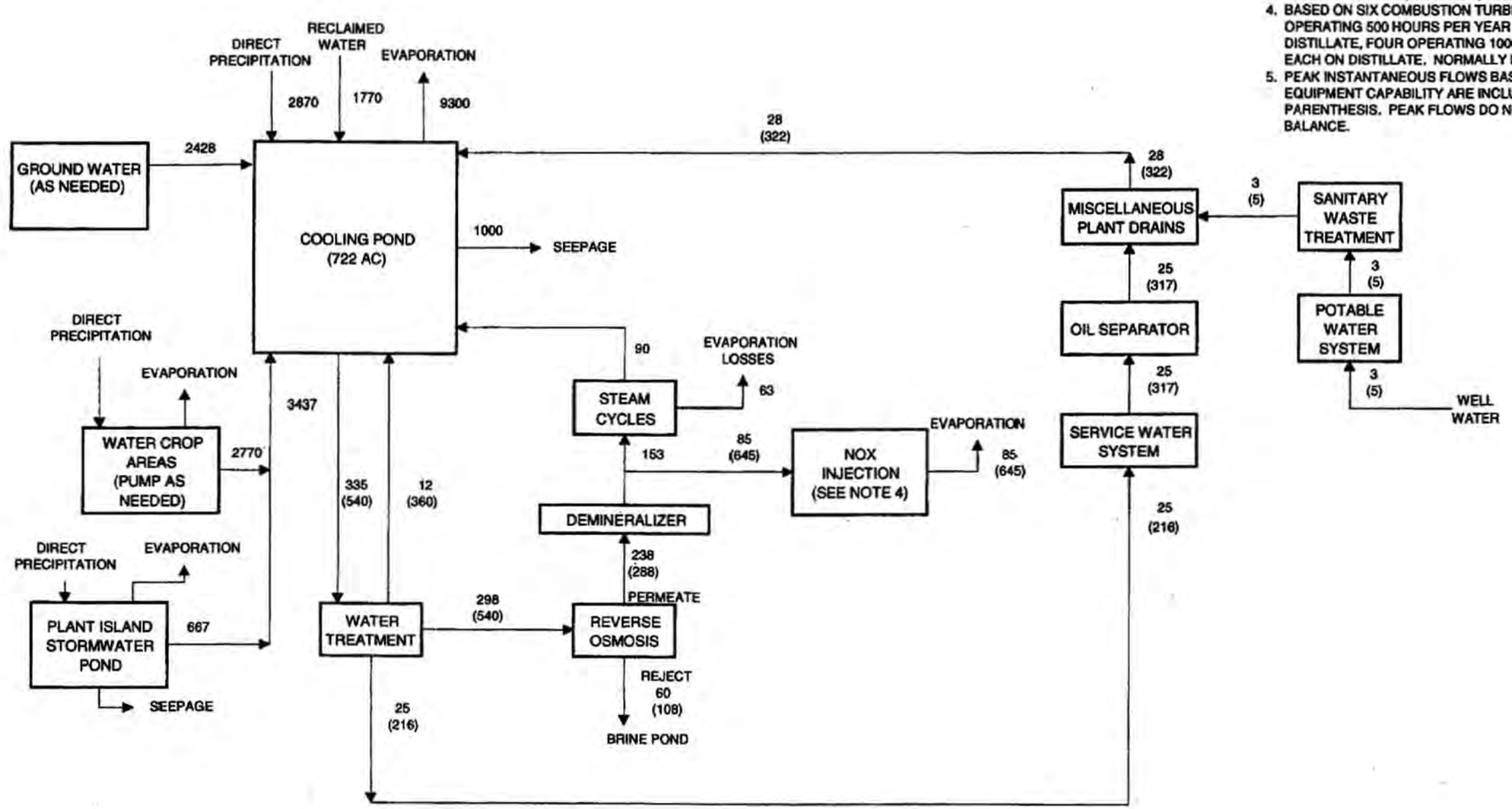
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FIGURE 3.5.1-2
WATER BALANCE DIAGRAM - POWER BLOCKS 1 AND 2

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NOTES:
1. ALL FLOWS IN 1000's of GAL/DAY.
2. BASED ON 85% LOAD AND ANNUAL AVERAGE PRECIPITATION AND EVAPORATION.
3. 1530 MW NOMINAL, BLOCKS 1, 2 AND 3.
4. BASED ON SIX COMBUSTION TURBINES, TWO OPERATING 500 HOURS PER YEAR EACH ON DISTILLATE, FOUR OPERATING 1000 HOURS PER YEAR EACH ON DISTILLATE. NORMALLY NO FLOW.
5. PEAK INSTANTANEOUS FLOWS BASED ON EQUIPMENT CAPABILITY ARE INCLUDED IN PARENTHESIS. PEAK FLOWS DO NOT NECESSARILY BALANCE.



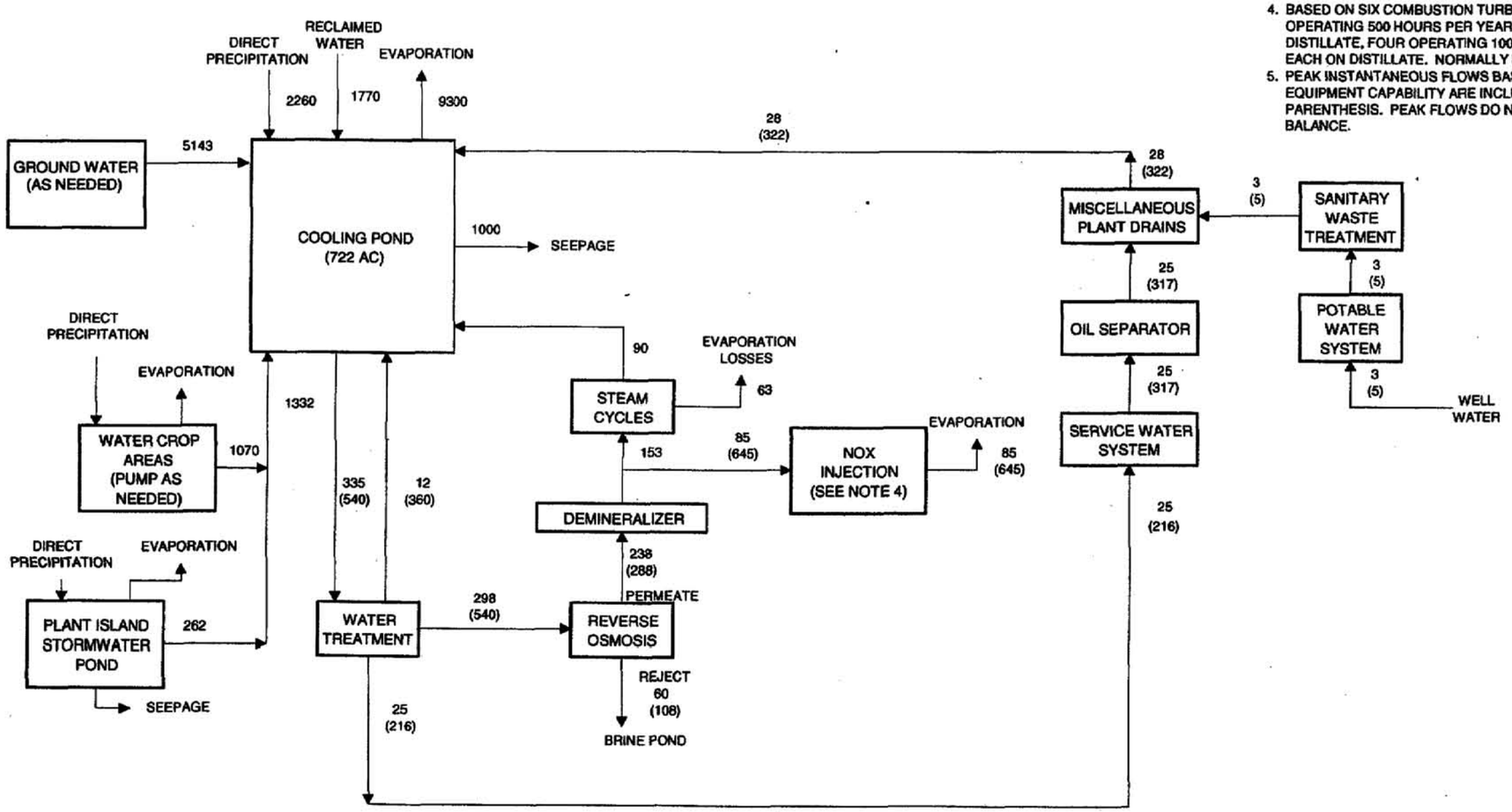
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FIGURE 3.5.1-3
WATER BUDGET DIAGRAM - (AVERAGE YEAR)
POWER BLOCKS 1, 2, AND 3

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NOTES:
1. ALL FLOWS IN 1000's of GAL/DAY.
2. BASED ON 85% LOAD AND ONE IN 10 YEARS PRECIPITATION AND EVAPORATION.
3. 1530 MW NOMINAL, BLOCKS 1, 2 AND 3.
4. BASED ON SIX COMBUSTION TURBINES, TWO OPERATING 500 HOURS PER YEAR EACH ON DISTILLATE, FOUR OPERATING 1000 HOURS PER YEAR EACH ON DISTILLATE. NORMALLY NO FLOW.
5. PEAK INSTANTANEOUS FLOWS BASED ON EQUIPMENT CAPABILITY ARE INCLUDED IN PARENTHESIS. PEAK FLOWS DO NOT NECESSARILY BALANCE.



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FIGURE 3.5.1-4
WATER BUDGET DIAGRAM - (DROUUGHT YEAR)
POWER BLOCKS 1, 2, AND 3

TABLE 3.5-1

POLK COUNTY RECLAIMED WATER SOURCES

Reclaimed Water Source WWTP	Treatment Level	Permitted Design Capacity (MGD)	Main Effluent Disposal Method	Average Monthly Flow (MGD)	BOD (mg/l)	TSS (mg/l)	Nitrate (mg/l)	Total Phosphorous (mg/l)
City of Bartow	Secondary	4.00	Reuse by Florida Power Corporation	1.92	1.7	2.7	1.9	**
Carefree RV Country Club	Modified AWT	0.75	Irrigation	0.03	3.1	1.5	3.6	**
City of Ft. Meade	Secondary	1.00	Reuse by Cargill Mine	0.43	1.3	11.8	5.9*	3.2
Garden Grove	AWT	2.00	Irrigation	0.79	2.5	2.1	8.4	**
City of Lakeland W. Carl Dicks	Secondary	10.80	Reuse by Power Plant	6.30	1.8	2.3	1.2*	3.3
City of Lakeland Northside	Secondary	6.25	Wetland App. & Reuse by Power Plant	2.90	6.0	1.2	7.8	2.7
City of Lake Wales	Modified AWT	1.90	Discharge to Peace Creek	1.02	5.0	0.9	4.0	**
City of Mulberry	AWT	0.75	Discharge to Alafia River	0.35	3.0	2.9	3.1	**
Polk County CRWWTF	Secondary	1.10	P/E Ponds	0.62	1.7	4.1	5.0	**
Polk County SWRWWTF	Modified AWT	2.00	Irrigation	1.14	2.0	1.8	1.0	**
Polk County Waverly	Secondary	0.13	P/E Ponds	0.04	3.5	6.7	2.2	**
City of Winterhaven #3	Secondary	5.00	Overland Flow	2.90	6.0	17.0	4.9	4.0

*Reported as Total Nitrogen.
** Data not reported.

Source: Florida Department of Environmental Protection, 2000

3.6 CHEMICAL AND BIOCIDE WASTE

The Hines Energy Complex is a zero surface water discharge facility with respect to the National Pollutant Discharge Elimination System (NPDES) program for industrial wastewaters. The key feature of this design is the Cooling Pond, which will serve not only as the heat dissipation device but also as a treated wastewater collection and reuse storage device.

The following subsections address the potential sources for chemical and biocide wastewaters.

3.6.1 Cooling Pond Circulating Water Treatment and Other Biocide Treatment

Intermittent shock biocide treatment will be used to prevent biofouling of the circulating water system. An oxidizing biocide will be fed within the intake structure to the circulating water pump suctions. The feed rate will be based on obtaining a total residual oxidant at the condenser outlets of 0.5 mg/l. The frequency and duration of each treatment cycle will be adjusted seasonally to provide the necessary biofouling control to keep the condensers clean. Total residual oxidant levels in the Cooling Pond are expected to be, on average, below the limits of detectability because of the large volume of water in the Cooling Pond, the biocide demand, and the short duration of treatment.

3.6.2 Process Water Treatment

The Cooling Pond supplies all process water. This water is filtered before use or storage. The filter backwash is returned to the Cooling Pond.

Demineralized water is produced by treatment through reverse osmosis and an ion-exchange process as described in Section 3.5.4. The reverse osmosis system treats process water to produce a low dissolved solids permeate suitable for treatment by an ion-exchange process. Between 70 and 80 percent of the Cooling Pond water entering the reverse osmosis system will be recovered as permeate. The remaining 20 to 30 percent (reject) will leave the system with roughly three to four times the inlet dissolved solids concentration and will be routed to the Brine Pond for evaporation. Mobile ion-exchange vessels, which are regenerated off-site, perform final demineralization, therefore no demineralizer regeneration wastes are disposed on-site.

3.6.3 Potable Water Treatment

Well water will be chlorinated for potable uses as described in Section 3.5.3.

3.6.4 Sanitary Waste Treatment

The on-site sanitary waste treatment system is described in Section 3.5.2. The collected treatment system solids will be periodically removed from the sludge holding tank and disposed as described in Section 3.7.

3.6.5 Steam Cycle Chemical Feed

The steam cycle will be treated with an oxygen scavenger, such as a dilute hydrazine solution, for dissolved oxygen control and with an amine, such as ammonia solution, for pH control. Hydrazine will break down to ammonia at the system operating temperature. Di- and tri-sodium phosphate solutions will be fed to control scaling and corrosion in the boiler drums. The phosphate will react with calcium hardness in the steam generators to form a non-adherent precipitate, which is removed with boiler blowdown. Boiler blowdown will be high purity water with small amounts of suspended solids and sodium phosphate, and will be routed to the Cooling Pond for reuse.

3.6.6 Chemical Cleaning Wastes

Steam generators and boiler steam cycle components will be chemically cleaned initially during commissioning, and periodically during the life of the plant. Chemicals used for these cleanings will not be permanently stored on-site and will be administered utilizing a temporary system. Typical cleaning chemicals include the following:

- Di- and tri-sodium phosphate
- Chelates, such as ammoniated EDTA and citric acid
- Nonfoaming wetting agents

As authorized by Condition of Certification XVII.L, (modified August 1997), chemical cleaning wastes resulting from the acid cleaning wash and successive rinses may either be collected and characterized individually to determine if they are hazardous wastes or commingled prior to characterization to determine if the mixture is a hazardous waste. Based on the analytical results, the wastes will be handled in accordance with applicable state and federal rules and Conditions of Certification, either on-site in the Brine Pond, on-site in the Cooling Pond, or off-site, as appropriate. Chemical boiler cleaning wastes will be

routed to the neutralization basin or to neutralization tanks for hazardous waste characterization. The mixture will then be neutralized and the resulting wastes disposed of appropriately. Any non-hazardous wastewater residual resulting from on-site treatment may either be recycled to the Cooling Pond, disposed of in the Brine Pond or shipped off-site for disposal. Any hazardous waste residues will be transported off-site by a licensed hazardous waste disposal contractor for appropriate treatment and disposal at a licensed hazardous waste facility.

If hazardous wastes regulated under 40 CFR 262-34, are treated on-site in tanks or containers as defined in 40 CFR 260.10, FP will comply with applicable waste analysis plan and notification requirements under 40 CFR 264.13 and 268.9(d). Boiler cleaning wastes treated in an Elementary Neutralization Unit or in a wastewater treatment unit as defined in 40 CFR 260.10 are not subject to these requirements.

3.6.7 Oil Spill Prevention

Oil separators will be provided for separation of oil and grease from contaminated wastewater. Treated wastewater effluent is discharged to the Cooling Pond. Any accumulated oil will be removed from the separator and recycled or disposed off-site by a licensed waste management contractor. Oil separators will be sized to contain the volume of oil produced by the total failure of the single largest source serviced by that separator.

Secondary containment is provided for site facilities containing significant amounts of oil. In the event of a spill, oil will be contained within the secondary containment area and removed for recycling or disposal by a licensed contractor. Drains within the containment area may be directed to the central oil/water separator and will normally be closed. After visual inspection of runoff within the containment area to ensure that no significant release of oil has occurred, the valves are opened to drain collected runoff to the oil/water separator.

3.6.8 Reference

Florida Power 1992. Polk County Site. Site Certification Application.

Siting Board. Final Order Modifying Conditions of Certification. In Re: Application for Plant Certification of Florida Power Polk County Site. DEP Case No. PA 92-33B.

3.7 SOLID AND HAZARDOUS WASTES AND BY-PRODUCTS

The solid and hazardous wastes to be generated at the Hines Energy Complex, including Power Block 3, and their associated methods of treatment, handling, storage and disposal are discussed in the following sections.

3.7.1. Solid Wastes

General solid wastes such as grass clippings, other yard wastes, and circulating water system screenings, will be recycled to the extent possible. Sanitary waste solids are disposed offsite at a licensed facility. Remaining wastes will be transported off-site to a licensed facility for disposal.

Filter backwash solids from service water pretreatment will be returned to the Cooling Pond.

The use of on-site clay settling areas for solid waste disposal as authorized by the 1994 Certification represents a major advantage for this particular power plant site. After ordinary mining reclamation, clays within the settling areas will form an effectively impermeable liner. No additional developments of onsite solid waste disposal facilities are proposed for Power Block 3.

FP has a corporate-wide commitment to waste minimization. This commitment includes extensive recycling of waste products, reduction at the source, and elimination of most hazardous product usage. This corporate commitment will be implemented on a continuing basis at the site.

3.7.2 Hazardous Wastes

Hazardous wastes will be managed in accordance with applicable state and federal regulations.

3.7.3 By-Products

As authorized by the 1994 Certification, FP currently utilizes the existing clay settling area (SA-9) for brine disposal. No additional brine disposal area is needed to support Power Block 3.

3.7.4 References

Florida Power. 1992. Polk County Site. Site Certification Application.

Siting Board. 1994. Final Order Approving Certification. In Re: Application for Power Plant Certification of Florida Power. Polk County Site PA 92-33. DOAH Case No. 92-5308 EPP.

3.8 ON-SITE DRAINAGE SYSTEM

Stormwater runoff associated with Power Block 3 will be managed consistent with the concept approved in the 1994 Site Certification, and explained in the Power Block 2 Supplemental Site Certification Application for all areas within the Hines Energy Complex site.

3.9 MATERIALS HANDLING

3.9.1 Construction Materials

Major components to be constructed at the Hines Energy Complex for Power Block 3 include the following:

- Two combustion turbines
- Two combustion turbine electrical generators
- Two heat recovery steam generators
- One steam turbine electrical generator
- One steam turbine
- Transformers

These components will be delivered to the site by rail or truck. No off-site or on-site upgrading of either rail or road facilities is expected to be necessary to facilitate delivery of construction materials. All oversized deliveries will receive necessary DOT approvals.

Once on site, materials will be unloaded and transported using mobile cranes and trucks. Some of the heaviest items will require rail delivery, multi-axle transport haul trailers, and special rigging for on-site handling.

Fuels for construction vehicles will be stored in fuel storage drums within a contained area in accordance with regulations. Gasoline and diesel fuel for cars and trucks used during construction and operation will be stored in tanks with appropriate secondary containment. Spent lubricants, paints, and solvents will be removed from the site for recycling or for disposal.

The construction sanitary wastewater system will consist of portable, self-contained chemical toilets. Wastes from these chemical toilets will be removed periodically by an off-site service, as needed. The existing site sewage treatment may also be used during the construction period.

Fugitive dust, surface water runoff, and waste disposal associated with material handling during construction will be controlled using the following techniques:

- Dust suppression will be accomplished by watering the unpaved roads, parking lots, and laydown areas, as needed.

- The Plant Island stormwater retention pond will be used to settle suspended sediment from rainfall runoff.

- Construction trash and other non-hazardous debris will be recycled, or will be collected for off-site disposal by a licensed disposal contractor in a permitted disposal facility.

- Commercial salvage of metal wastes will be implemented. If salvage is not feasible, these wastes will be removed from the site by a licensed contractor for recycling or disposal in a permitted disposal facility.

3.9.2 Operational Materials

The handling and storage of fuels for Power Block 3 (natural gas, fuel oil) are discussed in Section 3.3. Handling and storage of wastewater treatment sludge and other lesser-volume wastes are discussed in Section 3.7.

Other operational materials include water and wastewater treatment chemicals, lubrication oils, combustion and ST coolant and HRSG blanketing gas.

Water and wastewater treatment chemicals (e.g., sulfuric acid and sodium hypochlorite) will be stored in tanks adjacent to the water treatment systems. The chemical tanks will be located within containment areas.

Lubrication oil and greases will be stored in lube oil storage drums. The drums will be located within an enclosed curbed area designed to detain 110 percent of the stored material. An (normally closed) emergency drain system will route any spills within the curbed area to the plant oil/water separator.

Lubricating oil also will be stored in equipment-associated lube oil tanks and system piping. This equipment and piping will either be enclosed in a containment area or will be within an area protected by a drain system to the oil/water separator.

Nitrogen and carbon dioxide gases may be stored in bottles adjacent to the gas distribution system that serves the units.

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4.1 LAND IMPACT

For reference, the Hines Energy Complex site has been divided into six general areas as listed below:

- Plant Island Area
- Cooling Pond Area
- Water Crop Areas
- Brine Pond Area
- Buffer/Mitigation Areas
- McCullough Creek Watershed

4.1.1 General Construction Impacts

4.1.1.1 Plant Island Area

The Plant Island area is described in Section 3.2.1. There are no impacts to land except for minor grading in the 5-acre parcel that will contain Power Block 3. Mass earthwork activities necessary for construction of the Power Block 3 area were performed during initial site development activities that were completed in August 1996. The resultant topography was presented in the As-Built Drawings for Earthwork Construction dated November 1996 that are on file with the DEP. Only localized impacts are expected from installation of foundation systems and infrastructure piping systems to support Power Block 3.

The discussion of the impacts to surface water bodies by the topographical changes is presented in Section 4.2, and a discussion of impacts to biota is presented in Section 4.4.

4.1.1.2 Cooling Pond Area

The existing 722-acre Cooling Pond construction was completed in August 1996 and is capable of supporting Power Blocks 1, 2 and 3. Expansion of the existing Cooling Pond, therefore, is not required for Power Block 3. The description of the Cooling Pond area is provided in Section 3.2.2. There will be no land impacts associated with the Cooling Pond during the construction of Power Block 3 other than the construction of a new cooling water intake/discharge structure.

4.1.1.3 Water Crop Areas

Runoff from all of the Hines Energy Complex site areas, with the exception of SA-9, SA-10, SA-12 South, N-9B, N-11A, N-13 and Tiger Bay, will be used as an alternative water supply to provide Cooling Pond makeup water in support of Power Blocks 1 and 2. There will be no land impacts associated to Water Crop Areas during the construction of Power Block 3.

4.1.1.4 Brine Pond Area

The Brine Pond was constructed during the summer/fall of 1997 within former clay settling area SA-9. Brine enters the pond near the southwestern corner of the area. The Brine Pond utilizes the existing waste phosphatic clays as its liner system. No additional construction is anticipated in the Brine Pond during Power Block 3 construction.

4.1.1.5 Buffer/Mitigation Areas

Construction of the Buffer/Mitigation Area (N-9B, N-11A, N-11C, N-13, and Tiger Bay) was authorized by the 1994 Certification and is complete. No new construction authorization in the Buffer/Mitigation Area is being sought to support Power Block 3.

4.1.1.6 McCullough Creek Watershed

SA-10 and SA-12 South are considered headwater areas for McCullough Creek. Runoff from these areas is released slowly into the McCullough Creek system with a control weir at the northeast corner of SA-12 South. No new impacts associated with Power Block 3 are anticipated for these areas.

4.1.2 Roads

There will be no new roads constructed to support Power Block 3. The existing plant access road which will service Power Blocks 1, 2 and 3, presently connects to CR 555 and is paved and striped. There will be no land impact due to construction of roads.

4.1.3 Flood Zones

No impacts beyond those addressed as part of the 1992 SCA will occur during the construction phase of Power Block 3.

4.1.4 Topography and Soils

Impacts to soils and topography by power plant construction have been addressed in Section 4.1.1.1.

4.1.5 References

Florida Power. 1992. Polk County Site. Site Certification Application.

4.2 IMPACT ON SURFACE WATER BODIES AND USES

4.2.1 Impact Assessment

4.2.1.1 Off-Site Water Bodies

The off-site water bodies in the vicinity of the Hines Energy Complex include the Peace River, Camp Branch and McCullough Creek. Barber Branch, formerly located within and adjacent to the northeast corner of the site, has been mined and no longer exists in the site vicinity. The Six Mile Creek drainage has also been mined in the vicinity of the site. However, a substantial portion of the Six Mile Creek drainage will be proposed to be reestablished through off-site mine reclamation activities.

Site development activities associated with Power Block 3 include construction of the power generating units, the cooling and process water systems, the Unit 3 stormwater drainage facilities, and the associated on-site transmission and substation facilities.

Only minimal (if any) localized dewatering for foundation and infrastructure installation will be utilized for the construction activities for Power Block 3. As a result, no construction impacts to off-site water bodies are anticipated from dewatering. Section 4.3 provides details of construction dewatering impacts.

4.2.1.2 On-Site Water Bodies

Because only minimal, if any, localized dewatering in and around Power Block 3 will be required during Power Block 3 construction activities, no impacts are anticipated to Tiger Bay, the only onsite water body over which DEP, SWFWMD, and Polk County have claimed jurisdiction.

4.2.2 Measuring and Monitoring Programs

Since the potential for any impacts to surface water bodies from the construction of Power Block 3 is minimal, no new measuring or monitoring programs are proposed.

4.2.3 References

Florida Power Corporation. 1992. Polk County Site. Site Certification Application.

4.3 GROUND WATER IMPACTS

4.3.1 Construction Dewatering Impact Assessment

Temporary dewatering activities may be required during the construction of Power Block 3 and associated facilities. The following is a list of structures and/or equipment that may require dewatering activities due to the depth of the installation:

- Circulating Water Intake Structure (27 feet deep)
- Circulating Water Pipe Lines (15 feet deep)
- Circulating Water Discharge Structure (10 feet)
- Oil Water Separator & Waste Water Lift Station (20 feet deep)
- Two Boiler Blowdown Sumps (10 feet deep)

Dewatering for these structures and equipment will be performed using well points or open pit sump pumps. This type of dewatering will only affect the ground water in a very localized area, thereby, minimizing the impact on the ground water table.

The areas where dewatering may be required are all within the Plant Island. The soils at the Plant Island consist of engineered, compacted fill soil. The hydraulic conductivity of the engineered fill material in the Power Block area typically will be lower than found in the natural, undisturbed Surficial aquifer. As reported by Hutchinson (1978) the transmissivity of the Surficial aquifer averaged 1,900 ft^2/day. Using an aquifer thickness of 35 feet, the hydraulic conductivity of the Surficial aquifer in an undisturbed condition will typically be on the order of 50 ft/d (feet per day) or less. Where compacted, engineered fill material is located in the Plant Island, the hydraulic conductivity of the backfilled soil is expected to be much lower. Based on grain size analyses and compaction data, the hydraulic conductivity of the engineered fill is expected to be less than 50 ft/d.

Two temporary piezometers were installed in the engineered fill material near the proposed excavation locations. Piezometer 1 was installed in the Plant Island south of the Cooling Pond and piezometer 2 was installed near the northwest corner of Power Block 2. The piezometers were installed to measure the depth to the water table near the locations proposed for subsurface placement of the equipment and structures. Ground water levels were measured on November 19, 1998. The depth to ground water in piezometer 1 was 19.2 feet below grade while the water level in piezometer 2 was 25.6 feet below grade.

The proposed excavation depths will range up to approximately 30 feet. Because of the depth to the water table, as measured in the piezometers, lowering of the water table for excavation and construction will be minimal and localized.

The dewatering will be accomplished using standard construction dewatering techniques. Either well points will be installed surrounding the area to be excavated; or the excavation will be dewatered by pumping from the excavation. Discharge from dewatering systems will be localized and remain on-site.

SWFWMD Rule 40D-2.051(1)(f) states that no permit is required for temporary dewatering for construction of buildings or other foundations and roadways or for installation of utility pipeline, cables, culverts, and catch basins. The dewatering for the structures and equipment listed above would not require a dewatering permit from SWFWMD.

4.3.2 Ground Water Supply Wells

Two wells will be drilled to tap the Floridan Aquifer to provide make-up water to the Cooling Pond for Power Block. Seventeen and one-half MGD of ground water was permitted to support generating capacity beyond the first 940 MW in the 1994 Site Certification. The ground water supply wells will have 20-inch diameter casing and a total well depth of about 880 feet. Each well is expected to be equipped with a 2000 gpm pump. The wells will be located on the south side of the Cooling Pond, near the cooling water intake structure.

4.3.2 References

Hutchinson, C.B. 1978. Appraisal of Shallow Ground-Water Resources and Management Alternatives in the Upper Peace and Eastern Alafya River Basins,

Florida. U.S. Geological Survey, Water Resources Investigation 77-124.

SWFWMD, 1998. Consumptive Use of Water, Rule 40D-2.051(1)(f). July 1998.

Florida Power Corporation. 1992. Polk County Site. Site Certification Application.

4.4 ECOLOGICAL IMPACTS

4.4.1 Impact Assessment

The 1992 SCA addressed impacts associated with full site buildout. Impact assessment in this Supplemental SCA is based on whether the addition of Power Block 3 results in any additional ecological impacts not already reviewed and approved by the 1994 Certification.

4.4.1.1 Site Construction

The construction of Power Block 3 will be limited to land already cleared and prepared for this project. Construction will be limited to land that has been previously cleared during the site preparation phase of the project. No ecological impacts beyond those approved by the 1994 Certification are anticipated.

4.4.1.2 Environmental Management and Protection Plans for Construction

The FP Construction Compliance Manual will be used to maintain compliance during construction activities. This manual contains all necessary permits and procedures that must be followed.

Because construction of Power Block 3 will occur within the Plant Island area, and all runoff will be contained onsite, no further protective measures are necessary.

4.4.1.3 Aquatic Ecology

Negative impacts to aquatic habitats are not expected because the site preparation work has already taken place and because native aquatic habitats are separated from construction areas on the site.

4.4.1.4 Vegetation Communities

No adverse impacts to important native vegetation communities are expected with development of Power Block 3 because all construction will take place on lands previously cleared and prepared for this and additional units.

4.4.1.5 Enhancement Plan

As a part of the 1994 Certification, an environmental enhancement plan was proposed for development of the Hines Energy Complex site. The plan consisted of three major features: the acquisition of a portion of the Hooker's Prairie/Peace River Wildlife Corridor, the planting of native vegetation communities in the Buffer/Mitigation area, and the construction of the McCullough Creek drainage enhancement project.

The wildlife corridor component was acquired and a conservation easement was granted to the State in 1994.

Non-mandatory parcels N-11A, N-13, and N-9B have been reclaimed and provide a Buffer/Mitigation area of approximately 1,115 acres. These areas were reclaimed and revegetated to provide upland and wetland assemblages, in accordance with reclamation plans approved by the FDEP Bureau of Mine Reclamation. The post-reclamation vegetative cover in these Buffer/Mitigation areas will consist of a combination of various upland and wetland communities designed to represent naturally occurring systems and provide a wide variety of wildlife habitat. Emphasis has been put on the creation of habitat for native species of plants and animals.

4.4.1.6 Threatened or Endangered Animal and Plant Species

Only land previously developed to accommodate the Hines generating facilities will be affected by construction activities associated with Power Block 3. Therefore, the project is not expected to affect threatened or endangered species populations.

4.4.2 Monitoring Programs

Because construction will occur in limited areas and mostly on land recently cleared and graded, no significant impacts are expected to occur to important ecological resources and no monitoring program is needed.

4.4.3 References

Florida Power Corporation. 1994. Construction Compliance Manual.

Florida Power Corporation. 1992. Polk County Site. - Site Certification Application.

4.5 AIR IMPACT

4.5.1 Air Quality Impacts

During the construction period, unavoidable air pollutant emissions are likely to occur from various construction-related activities. The most prevalent construction emissions are fugitive dust. However, minor emissions of nitrogen oxides (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter, and volatile organic compounds (VOCs) are also likely during construction. Emissions of these pollutants generally are minimized through standard control measures.

4.5.1.1 Fugitive Dust

Fugitive dust is generally defined as natural and/or man-associated dusts that become airborne due to the forces of wind or human activity. Construction-phase fugitive dust emissions may be generated during site grading, excavation, vehicular activity, and other construction activities.

The quantities of fugitive dust emitted by the site construction vehicular traffic will be dependent on a number of factors, including the frequency of operations, specific operations being conducted, weather, and soil conditions. During construction, dust control measures will be used and will typically require moisture conditioning of the construction areas and along the defined roadways between these areas.

4.5.1.2 Other Air Pollutant Emissions

It is anticipated that total gaseous emissions during construction will be extremely small. Potential sources of VOC emissions include evaporative losses associated with on-site painting, refueling of construction equipment, and the application of adhesives and waterproofing chemicals. The frequency and extent of these activities are limited and they will have minimal impact on air quality.

Exhaust emissions from construction equipment will also contain small amounts of NO_x, SO_2, CO, particulate matter, and VOCs resulting from incomplete combustion of fuel. However, due to the nature of heavy-duty diesel-powered construction vehicles, which allow for more complete combustion and less volatile fuels than spark-ignited engines, these emissions are relatively low.

Open burning will emit particulate matter, CO, hydrocarbons, sulfur oxides, and NO_x. Open burning of construction debris may occur if the composition of that debris consists of wood products and other

relatively clean-burning components. Pollutant emissions from debris burning will depend upon the amount and moisture content of the debris.

4.5.2 Air Quality Control Methods

The impact of heavy construction activities and site preparation on air quality will be short term and confined to the immediate vicinity of the construction activity. This is primarily because most of the fugitive dust created by construction traffic and earth-moving operations consists of relatively large particles. These large particles tend to settle quickly rather than remain suspended for transport over long distances.

Job site guidelines for minimizing emissions of fugitive dust from identifiable construction sources will include a combination of the following techniques (if applicable):

- Contractors will be instructed to comply with any applicable state and local regulations governing open-bodied trucks hauling sand, gravel, or soil between on-site and off-site areas. This could include providing covers or moistening the load with water and wheel washing to reduce dusting.
- Areas disturbed during construction will be stabilized by mulching or seeding as soon as practical.
- When construction occurs on bare ground, water (possibly together with wetting agents) will be used as necessary to suppress dust.
- Temporary vehicular surfaces of crushed rock may be used in high traffic areas. Areas not subject to heavy traffic or continual disturbance will be wetted down using nontoxic substances to suppress dust.
- On-site concrete batch plants will be equipped with dust control systems that effectively mitigate off-site impacts.

Sandblasting operations will be located in isolated areas to minimize effects on adjacent work areas. Protective covers will also be utilized where practicable.

Only minor short-term air quality impacts are expected to result from open burning since these operations will be conducted in compliance with FDEP air pollution control regulations (Chapter 62-256 F.A.C.) that are applicable in rural areas.

Because of the mitigative measures that will be employed, it is not expected that vehicular emissions, fugitive dust, or smoke from open-burning operations will present any significant air quality problems during the construction period.

4.5.3 Ambient Air Quality Monitoring Program

Air quality monitoring for construction-related fugitive dust or other air pollutants is not being proposed. Periodic visual inspections of the job site will be conducted to ensure compliance with guidelines for minimizing emissions of fugitive dust during construction of the proposed facility.

4.6 IMPACT ON HUMAN POPULATIONS

The construction site is located in southwestern Polk County. The city of Fort Meade, which is located approximately 5 miles southeast of the Plant Island, is the largest population center in the vicinity. The unincorporated community of Homeland is approximately 1 mile northeast of the site boundary. Since the entire area around the site has historically been dominated by phosphate mining, operation of heavy machinery and large volumes of truck traffic in the area are common. Construction activities on-site are not expected to have a significant impact on these communities.

4.6.1 Construction Traffic Impacts

The employment of construction workers will create traffic impacts on the external roadway network. The magnitude of the traffic impact will be directly related to the number of construction workers. Traffic generated during the construction of Power Block 3 will not exceed the traffic levels generated by the construction of the Hines Energy Complex Power Block 1.

A traffic impact analysis was completed and submitted with the 1992 SCA. That traffic analysis addresses anticipated peak construction employment and full buildout.

The traffic impact analysis was reviewed by Polk County and the Florida Department of Transportation. As a result, a series of improvements became the subject of conditions of the Polk County CUP and the 1994 Conditions of Certification. The conditions relate to the need for roadways or intersection improvements to a level of employment and provide for monitoring of employment and traffic conditions to determine the timing of improvements.

Traffic monitoring was conducted during the construction of Power Block 1. All necessary roadway/traffic control improvements required by the 1994 Conditions of Certification (XXIX and XXX.8) and the Polk County CUP have been completed. No increased construction traffic impacts are anticipated for the construction of Power Block 3, and therefore, additional improvements are not required.

4.6.2 Socioeconomic Impacts

Construction of Power Block 3 is scheduled to begin in early 2004 and end by late 2005. Over the approximate two-year construction period, the construction workforce is expected to peak at 350 and average 145 employees. Annual payroll over the two-year construction period is estimated at $15 million. Actual experience during construction of Power Block 1 and Power Block 2 show that most construction workers were drawn from Polk County and the Central Florida area, and they commuted daily to the job

site. Consequently, construction of Power Block 3 is not expected to have a significant impact on Polk County's public services or housing market.

4.6.3 Construction Noise Impacts

Construction noise impacts from construction of all phases up to 3000 MW of ultimate site capacity were analyzed and shown to comply with applicable noise criteria as part of the 1992 SCA. The 1994 Certification finds these noise criteria will be met during construction of each future phase, including the proposed Power Block 3. This noise impact analysis is presented to reaffirm that earlier analysis and demonstration of no adverse impacts.

The construction of a power plant can be divided into five distinct phases for purposes of assessing potential noise impacts (Barnes et al., 1976). These include:

- Site preparation, including grading and excavation
- Concrete pouring
- Steel erection
- Machinery installation
- Site cleanup and plant start-up.

During the initial site preparation and foundation excavation phase, heavy diesel-powered earth moving equipment is the major source of noise. This equipment includes bulldozers, graders, roller compactors, dump trucks, backhoes, and front-end loaders. With the completion of Power Block 1 and the associated Cooling Pond, much of the site preparation activities have been completed. For Power Block 3, these activities will be minimal and primarily associated with the foundations for Power Block 3.

Equipment used during the concrete pouring stage includes concrete trucks, cranes, and some earth moving equipment for backfilling foundations. The steel erection phase requires the use of cranes in varying sizes, air compressors, welders, material delivery trucks, concrete trucks, and front-end loaders. The machinery installation phase requires the same types of equipment as the steel erection phase.

The final phase, consisting generally of site cleanup and plant start-up activities, is typically about 10 decibels quieter than the other phases (Barnes et al., 1976), except during the short periods of time when the steam lines are being cleaned. High-pressure steam is blown through the lines to remove scale or welding debris to prevent such material from passing through the turbines, where they could damage the turbine blades. The steam is vented directly to the atmosphere through a temporary bypass line constructed specifically for that purpose. During the construction of Power Block 1, continuous low pressure "wet" steam was used. This procedure, which is expected to be used for Power Block 3, produced much lower noise levels than conventional steam venting and resulted in noise levels of 90 dBA at about 50 feet. In contrast, conventional steam venting results in a peak sound pressure level at 50 feet of approximately 129

dBA. In setting the steam safety valves, steam will be released for about 6 minutes with a corresponding sound pressure level at 50 feet of approximately 121 dBA.

The temporary steam line blow out activity will produce noise levels less than 42 dBA at the nearest residences for a short duration. This impact is not considered significant because the duration is very short, the frequency of occurrence is low and the sound level produced is about the same as noise from a truck passing by on the highway.

Noise impacts have been assessed for Power Block 3 construction activities combined with the operation of Power Block 1 and Power Block 2. Because of the large separation between the plant site and the nearest residences (about 2.9 miles), the construction noise levels will be reduced to less than 40 dBA at the residences. This level is significantly below the existing 24-hr equivalent noise level of about 57 dBA measured at Location 1 near the residences closest to the Plant Island (see Section 2.3.8). Noise from construction activities and the operation of Power Block 1 and Power Block 2 would raise the noise levels by less than 1 dBA from the 24-hour leg at Location 1, an increase in the existing noise level that would not be noticeable. Consequently, normal construction activities associated with the construction of Power Block 3 will have an insignificant effect on the noise levels at residences in the vicinity of the Hines Energy Complex.

The construction work force, material delivery vehicular traffic levels and, consequently, the traffic noise impact levels will vary in relation to the size of the work force. The peak work force stage of the maximum impact scenario is expected to occur when the peak amount of construction workers will be on-site. The increase in traffic volume is expected to result in a temporary increase in traffic noise levels from 3 to 5 dBA on CR 555 between CR 630 and CR 640. Increases on other area roads will be significantly lower. Generally, increases of this low level are only slightly noticeable and they are particularly insignificant in this case since there are no noise receptors on this portion of the road. Consequently, no significant noise impact is anticipated from the construction of Power Block 3.

4.6.4 References

Barnes, J.D., L. N. Miller and E. W. Wood. 1976. Prediction of Noise from Power Plant Construction. Bolt Beranek and Newman, Inc. Report No. 3321.

Submittal to Empire State Electric Energy Research Corporation. Schenectady, New York.

Florida Power Corporation. 1992. Polk County Site - Site Certification Application.

4.7 IMPACT ON LANDMARKS AND SENSITIVE AREAS

The proposed site is located in an area that has been dominated by phosphate mining operations for the past several decades. There are no regional scenic, cultural, or natural landmarks within five miles of the site. Therefore, there will be no impact on landmarks or sensitive areas.

4.8 IMPACT ON ARCHAEOLOGICAL AND HISTORIC SITES

The Florida Department of State, Division of Historical Resources (DHR) has stated that because of the project location and/or nature, it is unlikely that any significant archaeological or historical sites will be affected.

4.9 SPECIAL FEATURES

No special features such as described in the SCA guidelines are expected to be associated with the construction of Power Block 3.

4.10 BENEFITS FROM CONSTRUCTION

The Hines Energy Complex site is located on lands that have been previously disturbed by phosphate mining activities. The project site contains both mandatory and non-mandatory lands.

Construction of plant facilities will result in a higher assessed value on the property than would otherwise be expected for reclaimed or unreclaimed phosphate lands. The reclamation of the mined phosphate lands for use as a power plant and associated facilities results in an increase in Polk County's property tax base and property tax revenues.

Construction at the Hines Energy Complex site will also result in increased employment and wages in Polk County, both through direct jobs and indirect jobs created as a result of the project. In addition to the direct construction jobs, construction of the project will result in the creation of indirect jobs in associated industries and support (retail and service) industries throughout Polk County.

4.11 VARIANCES

No construction related variances are expected to be required. Construction of the site will meet all applicable local, regional, state, and federal guidelines.

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5.1 EFFECTS OF THE OPERATION OF THE HEAT DISSIPATION SYSTEM

5.1.1 Temperature Effect on Receiving Body of Water

There will be no discharge of heated effluent to surface water from the Power Block 3 Cooling Pond. This section is not applicable.

5.1.2 Effects on Aquatic Life

There will be no discharge of heated effluent to marine or fresh waters from the Power Block 3 Cooling Pond. Additionally, there will be no intake or discharge structures located in off-site surface waters. This section is not applicable.

5.1.3 Biological Effects of Modified Circulation

There will be no discharge of heated effluent to marine or fresh waters from the Power Block 3 Cooling Pond. Additionally, there will be no intake or discharge structures located in off-site surface waters. This section is not applicable.

5.1.4 Effects of Offstream Cooling

The Cooling Pond is expected to operate at temperatures not significantly higher than ambient air and water temperatures, therefore, the Cooling Pond is not expected to produce fog in greater than normal amounts.

5.1.5 Measurement Program

Since no additional adverse effects are anticipated from operation of the heat dissipation system, FP does not propose any new measurement or monitoring programs.

5.2 EFFECTS OF CHEMICAL AND BIOCIDE DISCHARGES

5.2.1 Industrial Wastewater Discharges

There will be no industrial wastewater discharge from the Hines Energy Complex. Consequently, this section is not applicable.

5.2.2 Cooling Tower Blowdown

There will be no cooling tower blowdown from the Hines Energy Complex. Consequently, this section is not applicable.

5.2.3 Measurement Program

Since there is no potential for any industrial wastewater discharge from the Hines Energy Complex, no new measuring or monitoring programs are proposed.

5.3 IMPACTS ON WATER SUPPLIES

5.3.1 Surface Water

The off-site surface water bodies in the vicinity of the Hines Energy Complex include the Peace River, Camp Branch and McCullough Creek. Barber Branch, formerly located within and adjacent to the northeast corner of the site, has been mined through and no longer exists in the site vicinity. The Six Mile Creek drainage has also been mined through in the vicinity of the site. However, a portion of this drainage has been, or will be, reestablished through off-site mine reclamation activities. No impacts to off-site surface water bodies due to the operation of Power Block 3 are expected.

5.3.2 Ground Water

FP's water use plans for the Hines Energy Complex, as authorized in the 1994 Certification, incorporate all of the aspects of the District's long term and overall strategy. The Hines Energy Complex has refined and continues to refine its understanding of the water resources available to the plant through extensive ground water investigations and ongoing surface water studies. Water use plans for the facility incorporate alternative water supply sources including use of reclaimed water, water cropping, and water conservation in order to minimize groundwater withdrawals. In addition, to fully support the water use needs associated with Power Block 3, up to 17.5 MGD of groundwater withdrawals, as authorized in the 1994 Site Certification, are available.

5.3.2.1 Cooling Pond

The operational impacts of Power Block 3 on the Cooling Pond will not cause any additional ground water impacts beyond those already addressed.

5.3.2.2 Brine Pond

No additional impacts to the Brine Pond area are expected from the addition of Power Block 3.

5.3.2.3 Impacts of On-Site Solid Waste Disposal

The impacts associated with on-site solid waste disposal for the plant were presented in the 1992 SCA. No changes in those impacts are anticipated because of operation of Power Block 3, since there will be no on-site disposal of solid waste.

5.3.3 Drinking Water

5.3.3.1 Impacts of Withdrawal from a Drinking Water Source

Up to 5,000 GPD of ground water withdrawals for drinking and sanitary water are authorized in the 1994 Certification. This amount continues to be sufficient to support the addition of Power Block 3. Impacts to drinking water sources due to the groundwater withdrawals proposed in this application were reviewed and approved in the 1994 Site Certification.

5.3.3.2 Impacts of Discharge to a Drinking Water Source

A zone of discharge was authorized for the future solid waste disposal area, the Brine Pond, and the Cooling Pond at the Hines Energy Complex under the 1994 Certification (See Condition of Certification No. XVIII.A.1). The zone of discharge extends horizontally 100 feet out from the outside toe of the earthen dam along a consolidated boundary surrounding these facilities. The vertical extent of the zone of discharge is to the top of the Tampa member of the Hawthorn Group.

Discharges to groundwater from the Cooling Pond, Brine Pond, and solid waste disposal area for full site buildout (3000 MW) were addressed in the 1992 SCA. No impacts of ground water discharge are expected to a drinking water source due to the operation of Power Block 3.

5.3.4 Leachate and Runoff

Impacts to groundwater due to runoff or leachate are not anticipated.

5.3.5 Measurement Program

As required by Condition XVIII.A.9 of the 1994 Certification, FP has established a ground water monitoring program at the Hines Energy Complex. FP has implemented a ground water monitoring program which consists of the collection and analysis of ground water samples from six (6) Intermediate aquifer monitor wells and one (1) Upper Floridan aquifer monitor well.

5.3.6 References

Anderson, M. P. and W. W. Woessner. 1992. Applied Groundwater Modeling Simulation of Flow and Advective Transport. Academic Press, Inc. San Diego, California.

Bedient P. B. 1988. Hydrology and Floodplain Analysis. Addison-Wesley Publishing Co., Reading, Massachusetts.

de Marsily, G. 1986. Quantity Hydrogeology Groundwater Hydrology for Engineers. Academic Press, Inc. San Diego, California.

FDER (Florida Department of Environmental Regulation). 1990. Florida Solid Waste Disposal Facilities Regulations. Florida Administrative Code, Title 17. The Bureau of National Affairs Inc. Washington, D.C.

FIPR (Florida Institute of Phosphate Research). 1991. Volume 1. Documentation on FIPR hydrologic model. FIPR Project No. 88-03-085. Bartow, Florida.

Florida Power. 1992. Polk County Site. Site Certification Application.

Freeze, R. A. and J. A. Cherry. 1979. Groundwater. Prentice-Hall, Inc. Englewood Cliffs, New Jersey.

Hutchinson, C. B. 1978. Appraisal of Shallow Ground Water Resources and Management Alternatives in the Upper Peace and Eastern Alafia River Basins, Florida. USGS WRI 77-124. Tallahassee, Florida.

McDonald, M.G., and Harbaugh, A.W. 1988. A Modular Three-Dimensional Finite- Difference Ground Water Flow Model.

National Oceanic and Atmospheric Administration (NOAA). 1980-1990. Climatological Data, Florida; Annual Summary. U.S. Department of Commerce. Asheville, North Carolina.

Neuman, S. P. and P. A. Witherspoon. 1970. Finite Element Method of Analyzing Steady Seepage with a Free Surface. Water Resources Research. June 1970.

Partney, S. H., W. R. Murphy, and G. L. Henderson. 1990. A Comparative Hydrological Study of the McCullough Creek Basin --- YESTERDAY & TOMORROW, a Preliminary Hydrological Report. FDNR. November 5, 1990. Tallahassee, Florida.

Ryder, P. D. 1982. Digital Model of Predevelopment Flow in the Tertiary Limestone (Floridan) Aquifer System in West-Central Florida. U.S. Geological Survey Water-Resources Investigations 81-54.

Schroeder, P. R., B. M. McEnroe, and J. Sjostrum. 1988. Hydrologic Evaluation of Landfill Performance Model. U. S. Army Engineering Waterways Experiment Station.

Stewart, H. G. 1966. Ground Water Resources of Polk County. Florida Geological Survey. Report of Investigation No. 44.

SWFWMD (Southwest Florida Water Management District). 1987. Aquifer Characteristics Within The Southwest Florida Water Management District. SWFWMD Resource Management Department. Brooksville, Florida.

SWFWMD. 1989. Water Use Permit Information Manual. October 1989. Brooksville, Florida.

SWFWMD. 1991. Water Supply Needs and Sources, 1990-2020. Draft 4/29/91. Brooksville, Florida.

SWFWMD. 1992. Water Supply Needs & Sources 1990-2020. Revised Draft 1/31/92. Brooksville, Florida.

SWFWMD, 1998, Southern Water Use Caution Area, Information Report. April 1998.

USGS (U.S. Geological Survey). 1980-1990. Water Resources Data, Florida. Southwest Florida Surface Water. USGS, Water Resources Division. Tampa, Florida.
USGS. 1980-1991. Water Resources Data, Florida. Southwest Florida Groundwater. USGS Water Resources Division. Tampa, Florida.

USGS. 1990. Water Resources Data, Florida, Water Year 1990, Volume 3A, Southwest Florida Surface Water, USGS Water Data Report FL-90-3A. Tallahassee, Florida.

5.4 SOLID / HAZARDOUS WASTE DISPOSAL IMPACTS

5.4.1 Solid Waste

Solid wastes to be generated during plant operations are discussed in Section 3.7. General solid wastes, such as grass clippings, yard wastes and circulating water system screenings, will be recycled to the extent possible. Waste paper will be recycled where practical. Remaining solid wastes, such as office waste, will be transported off-site for disposal at a licensed waste disposal facility. No disposal of solid waste will occur on-site due to the operation of Power Block 3.

FP has a corporate-wide commitment to waste minimization. This commitment includes extensive recycling of waste, source reduction, and elimination of most hazardous waste product usage. The corporate commitment will be implemented on a continuing basis at the site.

Due to FP's significant recycling efforts and the minimal amount of solid waste to be generated by operation of Power Block 3, impacts related to off-site landfill operations and landfill space are negligible.

5.4.2 Hazardous Waste

No hazardous waste will be disposed on the Hines Energy Complex site.

Management of hazardous waste during plant operations will be in accordance with state and Federal regulations, specifically 40 CFR Part 262: Standards Applicable to Generators of Hazardous Wastes. If hazardous wastes are generated during the cleaning of steam generators and boiler steam cycle components, the wastes will be handled as discussed in Section 3.6.6.

The Hines Energy Complex uses mercury containing lamps and batteries that are regulated as Universal Wastes under federal (40CFR 273 and State Regulation (62-737, FAC)). FP complies with handling and disposal requirements for all Universal Wastes.

5.5 SANITARY AND OTHER WASTE DISCHARGES

Treatment of sanitary wastes generated during operation of Power Block 3 is discussed in Section 3.5.2. After treatment in the permitted on-site treatment plant, wastewater is routed to the Cooling Pond. Biodegradable solids collected in the treatment system are collected in a holding tank and disposed off-site at a licensed facility. No other related waste discharges will occur.

Wastewater reuse results in a slight reduction of water demand from other sources. No significant impacts are expected from the off-site disposal of the biodegradable solids.

5.6 AIR QUALITY IMPACTS

5.6.1 Impact Assessment

The air quality impacts of Power Block 3 are fully discussed in Sections 6, 7, and 8 of the PSD permit application provided as Appendix 10.1.5. Therefore, the analyses that address these air quality impacts are not repeated in their entirety in this section. A summary of the results of these analyses is presented in this section.

Air quality dispersion modeling analyses of the potential impacts of air emissions from the proposed Power Block 3 were performed for those pollutants which had proposed emissions greater than the PSD significant emission rates: Particulate Matter, SO_2, NO_x, and CO. These analyses were performed to address compliance with AAQS and PSD Class I and II increments.

For both natural gas-firing and oil-firing conditions, the ISCST3 air dispersion model was used to determine the maximum ambient air quality impacts for nine modeling scenarios that covered the range of operating loads and air inlet temperatures that the combustion turbines for Power Block 3 would likely experience. For each fuel, the nine modeling scenarios were as follows:

- Baseload operations for air inlet temperatures of 20°F, 59°F, and 90°F (natural gas-firing)/105°F (oil firing);
- 80% load for 20°F, 59°F, 90°F (natural gas-firing)/105°F (oil firing); and
- 60% load (for natural gas-firing)/65% load (oil-firing) for 20°F, 59°F, and 90°F (natural gas-firing)/105°F (oil firing).

Pollutant concentrations were predicted in a receptor grid containing more than 700 receptors that covered an area out to 50 kilometers from the site. Concentrations were predicted using five years of surface and upper air meteorological data for the years 1991 through 1995 from the National Weather Service (NWS) stations in Tampa and Ruskin, respectively. These data have been recommended and approved for use by the DEP in previous air permit applications to address air quality impacts for proposed sources locating in Polk County and adjacent counties.

In addition, pollutant concentrations were predicted at receptor locations placed at the boundary of the Chassahowitzka National Wilderness Area (NWA), which is located 118 kilometers from the plant site and is the nearest PSD Class I area. At distances beyond 50 km from a source, the EPA and FDEP currently recommend the CALPUFF model for predicting impacts. The CALPUFF model is a long-range transport model that was specifically developed for estimating the air quality impacts in areas that are more than 50

km from a source. As a result, the CALPUFF model was used to address impacts from Power Block 3 at the Chassahowitzka NWA.

The results of the ISCST3 and CALPUFF modeling analyses are summarized in Tables 5.6-1 and 5.6-2. In Table 5.6-1, the highest concentrations predicted for Power Block 3 for each pollutant are compared to the corresponding PSD Class II significance levels, PSD Class II increments, and ambient air quality standards. In Table 5.6-2, the highest concentrations predicted for Power Block 3 at the Chassahowitzka NWA are compared to the PSD Class I significance levels. As shown in these tables, the maximum concentrations for all pollutants are predicted to be less than the EPA PSD significance levels. Therefore, Power Block 3 will not have a significant impact on the ambient air quality of central Florida. In addition, these modeling results demonstrate that the maximum impacts predicted for Power Block 3 will not cause or contribute to an exceedance of any PSD increments or ambient air quality standards. Finally, since the impact of Power Block 3 on the Chassahowitzka NWA is less than significant and based on a regional haze analysis performed, there will not be a significant impact to the visibility in the NWA.

IMAGE QUALITY

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PLEASE NOTE THAT THE ORIGINAL
DOCUMENT WAS OF POOR QUALITY.

Table 5.6.1-1

SUMMARY OF MAXIMUM CONCENTRATIONS PREDICTED FOR POWER BLOCK 3 COMPARED TO THE PSD CLASS II SIGNIFICANT IMPACT LEVELS

Pollutant	Averaging Period	Maximum Predicted Concentration [a] ($\mu g/m^3$)	Polar Location [b]		Year	Significant Impact Level ($\mu g/m^3$)	Distance to Significant Impact Level (km)	Predicted Impact Greater than the Significant Impact Level? (Yes/No)
			Dir. (deg.)	Dist. (m)				
Carbon Monoxide	1-Hour	80	76	412	1993	2,000	None	No
	8-Hour	25.6	117	447	1993	500	None	No
Nitrogen Dioxide	Annual	0.094	90	1500	1992	1	None	No
Sulfur Dioxide	3-Hour	17.1	130	500	1993	25	None	No
	24-Hour	4.1	117	447	1993	5	None	No
	Annual	0.037	90	1500	1992	1	None	No
Particulate Matter (PM_{10}) [c]	24-Hour	2.5	117	447	1993	5	None	No
	Annual	0.039	90	1500	1992	1	None	No

(a) Concentrations are highest values for this analysis; annual average concentrations based on firing natural gas and fuel oil for 7,760 and 1,000 hours, respectively.

(b) With respect to zero point of 414.30 km E; 3,073.88 km N.

(c) As a conservative approach, all project emissions of particulate matter were assumed to be in the form of PM_{10}.

N/A = Not applicable

Golder, 2002.

Table 5.1.6.2

SUMMARY OF MAXIMUM CONCENTRATIONS PREDICTED FOR POWER BLOCK 3 COMPARED TO THE PSD CLASS I SIGNIFICANT IMPACT LEVELS

Pollutant	Averaging Period	Maximum Concentration Predicted for Power Block 2 [a] ($\mu g/m^3$)	PSD Class I Significant Impact Level ($\mu g/m3$)	Predicted Impact Greater than the PSD Significant Impact Level? (Yes/No)
Sulfur Dioxide (SO_2)	3-Hour	0.39	1.0	NO
	24-Hour	0.15	0.2	NO
	Annual	0.0012	0.1	NO
Particulate Matter (PM_{10})	24-Hour	0.11	0.3	NO
	Annual	0.0014	0.2	NO
Nitrogen Dioxide (NO_2)	Annual	0.0014	0.1	NO

[a] Concentrations are highest values for this analysis; annual average concentrations based on firing natural gas and fuel oil for 7,760 and 1,000 hours, respectively.

Source: Golder, 2002

5.7 NOISE

5.7.1 Impact Assessment

Noise impacts from operation of all phases up to 3000 MW of ultimate site capacity were analyzed and shown to comply with applicable noise criteria as part of the 1992 SCA. The 1994 Certification finds these noise criteria will be met during operation of each future phase, including the proposed Power Block 3. The 2000 supplemental certification application noise impact analysis reaffirmed the earlier analysis and demonstrated that no adverse impacts will occur because of the addition of Power Block 2. This noise impact analysis is presented to demonstrate that no adverse impacts will occur as a result of the addition of Power Block 3.

The potential noise impacts for the addition of Power Block 3 were determined based on the equipment manufacturers' far-field noise guarantee of 70 dBA at 400 feet for Power Block 1. Measurements taken during May 2000 as part of an ambient noise survey for Power Block 2 found actual noise levels of less than 70 dBA while Power Block 1 was operating. However, using the far-field noise guarantee of 70 dBA at 400 feet provides conservative estimates of noise impacts. Since the equipment will be substantially similar for Power Blocks 1,2, and 3, the operational noise levels for Power Block 3 were assumed the same as Power Blocks 1 and 2. This would produce a worst-case far-field noise level of 74.8 dBA at 400 ft from Power Blocks 1, 2, and 3, which is within the Hines Site boundary.

The offsite noise impacts were determined by decreasing the far-field noise level for Power Blocks 1, 2, and 3 by 6 dBA for each doubling of distance from the Plant Island. This noise reduction accounts for hemispheric spreading, but does not account for molecular absorption, terrain, vegetation, and barriers (including portions of the Power Block such as the HRSG). Therefore, the estimated noise impacts for Power Blocks 1, 2, and 3 are very conservative.

The noise contribution of Power Blocks 1, 2, and 3 were determined for 6 off-site locations. These off-site locations corresponded to the 4 noise monitoring locations where noise levels were determined in 1992 and 2000 (Locations 1 through 4) and 2 additional locations considered to be sensitive receptors in the 1992 SCA. These two locations included a church at the intersection of County Road 630 (CR 630) and CR 555 (Location 6), and the Trinity Cemetery located on CR 555 south of the Hines Energy Complex entrance road (Location 7). The six locations considered for noise impacts are:

- Location 1 CR 555 & CR 630
- Location 2 CR 555 & CR 640
- Location 3 Homeland
- Location 4 Fort Meade
- Location 6 Church at CR 630 and East CR 555
- Location 7 Trinity Cemetery

A survey of the area performed for Power Block 2 found no additional noise-sensitive receptors from those reported in the 1992 SCA. The estimated project noise impacts were appropriately added to the observed, baseline noise levels at the nearest noise-sensitive receptor locations. The noise conditions at each receptor were an average of the noise survey results observed in 1992 and 2000. The exception is monitoring location 4 where the nighttime noise levels due to a localized thunderstorm during the 2000 survey were excluded in the determination of the L_{dn} and, baseline L_{eq} and L_{dn} noise levels.

The results of the noise impacts analyses are summarized in Table 5.7.1-1 through 5.7.1-4. Tables 5.7.1-1 and -2 present the predicted impacts of Power Blocks 1, 2, and 3 together with the observed L_{eq} and L_{dn} noise levels, respectively. As shown in Table 5.7-2 for the column titled "Combined Impacts", the additional noise from Power Blocks 1, 2, and 3 together with the existing L_{dn} that result from noise from offsite passing trucks is, for most of the receptors, above the EPA recommended criteria of 55 dBA for residential and agricultural areas. However, the noise increase at these receptors due to Power Blocks 1, 2, and 3 is generally less than 0.5 dBA for all locations.

An increase in noise levels of 3 dBA or less is not noticeable. Further, ambient noise levels at these locations are already above the EPA criteria without the Hines Energy Complex operations.

The predicted impacts of Power Blocks 1, 2, and 3 together with the calculated existing baseline L_{eq} and L_{dn} noise levels are presented in Tables 5.7.1-3 and -4, respectively. As shown on Table 5.7.1-4, the additional noise from Power Blocks 1, 2, and 3 together with the baseline L_{dn}, is well below the EPA noise criteria for all locations. The additional noise from Power Blocks 1, 2, and 3, even during time when truck traffic is not present, will be less than 3 dBA and not be noticeable at any of the sensitive receptors. Moreover, the noise survey conducted in May 2000 supports this conclusion, since noise levels from Power Block 1 while it was in operation were low.

5.7.2 References

Adams, T.S. 1989. Noise Measurements at Shell Oil Company's Coal Gasification Demonstration Project in Deer Park, Texas. Unpublished. July. Norcross, Georgia.

Adams, T.S. and M.A. Bilello. 1991. Measurements of Noise from Rotary Coal Unloading Operations. Technical paper presented at NOISE-CON 91 in Tarrytown, New York. Sponsored by the Institute of Noise Control Engineering, Poughkeepsie, New York.

API (American Petroleum Institute). 1982. Manual 512, September, 1982.

Bolt, Beranek and Newman, Inc. (BBN). 1978. Electric Power Plant Environmental Noise Guide - Volume I. Prepared for Edison Electric Institute. Cambridge, Massachusetts.

Driscoll, D.A. 1984. NOISECALC (A Computer Program for Sound Propagation Calculations). State of New York Department of Public Service. Albany, New York.

EPA (U.S. Environmental Protection Agency). 1971. Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances. NTID300.1. Office of Noise Abatement and Control. Washington, D.C.

EPA (U.S. Environmental Protection Agency). 1974. Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety. EPA 550/9-74-004. Office of Noise Abatement and Control. Washington, D.C.

Table 5.7.1-1
Predicted Noise Impacts
Power Blocks 1, 2, and 3
Based on 1992 and 2000 L_{eq} Monitoring Data

Location	Description	Distance (Miles)[1]	Predicted Noise Levels from PB1, PB2 & PB3 (dBA)	Observed Noise Levels L_{eq}[2] (dBA)	Predicted Combined Impacts[3] (dBA)
1	CR 555 & CR 630	2.9	43.6	54.1	54.5
2		3.1	43.1	56.6	56.8
3	CR 555 & CR 640	3.4	42.4	50.0	50.7
4	Homeland	4.7	39.2	54.1	54.3
6	Fort Meade	2.8	43.9	54.1	54.5
7	CR 630; East CR 555 Trinity Cemetery	1.9	46.1	56.6	57.0

Notes:
1. Distance (Miles) from Plant Island.
2. Includes all noise sources, including transient sources such as trucks. Based on 1992 and 2000 monitoring data.
3. Includes all noise sources and predicted noise from PB1, PB2, and PB3.

Source: Golder Associates, 2002.

Table 5.7.1-2
Noise Impacts
Power Blocks 1, 2, and 3
Based on 1992 and 2000 L_{dn} Monitoring Data

Location	Description	Distance (Miles)[1]	Predicted Noise Levels from PB1,PB2 & PB3 (dBA)	Observed Noise Levels L_{eq}[2] (dBA)	Predicted Combined Impacts[3] (dBA)
1	CR 555 & CR 630	2.9	43.6	60.0	60.1
2		3.1	43.1	63.2	63.3
3	CR 555 & CR 640	3.4	42.4	54.1	54.4
4	Homeland	4.7	39.2	57.5	57.6
6	Fort Meade	2.8	43.9	60.0	60.1
7	CR 630; East CR 555	1.9	46.1	63.2	63.3
	Trinity Cemetery				

Notes:
1. Distance (Miles) from Plant Island.
2. Includes all noise sources, including transient sources such as trucks. Based on 1992 and 2000 monitoring data.
3. Includes all noise sources and predicted noise from PB1, PB2, and PB3.

Source: Golder Associates, 2002.

Table 5.7.1-3
Noise Impacts
Power Blocks 1, 2, and 3
Calculated Baseline L_{eq}

Location	Description	Distance (Miles) [1]	Predicted Noise Levels from PB1, PB2 & PB3 (dBA)	Baseline Noise Levels L_{eq} [2] (dBA)	Predicted Combined Impacts [3] (dBA)
1	CR 555 & CR 630	2.9	43.6	42.3	46.0
2	CR 555 & CR 640	3.1	43.1	45.7	47.6
3	Homeland	3.4	42.4	45.6	47.3
4	Fort Meade	4.7	39.2	48.2	48.7
6	CR 630; East CR 555	2.8	43.9	42.3	46.2
7	Trinity Cemetery	1.9	46.1	45.7	48.9

Notes:
1. Distance (Miles) from Plant Island.
2. Baseline excludes loud, transient noise sources, such as truck traffic. Calculated from 1992 and 2000 monitoring data.
3. Includes baseline and predicted noise impacts from PB1, PB2, and PB3.

Source: Golder Associates, 2002.

Table 5.7.1-4
Noise Impacts
Power Blocks 1, 2, and 3
Calculated Baseline L_{dn}

Location	Description	Distance (Miles)[1]	Predicted Noise Levels from PB1, PB2, & PB3 (dBA)	Baseline Noise Levels L_{eq}[2] (dBA)	Predicted Combined Impacts[3] (dBA)
1	CR 555 & CR 630	2.9	43.6	46.6	48.4
2	CR 555 & CR 640	3.1	43.1	50.6	51.3
3	Homeland	3.4	42.4	49.1	50.0
4	Fort Meade	4.7	39.2	50.0	50.3
6	CR 630; East CR 555	2.8	43.9	46.6	48.5
7	Trinity Cemetery	1.9	46.1	50.6	51.9

Notes:
1. Distance (Miles) from Plant Island.
2. Baseline excludes loud, transient noise sources, such as truck traffic. Calculated from 1992 and 2000 monitoring data.
3. Includes baseline and predicted noise impacts from PB1, PB2, and PB3.

Source: Golder Associates, 2002.

5.8 CHANGES IN NONAQUATIC SPECIES POPULATIONS

5.8.1 Impacts

Emissions from Power Block 3 will comply with all state and federal ambient air quality standards. Those standards have been established to protect public health and welfare, with an adequate margin of safety. Compliance with these standards will be protective of the environment.

5.8.2 Monitoring

Monitoring of off-site non-aquatic species is not proposed because of the minimal opportunity for impacts to occur.

5.9 OTHER PLANT OPERATION EFFECTS

5.9.1 Highway Traffic

Traffic associated with operation of the Hines Energy Complex represents a long-term impact to Polk County roadways, since they will be recurring into the future. Traffic impacts are directly related to the number of employees, since materials for plant operations will arrive primarily by rail and/or pipeline. An estimated total of 55 operations workers will be needed for ultimate site development. This employment projection was considered in the traffic impact analysis that was conducted by Kimley-Horn in 1992 and submitted with the 1992 SCA.

Both Polk County and the Florida Department of Transportation (FDOT) reviewed the traffic impact analysis. Recommendations for roadway and intersection improvements were developed with input from both agencies. These improvements became the subject of conditions of the Polk County CUP, and were completed in conjunction with construction of Power Block 1. The CUP condition related the need for roadway or intersection improvements to a level of employment rather than a specific year and provided for monitoring of employment and traffic conditions to determine the appropriate timing of the improvements. Since peak employment on-site already occurred during site development and construction of Power Block 1, no further monitoring or roadway/intersection improvements are required.

5.9.2 Roadway Improvements

The improvements necessary to accommodate operations traffic were also recommended as a part of the construction traffic analysis (Section 4.6.1). No other improvements are required to accommodate the traffic impacts from the construction or operation of Power Block 3.

Using the number of employees rather than a specific year is the most appropriate measure of the need for improvement. A summary of the improvements and monitoring conditions that have been completed is presented below.

- Traffic monitoring program at the intersection of CR 555 and SR 640 to determine the need to install a traffic signal or make geometric improvements. As a result, minor geometric improvements were completed;

- Construction of a Case III intersection at the main driveway connection to CR 555 including left turn storage and acceleration/deceleration lanes;

- Construction of a Case II intersection at the secondary or southern-most driveway connection to CR 555;

- Traffic monitoring has been completed at the intersection of SR 37 and CR 640 to determine the need to install a traffic signal or make geometric improvements. Based on the occurrence of the peak numbers of employees, a traffic signal was installed by the County; and

- The addition of a signal phase for westbound left-turns that operates as protected/permissive at the intersection of CR 555 and SR 60.

The transportation improvements listed above conform to FDOT and Polk County requirements.

5.9.3. References

Florida Power Corporation. 1992. Polk County Site. Site Certification Application.

5.10 ARCHAEOLOGICAL SITES

As a result of the highly disturbed nature of the site, no significant archaeological sites are expected to be encountered. The State of Florida Division of Historical Resources provided this determination in a letter dated January 30, 1992.

5.11 RESOURCES COMMITTED

5.11.1 Physical Resources

The physical state resources committed to plant operation for Power Block 3 includes water and air.

The consumptive use of ground water related to the operation of Power Block 3 at the Hines Energy Complex is described in Section 3.5.

No irreversible or irretrievable commitment of air resources is anticipated as a result of project operation. Analysis of likely air quality impacts of the project (Section 5.6) indicates that applicable ambient air quality standards would not be exceeded by operation of Power Block 3. The site is located 118 km (73 mi) from the nearest Class I PSD area. As demonstrated in Section 5.6, the plant should have no significant impact on that Class I area.

5.11.2 Biological Resources

As discussed in Section 5.1.2, aquatic communities near the proposed plant will not experience adverse effects from operation of Power Block 3. Construction and operation of the plant will have no measurable effect on wildlife species populations, or on the growth and productivity of surrounding vegetation, including agricultural crops.

5.11.3 Economic and Cultural Resources

Economic resources committed to the project will include human labor, financial commitments, and the displacement of other potential economic uses of the site. Because the plant will require no expansion of government-supplied services, no commitment of state or local government financial resources is anticipated.

Any effects on schools, utilities, highways, and other public facilities will be more than offset by taxes paid in Polk County.

No cultural resources are known to exist on-site, therefore no commitment of cultural resources is anticipated.

5.12 VARIANCES

No variances from applicable federal or state standards are required.

[redacted]

SECTION 6

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6.1 TRANSMISSION LINES

The previously approved and existing 230 kv transmission system from the Barcola Substation to the Hines Energy Complex and from the Hines Energy Complex to the Fort Meade substation with double circuit structures is currently adequate to support electric transmission related to Power Block 3. No new off-site electrical transmission facilities or other associated linear facilities are required for operation of Power Block 3.

SECTION 7

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7.1 SOCIOECONOMIC BENEFITS AND COSTS

The Hines Energy Complex will continue to provide a substantial net benefit to Polk County, both in terms of the large increase in property tax base that will occur, and the project's employment and payroll. The level of permanent employment will continue to increase with the addition of generating units. Current employment at the Hines Energy Complex for operation of Power Block 1 is 29 employees, generating an annual payroll of $2.7 million. The expected increase in staff for the operation of Power Block 3 is 5 employees, for an expected increase in annual payroll of $500,000. Personnel for the Hines Energy Complex are recruited nationally. Local individuals are hired if their qualifications equal or exceed those of other applicants. Spending for parts, materials and parts rebuilding amounts to about $4.6 million per year. Actual experience in 2000 suggests that about 10 to 15 percent of this spending will be done with local vendors.

In addition to the increase in direct employment at the site, the increased economic activity in the county will have a multiplier effect, resulting in the creation of jobs in related industries such as construction, retail trade, business services, and health services. Estimates of the indirect jobs created are based on multipliers developed specifically for Polk County by the U.S. Department of Commerce, Bureau of Economic Analysis. The Regional Input-Output Modeling System (RIMS II) multipliers that were used reflect input-output data for the 1997 annual input-output table for the nation and 1999 regional data. RIMS II multipliers based on these sources were first released in June 2002. Using the direct effect multipliers, the estimated number of additional jobs expected as a result of the five new permanent jobs for operation of Power Block 3 is 10, generating earnings of $457,700.

In 2001, FP paid $6.7 million in property taxes to Polk County for the Hines Energy Complex and the Tiger Bay electric generating facility. The estimated increase in property taxes associated with Power Block 2, which is now under construction and will come on-line in 2004, is about $3.1 million. The estimated increase in property taxes for Power Block 3, projected for completion in 2005, is $3.4 million. These estimates are based on the 2001 Polk County millage rate. Over half of this revenue goes to support the Polk County school system. Since the County is required to provide very few services to the Hines Energy Complex, the net benefit of these revenues to the County and the school system is substantial.

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8.1 SITE AND DESIGN ALTERNATIVES

This optional chapter is not being submitted as part of this SCA because an Environmental Impact Statement required by the National Environmental Policy Act is not required for the development of Power Block 3.

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9.1 COORDINATION

The following individuals have been contacted regarding this SSCA:

Name	Agency	Telephone Number
Hamilton Oven	DEP	(850) 487-0472
Paul Darst	DCA	(850) 488-4925

Florida Power
A Progress Energy Company

Supplemental Site Certification Application

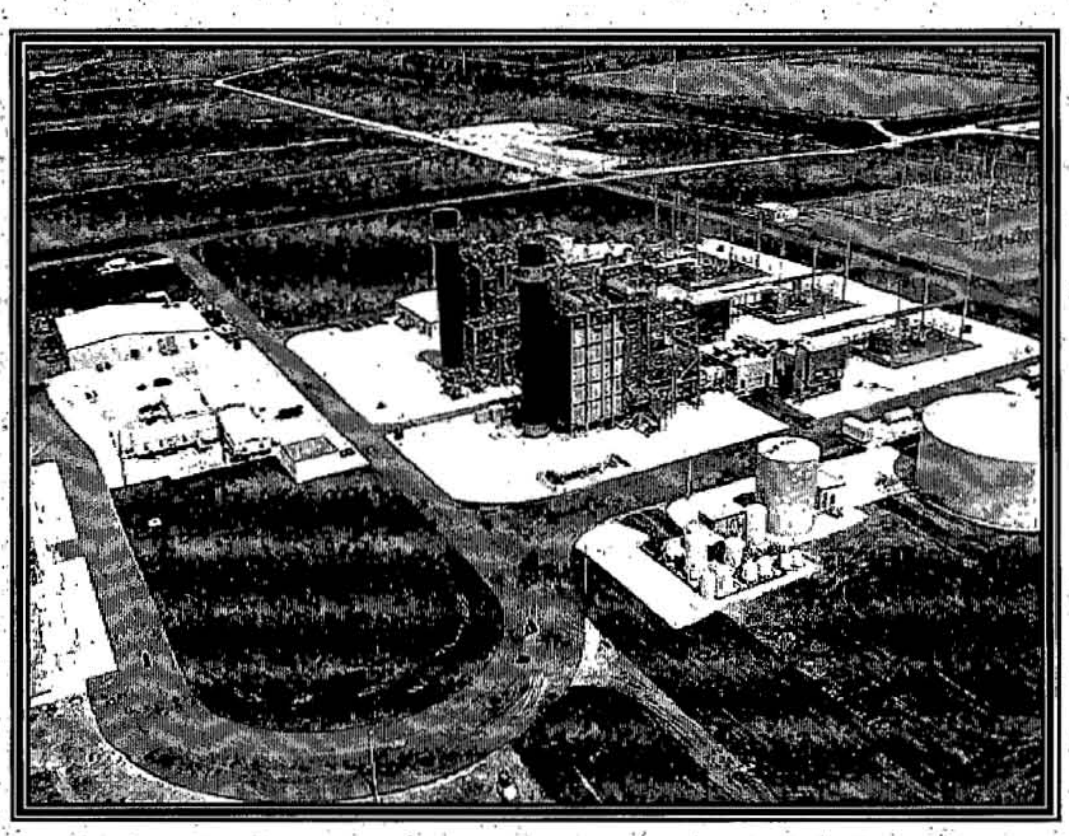
Hines Energy Complex

Power Block 3

September 2002

Volume 2

Florida Power
A Progress Energy Company



Supplemental

Site Certification Application

Hines Energy Complex

Power Block 3

September 2002

Volume 2

SUPPLEMENTAL SITE CERTIFICATION

FOR THE

FLORIDA POWER

HINES ENERGY COMPLEX

POWER BLOCK 3

POLK COUNTY, FLORIDA

VOLUME II OF II

SEPTEMBER 2002

SECTION 10.0

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10.0 APPENDICES

10.1 FEDERAL PERMIT APPLICATIONS OR APPROVALS

10.1.1 316 Demonstrations

There is no surface water intake or point source thermal discharge to surface waters located at the Hines Energy Complex. Therefore, no demonstrations pursuant to Sections 316(a) or (b) of the Clean Water Act are required. This section is not applicable.

10.1.2 NPDES Application/Permit

The Hines Energy Complex will operate as a zero discharge facility for industrial wastewaters. Therefore, no NPDES permit or permit application will be required for operation of the Power Blocks. This section is not applicable.

10.1.3 Hazardous Waste Management Application/Permit

The Hines Energy Complex has been designed to operate so that a federal or state hazardous waste treatment, storage or disposal permit is not required. This section is not applicable.

10.1.4 Section 10 or 404 Application/Permit

A copy of the U.S. Army Corps of Engineers (COE) Permit No. 199302169 (IP-MN) previously issued is available upon request.

10.1.5 Prevention of Significant Deterioration Permit Application

Following is a copy of the Prevention of Significant Deterioration (PSD) permit application for Power Block 3 submitted to the DEP pursuant to requirements of the Federal Clean Air Act.

PSD
APPLICATION

PSD PERMIT APPLICATION

FOR

FLORIDA POWER
HINES ENERGY COMPLEX
POWER BLOCK 3

September 2002

Florida Power
One Power Plaza
263 13th Ave. South
St. Petersburg, Florida 33701

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APPLICATION FORMS

Department of
Environmental Protection

Division of Air Resources Management

APPLICATION FOR AIR PERMIT - TITLE V SOURCE

See Instructions for Form No. 62-210.900(1)

I. APPLICATION INFORMATION

Identification of Facility

1. Facility Owner/Company Name: **Florida Power**	
2. Site Name: **Hines Energy Complex**	
3. Facility Identification Number:	[X] Unknown
4. Facility Location: Street Address or Other Locator: **7700 County Road 555** City: **Bartow** County: **Polk** Zip Code: **33830**	
5. Relocatable Facility? [ ] Yes [X] No	6. Existing Permitted Facility? [X] Yes [ ] No

Application Contact

1. Name and Title of Application Contact: **Jamie Hunter, Lead Environmental Specialist**
2. Application Contact Mailing Address: Organization/Firm: **Florida Power** Street Address: **P.O. Box 14042, MAC BB1A** City: **St. Petersburg** State: **FL** Zip Code: **33733-4042**
3. Application Contact Telephone Numbers: Telephone: **(727) 826 - 4363** Fax: **(727) 826 - 4216**

Application Processing Information (DEP Use)

1. Date of Receipt of Application:	
2. Permit Number:	
3. PSD Number (if applicable):	
4. Siting Number (if applicable):	

Purpose of Application

Air Operation Permit Application

This Application for Air Permit is submitted to obtain: (Check one)

[ ] Initial Title V air operation permit for an existing facility which is classified as a Title V source.

[ ] Initial Title V air operation permit for a facility which, upon start up of one or more newly constructed or modified emissions units addressed in this application, would become classified as a Title V source.

Current construction permit number:_____

[ ] Title V air operation permit revision to address one or more newly constructed or modified emissions units addressed in this application.

Current construction permit number:_____

Operation permit number to be revised:_____

[ ] Title V air operation permit revision or administrative correction to address one or more proposed new or modified emissions units and to be processed concurrently with the air construction permit application. (Also check Air Construction Permit Application below.)

Operation permit number to be revised/corrected:_____

[ ] Title V air operation permit revision for reasons other than construction or modification of an emissions unit. Give reason for the revision; e.g., to comply with a new applicable requirement or to request approval of an "Early Reductions" proposal.

Operation permit number to be revised:_____

Reason for revision:_____

Air Construction Permit Application

This Application for Air Permit is submitted to obtain: (Check one)

[X] Air construction permit to construct or modify one or more emissions units.

[ ] Air construction permit to make federally enforceable an assumed restriction on the potential emissions of one or more existing, permitted emissions units.

[ ] Air construction permit for one or more existing, but unpermitted, emissions units.

Image Quality

As you review the next group of images,

Please note that the original documents were of poor quality.

Owner/Authorized Representative or Responsible Official

1. Name and Title of Owner/Authorized Representative or Responsible Official:
   Bruce Baldwin, Vice President – Combustion Turbine Operations

2. Owner/Authorized Representative or Responsible Official Mailing Address:
   Organization/Firm: **Florida Power**
   Street Address: **P.O. Box 14042, MAC BB1C**
   City: **St. Petersburg** State: **FL** Zip Code: **33733-4042**

3. Owner/Authorized Representative or Responsible Official Telephone Numbers:
   Telephone: **(813) 826- 4201** Fax: **(813) 826- 4222**

4. Owner/Authorized Representative or Responsible Official Statement:

   I, the undersigned, am the owner or authorized representative(check here [X], if so) or the responsible official (check here [ ], if so) of the Title V source addressed in this application, whichever is applicable. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof. I understand that a permit, if granted by the Department, cannot be transferred without authorization from the Department, and I will promptly notify the Department upon sale or legal transfer of any permitted emissions unit.*

   Signature 8-30-02 Date

* Attach letter of authorization if not currently on file.

Professional Engineer Certification

1. Professional Engineer Name: **Kennard F. Kosky**
   Registration Number: **14996**

2. Professional Engineer Mailing Address:
   Organization/Firm: **Golder Associates Inc.**
   Street Address: **6241 NW 23rd Street, Suite 500**
   City: **Gainesville** State: **FL** Zip Code: **32653-1500**

3. Professional Engineer Telephone Numbers:
   Telephone: **(352) 336 - 5600** Fax: **(352) 336 - 6603**

4. Professional Engineer Statement:

I, the undersigned, hereby certify, except as particularly noted herein, that:*

(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this Application for Air Permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and

(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.

If the purpose of this application is to obtain a Title V source air operation permit (check here [ ], if so), I further certify that each emissions unit described in this Application for Air Permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance schedule is submitted with this application.

If the purpose of this application is to obtain an air construction permit for one or more proposed new or modified emissions units (check here [X], if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.

If the purpose of this application is to obtain an initial air operation permit or operation permit revision for one or more newly constructed or modified emissions units (check here [ ], if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.

Signature

August 30, 2002
Date

(seal)

Attach any exception to certification statement.

Golder Associates - Board of Professional Engineers
Certificate of Authorization Number 00001670

Poor Original

Scope of Application

Emissions Unit ID	Description of Emissions Unit	Permit Type	Processing Fee
---	CT- 3a; Power Block 3	AC1A	
---	CT- 3b; Power Block 3	AC1A	

Application Processing Fee

Check one: [ ] Attached - Amount: $: _____ [X] Not Applicable

Construction/Modification Information

1. Description of Proposed Project or Alterations:

Power Block 3 consists of two nominal 170 MW Siemens Westinghouse 501FD combustion turbines (CTs), two unfired heat recovery steam generators (HRSGs), and one 190 MW steam turbine; nominal rating of 530 MW combined cycle unit. See PSD Application. Fee included with Site Certification Application.

2. Projected or Actual Date of Commencement of Construction: **November, 2003**

3. Projected Date of Completion of Construction: **November, 2005**

Application Comment

This application has been submitted and will be reviewed within the Florida Power Plant Siting Act (PPSA). See PSD Application. Power Block 1 has permit PA-92-33; PSD-FL-195A. Power Block 2 has permit PA92-33SA, PSD-FL-296.

II. FACILITY INFORMATION

A. GENERAL FACILITY INFORMATION

Facility Location and Type

1. Facility UTM Coordinates: Zone: **17** East (km): **414.4** North (km): **3073.9**			
2. Facility Latitude/Longitude: Latitude (DD/MM/SS): **27 / 47 / 19** Longitude (DD/MM/SS): **81 / 52 / 10**			
3. Governmental Facility Code: **0**	4. Facility Status Code: **C**	5. Facility Major Group SIC Code: **49**	6. Facility SIC(s): **4911**
7. Facility Comment (limit to 500 characters): **Operation of Power Block 1 began in 1999. Power Block 1 is a nominal 470 MW combined cycle unit consisting of 2 CTs, 2 HRSGs and 1 steam turbine. The CTs fire natural gas with distillate oil as backup. The HRSGs are unfired. Power Block 2 is a nominal 530 MW combined-cycle unit consisting of 2 CTs, 2 HRSGs, and 1 steam turbine. This application is for the addition of Power Block 3, an additional nominal 530 MW combined-cycle application. See PSD Application.**			

Facility Contact

1. Name and Title of Facility Contact: **Roger Zirkle, Plant Manager**
2. Facility Contact Mailing Address: Organization/Firm: **Hines Energy Complex** Street Address: **7700 County Road 555** City: **Bartow** State: **FL** Zip Code: **33830**
3. Facility Contact Telephone Numbers: Telephone: **(863) 519 - 6103** Fax: **(863) 519 - 6110**

Facility Regulatory Classifications

Check all that apply:

1. [ ] Small Business Stationary Source?	[ ] Unknown
2. [X] Major Source of Pollutants Other than Hazardous Air Pollutants (HAPs)?	
3. [ ] Synthetic Minor Source of Pollutants Other than HAPs?	
4. [ ] Major Source of Hazardous Air Pollutants (HAPs)?	
5. [ ] Synthetic Minor Source of HAPs?	
6. [X] One or More Emissions Units Subject to NSPS?	
7. [ ] One or More Emission Units Subject to NESHAP?	
8. [ ] Title V Source by EPA Designation?	
9. Facility Regulatory Classifications Comment (limit to 200 characters): **Applicable NSPS is 40 CFR Part 60; Subpart GG.**	

List of Applicable Regulations

62-212.400, F.A.C. See PSD Application	

B. FACILITY POLLUTANTS

List of Pollutants Emitted

1. Pollutant Emitted	2. Pollutant Classif.	3. Requested Emissions Cap lb/hour	tons/year	4. Basis for Emissions Cap	5. Pollutant Comment
PM	A				Particulate Matter – Total
SO_2	A				Sulfur Dioxide
NO_X	A				Nitrogen Oxides
CO	A				Carbon Monoxide
VOC	A				Volatile Organic Compounds
SAM	B				Sulfuric Acid Mist

C. FACILITY SUPPLEMENTAL INFORMATION

Supplemental Requirements

1. Area Map Showing Facility Location:
   [X] Attached, Document ID: **Fig. 1-1; PSD** [ ] Not Applicable [ ] Waiver Requested

2. Facility Plot Plan:
   [X] Attached, Document ID: **Fig. 2-1; PSD** [ ] Not Applicable [ ] Waiver Requested

3. Process Flow Diagram(s):
   [X] Attached, Document ID: **Fig. 2-2; PSD** [ ] Not Applicable [ ] Waiver Requested

4. Precautions to Prevent Emissions of Unconfined Particulate Matter:
   [X] Attached, Document ID: **PSD Appl.** [ ] Not Applicable [ ] Waiver Requested

5. Fugitive Emissions Identification:
   [ ] Attached, Document ID: _____ [X] Not Applicable [ ] Waiver Requested

6. Supplemental Information for Construction Permit Application:
   [X] Attached, Document ID: **PSD Appl.** [ ] Not Applicable

7. Supplemental Requirements Comment:

Additional Supplemental Requirements for Title V Air Operation Permit Applications

8. List of Proposed Insignificant Activities:
   [ ] Attached, Document ID:_____ [ ] Not Applicable

9. List of Equipment/Activities Regulated under Title VI:
   [ ] Attached, Document ID:_____
   [ ] Equipment/Activities On site but Not Required to be Individually Listed
   [ ] Not Applicable

10. Alternative Methods of Operation:
   [ ] Attached, Document ID:_____ [ ] Not Applicable

11. Alternative Modes of Operation (Emissions Trading):
   [ ] Attached, Document ID:_____ [ ] Not Applicable

12. Identification of Additional Applicable Requirements:
   [ ] Attached, Document ID:_____ [ ] Not Applicable

13. Risk Management Plan Verification:
   [ ] Plan previously submitted to Chemical Emergency Preparedness and Prevention Office (CEPPO). Verification of submittal attached (Document ID:_____) or previously submitted to DEP (Date and DEP Office:_____)
   [ ] Plan to be submitted to CEPPO (Date required:_____)
   [ ] Not Applicable

14. Compliance Report and Plan:
   [ ] Attached, Document ID:_____ [ ] Not Applicable

15. Compliance Certification (Hard-copy Required):
   [ ] Attached, Document ID:_____ [ ] Not Applicable

III. EMISSIONS UNIT INFORMATION

A separate Emissions Unit Information Section (including subsections A through J as required) must be completed for each emissions unit addressed in this Application for Air Permit. If submitting the application form in hard copy, indicate, in the space provided at the top of each page, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application.

A. GENERAL EMISSIONS UNIT INFORMATION
(All Emissions Units)

Emissions Unit Description and Status

1. Type of Emissions Unit Addressed in This Section: (Check one)

[X] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

2. Regulated or Unregulated Emissions Unit? (Check one)

[X] The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

[ ] The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

3. Description of Emissions Unit Addressed in This Section (limit to 60 characters):

CT-3A; Power Block 3

4. Emissions Unit Identification Number: [ ] No ID
ID: [X] ID Unknown

5. Emissions Unit Status Code:	6. Initial Startup Date:	7. Emissions Unit Major Group SIC Code:	8. Acid Rain Unit?
C		**49**	[X]

9. Emissions Unit Comment: (Limit to 500 Characters)

Siemens Westinghouse 501 FD combustion turbine firing natural gas with distillate oil back-up.

Emissions Unit Control Equipment

1. Control Equipment/Method Description (Limit to 200 characters per device or method):

Dry Low NO_X combustion-natural gas firing

Selective Catalytic Reduction (SCR) – natural gas firing/ distillate oil firing.

Water Injection – distillate oil firing

2. Control Device or Method Code(s): **25, 65, 28**

Emissions Unit Details

1. Package Unit: Manufacturer: **Siemens Westinghouse**		Model Number: **501 FD**	
2. Generator Nameplate Rating:	**170**	MW	
3. Incinerator Information:			
Dwell Temperature:			°F
Dwell Time:			seconds
Incinerator Afterburner Temperature:			°F

B. EMISSIONS UNIT CAPACITY INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Operating Capacity and Schedule

1. Maximum Heat Input Rate:		**1,830**	mmBtu/hr
2. Maximum Incineration Rate:	lb/hr		tons/day
3. Maximum Process or Throughput Rate:			
4. Maximum Production Rate:			
5. Requested Maximum Operating Schedule:			
	hours/day		days/week
	weeks/year	**8,760**	hours/year
6. Operating Capacity/Schedule Comment (limit to 200 characters):			

Heat input is HHV with natural gas; heat input at 59°F turbine inlet temperature; MW nominal rating.

C. EMISSIONS UNIT REGULATIONS
(Regulated Emissions Units Only)

List of Applicable Regulations

See Attachment HEC-EU1-C	
See PSD Application	

D. EMISSION POINT (STACK/VENT) INFORMATION
(Regulated Emissions Units Only)

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram? **Fig 2-1**	2. Emission Point Type Code: **1**

3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking (limit to 100 characters per point):

Exhausts through a single stack.

4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common:

5. Discharge Type Code: **V**	6. Stack Height: **125** feet	7. Exit Diameter: **19** feet
8. Exit Temperature: **190** °F	9. Actual Volumetric Flow Rate: **1,009,487** acfm	10. Water Vapor: %
11. Maximum Dry Standard Flow Rate: dscfm	12. Nonstack Emission Point Height: feet	

13. Emission Point UTM Coordinates:

Zone: **17** East (km): **414.4** North (km): **3073.9**

14. Emission Point Comment (limit to 200 characters):

Temperature and flow for natural gas at 59°F turbine inlet; See Tables 2-1 and 2-2 in PSD application.

E. SEGMENT (PROCESS/FUEL) INFORMATION
(All Emissions Units)

Segment Description and Rate: Segment 1 of 2

1. Segment Description (Process/Fuel Type) (limit to 500 characters): **Natural Gas**		
2. Source Classification Code (SCC): **2-01-002-01**	3. SCC Units: **Million Cubic Feet**	
4. Maximum Hourly Rate: **1.92**	5. Maximum Annual Rate: **15,564**	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit: **1,030**
10. Segment Comment (limit to 200 characters): **Based on 1,030 BTU/CF (HHV); maximum hourly at 20°F; annual at 59°F; turbine inlet temperatures.**		

Segment Description and Rate: Segment 2 of 2

1. Segment Description (Process/Fuel Type) (limit to 500 characters): **Distillate Fuel Oil**		
2. Source Classification Code (SCC): **2-01-001-01**	3. SCC Units: **1,000 Gallons Used**	
4. Maximum Hourly Rate: **14.9**	5. Maximum Annual Rate: **13,683**	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit: **141.2**
10. Segment Comment (limit to 200 characters): **BTU based on HHV of 141.2 MMBtu/1,000 gallons. Aggregate fuel usage of 27,365,000 gallons per year requested for Power Block 3.**		

F. EMISSIONS UNIT POLLUTANTS
(All Emissions Units)

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
PM			
SO_2			
NO_X	025, 028	065	EL
CO			EL
VOC			EL
SAM			

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **PM**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **64.8** lb/hour **60.3** tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference: **Siemens Westinghouse, 2000**	7. Emissions Method Code: **2**
8. Calculation of Emissions (limit to 600 characters): **See Section 2.0 and Appendix A in PSD Application**	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters): **Max lb/hr for oil firing at 20°F turbine inlet; TPY at 59°F turbine inlet with 7,760 hrs/yr-gas; equivalent of 1,000 hrs/yr/CT-oil.**	

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **10 % Opacity**	4. Equivalent Allowable Emissions: **8.5** lb/hour **34.6** tons/year
5. Method of Compliance (limit to 60 characters): **EPA Method 9; Initially and Annually.**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Gas Firing: lb/hr at 20°F turbine inlet; TPY for 8,760 hrs/yr at 59°F turbine inlet.**	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **PM**	2. Total Percent Efficiency of Control:
3. Potential Emissions: lb/hour tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference:	7. Emissions Method Code:
8. Calculation of Emissions (limit to 600 characters):	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **20% Opacity**	4. Equivalent Allowable Emissions: **64.8** lb/hour **29.8** tons/year
5. Method of Compliance (limit to 60 characters): **EPA Method 9; When oil firing greater than 400 hrs/year.**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Oil firing: lb/hr at 20°F turbine inlet; TPY equivalent of 1,000 hrs/yr/CT-oil at 59°F turbine inlet.**	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **SO_2**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **105.6** lb/hour **68.4** tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference: **Siemens Westinghouse, 2000**	7. Emissions Method Code: **2**
8. Calculation of Emissions (limit to 600 characters): **See Section 2.0 and Appendix A in PSD Application**	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters): **Max lb/hr for oil firing at 20°F turbine inlet; TPY at 59°F turbine inlet; TPY at 59°F turbine inlet with 7,760 hrs/yr-gas; equivalent of 1,000 hrs/yr/CT-oil.**	

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **Natural Gas**	4. Equivalent Allowable Emissions: **5.5** lb/hour **22.4** tons/year
5. Method of Compliance (limit to 60 characters): **Fuel Sampling – Vendor or Applicant**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Gas Firing: lb/hr at 20°F turbine inlet; TPY for 8,760 hrs/yr at 59°F turbine inlet.**	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **SO_2**	2. Total Percent Efficiency of Control:
3. Potential Emissions: lb/hour tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference:	7. Emissions Method Code:
8. Calculation of Emissions (limit to 600 characters):	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **0.05 % Sulfur Oil**	4. Equivalent Allowable Emissions: **105.6** lb/hour **48.6** tons/year
5. Method of Compliance (limit to 60 characters): **Fuel Sampling – Vendor or Applicant**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Oil Firing: lb/hr at 20°F turbine inlet; TPY equivalent of 1,000 hrs/yr/CT-oil at 59°F turbine inlet.**	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **NO_X**	2. Total Percent Efficiency of Control:

3. Potential Emissions: **92.3** lb/hour **133.4** tons/year	4. Synthetically Limited? [ ]

5. Range of Estimated Fugitive Emissions:
[ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year

6. Emission Factor: Reference: **Siemens Westinghouse, 1998**	7. Emissions Method Code: **2**

8. Calculation of Emissions (limit to 600 characters):

Maximum lb/hour based on oil-firing. See Section 2.0 and Appendix A in PSD Application.

9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):

Max lb/hr for oil firing at 20°F turbine inlet; TPY at 59°F turbine inlet with 7,760 hrs/yr-gas; equivalent of 1,000 hrs/yr/CT-oil.

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **3.5 ppmvd at 15% O_2**	4. Equivalent Allowable Emissions: **25.0** lb/hour **101.2** tons/year

5. Method of Compliance (limit to 60 characters):

CEM; part 75; 24-hour block average; midnight to midnight

6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):

Gas Firing: lb/hr at 20°F turbine inlet; TPY for 8,760 hrs/yr at 59°F turbine inlet.

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **NO_X**	2. Total Percent Efficiency of Control:
3. Potential Emissions: lb/hour tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference:	7. Emissions Method Code:
8. Calculation of Emissions (limit to 600 characters):	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **12 ppmvd @ 15% O_2**	4. Equivalent Allowable Emissions: **92.3** lb/hour **44** tons/year
5. Method of Compliance (limit to 60 characters): **CEM; Part 75; 24-hour block average; midnight to midnight**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Oil Firing: lb/hr at 20°F turbine inlet; TPY equivalent of 1,000 hrs/yr/CT-oil at 59°F turbine inlet.**	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **CO**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **154** lb/hour **372** tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference: **Siemens Westinghouse, 2000**	7. Emissions Method Code: **2**
8. Calculation of Emissions (limit to 600 characters): **See Section 2.0 and Appendix A in PSD Application**	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters): **Max lb/hr for gas firing at 60% load and 20°F turbine inlet; TPY at 59°F turbine inlet with 7,760 hrs/yr-gas includes 3,000 hrs at 60% load; equivalent of 1,000 hrs/yr/CT-oil.**	

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **10 ppmvd – Base Load/50 ppmvd at 60% load**	4. Equivalent Allowable Emissions: **154** lb/hour **340** tons/year
5. Method of Compliance (limit to 60 characters): **EPA Method 10 @ 15% O_2**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Gas Firing: lb/hr at 20°F turbine inlet 60% load; TPY for 5,760 hrs/yr (100% load) and 3,000 hours (60% load) at 59°F turbine inlet.**	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **CO**	2. Total Percent Efficiency of Control:
3. Potential Emissions: lb/hour tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference:	7. Emissions Method Code:
8. Calculation of Emissions (limit to 600 characters):	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **30 ppmvd**	4. Equivalent Allowable Emissions: **112** lb/hour **53** tons/year
5. Method of Compliance (limit to 60 characters): **EPA Method 10; Initial and Annual at Base Load**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Oil Firing: lb/hr at 20°F turbine inlet; TPY equivalent of 1,000 hrs/yr/CT-oil at 59°F turbine inlet.**	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **VOC**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **22** lb/hour **28.4** tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference: **Siemens Westinghouse, 2000**	7. Emissions Method Code: **2**
8. Calculation of Emissions (limit to 600 characters): **See Section 2.0 and Appendix A in PSD Application**	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters): **Max lb/hr for oil firing at 20°F turbine inlet; TPY at 59°F turbine inlet with 7,760 hrs/yr-gas (100% and 60% loads); equivalent of 1,000 hrs/yr/CT-oil.**	

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **1.8 ppmvd – Baseload/ 3 ppmvd – 60% load**	4. Equivalent Allowable Emissions: **5.3** lb/hour **20** tons/year
5. Method of Compliance (limit to 60 characters): **EPA Method 25A; at 15% O_2**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Gas Firing: lb/hr at 60% load 20°F turbine inlet; TPY for 5,760 hrs/yr (100% load) and 3,000 hrs (60% load) at 59°F turbine inlet.**	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **VOC**	2. Total Percent Efficiency of Control:
3. Potential Emissions: lb/hour tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference:	7. Emissions Method Code:
8. Calculation of Emissions (limit to 600 characters):	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **10 ppmvw**	4. Equivalent Allowable Emissions: **22** lb/hour **10.5** tons/year
5. Method of Compliance (limit to 60 characters): **EPA Method 25A**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Oil Firing: lb/hr at 20°F turbine inlet; TPY equivalent of 1,000 hrs/yr/CT-oil at 59°F turbine inlet.**	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **SAM**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **16.2** lb/hour **10.5** tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: **10 % SO_2** Reference: **Golder, 2000**	7. Emissions Method Code: **2**
8. Calculation of Emissions (limit to 600 characters): **Emission Factor is converted to SAM. See Section 2.0 and Appendix A in PSD Application.**	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters): **Max lb/hr for oil firing at 20°F turbine inlet; TPY at 59°F turbine inlet with 7,760 hrs/yr-gas; equivalent of 1,000 hrs/yr/CT-oil.**	

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **Natural Gas**	4. Equivalent Allowable Emissions: **0.9** lb/hour **3.4** tons/year
5. Method of Compliance (limit to 60 characters): **Fuel Sampling – Vendor or Applicant**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Gas Firing: lb/hr at 20°F turbine inlet; TPY for 8,760 hrs/yr at 59°F turbine inlet.**	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **SAM**	2. Total Percent Efficiency of Control:
3. Potential Emissions: lb/hour tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference:	7. Emissions Method Code:
8. Calculation of Emissions (limit to 600 characters):	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **0.05 % Sulfur oil**	4. Equivalent Allowable Emissions: **16.2** lb/hour **7.44** tons/year
5. Method of Compliance (limit to 60 characters): **Fuel Sampling – Vendor or Applicant**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Oil Firing: lb/hr at 20°F turbine inlet; TPY equivalent of 1,000 hrs/yr/CT-oil at 59°F turbine inlet.**	

H. VISIBLE EMISSIONS INFORMATION
(Only Regulated Emissions Units Subject to a VE Limitation)

Visible Emissions Limitation: Visible Emissions Limitation 1 of 3

1. Visible Emissions Subtype: **VE10**	2. Basis for Allowable Opacity: [ ] Rule [X] Other
3. Requested Allowable Opacity: Normal Conditions: **10** % Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance: **EPA Method 9.**	
5. Visible Emissions Comment (limit to 200 characters): **Gas Firing**	

I. CONTINUOUS MONITOR INFORMATION
(Only Regulated Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor 1 of 2

1. Parameter Code: **EM**	2. Pollutant(s): **NO_X**
3. CMS Requirement:	[X] Rule [ ] Other
4. Monitor Information: Manufacturer: **Not Yet Determined** Model Number: Serial Number:	
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment (limit to 200 characters): **NO_X CEM required by 40 CFR Part 75. A carbon dioxide or oxygen monitor will be included.**	

H. VISIBLE EMISSIONS INFORMATION
(Only Regulated Emissions Units Subject to a VE Limitation)

Visible Emissions Limitation: Visible Emissions Limitation 2 of 3

1. Visible Emissions Subtype: **VE20**	2. Basis for Allowable Opacity: [ ] Rule [X] Other
3. Requested Allowable Opacity: Normal Conditions: **20** % Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance: **EPA Method 9.**	
5. Visible Emissions Comment (limit to 200 characters): **Oil Firing**	

I. CONTINUOUS MONITOR INFORMATION
(Only Regulated Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor 2 of 2

1. Parameter Code: **EM**	2. Pollutant(s): **NO_X**
3. CMS Requirement:	[X] Rule [ ] Other
4. Monitor Information: Manufacturer: **Siemens Westinghouse** Model Number: Serial Number:	
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment (limit to 200 characters): **Parameter Code: WTF. Required by 40 CFR 60; Subpart GG; S.60.334; oil firing. Request Part 75 NO_X CEM in lieu of WTF monitoring**	

H. VISIBLE EMISSIONS INFORMATION
(Only Regulated Emissions Units Subject to a VE Limitation)

Visible Emissions Limitation: Visible Emissions Limitation 3 of 3

1. Visible Emissions Subtype: **VE99**	2. Basis for Allowable Opacity: [X] Rule [ ] Other
3. Requested Allowable Opacity: Normal Conditions: % Exceptional Conditions: **100** % Maximum Period of Excess Opacity Allowed: **60** min/hour	
4. Method of Compliance: **None**	
5. Visible Emissions Comment (limit to 200 characters): **FDEP Rule 62-210.700(2); allowed for 2 hours (120 minutes) per 24 hours for startup, shutdown and malfunction.**	

I. CONTINUOUS MONITOR INFORMATION
(Only Regulated Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor _____ of _____

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement:	[ ] Rule [ ] Other
4. Monitor Information: Manufacturer: Model Number: Serial Number:	
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment (limit to 200 characters):	

J. EMISSIONS UNIT SUPPLEMENTAL INFORMATION
(Regulated Emissions Units Only)

Supplemental Requirements

1. Process Flow Diagram
   [X] Attached, Document ID: **Fig 2-2** [ ] Not Applicable [ ] Waiver Requested

2. Fuel Analysis or Specification
   [X] Attached, Document ID: **Tab 2-4/2-5** [ ] Not Applicable [ ] Waiver Requested

3. Detailed Description of Control Equipment
   [X] Attached, Document ID: **Sec 4.0** [ ] Not Applicable [ ] Waiver Requested

4. Description of Stack Sampling Facilities
   [X] Attached, Document ID: **PSD Appl.** [ ] Not Applicable [ ] Waiver Requested

5. Compliance Test Report
   [ ] Attached, Document ID:_____
   [ ] Previously submitted, Date:_____
   [X] Not Applicable

6. Procedures for Startup and Shutdown
   [ ] Attached, Document ID:_____ [X] Not Applicable [ ] Waiver Requested

7. Operation and Maintenance Plan
   [ ] Attached, Document ID:_____ [X] Not Applicable [ ] Waiver Requested

8. Supplemental Information for Construction Permit Application
   [X] Attached, Document ID: **PSD Appl.** [ ] Not Applicable

9. Other Information Required by Rule or Statute
   [X] Attached, Document ID: **PSD Appl.** [ ] Not Applicable

10. Supplemental Requirements Comment:

Additional Supplemental Requirements for Title V Air Operation Permit Applications

11. Alternative Methods of Operation
[ ] Attached, Document ID:_____ [ ] Not Applicable

12. Alternative Modes of Operation (Emissions Trading)
[ ] Attached, Document ID:_____ [ ] Not Applicable

13. Identification of Additional Applicable Requirements
[ ] Attached, Document ID:_____ [ ] Not Applicable

14. Compliance Assurance Monitoring Plan
[ ] Attached, Document ID:_____ [ ] Not Applicable

15. Acid Rain Part Application (Hard-copy Required)

[ ] Acid Rain Part - Phase II (Form No. 62-210.900(1)(a))
Attached, Document ID:_____

[ ] Repowering Extension Plan (Form No. 62-210.900(1)(a)1.)
Attached, Document ID:_____

[ ] New Unit Exemption (Form No. 62-210.900(1)(a)2.)
Attached, Document ID:_____

[ ] Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)
Attached, Document ID:_____

[ ] Phase II NOx Compliance Plan (Form No. 62-210.900(1)(a)4.)
Attached, Document ID:_____

[ ] Phase NOx Averaging Plan (Form No. 62-210.900(1)(a)5.)
Attached, Document ID:_____

[ ] Not Applicable

III. EMISSIONS UNIT INFORMATION

A separate Emissions Unit Information Section (including subsections A through J as required) must be completed for each emissions unit addressed in this Application for Air Permit. If submitting the application form in hard copy, indicate, in the space provided at the top of each page, the number of this Emissions Unit Information Section and the total number of Emissions Unit Information Sections submitted as part of this application.

A. GENERAL EMISSIONS UNIT INFORMATION
(All Emissions Units)

Emissions Unit Description and Status

1. Type of Emissions Unit Addressed in This Section: (Check one)

[X] This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

[ ] This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

2. Regulated or Unregulated Emissions Unit? (Check one)

[X] The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

[ ] The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

3. Description of Emissions Unit Addressed in This Section (limit to 60 characters):

CT- 3b; Power Block 3

4. Emissions Unit Identification Number: [ ] No ID
ID: [X] ID Unknown

5. Emissions Unit Status Code:	6. Initial Startup Date:	7. Emissions Unit Major Group SIC Code:	8. Acid Rain Unit?
C		**49**	[X]

9. Emissions Unit Comment: (Limit to 500 Characters)

Siemens Westinghouse 501 FD combustion turbine firing natural gas with distillate oil back-up.

Emissions Unit Control Equipment

1. Control Equipment/Method Description (Limit to 200 characters per device or method):

Dry Low NO_X combustion-natural gas firing

Selective Catalytic Reduction (SCR) – natural gas firing/ distillate oil firing.

Water Injection – distillate oil firing

2. Control Device or Method Code(s): **25, 65, 28**

Emissions Unit Details

1. Package Unit: Manufacturer: **Siemens Westinghouse**		Model Number: **501 FD**	
2. Generator Nameplate Rating:	**170**	MW	
3. Incinerator Information:			
Dwell Temperature:			°F
Dwell Time:			seconds
Incinerator Afterburner Temperature:			°F

B. EMISSIONS UNIT CAPACITY INFORMATION
(Regulated Emissions Units Only)

Emissions Unit Operating Capacity and Schedule

1. Maximum Heat Input Rate:		**1,830**	mmBtu/hr
2. Maximum Incineration Rate:	lb/hr		tons/day
3. Maximum Process or Throughput Rate:			
4. Maximum Production Rate:			
5. Requested Maximum Operating Schedule:			
	hours/day		days/week
	weeks/year	**8,760**	hours/year

6. Operating Capacity/Schedule Comment (limit to 200 characters):

Heat input is HHV with natural gas; heat input at 59°F turbine inlet temperature; MW nominal rating.

C. EMISSIONS UNIT REGULATIONS
(Regulated Emissions Units Only)

List of Applicable Regulations

See Attachment HEC-EU1-C	
See PSD Application	

D. EMISSION POINT (STACK/VENT) INFORMATION
(Regulated Emissions Units Only)

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram? **Fig 2-1**	2. Emission Point Type Code: **1**

3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking (limit to 100 characters per point):

Exhausts through a single stack.

4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common:

5. Discharge Type Code: **V**	6. Stack Height: **125** feet	7. Exit Diameter: **19** feet
8. Exit Temperature: **190** °F	9. Actual Volumetric Flow Rate: **1,009,487** acfm	10. Water Vapor: %
11. Maximum Dry Standard Flow Rate: dscfm	12. Nonstack Emission Point Height: feet	

13. Emission Point UTM Coordinates:

Zone: **17** East (km): **414.4** North (km): **3073.9**

14. Emission Point Comment (limit to 200 characters):

Temperature and flow for natural gas at 59°F turbine inlet; See Tables 2-1 and 2-2 in PSD application.

E. SEGMENT (PROCESS/FUEL) INFORMATION
(All Emissions Units)

Segment Description and Rate: Segment 1 of 2

1. Segment Description (Process/Fuel Type) (limit to 500 characters): **Natural Gas**		
2. Source Classification Code (SCC): **2-01-002-01**	3. SCC Units: **Million Cubic Feet**	
4. Maximum Hourly Rate: **1.92**	5. Maximum Annual Rate: **15,564**	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit: **1,030**
10. Segment Comment (limit to 200 characters): **Based on 1,030 BTU/CF (HHV); maximum hourly at 20°F; annual at 59°F; turbine inlet temperatures.**		

Segment Description and Rate: Segment 2 of 2

1. Segment Description (Process/Fuel Type) (limit to 500 characters): **Distillate Fuel Oil**		
2. Source Classification Code (SCC): **2-01-001-01**	3. SCC Units: **1,000 Gallons Used**	
4. Maximum Hourly Rate: **14.9**	5. Maximum Annual Rate: **13,683**	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur:	8. Maximum % Ash:	9. Million Btu per SCC Unit: **141.2**
10. Segment Comment (limit to 200 characters): **BTU based on HHV of 141.2 MMBtu/1,000 gallons. Aggregate fuel usage of 27,365,000 gallons per year requested for Power Block 3.**		

F. EMISSIONS UNIT POLLUTANTS
(All Emissions Units)

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
PM			
SO_2			
NO_X	025, 028	065	EL
CO			EL
VOC			EL
SAM			

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units -
Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **PM**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **64.8** lb/hour **60.3** tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference: **Siemens Westinghouse, 2000**	7. Emissions Method Code: **2**
8. Calculation of Emissions (limit to 600 characters): **See Section 2.0 and Appendix A in PSD Application**	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters): **Max lb/hr for oil firing at 20°F turbine inlet; TPY at 59°F turbine inlet with 7,760 hrs/yr-gas; equivalent of 1,000 hrs/yr/CT-oil.**	

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **10 % Opacity**	4. Equivalent Allowable Emissions: **8.5** lb/hour **34.0** tons/year
5. Method of Compliance (limit to 60 characters): **EPA Method 9; Initially and Annually**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Gas Firing: lb/hr at 20°F turbine inlet; TPY for 8,760 hrs/yr at 59°F turbine inlet.**	

Emissions Unit Information Section 2 **of** 2 — **CT-3B – Power Block 3**

Pollutant Detail Information Page 1 **of** 6 — **Particulate Matter - Total**

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **PM**	2. Total Percent Efficiency of Control:
3. Potential Emissions: lb/hour tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference:	7. Emissions Method Code:
8. Calculation of Emissions (limit to 600 characters):	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **20% Opacity**	4. Equivalent Allowable Emissions: **64.8** lb/hour **29.8** tons/year
5. Method of Compliance (limit to 60 characters): **EPA Method 9; When oil firing is greater than 400 hrs/year**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Oil firing: lb/hr at 20°F turbine inlet; TPY equivalent of 1,000 hrs/yr/CT-oil at 59°F turbine inlet.**	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **SO_2**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **105.6** lb/hour **68.4** tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference: **Siemens Westinghouse, 2000**	7. Emissions Method Code: **2**
8. Calculation of Emissions (limit to 600 characters): **See Section 2.0 and Appendix A in PSD Application**	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters): **Max lb/hr for oil firing at 20°F turbine inlet; TPY at 59°F turbine inlet; TPY at 59°F turbine inlet with 7,760 hrs/yr-gas; equivalent of 1,000 hrs/yr/CT-oil.**	

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **Natural Gas**	4. Equivalent Allowable Emissions: **5.5** lb/hour **22.4** tons/year
5. Method of Compliance (limit to 60 characters): **Fuel Sampling – Vendor or Applicant**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Gas Firing: lb/hr at 20°F turbine inlet; TPY for 8,760 hrs/yr at 59°F turbine inlet.**	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: SO_2	2. Total Percent Efficiency of Control:
3. Potential Emissions: lb/hour tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference:	7. Emissions Method Code:
8. Calculation of Emissions (limit to 600 characters):	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **0.05 % Sulfur Oil**	4. Equivalent Allowable Emissions: **105.6** lb/hour **48.6** tons/year
5. Method of Compliance (limit to 60 characters): **Fuel Sampling – Vendor or Applicant**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Oil Firing: lb/hr at 20°F turbine inlet; TPY equivalent of 1,000 hrs/yr/CT-oil at 59°F turbine inlet.**	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **NO_X**	2. Total Percent Efficiency of Control:

3. Potential Emissions: **92.3** lb/hour **133.4** tons/year	4. Synthetically Limited? [X]

5. Range of Estimated Fugitive Emissions:
[ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year

6. Emission Factor: Reference: **Siemens Westinghouse, 1998**	7. Emissions Method Code: **2**

8. Calculation of Emissions (limit to 600 characters):

Maximum lb/hour based on oil-firing. See Section 2.0 and Appendix A in PSD Application.

9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):

Max lb/hr for oil firing at 20°F turbine inlet; TPY at 59°F turbine inlet with 7,760 hrs/yr-gas; equivalent of 1,000 hrs/yr/CT-oil.

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **3.5 ppmvd at 15% O_2**	4. Equivalent Allowable Emissions: **25.0** lb/hour **101.2** tons/year

5. Method of Compliance (limit to 60 characters):

CEM; part 75; 24-hour block average; midnight to midnight

6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):

Gas Firing: lb/hr at 20°F turbine inlet; TPY for 8,760 hrs/yr at 59°F turbine inlet.

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **NO_X**	2. Total Percent Efficiency of Control:
3. Potential Emissions: lb/hour tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference:	7. Emissions Method Code:
8. Calculation of Emissions (limit to 600 characters):	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **12 ppmvd @ 15% O_2**	4. Equivalent Allowable Emissions: **92.3** lb/hour **44** tons/year
5. Method of Compliance (limit to 60 characters): **CEM; Part 75; 24-hour block average; midnight to midnight**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Oil Firing: lb/hr at 20°F turbine inlet; TPY equivalent of 1,000 hrs/yr/CT-oil at 59°F turbine inlet.**	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **CO**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **154** lb/hour **372** tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference: **Siemens Westinghouse, 2000**	7. Emissions Method Code: **2**
8. Calculation of Emissions (limit to 600 characters): **See Section 2.0 and Appendix A in PSD Application**	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters): **Max lb/hr for gas firing at 60% load and 20°F turbine inlet; TPY at 59°F turbine inlet with 7,760 hrs/yr-gas includes 3,000 hrs at 60% load; equivalent of 1,000 hrs/yr/CT-oil.**	

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **10 ppmvd – Base Load/50 ppmvd at 60% load**	4. Equivalent Allowable Emissions: **154** lb/hour **340** tons/year
5. Method of Compliance (limit to 60 characters): **EPA Method 10 @ 15% O_2**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Gas Firing: lb/hr at 20°F turbine inlet 60% load; TPY for 5,760 hrs/yr (100% load) and 3,000 hours (60% load) at 59°F turbine inlet.**	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **CO**	2. Total Percent Efficiency of Control:
3. Potential Emissions: lb/hour tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference:	7. Emissions Method Code:
8. Calculation of Emissions (limit to 600 characters):	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **30 ppmvd**	4. Equivalent Allowable Emissions: **112** lb/hour **53** tons/year
5. Method of Compliance (limit to 60 characters): **EPA Method 10; Initial and Annual at Base Load**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Oil Firing: lb/hr at 20°F turbine inlet; TPY equivalent of 1,000 hrs/yr/CT-oil at 59°F turbine inlet.**	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **VOC**	2. Total Percent Efficiency of Control:
3. Potential Emissions: **22** lb/hour **28.4** tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference: **Siemens Westinghouse, 2000**	7. Emissions Method Code: **2**
8. Calculation of Emissions (limit to 600 characters): **See Section 2.0 and Appendix A in PSD Application**	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters): **Max lb/hr for oil firing at 20°F turbine inlet; TPY at 59°F turbine inlet with 7,760 hrs/yr-gas (100% and 60% loads); equivalent of 1,000 hrs/yr/CT-oil.**	

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **1.8 ppmvd – Baseload/ 3 ppmvd – 60% load**	4. Equivalent Allowable Emissions: **5.3** lb/hour **20** tons/year
5. Method of Compliance (limit to 60 characters): **EPA Method 25A; at 15% O_2**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Gas Firing: lb/hr at 60% load 20°F turbine inlet; TPY for 5,760 hrs/yr (100% load) and 3,000 hrs (60% load) at 59°F turbine inlet.**	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **VOC**	2. Total Percent Efficiency of Control:
3. Potential Emissions: lb/hour tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference:	7. Emissions Method Code:
8. Calculation of Emissions (limit to 600 characters):	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **10 ppmvw**	4. Equivalent Allowable Emissions: **22** lb/hour **10.5** tons/year
5. Method of Compliance (limit to 60 characters): **EPA Method 25A**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Oil Firing: lb/hr at 20°F turbine inlet; TPY equivalent of 1,000 hrs/yr/CT-oil at 59°F turbine inlet.**	

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units - Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **SAM**	2. Total Percent Efficiency of Control:

3. Potential Emissions: **16.2** lb/hour **10.5** tons/year	4. Synthetically Limited? [ ]

5. Range of Estimated Fugitive Emissions:
[ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year

6. Emission Factor: **10 % SO_2** Reference: **Golder, 2000**	7. Emissions Method Code: **2**

8. Calculation of Emissions (limit to 600 characters):

Emission Factor is converted to SAM. See Section 2.0 and Appendix A in PSD Application.

9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):

Max lb/hr for oil firing at 20°F turbine inlet; TPY at 59°F turbine inlet with 7,760 hrs/yr-gas; equivalent of 1,000 hrs/yr/CT-oil.

Allowable Emissions Allowable Emissions 1 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **Natural Gas**	4. Equivalent Allowable Emissions: **0.9** lb/hour **3.4** tons/year

5. Method of Compliance (limit to 60 characters):

Fuel Sampling – Vendor or Applicant

6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters):

Gas Firing: lb/hr at 20°F turbine inlet; TPY for 8,760 hrs/yr at 59°F turbine inlet.

G. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION
(Regulated Emissions Units -
Emissions-Limited and Preconstruction Review Pollutants Only)

Potential/Fugitive Emissions

1. Pollutant Emitted: **SAM**	2. Total Percent Efficiency of Control:
3. Potential Emissions: lb/hour tons/year	4. Synthetically Limited? [ ]
5. Range of Estimated Fugitive Emissions: [ ] 1 [ ] 2 [ ] 3 _____ to _____ tons/year	
6. Emission Factor: Reference:	7. Emissions Method Code:
8. Calculation of Emissions (limit to 600 characters):	
9. Pollutant Potential/Fugitive Emissions Comment (limit to 200 characters):	

Allowable Emissions Allowable Emissions 2 of 2

1. Basis for Allowable Emissions Code: **OTHER**	2. Future Effective Date of Allowable Emissions:
3. Requested Allowable Emissions and Units: **0.05 % Sulfur oil**	4. Equivalent Allowable Emissions: **16.2** lb/hour **7.44** tons/year
5. Method of Compliance (limit to 60 characters): **Fuel Sampling – Vendor or Applicant**	
6. Allowable Emissions Comment (Desc. of Operating Method) (limit to 200 characters): **Oil Firing: lb/hr at 20°F turbine inlet; TPY equivalent of 1,000 hrs/yr/CT-oil at 59°F turbine inlet.**	

H. VISIBLE EMISSIONS INFORMATION
(Only Regulated Emissions Units Subject to a VE Limitation)

Visible Emissions Limitation: Visible Emissions Limitation 1 of 3

1. Visible Emissions Subtype: **VE10**	2. Basis for Allowable Opacity: [ ] Rule [X] Other
3. Requested Allowable Opacity: Normal Conditions: **10** % Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance: **EPA Method 9.**	
5. Visible Emissions Comment (limit to 200 characters): **Gas Firing**	

I. CONTINUOUS MONITOR INFORMATION
(Only Regulated Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor 1 of 2

1. Parameter Code: **EM**	2. Pollutant(s): **NO_X**
3. CMS Requirement:	[X] Rule [ ] Other
4. Monitor Information: Manufacturer: **Not Yet Determined** Model Number: Serial Number:	
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment (limit to 200 characters): **NO_X CEM required by 40 CFR Part 75. A carbon dioxide or oxygen monitor will be included.**	

H. VISIBLE EMISSIONS INFORMATION
(Only Regulated Emissions Units Subject to a VE Limitation)

Visible Emissions Limitation: Visible Emissions Limitation 2 of 3

1. Visible Emissions Subtype: **VE20**	2. Basis for Allowable Opacity: [ ] Rule [X] Other
3. Requested Allowable Opacity: Normal Conditions: **20** % Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance: **EPA Method 9.**	
5. Visible Emissions Comment (limit to 200 characters): **Oil Firing**	

I. CONTINUOUS MONITOR INFORMATION
(Only Regulated Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor 2 of 2

1. Parameter Code: **EM**	2. Pollutant(s): **NO_X**
3. CMS Requirement:	[X] Rule [ ] Other
4. Monitor Information: Manufacturer: **Siemens Westinghouse** Model Number: Serial Number:	
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment (limit to 200 characters): **Parameter Code: WTF. Required by 40 CFR 60; Subpart GG; S.60.334; oil firing. Request NO_X CEM in lieu of WTF monitoring**	

H. VISIBLE EMISSIONS INFORMATION
(Only Regulated Emissions Units Subject to a VE Limitation)

Visible Emissions Limitation: Visible Emissions Limitation 3 of 3

1. Visible Emissions Subtype: **VE99**	2. Basis for Allowable Opacity: [X] Rule [ ] Other
3. Requested Allowable Opacity: Normal Conditions: % Exceptional Conditions: **100** % Maximum Period of Excess Opacity Allowed: **60** min/hour	
4. Method of Compliance: **None**	
5. Visible Emissions Comment (limit to 200 characters): **FDEP Rule 62-210.700(2); allowed for 2 hours (120 minutes) per 24 hours for startup, shutdown and malfunction.**	

I. CONTINUOUS MONITOR INFORMATION
(Only Regulated Emissions Units Subject to Continuous Monitoring)

Continuous Monitoring System: Continuous Monitor _____ of _____

1. Parameter Code:	2. Pollutant(s):
3. CMS Requirement:	[ ] Rule [ ] Other
4. Monitor Information: Manufacturer: Model Number:	Serial Number:
5. Installation Date:	6. Performance Specification Test Date:
7. Continuous Monitor Comment (limit to 200 characters):	

J. EMISSIONS UNIT SUPPLEMENTAL INFORMATION
(Regulated Emissions Units Only)

Supplemental Requirements

1. Process Flow Diagram
   [X] Attached, Document ID: **Fig 2-2** [ ] Not Applicable [ ] Waiver Requested

2. Fuel Analysis or Specification
   [X] Attached, Document ID: **Tab 2-4/2-5** [ ] Not Applicable [ ] Waiver Requested

3. Detailed Description of Control Equipment
   [X] Attached, Document ID: **Sec 4.0** [ ] Not Applicable [ ] Waiver Requested

4. Description of Stack Sampling Facilities
   [X] Attached, Document ID: **PSD Appl.** [ ] Not Applicable [ ] Waiver Requested

5. Compliance Test Report
   [ ] Attached, Document ID:_____
   [ ] Previously submitted, Date:_____
   [X] Not Applicable

6. Procedures for Startup and Shutdown
   [ ] Attached, Document ID:_____ [X] Not Applicable [ ] Waiver Requested

7. Operation and Maintenance Plan
   [ ] Attached, Document ID:_____ [X] Not Applicable [ ] Waiver Requested

8. Supplemental Information for Construction Permit Application
   [X] Attached, Document ID: **PSD Appl.** [ ] Not Applicable

9. Other Information Required by Rule or Statute
   [X] Attached, Document ID: **PSD Appl.** [ ] Not Applicable

10. Supplemental Requirements Comment:

Additional Supplemental Requirements for Title V Air Operation Permit Applications

11. Alternative Methods of Operation
[ ] Attached, Document ID:_____ [ ] Not Applicable

12. Alternative Modes of Operation (Emissions Trading)
[ ] Attached, Document ID:_____ [ ] Not Applicable

13. Identification of Additional Applicable Requirements
[ ] Attached, Document ID:_____ [ ] Not Applicable

14. Compliance Assurance Monitoring Plan
[ ] Attached, Document ID:_____ [ ] Not Applicable

15. Acid Rain Part Application (Hard-copy Required)

[ ] Acid Rain Part - Phase II (Form No. 62-210.900(1)(a))
Attached, Document ID:_____

[ ] Repowering Extension Plan (Form No. 62-210.900(1)(a)1.)
Attached, Document ID:_____

[ ] New Unit Exemption (Form No. 62-210.900(1)(a)2.)
Attached, Document ID:_____

[ ] Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)
Attached, Document ID:_____

[ ] Phase II NOx Compliance Plan (Form No. 62-210.900(1)(a)4.)
Attached, Document ID:_____

[ ] Phase NOx Averaging Plan (Form No. 62-210.900(1)(a)5.)
Attached, Document ID:_____

[ ] Not Applicable

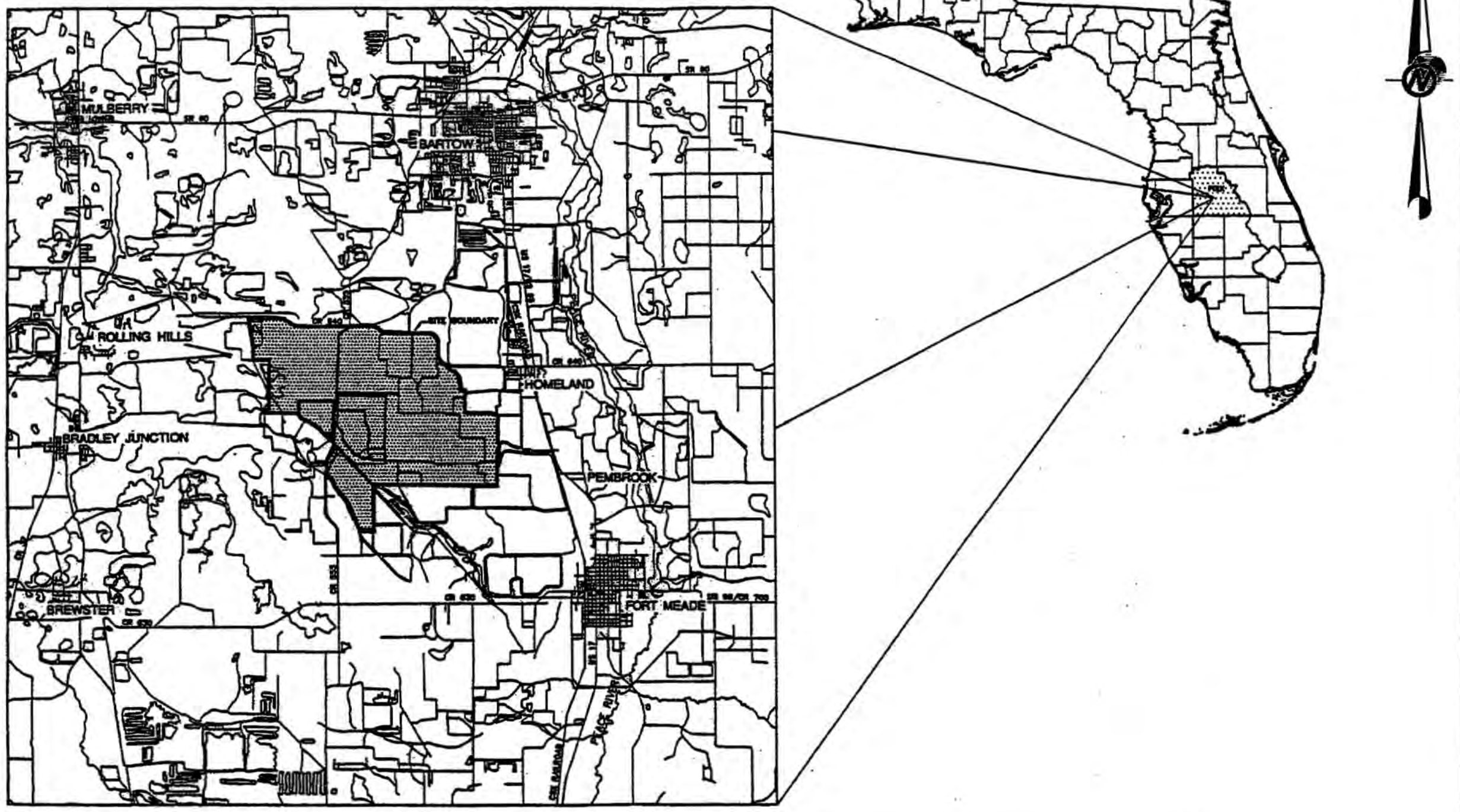
1.0 INTRODUCTION

Florida Power (FP) is the owner and operator of the Hines Energy Complex which is located in the southwest portion of Polk County, about seven miles south-southwest of Bartow and five miles west-northwest of Fort Meade (see Figure 1-1). Currently in operation is Power Block 1, consisting of one 485 MW (MW-nominal 500 MW) combined cycle (CC) power generation unit. Power Block 2 is a 530 MW CC power generation unit and is currently under construction. The expansion of generating capacity at the Hines Energy Complex will be accomplished by using the most efficient generation technology throughout the life of the project. This approach offers Florida Power's maximum flexibility and cost control as both technology and electrical demand increases.

Power Block 3 (the Project) consists of two nominal 170 MW Siemens Westinghouse 501 FD combustion turbines (CTs), two unfired heat recovery steam generators (HRSGs), and one nominal 190 MW steam turbine generator (STG); i.e., a two-on-one configuration. The total nominal rating for Power Block 3 is approximately 530 MW. Pipeline quality natural gas will be utilized as the primary fuel with limited use of low sulfur fuel oil as the back-up fuel. Among the advantages of this CC technology are its fuel flexibility, modularity, and efficiency.

The U.S. Environmental Protection Agency (EPA) has promulgated Prevention of Significant Deterioration (PSD) regulations (40 CFR 52.21), which require a permit review and approval for new or modified sources that increase air pollutant emissions above specified threshold levels. These emission threshold levels will be exceeded for several criteria pollutants during operation of Power Block 3. As a result, Power Block 3 is subject to PSD review for these pollutants. The Federal PSD regulations are implemented in Florida by the Florida Department of Environmental Protection (FDEP). FDEP's PSD regulations are codified in Rule 62-212.400 F.A.C. The technical information and analysis required by the federal and state PSD regulations are contained in this PSD permit application. Although this document will be an appendix to the Site Certification Application (SCA) and only addresses Power Block 3, it has been prepared as a stand-alone PSD permit application. The permit application is divided into eight major sections. Presented in Section 2.0 is a description of the facility, including air pollutant emissions and stack parameters. Air quality review requirements and applicability are presented in Section 3.0. The best available control technology (BACT) evaluation is presented in Section 4.0. An ambient air quality monitoring data analysis is presented in Section 5.0, and the air quality modeling methodology, the results of the air quality impact assessment, and additional impacts analysis performed for the proposed project are presented in Sections 6.0, 7.0, and 8.0, respectively. Section 9.0 contains a list of references and materials cited.

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SOURCE: 1992 SCA

Florida Power
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Hines Energy Complex

FIGURE 1-1
SITE LOCATION MAP

2.0 PROJECT DESCRIPTION

2.1 GENERAL DESCRIPTION

The proposed Power Block 3 project will consist of the construction of approximately 530 MW of generation. The CC configuration consists of two CTs, two HRSGs, and one steam turbine. In this "two-on-one" configuration, each of the two CTs are nominally rated at 170 MW, and the steam turbine has a nominal rating of 190 MW. Each CT will be served by a single HRSG, exhausting to an individual stack. There will be no HRSG bypass stacks for simple cycle operation. Also, there will be no supplemental firing of the HRSGs. The expected primary fuel is natural gas, with low sulfur fuel oil as a backup.

The CC units will utilize low sulfur fuel to limit sulfur dioxide (SO_2) emissions and sulfuric acid mist, selective catalytic reduction (SCR) to limit emissions of oxides of nitrogen (NO_X), and good combustion practices and clean fuels for the minimization of particulate matter (PM/PM_{10}), carbon monoxide (CO), volatile organic compounds (VOCs), and other (trace metals) emissions. The proposed emission control techniques are described in detail in Section 4.0 of this application.

2.2 PROPOSED SOURCE EMISSIONS AND STACK PARAMETERS

As the steam turbine is not a combustion source, estimated mass emissions are based on operation of only the CTs. However, the exhaust gas characteristics reflect flow through the HRSG (i.e., the characteristics reflect the impact of the steam turbine). Therefore, the estimated stack emissions that are representative of the advanced CT designs proposed for Power Block 3 are presented in Tables 2-1 and 2-2 for a 170 MW CT unit (refer to Appendix A for detailed turbine performance and emissions data). The exhaust parameters presented in these tables are reflective of the combined cycle configuration. These tables cover the natural gas and fuel oil cases for three compressor inlet temperatures: 1) the high temperature case of 105°F for oil and 90°F for gas, 2) the ISO reference temperature case of 59°F and 3) the low temperature case that represents the shaft limit or the maximum physical output of the equipment, i.e., 20°F for oil/natural gas. Maximum hourly emission rates for all pollutants, in units of pounds per hour (lb/hr) are projected to occur for operations at low compressor inlet temperature and base (100 percent) load operation. Maximum annual potential emission rates (after the application of BACT) for the proposed sources with respect to regulated criteria air pollutants and regulated non-criteria air pollutants are presented in Table 2-3.

Worst-case air quality impacts due to the proposed facility are a function of emission rate and plume rise. A number of operating cases (combinations of operating conditions and fuel types) were examined to represent the range that will occur during actual operations. The low (20°F) and high (105°F oil/90°F gas) compressor inlet temperatures and a range of loads (100 to 60 percent for natural gas and 100 to 65 percent for oil) represent the range of combustion turbine performance and emissions/exhaust characteristics that will occur during normal operation. At high compressor inlet temperatures, the units cannot generate as much power because of lower inlet air density. To compensate for a portion of the loss of output (which can be on the order of 20 MW compared to referenced temperatures), inlet cooling is proposed to be installed ahead of the combustion turbine inlet. Therefore, the 59°F temperature case represents a conservative average temperature condition for estimating annual emissions for Power Block 3, inclusive of potential inlet cooling.

Since the performance of the CTs might be slightly higher than the design criteria, FP requests permit maximum heat input rates equivalent to those permitted for Power Block 2. The requested maximum heat input rates, based on the higher heating valve of fuels, and an ambient temperature of 59°F are 1915 mmBTU/hr when firing natural gas and 2020 mmBTU/hr when firing distillate fuel oil.

A review of the CT unit design information in Tables 2-1 and 2-2 indicates that the highest criteria air pollutant emission rates for SO_2, PM/PM_{10}, NO_X, CO, and VOCs occur when burning fuel oil. Combustion of fuel oil also results in higher exhaust gas flow rates and stack exit temperatures, which are directly related to plume rise. Although the highest emission rates occur under the low compressor inlet temperature (20°F) condition, the lowest exhaust gas volumetric flow rate for the CC units occurs under the 105°F ambient temperature condition. Detailed discussion on the determination of worst-case impacts is presented in Section 6.0 (Air Quality Modeling Methodology).

Typical fuel analyses for natural gas and fuel oil are presented in Tables 2-4 and 2-5, respectively. For oil firing, it is requested that an aggregate annual fuel usage for Power Block 3 of 27,365,000 gallons be included as a permit condition. This equates to a maximum of 1,000 hours per year per turbine of generation at full load (59° F).

2.3 SITE LAYOUT AND STRUCTURES

The site arrangement for Power Block 3 as well as existing Power Blocks 1 and 2 is depicted in Figure 2-1. Each power block consists of two CTs, two HRSGs, and one steam turbine. The six HRSG stacks are arranged in an east-west line. The flow diagram for a CC unit is depicted in Figure 2-2. Stack sampling facilities will be constructed in accordance with Rule 62-297.310(6) F.A.C.

TABLE 2-1
COMBUSTION TURBINE UNIT (170 MW)
ESTIMATED [1] PERFORMANCE ON NATURAL GAS

CONDITIONS			
Ambient Temperature (°F)	20	59	90
Ambient Relative Humidity (%)	60	60	60
Load Condition (%)	100	100	100
Maximum Heat Input Rate (MMBtu/hr)[2]	2,012	1,830	1,705
EMISSIONS (lb/hr)			
Carbon Monoxide (10 ppm at 15% O_2)	46	42	37
Nitrogen Oxides (3.5 ppmvd at 15% O_2)[3]	25.0	23.1	21.2
Sulfur Dioxide	5.6	5.1	4.8
Particulate Matter (PM_{10})	8.5	7.9	7.2
Opacity (%)	10	10	10
VOCs (1.8 ppmvd at 15% O_2)	4.7	4.4	3.8
Lead	Neg.	Neg.	Neg.
Sulfuric Acid Mist	0.9	0.8	0.7
STACK PARAMETERS			
Stack Height (ft)	125	125	125
Stack Diameter (ft)	19.0	19.0	19.0
Stack Gas Temperature (°F)	190	190	190
Stack Gas Exit Velocity (ft/sec)	63.3	59.2	55.4

Notes:
(1) Emission estimates based on manufacturer's data; see Appendix A
(2) For CTs the heat-input rate is based on the higher heating value (HHV) of the fuel (1,030 Btu/SCF, 23,345 Btu/lb).
(3) Not corrected to ISO conditions.

VOCs = Volatile Organic Compounds Neg. = Negligible

TABLE 2-2

COMBUSTION TURBINE UNIT (170 MW)

ESTIMATED [1] PERFORMANCE ON FUEL OIL

CONDITIONS			
Ambient Temperature (°F)	20	59	105
Ambient Relative Humidity (%)	60	60	60
Load Condition (%)	100	100	100
Maximum Heat Input Rate (MMBtu/hr)[2]	2,100	1,932	1,707
EMISSIONS (lb/hr)			
Carbon Monoxide (30 ppmvd)	112	106	91
Nitrogen Oxides (12 ppmvd at 15% O_2)	92.3	87.5	77.3
Sulfur Dioxide	105.6	97.1	85.8
Particulate Matter (PM_{10})	64.8	59.6	52.5
Opacity (%)	20	20	20
Volatile Organic Compounds (10 ppmvw)	22	21	19
Lead [4]	0.022	0.021	0.018
Sulfuric Acid Mist	16	15	13
STACK PARAMETERS			
Stack Height (ft)	125	125	125
Stack Diameter (ft)	19.0	19.0	19.0
Stack Gas Temperature (°F)	270	270	270
Stack Gas Exit Velocity (ft/sec)	69.4	67.0	60

Notes: (1) Emission estimates based on manufacturer's data; see Appendix A.

(2) For CTs the heat input rate is based on the higher heating value (HHV) of the fuel (19,892 Btu/lb).

TABLE 2-3
MAXIMUM POTENTIAL ANNUAL EMISSIONS (530 MW)
AND PSD SIGNIFICANCE VALUES

Pollutant	Emissions (TPY)[a]	PSD Significant Emission Rate (TPY)	PSD Review Required (Yes/No)
Carbon Monoxide	744	100	Yes
Nitrogen Oxides	267	40	Yes
Sulfur Dioxide	137	40	Yes
Particulate Matter (PM_{10})	121	15	Yes
Total Suspended Particulates	121	25	Yes
Volatile Organic Compounds	57	40	Yes
Lead	0.02	0.6	No
Sulfuric Acid Mist	21	7	Yes
Individual HAPs	2.0	10[b]	NA
Total HAPs	7.3	25[b]	NA

[a]TPY = Tons per year for the proposed Power Block 3 project.

Basis: Refer to Table A-25 in Appendix A.

[b]Criteria for review under 112 g regulations for determination of MACT.

TABLE 2-4

TYPICAL NATURAL GAS ANALYSIS

ANALYSIS	MOLE (%)
Carbon Dioxide	0.576
Ethane	2.18
Hexanes Plus	0.0077
Iso-Butane	0.064
Methane	96.55
Nitrogen	0.213
Normal-Butane	0.063
Pentanes Plus	0.018
Propane	0.299
Total:	100.000
Specific Gravity (air at 1)	0.5782

Quality Information	Parameters
Heating Value (HHV)	1030 Btu/cf
Total Sulfur (Maximum)	1 grain/100 SCF

Source: Florida Gas Transmission

TABLE 2-5
TYPICAL NO. 2 FUEL OIL ANALYSIS

NO. 2 DISTILLATE OIL	PERCENT (BY WEIGHT)
Carbon Residue	<0.01
Nitrogen	0.015[a]
Sulfur	0.05[b]
Ash	0.05[a]

Lower Heating Value: 17,290 Btu/lb

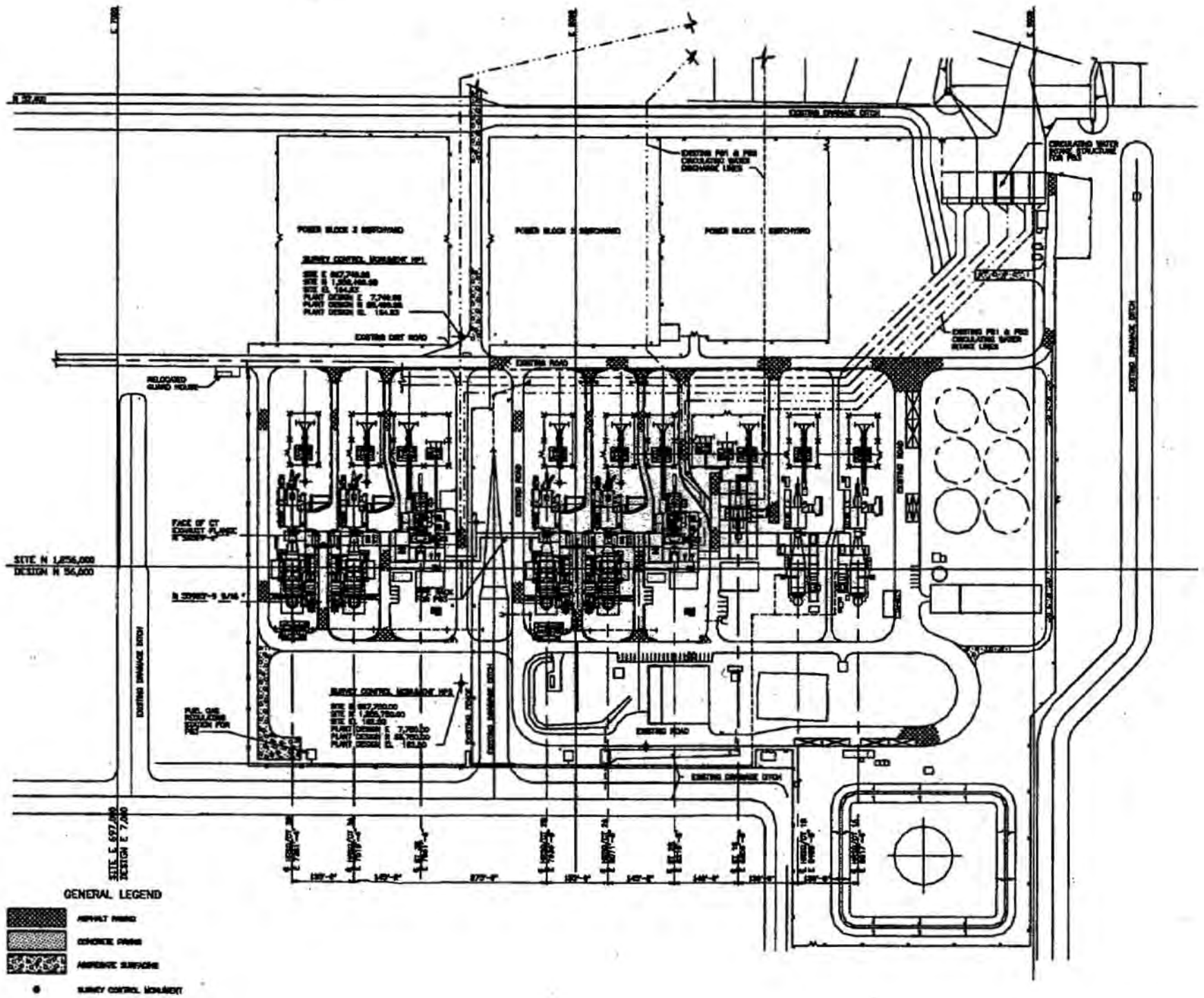
Higher Heating Value: 19,892 Btu/lb

[a] Emission guarantees based on these values.

[b] The sulfur content is the maximum, as required by permit.

Source FP, 1999

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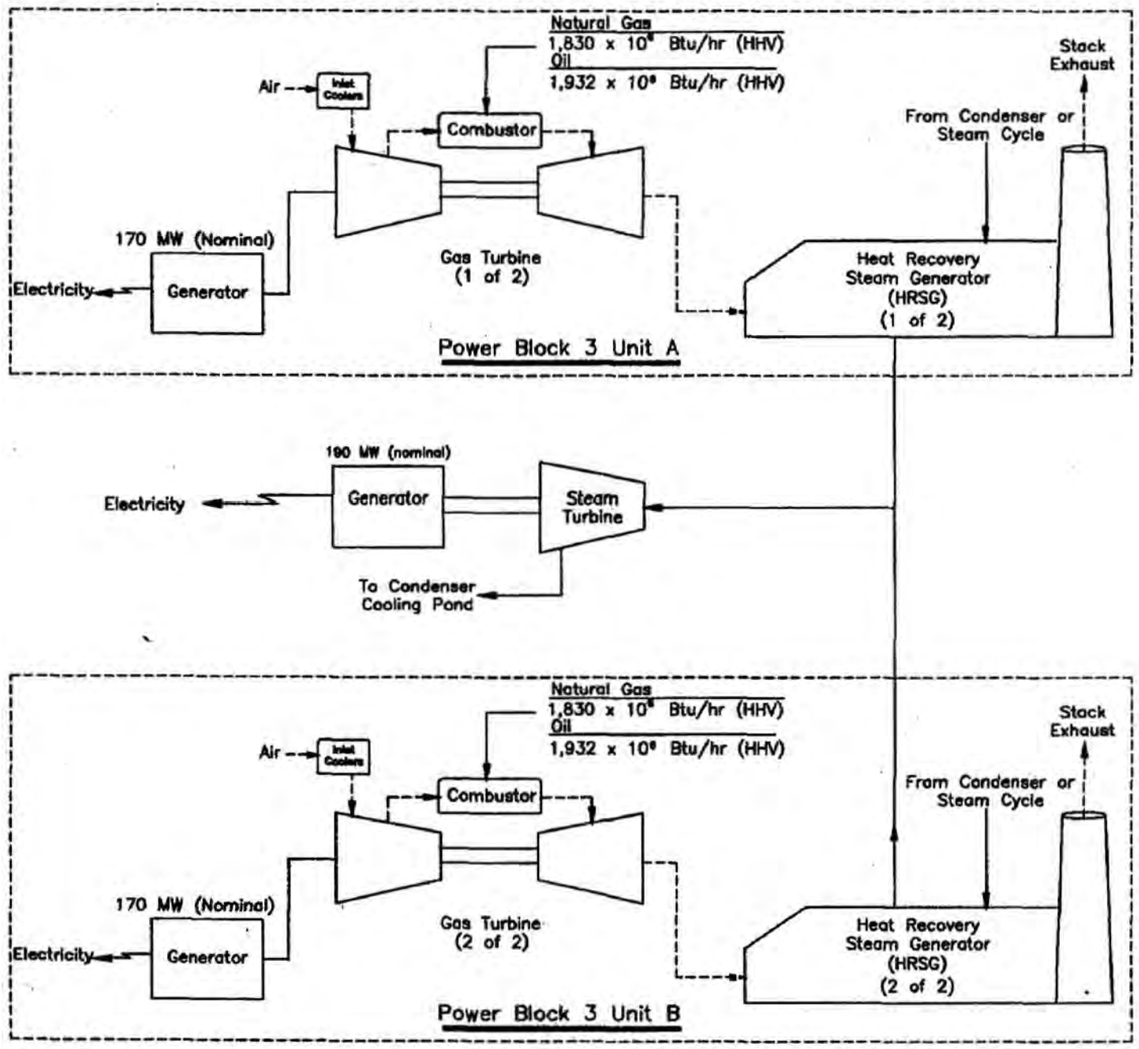
Hines Energy Complex

FIGURE 2-1
SITE ARRANGEMENT MAP

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Baseload Operation
Turbine Inlet Temperature of 59° F

Natural Gas–Firing	Oil firing
1,009,500 ACFM	1,139,394 ACFM
59.2 ft/sec	67.0 ft/sec
190°F	270° F



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Hines Energy Complex

FIGURE 2-2
PROCESS FLOW DIAGRAM

3.0 AIR QUALITY REVIEW REQUIREMENTS AND APPLICABILITY

The following discussion pertains to the federal and state air regulatory requirements and their applicability to Power Block 3. These regulations must be satisfied before the proposed facility can be constructed and begin operation.

3.1 NATIONAL AND FLORIDA AMBIENT AIR QUALITY STANDARDS (NAAQS/FAAQS)

The applicable federal and state ambient air quality standards are presented in Table 3-1 (PSD increments are also presented in Table 3-1, but discussed in Section 3.2.2). The primary National Ambient Air Quality Standards and Florida Ambient Air Quality Standards (NAAQS/FAAQS) were promulgated to protect the public health, and the secondary NAAQS/FAAQS were promulgated to protect the public health and welfare from any known or anticipated adverse effects associated with the presence of pollutants in the ambient air. Polk County is an attainment area for all criteria pollutants, meaning that existing ambient concentrations meet the allowable standards.

3.2 PSD REVIEW REQUIREMENTS

3.2.1 General Requirements

Under the federal and FDEP Prevention of Significant Deterioration (PSD) permit review requirements, all major new or modified existing sources of air pollutants located in attainment areas and regulated under the Clean Air Act (CAA) must be reviewed and approved. A "major stationary source" is defined as any one of 28 specified source categories which has the potential to emit 100 tons per year (TPY) or more, or any other stationary source which has the potential to emit 250 TPY or more of any air pollutant regulated under the CAA. Fossil fuel-fired steam electric plants of more than 250 MMBtu/hr of heat input comprise one of the 28 specified source categories. As Power Block 3 constitutes a modification to an existing major source, the proposed project "potential to emit" is compared to the PSD significant emission rates (TPY). The term "potential to emit" means the capability, at maximum design capacity, to emit a pollutant after the application of control equipment. As presented earlier in Table 2-3, the potential emissions from the proposed project will exceed the significance rates for all criteria pollutants; therefore, the project is considered a modification to an existing major stationary source and is subject to PSD review.

PSD review is used to ensure that significant air quality deterioration will not result from the new or modified source located in an attainment area. The PSD regulations are contained in rule 62-212.400 F.A.C. Major sources and modifications are required to undergo the following analyses under PSD for each air pollutant emitted where potential emissions exceed the significant emission rates:

- A control technology analysis;
- An air quality impacts analysis; and
- An additional impacts analysis.

In addition to these analyses, a new source must also be reviewed with respect to Good Engineering Practice (GEP) stack height regulations (EPA, 1985a), New Source Performance Standards (NSPS), and any applicable state emission standard as discussed in Section 3.3.

3.2.2 PSD Increments/Classifications

In promulgating the 1977 Clean Air Act (CAA) Amendments, Public Law 95-95, Congress specified that certain increases above an air quality "baseline concentration" level for SO_2 and TSP concentrations would constitute "significant deterioration." The magnitude of the allowable increment depends on the classification of the area in which a new source (or modification) will be located or have a significant impact. Three classifications were designated based on criteria established in the CAA Amendments.

Initially, Congress designated PSD areas as Class I (international parks, national wilderness areas, and memorial parks larger than 5,000 acres, and national parks larger than 6,000 acres) or as Class II (all areas not designated as Class I). No Class III areas, which would allow greater deterioration than Class II areas, were designated. EPA subsequently incorporated the requirements for classifications and area designation into the PSD regulations.

On October 17, 1988, the EPA promulgated regulations to prevent significant deterioration due to NO_X emissions and established PSD increments for NO_2 concentrations. The allowable PSD increments for SO_2, TSP, and NO_2 are presented in Table 3-1. The FDEP has adopted the EPA PSD classification scheme and the allowable PSD increments for SO_2, PM_{10}, and NO_2.

The term "baseline concentration" is derived from federal and state PSD regulations and denotes a concentration level corresponding to a specified baseline date and contributions from certain additional baseline sources. The PSD regulations (40 CFR 51.166) define baseline concentration as the ambient concentration level which exists in the baseline area at the time of the applicable baseline date. Emission increases after the baseline date consume PSD increments. A baseline concentration is determined for each pollutant for which PSD increments are promulgated and a baseline date is established. The baseline concentration includes:

The actual emissions representative of sources in existence on the applicable baseline date; and

The allowable emissions of major stationary sources which commenced construction before January 6, 1975, for SO_2 and PM_{10} concentrations, or before February 8, 1988, for NO_2 concentrations, but which were not in operation by the applicable baseline date.

The air quality analysis results, which demonstrate project compliance with these requirements, are presented in Section 7.0.

3.2.3 Control Technology

The control technology review requirements of the PSD regulations require that all applicable federal and state emission-limiting standards be met and that Best Available Control Technology (BACT) be applied to control emissions from the source. The BACT requirements apply to all applicable regulated and unregulated air pollutants for which the increase in emissions from the source or modification exceeds significant emission rate.

BACT is defined in rule 62-210.200 F.A.C. as:

> An emission limitation, including a visible emissions standard, based on the maximum degree of reduction of each pollutant emitted which the Department, on a case by case

basis, taking into account energy, environmental and economic impacts, and other costs, determines is achievable through application of production processes and available methods, systems and techniques (including fuel cleaning or treatment or innovative fuel combustion techniques) for control of each such pollutant.

(a) If the Department determines that technological or economic limitations on the application of measurement methodology to a particular part of an emission unit or facility would make the imposition of an emission standard infeasible, a design, equipment, work practice, operational standard or combination thereof, may be prescribed instead to satisfy the requirement for the application of BACT. Such standard shall, to the degree possible, set forth the emissions reductions achievable by implementation of such design, equipment, work practice or operation.

(b) Each BACT determination shall include applicable test methods or shall provide for determining compliance with the standard(s) by means which achieve equivalent results.

The requirements for BACT were incorporated within the PSD framework in the 1977 CAA Amendments. The primary purpose of BACT is to minimize consumption of PSD increments and thereby increase the potential for future economic growth without significantly degrading air quality. Guidelines for the evaluation of BACT can be found in the draft "New Source Review Workshop Manual" (EPA, 1990b) and the draft "Top-Down BACT Guidance Document" (EPA, 1990c). These guidelines were issued by EPA to provide a consistent approach to BACT and to ensure that the impacts of alternative emission control systems are measured by the same set of parameters. The "top-down" approach to BACT has been followed in this application. BACT is determined on a case-by-case basis, and BACT for a source in one area may not be the same for an identical source located in another area. BACT analyses for the same types of emissions units and the same pollutants in different locations or situations may determine that different control strategies should be applied to the different sites, depending on site-specific factors.

The BACT requirements are intended to ensure that the control systems incorporated in the design of a proposed facility reflect the latest in control technologies used in a particular industry and take into consideration existing and future air quality in the vicinity of the proposed facility. BACT must, at a minimum, demonstrate compliance with NSPS for a source (if applicable). An evaluation of the air pollution control techniques and systems, including a cost-benefit analysis of alternative control technologies capable of achieving a higher degree of emission reduction than the proposed control technology, is required. The cost-benefit analysis requires the documentation of the materials, energy, and economic penalties associated with the proposed and alternative control systems, as well as the environmental benefits derived from these systems. A determination of BACT is to be based on sound judgment, balancing environmental benefits with energy, economic, and other impacts. Section 4.0 presents the BACT discussion and recommendations for this project.

3.2.4 Ambient Air Quality Monitoring Requirements

In accordance with the requirements of Rule 62-212.400(5)(f) F.A.C., any application for a PSD permit must contain an analysis of ambient air quality monitoring data in the area affected by the proposed major stationary source or major modification.

In accordance with Rule 62-212.400(5)(f)(2), ambient air monitoring for a period of up to one year may be required to satisfy the PSD monitoring requirements. A minimum of four months of data would be required. Existing data from the vicinity of the proposed source may be utilized if the data meet certain quality assurance requirements; otherwise, additional data may need to be gathered.

However, the FDEP PSD regulations include an exemption, which excludes or limits the pollutants for which an ambient air quality analysis must be conducted (Rule 62-212.400(3)(e)). This exemption states that a proposed major stationary source or major modification is exempt from the monitoring requirements with respect to a particular pollutant if the emissions increase of the pollutant from the source or modification would cause, in any area, air quality impacts less than the *de minimis* air quality impact levels presented in Table 3-2.

Ambient air quality monitoring data is discussed in Section 5.0 of this application.

3.2.5 Source Impact Analysis

A source impact analysis of air quality must be performed for a proposed major source subject to PSD for each air pollutant for which the increase in emissions exceeds the significant emission rate. The PSD regulations specifically require the use of atmospheric dispersion models in performing air quality impact analysis, estimating baseline and future air quality levels, and determining compliance with NAAQS/FAAQS and allowable PSD increments. Reference EPA models must normally be used in performing the impact analysis. Use of non-reference EPA models requires EPA's consultation and prior approval. Guidance for the regulatory application of dispersion models is presented in the U.S. EPA "Guideline on Air Quality Models (Revised)" (EPA, 1997). The modeling methodology utilized for the source impact analysis is described in detail in Section 6.0 of this application.

3.2.6 Additional Impacts Analysis

In addition to air quality impact analyses, the PSD regulations require analyses of the impairment to visibility and the impacts on soils and vegetation that would occur as a result of the proposed source. These analyses are to be conducted primarily for PSD Class I areas. Impacts on air quality due to general commercial, residential, industrial, and other growth related activities associated with the source must

also be addressed. These analyses are required for each pollutant emitted in significant quantities. Section 8.0 of this application contains the additional impact analyses.

3.3 OTHER REQUIREMENTS

In addition to the requirements of the PSD program, any new or modified source of air pollution must be reviewed with respect to the GEP stack height regulations (EPA, 1985a), the federal NSPS requirements, and any state-specific emission standards.

3.3.1 Good Engineering Practice (GEP) Stack Height

The 1977 CAA Amendments require under Section 123 that the degree of emission limitation required for control of any air pollutant not be affected by a stack height that exceeds GEP, or any other dispersion technique. On July 8, 1985, EPA promulgated final stack height regulations (EPA, 1985a).

The EPA's final stack height regulations define GEP stack height in part as the greater of:

(1) 65 meters, measured from the ground-level elevation at the base of the stack; or

(2) $H_g = H + 1.5\ L$

where:

H_g = GEP stack height, measured from the ground-level elevation at the base of the stack;

H = Height of nearby structure(s) measured from the ground-level elevation at the base of the stack; and

L = Lesser dimension, height or projected width of nearby structure(s).

The term "nearby" is defined by the GEP stack height regulations as a distance up to five times the lesser of the height or width dimensions of a structure or terrain feature, but not greater than 0.8 km. Although GEP stack height regulations require that the stack height credit used in modeling for determining compliance with NAAQS/FAAQS and PSD increments not exceed the GEP stack height, the actual stack height may be greater. In this case, the proposed stacks for each unit are 125.0 feet (38.1 meters) above ground level. This height does not exceed the *de minimus* GEP stack height of 65m. See Section 6.7 of this application for a discussion of building downwash considerations for this project.

3.3.2 New Source Performance Standards (NSPS)

The CAA required the U.S. EPA to adopt standards of performance for new or modified stationary sources of air pollution. To date, the U.S. EPA has adopted regulations for approximately 80 stationary source categories. These regulations are contained in 40 CFR Part 60. A review of the regulations reveals

that the Power Block 3 CC units are subject to a specific NSPS. Any source subject to a specific NSPS is also subject to the general provisions of 40 CFR 60 Subpart A.

3.3.2.1 General Provisions

The general provisions of the NSPS regulations are found in 40 CFR 60, Subpart A. The general provisions specify the notification and record keeping requirements (40 CFR 60.7), compliance with standards and maintenance requirements (40 CFR 60.11), and the monitoring requirements (40 CFR 60.13) for each affected source.

3.3.2.2 Combined Cycle Units

NSPS for combined cycle units are covered in 40 CFR 60 and potentially include: Subpart Da-Standards of Performance for Electric Utility Steam Generating Units, for which construction is commenced after September 18, 1978; in 40 CFR 60, Subpart Db - Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units; and in 40 CFR 60, Subpart GG - Standards of Performance for Stationary Gas Turbines. Because the steam generators associated with Power Block 3 (i.e., HRSGs) will utilize only the waste heat from the combustion turbines, only the requirements of Subpart GG and Subpart A will apply.

Subpart GG regulates the CC units as electric utility stationary gas turbines and establishes emission limitations on both NO_x and SO_2. The NO_x emission limitation is set by the following equation:

$$STD = 0.0075 \frac{(14.4)}{Y} + F \qquad 1$$

where:

STD =allowable NO_X emissions (percent by volume at 15 percent oxygen and on a dry basis).

Y = manufacturer's rated heat rate at manufacturer's rated load (kilojoules per watt hour) or actual measured heat rate based on lower heating value of fuel as measured at actual peak load for the facility. The value of Y shall not exceed 14.4 kilojoules per watt-hour.

F = NO_X emission allowance for fuel-bound nitrogen as defined below:

Fuel-bound nitrogen (percent by weight)	F (NO_X percent by volume)
N<0.015	0
0.015<N<0.1	0.04(N)
0.1<N<0.25	0.004 + 0.0067(N-0.1)
N>0.25	0.005

where:

N = the nitrogen content of the fuel (percent by weight).

This results in an emission limitation of 113.5 parts per million on a dry volume basis (ppmvd) at 15 percent oxygen for the proposed units when fired on natural gas and 112.7 ppmvd at 15 percent oxygen when fired on fuel oil. (These values do not include the allowance for fuel-bound nitrogen). The SO_2 emission limitations are set at 150 ppmvd corrected to 15 percent oxygen in the exhaust stream or a fuel sulfur content less than or equal to 0.8 percent by weight.

40 CFR 60 Subparts Da, Db, and Dc are not applicable to the CC units since the HRSGs will not be fired with any type of auxiliary fuel.

3.3.2.3 Excess Emissions

The EPA has adopted general and specific recordkeeping and reporting requirements relating to excess emissions in 40 CFR 60.7(b) and 40 CFR 60.334(c). The EPA requirements specify maintaining records and submittal of a quarterly report (calendar year) on excess emissions associated with start-ups, shutdowns, malfunctions, inoperative continuous monitoring systems, low water-to-fuel ratio, and fuel sulfur content greater than 0.8% by weight. The reporting requirement includes submittal of the semi-annual report even when no excess emissions occur. EPA has not adopted any specific time limits related to excess emissions from a CC unit, or from combustion turbine units regulated under 40 CFR Part 60, Subpart GG.

3.3.3 State-Specific and General Emission Standards

In addition to federal requirements, FDEP has adopted specific and general emission limiting and performance standards. These standards may be found in rule 62-296, F.A.C. The requirements of these standards must be met along with any federal PSD or NSPS limitation or requirement.

3.3.3.1 General Emission Standards

The FDEP has adopted general particulate matter emission limits as well as general pollutant emission limits (rule 62-296.320, F.A.C.). These limits apply when no specific emission standard is applicable.

3.4 SOURCE APPLICABILITY

3.4.1 Pollutant Applicability

The PSD regulations apply to the proposed generation project due to the attainment status for the Polk County Site. Polk County and the surrounding counties are designated as PSD Class II areas for SO_2, PM_{10}, and NO_2. The Polk County Site is located approximately 118 km southeast of the Chassahowitzka National Wilderness Area (NWA), the nearest PSD Class I area. The Chassahowitzka NWA is that portion of the Chassahowitzka National Wildlife Refuge that has been officially designated as wilderness.

Pollutant applicability for the proposed facilities is addressed in Sections 2.0 and 4.0 and briefly summarized here. The proposed Power Block 3 project is considered to be a modification to an existing major source under the PSD regulations. PSD review is required for any regulated pollutant for which the net increase in emissions exceeds the PSD significant emission rates presented in Table 2-3. As shown, the potential emissions for the proposed facilities will exceed the PSD significant emission rates for the following regulated pollutants: CO, NO_X, SO_2, PM_{10}, VOC, and sulfuric acid mist. The proposed project is subject to PSD review for these pollutants.

3.4.2 Ambient Air Quality Monitoring

Based upon the net increase in emissions from the proposed facility presented in Table 2-3, a PSD preconstruction ambient air monitoring analysis is required, as part of the air quality impact analysis for CO, NO_2, SO_2, PM_{10}, O_3 (based on VOC emissions), and sulfuric acid mist. However, if the net increase in a source's impact of a pollutant is less than the *de minimis* air quality impact level, as shown in Table 3-2, then preconstruction ambient air quality monitoring is not required for that pollutant. In addition, if an acceptable ambient air monitoring method for the pollutant has not been established by EPA, monitoring is not required.

Dispersion modeling was performed to determine those pollutants that could be exempted from the monitoring requirement. As described in Sections 6.0 and 7.0, the increases in air quality impacts are predicted to fall below the *de minimis* impact levels presented in Table 3-2; therefore, pre-construction monitoring is not required. The results for these pollutants are presented in Section 5.0.

IMAGE QUALITY

AS YOU REVIEW THE NEXT GROUP OF IMAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENTS WERE OF POOR QUALITY.

Table 3-1. National and State AAQS, Allowable PSD Increments, and Significant Impact Levels

Pollutant	Averaging Time	AAQS ($\mu g/m^3$)			PSD Increments ($\mu g/m^3$)		Significant Impact Levels ($\mu g/m^3$)
		Primary Standard	Secondary Standard	Florida	Class I	Class II	
Particulate Matter (PM10)	Annual Arithmetic Mean	50	50	50	4	17	1
	24-Hour Maximum	150	150	150	8	30	5
Sulfur Dioxide	Annual Arithmetic Mean	80	NA	60	2	20	1
	24-Hour Maximum	365	NA	260	5	91	5
	3-Hour Maximum	NA	1,300	1,300	25	512	25
Carbon Monoxide	8-Hour Maximum	10,000	10,000	10,000	NA	NA	500
	1-Hour Maximum	40,000	40,000	40,000	NA	NA	2,000
Nitrogen Dioxide	Annual Arithmetic Mean	100	100	100	2.5	25	1
Ozone	1-Hour Maximum	235	235	235	NA	NA	NA
Lead	Calendar Quarter Arithmetic Mean	1.5	1.5	1.5	NA	NA	NA

Note: Particulate matter (PM10) = particulate matter with aerodynamic diameter less than or equal to 10 micrometers.
NA = Not applicable, i.e., no standard exists.

Sources: Federal Register, Vol. 43, No. 118, June 19, 1978.
40 CFR 50; 40 CFR 52.21.
Chapter 62-272, F.A.C.

Table 3-2. PSD Significant Emission Rates and *De Minimis* Monitoring Concentrations

Pollutant	Regulated Under	Significant Emission Rate (TPY)	*De Minimis* Monitoring Concentration[a] ($\mu g/m^3$)
Sulfur Dioxide	NAAQS, NSPS	40	13, 24-hour
Particulate Matter [PM(TSP)]	NSPS	25	10, 24-hour
Particulate Matter (PM10)	NAAQS	15	10, 24-hour
Nitrogen Dioxide	NAAQS, NSPS	40	14, annual
Carbon Monoxide	NAAQS, NSPS	100	575, 8-hour
Volatile Organic Compounds (Ozone)	NAAQS, NSPS	40	100 TPY[b]
Lead	NAAQS	0.6	0.1, 3-month
Sulfuric Acid Mist	NSPS	7	NM
Total Fluorides	NSPS	3	0.25, 24-hour
Total Reduced Sulfur	NSPS	10	10, 1-hour
Reduced Sulfur Compounds	NSPS	10	10, 1-hour
Hydrogen Sulfide	NSPS	10	0.2, 1-hour
Mercury	NESHAP	0.1	0.25, 24-hour

Note: Ambient monitoring requirements for any pollutant may be exempted if the impact of the increase in emissions is below *de minimis* monitoring concentrations.

NAAQS = National ambient air quality Standards.
NM = No ambient measurement method established; therefore, no *de minimis* concentration has been established.
NSPS = New Source Performance Standards.
NESHAP = National Emission Standards for Hazardous Air Pollutants.
g/m^3 = Micrograms per cubic meter.

[a] Short-term concentrations are not to be exceeded.

[b] No *de minimis* concentration; an increase in VOC emissions of 100 TPY or more will require monitoring analysis for ozone.

Sources: 40 CFR 52.21.
Rule 62-212.400

4.0 CONTROL TECHNOLOGY REVIEW

4.1 APPLICABILITY

The PSD regulations require new major stationary sources to undergo a control technology review for each pollutant that may potentially be emitted above significant amounts. The control technology review requirements of the PSD regulations are applicable to emissions of NO_x, SO_2, CO, PM/PM_{10}, VOC, and sulfuric acid mist (see Section 2.0). The maximum potential annual emissions of these pollutants from the proposed "F" Class CTs are summarized in Table 2-3.

This section presents the applicable NSPS and the proposed BACT for these pollutants. The approach to the BACT analysis is based on the regulatory definitions of BACT, as well as consideration of EPA's current policy guidelines requiring a top-down approach. A BACT determination requires an analysis of the economic, environmental, and energy impacts of the proposed and alternative control technologies [see 40 CFR 52.21(b)(12)]. The analysis must be, by definition, specific to the project (i.e., case by case).

4.2 NEW SOURCE PERFORMANC STANDARDS

The applicable NSPS for CTs are codified in 40 CFR 60, Subpart GG and summarized in Appendix B. The applicable NSPS emission limit for NO_x is 75 parts per million by volume dry (ppmvd) corrected for heat rate and 15-percent O_2. For the CTs being considered for the Project, the NSPS emission limit for NO_x, with the NSPS heat rate correction, is over 100 parts per million (ppm) firing natural gas and distillate oil (corrected to 15-percent O_2 at a fuel-bound nitrogen content of 0.015 percent). The proposed NO_x emission limits for the Project will be 29 times lower than the NSPS when firing natural gas and 8 times lower than the NSPS when firing distillate oil.

4.3 BEST AVAILABLE CONTROL TECHNOLOGY

4.3.1 Overview Of Proposed BACT

In recent permitting actions, BACT for heavy-duty industrial gas turbines has been determined. These decisions established emission rates that were achieved through the use of advanced DLN combustors and SCR for limiting emissions of NO_x, good combustion practices for minimizing CO and VOC emissions, and the use of clean fuels (natural gas) for control of other emissions, including PM_{10} and SO_2 and SAM. The BACT proposed for the Project is consistent with these permits. The results of the BACT analysis have concluded the following controls as BACT for the Project.

1. The Project will use state-of-the-art DLN combustion technology and SCR to achieve gas turbine exhaust NO_x levels of no greater than 3.5 ppmvd corrected to 15-percent O_2, 24-hour block average (midnight-to-midnight) when firing natural gas and 12 ppmvd corrected to 15-percent O_2, 24-hour block average (midnight-to-midnight) when firing oil.

2. CO emissions when firing natural gas will be limited to 16 ppmvd corrected to 15-percent O_2, and 30 ppmvd corrected to 15-percent O_2, when firing distillate oil.

3. VOC emissions when firing natural gas will be limited to 2.0 ppmvd corrected to 15-percent O_2 and when firing distillate oil VOC will be limited to 10 ppmvd corrected to 15-percent O_2.

4. Emission rates of PM_{10}, SO_2, and SAM will be limited using natural gas.

A summary of the emission rates proposed as BACT is presented in Table 4-1.

4.3.2 NITROGEN OXIDES

4.3.2.1 Introduction

The BACT analysis was performed based on those available and feasible control technologies that can provide the maximum degree of emission reduction for NO_x emissions. An evaluation of the available and feasible control technologies determined that combustion along with SCR could provide the maximum degree of emission reduction. $SCONO_x$™ is commercially available but has not been demonstrated on "F" Class combustion turbines. Other available technologies such as NO_xOut, Thermal DeNO_x, SNCR, and XONON™ Combustion System were evaluated and determined to be technically infeasible or not commercially demonstrated for the Project. Appendix B presents a discussion of these NO_x control technologies and their feasibility for the Project.

DLN combustor technology has been offered and installed by manufacturers to reduce NO_x emissions by inhibiting thermal NO_x formation through premixing fuel and air prior to combustion and providing staged combustion to reduce flame temperatures. NO_x emissions from 25 ppmvd (corrected to 15-percent O_2) and less has been offered by manufacturers for advanced CTs. This technology prevents pollution since NO_x emissions are inhibited from forming. When firing distillate oil, NO_x is limited using water injection to 42 ppmvd (corrected to 15-percent O_2).

SCR is a post-combustion process where NO_x in the gas stream is reacted with ammonia in the presence of a catalyst to form nitrogen and water. It is available from vendors for combined cycle applications. The reaction occurs typically between 600°F and 750°F, which occur in combined cycle units in the HRSG. SCR has been installed and operated on combined cycle facilities using catalysts with temperature ranges from 600 to 750°F and generally achieving 9 ppmvd (corrected to 15-percent O_2) or less while burning natural gas.

Ammonium salts (ammonium sulfate and ammonium bisulfate) are formed by the reaction of sulfur oxides in the gas stream and ammonia. These salts are highly acidic and special precautions in materials and ammonia injection rates must be implemented to minimize their formation.

Ammonia injected in the SCR system, which does not react with NO_x, is emitted directly and referred to as ammonia slip. In general, SCR manufacturers guarantee an ammonia slip to be no more than 9 ppmvd corrected to 15-percent O_2. SCR is technically feasible for the Project.

Although SCONO$_x$™ is technically feasible, it has not been demonstrated on a "F" Class combustion turbine. Performance data on future applications on "F" Class turbines considering SCONO$_x$™ will only likely be available after 2005, well after the facility is scheduled for construction. The SCONO$_x$™ system has only been operated on a 32-MW facility in California since 1996 and a 5 MW unit in Massachusetts since 1999. The scale up of this complicated technology should not be underestimated. The SCONO$_x$™ technology installed on an "F" Class turbine would involve about a dozen or more different chambers of catalyst for absorption and regeneration. Every 15 to 30 minutes, dampers would be operated to isolate a particular catalyst chamber for regeneration. Each regeneration cycle must isolate the chamber so that oxygen is not introduced and regeneration gas (hydrogen) is introduced. Seal leaks could be significant as applied to the large volume flows associated with a "F" Class turbine. Although the amount of sulfur in natural gas is very low, the SCONO$_x$™ catalyst is poisoned with sulfur compounds requiring the installation of the SCOSO$_x$™ to further remove sulfur compounds as part of the overall system. While the distillate oil proposed for the Project will contain 0.05-percent sulfur or less, the amount will be about 20 times higher than that normally contained in natural gas. The ability of SCOSO$_x$™ to further remove sulfur compounds as part of the overall SCONO$_x$™ system has not been demonstrated when firing distillate oil.

Over the last several years, the permitting trend for advanced CTs, even in combined cycle configuration, is the use of DLN combustors with SCR. In Region IV, the predominate emission rate

established as BACT has been 3.5 ppmvd corrected to 15-percent O_2 when firing natural gas. However, recent projects in EPA Region IV have established case-by-case BACT of 3.5 and 2.5 ppmvd corrected to 15-percent O_2 when firing natural gas using DLN and SCR.

The proposed CTs will be fired primarily with natural gas with distillate oil as a backup fuel. Table 4-2 presents a summary of emissions for the Project. The BACT evaluation was based on DLN combustors in combination with SCR and SCONO$_x$™.

The following sections present a summary of the economic, environmental, and energy impacts of the available, technically feasible and demonstrated control technology alternatives for the combined cycle units. Appendix B contains the detailed information on the costs, environmental, and energy impacts.

4.3.2.2 Impacts Analysis

Economic--The total estimated capital costs, annualized costs, and incremental cost effectiveness of adding SCR and SCONO$_x$™ to the DLN combustors on a CT/HRSG are as follows:

	SCR	SCONO$_x$™	% Difference
Capital Cost	$3,470,485.0	$26,572,482.0	765
Annualized Cost	$1,809,118.0	$5,673,648.0	314
Cost Effectiveness from DLN Combustors per ton NO_x removed. (25 ppmvd to 3.5 ppmvd)	$2,741.0	$8,597.0	314

Appendix B contains the detailed cost estimates for the capital and annualized costs. The capital and annualized costs for SCR and SCONO$_x$™ are based on a budgetary cost estimates provided by Englehard and ABB Alstom Environmental Systems, respectively. As shown above, the SCONO$_x$™ capital cost and cost effectiveness are 765% and 314% greater than that of SCR with uncertainty in its demonstrated feasibility. It should be noted that the annualized costs for SCONO$_x$™ did not include provisions for required mechanical maintenance activities. SCONO$_x$™ control technology clearly has an economic disadvantage compared to SCR, while achieving the same NO_x control.

Environmental--The maximum predicted annual average NO_x impact of the Project compared to the PSD Class II increment and AAQS is as follows:

Maximum Annual Project NO_x Impact	Annual NO_x PSD Class II Increment	Annual NO_x AAQS	Percent of the AAQS
(ug/m^3)	(ug/m^3)	(ug/m^3)	(%)
0.094	25	100	0.094

The addition of SCR will reduce NO_x emissions by about 660 TPY per CT/HRSG (about 82-percent reduction) beyond those achieved through the use of DLN combustors.

The use of DLN combustor technology is "pollution prevention". The use of SCR has associated primary and secondary environmental impacts. Emissions of ammonia and ammonium salts (such as ammonium sulfate and bisulfate) will occur. Ammonia emissions with the use of SCR are a result of unreacted ammonia that may be emitted. Vendors typically provide ammonia slip guarantees of 9 ppmvd corrected to 15-percent O_2. Maximum ammonia emissions are 113 TPY at the guarantee ammonia slip level. However, this level of ammonia slip occurs only as the catalyst ages. Initial ammonia slip levels are less than 5 ppmvd. Potential emissions of ammonium sulfate and bisulfate will increase emissions of PM_{10} and up to 9.9 TPY could be emitted.

The electrical energy required to run the SCR system and the backpressure on the turbine will reduce the available power from the Project. The backpressure is a result of the catalyst modules located in the exhaust gas stream in the HRSG. With use of DLN combustors at an emission level of 25 ppmvd (corrected to 15-percent O_2), the backpressure to reduce NO_x to 3.5 ppmvd (corrected to 15-percent O_2), based on vendor data, is about 2.7 inches of water gauge. This backpressure reduces the power generated by the combustion turbine. This lost power, which would otherwise be available to the electrical system, will have to be replaced by other less efficient units. The replacement power will cause secondary air pollutant emissions that would not have occurred without SCR. The net reduction in emissions with SCR (i.e., reduction in NO_x minus ammonia and secondary emissions), when all criteria pollutants are considered, will be about 520 TPY. In addition to criteria pollutants, additional secondary emissions of carbon dioxide would be emitted.

SCR will also require the construction and maintenance of storage vessels for aqueous ammonia for use in the reaction. Ammonia has potential health effects, and the construction of ammonia storage facilities triggers the application of at least three major standards: Clean Air Act (section 112), Occupational Safety and Health Administration (OSHA) 29 CFR 1910.1000, and OSHA 29 CFR 1910.119. The Project proposes using aqueous ammonia for the SCR system.

While ammonia is not used or emitted from a $SCONO_x$™ system, there are substantial natural gas, steam requirements, and increased turbine backpressure for the $SCONO_x$™ system that would directly

result in environmental impacts. SCONO$_x$™ requires about 18,000 lb/hr of steam and 80 lb/hr of natural gas for operation. In addition, the backpressure of the SCONO$_x$™ system is 200 percent over that of the SCR. This increased energy use would create additional criteria pollutants of about 41 tons per year per unit and about 23,000 tons per year per unit of additional carbon dioxide emissions compared to the Project using SCR (i.e., about 3,700 tons of carbon dioxide per year per unit).

Energy–Energy penalties occur with SCR and SCONO$_x$™ systems. The output of the CT will be reduced over that of advanced low-NO$_x$ combustors due to the backpressure on the CT. The energy penalties of SCR and SCONO$_x$™ with a low base emission level (i.e., 25 ppmvd corrected to 15-percent O_2) and 82 percent NO$_x$ reduction are as follows:

	Units	SCR	SCONO$_x$™	% Difference
Backpressure	inches of water	2.7	5.0	185
CT Output Reduction	%	0.32	0.6	188
Equivalent Lost Energy	kWh/yr	5,155,560	9,552,254	185
Energy Requirement	kWh/yr	700,800	26,045,082	3,716
Total Lost Energy	kWh/yr	5,856,360	35,597,336	608
Equivalent Residential Customers/year	Customers	488	2,966	608
Equivalent Heat Loss	MMBtu/yr	58,970	358,441	608
Equivalent Natural Gas	mmcf/yr	59	358	608

As shown above, SCONO$_x$™, in contrast to SCR, is very energy intensive. The SCONO$_x$™ system has about 2 times more backpressure on the turbine and requires steam and natural gas for the regeneration process. The natural gas needed to generate the steam for the SCONO$_x$™ system is equivalent to 26 MMBtu/hr/unit or 230,000 MMBtu per year per unit. When all the energy requirements for SCONO$_x$™ are considered, it is about 2.24 percent of the combustion turbine heat input. In contrast, SCR results in an additional 0.37 percent of the combustion turbine heat input.

Technology Comparison--The proposed Project will use an advanced heavy-duty industrial gas turbine with advanced DLN combustors. This type of machine advances the state-of-the-art for CTs by being more efficient and less polluting than previous CTs. Integral to the machine's design are DLN combustors that prevent the formation of air pollutants within the combustion process, thereby minimizing the amount of add-on controls that can have an impact on the environment. An analogy of this technology is a more efficient automotive engine that gives better mileage and reduces pollutant formation without the need for a catalytic converter.

An advanced gas turbine is unique from an engineering perspective in two ways. First, the advanced machine is larger and has higher initial firing (i.e., combustion) temperatures than conventional turbines. This results in a larger, more thermally efficient machine. For example, the electrical generating capability of the proposed "F" class advanced machine is about 170 MW compared to the 70 to 120 MW conventional machines. The higher initial firing temperature (i.e., 2,600°F) results in about 20 percent more electrical energy produced for the same amount of fossil fuel used in conventional machines. This has the added advantage of producing less air pollutant emissions (e.g., NO_x, PM, and CO) for each MW generated. While the increased firing temperature increases the thermal NO_x generated, this NO_x increase is controlled through combustor design.

The second unique attribute of the advanced machine is the use of DLN combustors that will reduce NO_x emissions to 25 ppmvd when firing natural gas. Thermal NO_x formation is inhibited by using staged combustion techniques where the natural gas and combustion air is premixed prior to ignition. This level of control will result in NO_x emissions of about 0.04 lb/10^6 Btu for gas firing, which are less than half of the emissions generated from conventional fossil fuel-fired steam generators.

The use of SCR on combined cycle projects has been a recent trend in Florida and Region IV. Its use can limit NO_x emissions, while retaining much of the benefits of the advanced CT technology in combined cycle configuration.

From a technology standpoint, SCR has been demonstrated as feasible on over 100 combined cycle projects. In contrast, SCONO$_x$™ has only been operating over a few years on small turbines that are over ten times smaller than the "F" Class turbine being proposed for the Project. As noted from the information in Appendix B, the SCONO$_x$™ system requires a considerable amount of mechanical equipment that must be operated in a high volume flow field. SCR has no moving parts to complicate operation. Over time, there is considerable uncertainty in the maintenance and replacement requirements of the mechanical components of the SCONO$_x$™ system on a large turbine.

NO_x Emission Rate of 2.5 ppmvd Corrected to 15-percent O_2-Appendix B contains cost evaluations for NO_x emission rates of 3.5 and 2.5 ppmvd corrected to 15-percent O_2 when firing natural gas. The NO_x emission rate when firing distillate oil was kept at 12 ppmvd corrected to 15-percent O_2. The costs for SCR were adjusted based on vendor estimates. For SCONO$_x$, the capital cost was kept the same and only the catalyst changeout costs were increased.

The results of the evaluation for total cost effectiveness are presented below:

	SCR @ 3.5 ppmvd	SCR @ 2.5 ppmvd
Total Annualized Costs	$1,809,118	$1,899,167
Cost Effectiveness	$2,741	$2,770
	$SCONO_X$ @ 3.5 ppmvd	$SCONO_X$ @ 2.5 ppmvd
Total Annualized Costs	$5,673,648	$5,751,900
Cost Effectiveness	$8,897	$8,390
Note: Total tons removed are 660 tons/year at 3.5 ppmvd and 686 tons/year at 2.5 ppmvd.		

It should be emphasized that $SCONO_X$ is not considered a demonstrated technology for "F" Class combustion turbines and has not been used or proposed when firing distillate oil. Moreover, the operational experience is non-existent on "F" Class turbines. Indeed, the cost effectiveness did not consider any additional operational cost of this technology as a result of the extensive mechanical equipment required. Moreover, $SCONO_X$ has considerable collateral environmental and energy impacts as noted in the application.

The incremental cost using SCR from an emissions rate of 3.5 ppmvd corrected to 15-percent O_2 to 2.5 ppmvd corrected to 15-percent O_2 is shown below:

Incremental Cost effectiveness (3.5 to 2.5 ppmvd)	
$1,899,167	Annualized cost for SCR at 2.5 ppmvd
$1,809,118	Annualized cost for SCR at 3.5 ppmvd
$90,049	Difference
107	tpy emissions at 2.5 ppmvd
133	tpy emissions at 3.5 ppmvd
26	tpy reduced
$3,463	Incremental Cost Effectiveness

As shown in the table, the incremental cost effectiveness for an SCR system from achieving 3.5 to 2.5 ppmvd corrected to 15-percent O_2 increases to over $3,000 per incremental ton of NO_x removed.

There are also significant issues in demonstrating compliance with an emission limit as low as 2.5 ppmvd corrected to 15-percent O_2. Such problems will occur with an emission rate of 3.5 ppmvd but are exacerbated with an even lower limit. The difficulties include the reliability of the continuous emission monitoring measurement, availability and stability of calibration gases, precision and accuracy of reference measurements (e.g., EPA Method 7E) and increased ammonia slip. Moreover, there is a general lack of experience in demonstrating compliance over the long term. These concerns are being evaluated by the Electric Power Research Institute (EPRI) Low Level NO_x Project and the

project has validated many of these concerns. While this project is still on going, the information to date suggests the potential trend of increasing ammonia injection rates to maintain low NO_X levels and difficulties in monitoring performance. The latter included increased span drift and bias test failures during RATA testing.

There would also be collateral environmental consequences to achieve a NO_X emission rate of 2.5 ppmvd corrected to 15-percent O_2 rather than 3.5 ppmvd corrected to 15-percent O_2. This will be a direct result of increased backpressure on the turbine resulting from more catalyst volume required. Backpressure will increase by 4 percent over the proposed BACT emission rate resulting in increased energy losses and greater secondary emissions. Indeed, the lost energy will increase by 206,222 kW-hours/year/turbine or enough additional electric power to support about 17 residential customers for a year. To supply this lost energy, at least 0.3 tons/year of additional criteria pollutants as well as 131 tons/year of additional carbon dioxide would be generated.

The Project also has a significant environmental benefit of displacing power produced by older less efficient electric generating units. As proposed, the Project would be the dispatched in favor of old less efficient units with much higher emission levels. Each turbine and HRSG associated with Project will have potential emissions of 133 tons/year of NO_x at 3.5 ppmvd corrected to 15-percent O_2. The reduction of NO_x emissions to 2.5 ppmvd corrected to 15-percent O_2 would produce an incremental reduction of only 26 tons/year/CT-HRSG.

In conclusion, an emission rate of 2.5 ppmvd corrected to 15-percent O_2 should be rejected as BACT for the following reasons:

- There would be increased difficulty in demonstrating compliance with a 2.5 ppmvd emission limit.

- There is no environmental benefit in the NO_X reduction and would cause an increase of other air emissions (ammonia and carbon dioxide).

4.3.2.3 Proposed BACT and Rationale for Combined Cycle Operation

The proposed BACT for combined cycle operation is advanced DLN combustion technology and SCR. The proposed NO_x emissions level using this technology is 3.5 ppmvd corrected to 15-percent O_2 when firing natural gas and 12 ppmvd corrected to 15-percent O_2 when firing distillate fuel oil. This combination of technology can achieve the maximum amount of emission reduction available that is technically feasible and demonstrated for the Project. SCR cannot be rejected based on the economic, environmental, and energy impacts given the recent BACT decisions on other similar projects.

SCONO$_x$™ is rejected as BACT based on significant energy, environmental and economic impacts. The costs are significantly different between SCR and SCONO$_x$™, yet both technologies can achieve the same level of NO_x reduction. From an environmental perspective, the only advantage of SCONO$_x$™ is the lack of ammonia slip. Ammonia is an unregulated air pollutant and ammonia slip can be minimized through design and operation of the SCR system. SCONO$_x$™ requires steam and natural gas that SCR does not require. These have direct environmental consequences in the form of additional air pollutant emissions including about 23,000 tons per year per unit of additional CO_2. Thus, the energy and other environmental disadvantages of SCONO$_x$™ outweigh any advantages in the reduction of these emissions. Taking together the energy, economic and environmental impacts and other costs, SCONO$_x$™ is rejected as BACT. In addition, the use of distillate fuel oil further limits the ability of SCONO$_x$™ to be used for the Project.

4.3.3 CARBON MONOXIDE

4.3.3.1 Introduction

Emissions of CO are dependent on the combustor design, which is a result of the manufacturer's operating specifications, including the air-to-fuel ratio, staging of combustion, and the amount of water injected. The CTs proposed for the Project have designs to optimize combustion efficiency and minimize NO_x emissions to the lowest achievable using DLN combustion technology while maintaining low CO emission levels.

For the Project, the following alternatives were evaluated as BACT:

1. Combustion controls, and
2. Oxidation catalyst at 2 ppmvd emission rate.

There are two alternatives for installing an oxidation catalyst. The first would be to install a catalyst prior to the HRSG to reduce CO emissions from the turbine. The second alternative is to install an oxidation catalyst or SCONO$_x$™ within the HRSG. Table 4-2 presents emission estimates for the two alternatives evaluated.

4.3.3.2 Impact Analysis

Economic--The estimated capital cost for an oxidation catalyst installed in the HRSG is $1.64 million. The annualized cost of a CO oxidation catalyst is $700,340. The resulting cost effectiveness is approximately $3,773 per ton of CO removed for gas and oil firing. No costs are associated with combustion techniques, since they are inherent in the design.
SCONO$_x$™ also reduces CO emissions. The incremental cost effectiveness for CO removal for this system is over $20,000 per ton. This is based on the differential between the annualized cost of

$SCONO_x$™ ($5.7 million) and SCR ($1.6 million) and the tons of CO potentially removed in the $SCONO_x$™ system.

Environmental--The air quality impacts of both oxidation catalyst control and combustion design control techniques are below the significant impact levels for CO. Therefore, no significant environmental benefit would be realized by the installation of a CO catalyst. Moreover, the air quality impacts, at the proposed CT emission rate, are predicted to be much less than the PSD significant impact levels. The maximum CO impacts are less than 0.1 percent of the applicable AAQS. There would also be no secondary benefits, such as reductions in O_3 precursors and acidic deposition, to reducing CO.

In contrast, the installation of an oxidation catalyst would create additional back pressure on the turbine that will result in lost electric generation that would otherwise be available and thus replaced by older, less efficient technology. The end result is an additional 2,030 tons/year of carbon dioxide (CO_2). The ultimate end product of CO is CO_2, regardless of whether the process results from an oxidation catalyst or in the atmosphere. The lost energy caused by the back pressure from the oxidation catalyst would result in the generation of 10 times more greenhouse gases than the amount of CO converted to CO_2 in the oxidation catalyst.

Energy--An energy penalty would result from the pressure drop across the catalyst bed. A pressure drop of about 1.5 to 2 inches of water gauge would be expected. A catalyst back pressure of 2 inches would result in an energy penalty of about three million kWh/yr. The energy penalties are sufficient to supply the electrical needs of about 265 residential customers for a year. To replace this lost energy, about 3.2×10^{10} Btu/yr or about 32 million ft^3/yr of natural gas would be required. In contrast, the total energy requirements of $SCONO_x$™ is 35.8×10^{10} Btu/yr or about 358 million ft^3/yr of natural gas.

4.3.3.3 Proposed BACT and Rationale

Combustion design is proposed as BACT, as there are adverse technical and economic consequences of using catalytic oxidation on CTs. The proposed BACT emission rates for CO will not exceed 16 ppmvd when firing natural gas and 30 ppmvd when firing distillate oil. Catalytic oxidation is considered unreasonable for the following reasons:

1. Catalytic oxidation will not produce measurable reduction in the air quality impacts,
2. The economic impacts are significant (i.e., the capital cost is $1.64 million, with an annualized cost of about $700,340 per year per unit), and
3. Recent projects in Florida and Region IV have been authorized with BACT emission limits of similar magnitude.

$SCONO_x$™ is rejected as BACT based on the high differential costs of the technology. Also, as described in the BACT evaluation for NO_x, the use of $SCONO_x$™ on a "F" Class turbine has associated technical uncertainty, as well as significant energy and environmental impacts.

Combustion design is proposed as BACT as a result of the technical and economic consequences of using catalytic oxidation on CTs. Catalytic oxidation is considered unreasonable, since it will not produce a measurable reduction in the air quality impacts. Indeed, recent BACT decisions for similar advanced CTs have set limits in the 9- to 25-ppmvd range when firing natural gas and distillate oil. The cost of an oxidation catalyst would be significant and not be cost effective given the maximum proposed emission limits.

The cost effectiveness calculations are significantly understated if the actual emission performance is considered. The actual CO emissions performance of the Siemens Westinghouse 501F turbines is expected to be much less than the guaranteed rates. This is a direct result of turbine manufacturers including significant margins on emissions of CO and VOCs to assure that NO_X emission guarantees can be achieved in the combustion systems.

4.3.4 PM/PM10, SO2, and Sulfuric Acid Mist

The PM/PM_{10} emissions from the CTs are a result of incomplete combustion and trace elements in the fuel. The design of the CT ensures that particulate emissions will be minimized by combustion controls and the use of clean fuels. A review of EPA's BACT/LAER Clearinghouse Documents did not reveal any post-combustion particulate control technologies being used on gas-fired or distillate oil-fired CTs.

The maximum particulate emissions from the CT will be lower in concentration than that normally specified for fabric filter designs. The grain loading associated with the maximum particulate emissions (less than 20 lb/hr when firing natural gas) is less than 0.01 grain per standard cubic foot (gr/scf), which is a typical design specification for a baghouse. This further demonstrates that no further particulate controls are necessary for the proposed Project.

There are no technically feasible methods for controlling the emissions of SO_2 and sulfuric acid mist from CTs, other than the inherent quality of the fuel. The use of flue gas desulfurization (FGD) systems are not available, technically feasible, demonstrated or cost effective on CTs using natural gas. The use of natural gas and low sulfur distillate fuel oil, clean fuels, represents BACT and will limit emissions of SO_2.

4.3.5 Volatile Organic Compounds

VOCs will be emitted by the CTs as a result of incomplete combustion. The proposed emission rates for VOC emissions will be the use of combustion technology and the use of clean fuels so that emissions when firing natural gas will not exceed 2.0 ppmvd and 10 ppmvd when firing distillate oil. This emission level is similar to the BACT emission levels established for other similar sources.

Combustion controls and the use of clean fuels have been overwhelmingly approved as BACT for CTs. The environmental effect of further reducing emissions would not be significant.

A review of the BACT/LAER Information System (BLIS) did not indicate any oxidation catalysts on natural gas fired combustion turbines to limit emissions of VOCs. A vendor of oxidation catalysts was contacted to determine the removal of VOCs in an oxidation catalyst typically used (i.e., primarily used for CO in nonattainment areas as LAER). The vendor stated that the typical VOC removal in a turbine application is from 30 to 40 percent.

The cost effectiveness calculation is presented below:

VOC Cost Effectiveness Calculations	
4.4	lb/hr gas firing at baseload
21	lb/hr oil firing
27.6	tpy
40.0%	removal
11	tpy removed
$63,501	per ton VOC removed
90.00%	removal
24.8	tpy removed
$28,223	per ton VOC removed

At 40-percent VOC removal the cost effectiveness of an oxidation catalyst is over $60,000 per ton of VOC removed. Assuming that 90 percent reductions were available at the same cost, the cost effectiveness is over $28,000 per ton of VOC removed.

Similar to the results for CO, the actual VOC emission rates have been extremely low when compared with the emission guarantees. The actual VOC emissions are expected to be in the order of 5 times lower than the guarantee emission level.

Table 4-1. Proposed BACT Emission Limitations and Compliance Methods For Each CT/HRSG Unit

Pollutant	Emission Rate (Basis[a])	Conditions[b]	Compliance Method Proposed
Particulate Matter	WP	Gas Firing;	Fuel Monitor, VE < 10%; Initial and Annual
	WP	Oil Firing	Fuel Monitor, VE < 20%; Initial and Annual> 400 hours
Sulfur Dioxide	WP	Gas Firing;	Pipeline Natural Gas
	WP	Oil Firing	Distillate Oil (0.05% maximum sulfur)
Nitrogen Oxides	3.5 ppmvd Corrected to 15% O_2	Gas Firing	EPA Method 7E Initial Test during CEM RATA; CEM 24-hour Block Average
	12.0 ppmvd Corrected to 15% O_2	Oil Firing	EPA Method 7E Initial Test during CEM RATA; CEM 24-hour Block Average
Carbon Monoxide	16 ppmvd	Gas Firing;	EPA Method 10; Initial only and Annual
	30 ppmvd	Oil Firing	EPA Method 10; Initial only and Annual
Volatile Organic Compounds	2.0 ppmvd	Gas Firing;	EPA Methods 18, 25, or 25a; Initial only
	10 ppmvd	Oil Firing	EPA Methods 18, 25, or 25a; Initial only

Note: ppmvd = parts per million, volume dry.
WP = Work practice – natural gas and ≤ 0.05%S distillate oil.

[a] Based on maximum emission rate over turbine inlet operating conditions.
[b] Operating loads from 70 to 100 percent under all turbine inlet temperatures.

Table 4-2. NO_x and CO Emission Estimates (TPY) of BACT Alternative Technologies (per Unit)

Alternative BACT Control Technologies	Pollutant Emissions (TPY)	
	NO_x	CO
Combined-Cycle Operation[a]		
DLN/Water Injection	793	216
DLN/Water Injection with SCR or OC/SCONO$_x$™ (3.5 ppmvd @15% O_2)	133	30
Reduction	(660)	(186)

[a] Emission rates are based on one CT firing natural gas at 100-percent load for 7,760 hours; firing distillate oil at 100-percent load for 1000 hours. Emission data are based on an ambient temperature of 59°F at baseload emission rate.

Note: DLN = Dry low-NO_x.
SCR = Selective catalytic reduction.
TPY = Tons per year.
OC = Oxidation Catalyst.

5.0 AMBIENT AIR QUALITY MONITORING DATA ANALYSIS

5.1 PSD PRECONSTRUCTION MONITORNING APPLICABILITY

The maximum concentrations predicted for Power Block 3 emissions are compared to the monitoring *de minimis* levels in Table 5-1. Based on the worst-case proposed source emissions data and air quality modelling results for the proposed Power Block 3, ambient air quality monitoring is not required for SO_2, PM_{10}, NO_2, or CO because the maximum predicted impacts are less than the PSD pre-construction monitoring *de minimis* values for those pollutants (FDEP Rule 62-212.400). For ozone (O_3), annual volatile organic compound (VOC) emissions from Power Block 3 are estimated to be less than 100 tons per year. As a result, preconstruction monitoring data are also not required to be submitted as part of this application. For sulfuric acid mist, which is a noncriteria pollutant, although the proposed source's emissions are greater than the significant emission rate, EPA has established no acceptable monitoring method for this pollutant.

Therefore, per FDEP Rule 62-212.400(3)(e), Power Block 3 is exempt from preconstruction monitoring for these pollutants.

TABLE 5-1
SUMMARY OF MAXIMUM MODELED POWER BLOCK 3 IMPACTS
COMPARED TO THE PSD MONITORING *DE MINIMIS* VALUES

Pollutant	Averaging Period	Highest Modeled Concentration ($\mu g/m^3$)	PSD *De Minimis* Level ($\mu g/m^3$)	Greater than the *De Minimis* Level?
Sulfur Dioxide (SO_2)	24-Hour	4.1	13	NO
Particulate Matter (PM_{10})	24-Hour	2.5	10	NO
Nitrogen Dioxide (NO_2)	Annual	0.09	14	NO
Carbon Monoxide (CO)	8-Hour	26	575	NO
Volatile Organic Compounds (VOC)	Annual	57	100 TPY	NO

Source: Golder, 2002.

6.0 AIR QUALITY MODELING APPROACH

This section summarizes the air quality modeling protocol and input parameters utilized in the air impact determinations presented in Section 7.0. Included are descriptions of the models, meteorology, options selected, listings of modeling parameters for the proposed facilities and existing sources, receptor locations, and step-by-step procedures that were used to develop the necessary projected impacts.

The scope of the required modeling analysis is limited to those pollutants that were determined to be subject to PSD review in Section 2.0, Table 2-3 for which significant impact levels and ambient air quality standards have been established (CO, NO_x, SO_2, and PM).

The proposed source emissions of sulfuric acid mist and VOC are shown in Table 2-3 to be above the PSD significant emission rates. However, for sulfuric acid mist, the PSD regulations do not define significant impact levels nor are ambient air quality standards established. In addition, VOC emissions are not modeled for single point sources, such as those for the Project, since O_3 is a pollutant formed by complex photochemical processes with regional VOC and NO_x emission sources.

6.1 GENERAL MODELING APPROACH

The PSD regulations require an air quality impact assessment consisting of a proposed source significant impact area analysis, a PSD increment consumption analysis, an ambient air quality standards impact analysis, and an additional impacts analysis. These analyses are discussed in greater detail in the following sections under specific modeling methodologies. The modeling approach followed EPA and FDEP guidelines for determining compliance with applicable PSD increments and ambient air quality standards.

These results from the modeling analyses were compared to the PSD Class II and I significance levels for each pollutant in order to determine whether additional modeling was necessary. All predicted maximum concentrations were less than the PSD Class II and I significance values and *de minimis* monitoring levels.

6.2 MODEL SELECTION AND OPTIONS

6.2.1 Dispersion Model Selection

The selection of an air quality model to calculate air quality impacts for the Hines Energy Complex was based on its applicability to simulate impacts in areas surrounding the Project as well as at the PSD Class I area of the Chassahowitzka NWA, located about 118 km from the proposed source. Two air quality dispersion models were selected and used in these analyses to address air quality impacts for the proposed source. These models were:

- The Industrial Source Complex Short Term (ISCST3) dispersion model, and
- The California Puff model (CALPUFF)

The Industrial Source Complex Short-term (ISCST3, Version 02035) dispersion model (EPA, 2002) was used to evaluate the pollutant impacts due to the proposed source in nearby areas surrounding the site. This model is maintained by the EPA on its Internet website, Support Center for Regulatory Air Models (SCRAM), within the Technical Transfer Network (TTN). The ISCST3 model is designed to calculate hourly concentrations based on hourly meteorological data (i.e., wind direction, wind speed, atmospheric stability, ambient temperature, and mixing heights).

The ISCST3 model was used to provide maximum concentrations for the annual and 24-, 8-, 3-, and 1-hour averaging times. To estimate impacts due to emissions from the proposed source, an emission rate of 79.365 pounds per hour (lb/hr) or 10 grams per second (g/s) was initially used to produce relative concentrations as a function of the modeled emission rate (i.e., $\mu g/m^3$ per 10 g/s). These impacts are referred to as generic pollutant impacts. Maximum air quality impacts for specific pollutants were then determined by multiplying the maximum pollutant-specific emission rate in lb/hr (g/s) to the maximum predicted generic impact divided by 79.365 lb/hr (10 g/s).

At distances beyond 50 km from a source, the CALPUFF model, Version 5.5 (EPA, 2002), is recommended for use by the EPA and FDEP. The CALPUFF model is a long-range transport model applicable for estimating the air quality impacts in areas that are more than 50 km from a source. The methods and assumptions used in the CALPUFF model were based on the latest recommendations for modeling analysis as presented in Section 8.0. This model is also maintained by the EPA on the SCRAM website.

As a result, the CALPUFF model was used to perform the significant impact analysis for Power Block 3 at the Class I area of the Chassahowitzka NWA. The CALPUFF model was also used to assess the proposed source's impact on regional haze and deposition at the Class I area (see Section 8.0). In this analysis, concentrations were predicted for the operating load and ambient temperature that had the

highest emissions. A more detailed description of the assumptions and methods used for the CALPUFF model is presented in Appendix C.

6.2.2 DISPERSION MODEL OPTIONS

The area surrounding the Hines Energy Complex has been determined by previous PSD permit applications to be a rural area based upon the technique for urban/rural determinations documented in the EPA "Guideline on Air Quality Models", which applies land use criteria. Based upon this determination, the rural dispersion option was used in ISCST3 model.

The Regulatory Default option was used in the ISCST3 model for this analysis. The ISCST3 model was applied without terrain adjustment data because the area in which the Polk County Site is located has very little relief (e.g., a net change in ground level elevation in the range of only 10 feet). The ISCST3 model's building downwash options were applied because the stacks for the proposed sources will be less than the stack height at which downwash effects may occur.

In the 1992 PSD application for the Hines Energy Complex, expected emissions from both Power Block 1 and Power Block 2 were included in the dispersion modeling analysis. The analysis evaluated the total impact of the two power blocks with respect to PSD increment consumption and ambient air quality impacts. The 2000 supplemental SCA application for Power Block 2 reassessed the Project impacts of Power 2 with more recent meteorological data and revised models.

Hines Power Block 3 represents a new project for the Hines Energy Complex, subject to PSD review. For this PSD application, Project impacts resulting from Power Block 3 are addressed only.

The air quality impact assessment for PM assumed that all PM emissions were PM_{10} emissions. This assumption simplified the PM modeling analysis and makes for a conservative approach to modeling PM impacts.

Descriptions of the dispersion options for the CALPUFF model are presented in Appendix C.

6.3 METEOROLOGICAL DATA

The air quality modeling analysis used hourly preprocessed National Weather Service (NWS) surface meteorological data from Tampa, Florida, and concurrent twice-daily upper air soundings from Ruskin, Florida, for the years 1991 to 1995. The meteorological data were supplied by FDEP in the preprocessed format required by the ISCST3 model. The preprocessed hourly meteorological data file for each year of record used in the analysis contains randomized wind direction, wind speed, ambient temperature, atmospheric stability using the Turner (1970) stability classification scheme, and mixing heights. The anemometer height of 6.7 meters, used in the modeling analysis, was obtained from NWS Local Climatological Data summaries for Tampa.

These meteorological data are the most complete and representative of the region around the Project Site because both the Hines Energy Complex and the weather stations are located in areas that experience similar weather conditions, such as frontal passages. In addition, these data have been approved for use by the FDEP in previous air permit applications to address air quality impacts for other proposed sources locating in Polk County and adjacent counties.

For the CALPUFF model, additional meteorological parameters are needed (e.g., precipitation, relative humidity) to predict air quality concentrations than that required for the ISCST3 model. More detailed descriptions of the assumptions and methods used for processing the meteorological data and establishing the model domain are presented in Appendix C.

6.4 EMISSIONS INVENTORY

6.4.1 Proposed Source

The proposed combined-cycle facility will have the capability of firing natural gas and low sulfur fuel oil. The fuel scenarios evaluated for the proposed source include natural gas firing at 100%, 80%, and 60% load at 20°F, 59°F, and 90°F compressor air inlets temperature; and fuel oil firing at 100%, 80%, and 65% load at 20°F, 59°F, and 105°F compressor air inlets temperatures.

The emissions inventories for the proposed source and fuel scenarios identified above are presented in Appendix A. The pollutant emission rates shown in those tables are representative of BACT as demonstrated in Section 4.0. The air quality modeling analysis for the proposed sources assumed that maximum design capacity emissions represent actual emissions for purposes of determining PSD increment consumption.

The proposed source worst-case fuel .scenario was determined by modeling each temperature and load scenario for each fuel using the ISCST3 model. The maximum impacts for the proposed source were predicted in the vicinity of the Hines Energy Complex when the source is firing fuel oil at full load at 105°F for all pollutants except CO. For CO, the maximum impacts were predicted when the source is firing natural gas at 60% load at 20°F. For PSD Class I impacts, the maximum impacts for the proposed source were predicted when the source is firing fuel oil at full load at 20°F.

6.4.2 Existing Sources

The results of the proposed source significant impact area analysis (which is described in Section 7.0) indicated that the proposed facility's air quality impacts are less than the PSD significant impact levels. Therefore, no additional impact modeling to determine compliance with PSD Class II increments or ambient air quality standards impact is necessary.

6.5 RECEPTOR LOCATIONS

A description of the receptor grids used in this modeling analysis is presented below.

6.5.1 Receptor Grid for Proposed Source Significant Impact Analysis

This modeling analysis used a polar receptor grid beginning at 500 meters (m) and extending out to cover a 50-kilometer (km) radius centered over the proposed source. The polar grid consisted of 36 radials, each separated by 10-degree increments and extending outward at ring distances of 500 m, 1 km, and 1.5, 2.0, 2.5, 5.0, 10.0, 15.0, 20.0, 25.0, 30.0, 35.0, 40.0, 45.0, and 50.0 km with reference to the proposed source location.

In addition, receptors were placed at 100-meter intervals along the plant property boundary to assess the potential impact at the FP property line. An additional Cartesian receptor grid with receptors placed at 100-meter intervals was input to assess concentrations near the property line closest to the source, which is to the southeast of the facility.

In total, the receptor grid, which consisted of more than 700 receptors, is shown in Figures 6-1 and 6-2.

The modeling results indicated no significant impacts for the PSD pollutants.

6.5.2 Receptor Grid for Class I PSD Analysis

A network of 13 discrete receptors was placed at the boundary of the Chassahowitzka NWA in order to assess the potential incremental impact of the proposed source on that Class I area. The NWA receptors were obtained from the FDEP and were also used in the modeling analysis for the 1992 and 2000 PSD permit applications. The coordinates of these receptor points are listed in Table 6-1.

6.6 BUILDING DOWNWASH EFFECTS

Based on the building dimensions associated with structures planned at the Hines Energy Complex, the 38.1-meter stacks for the proposed Power Block 3 will be less than the calculated value (61.0 meters) at which downwash effects would not be expected to occur. Therefore, the potential for building downwash was considered in the modeling analysis.

The procedures used for addressing the effects of building downwash are those recommended in the ISC Dispersion Model User's Guide. The building height, length, and width are input to the Building Parameter Input Program (BPIP) model, which uses these parameters to create the effective wind direction-specific building dimensions for input to the model. For short stacks (i.e., physical stack height is less than $H_b + 0.5\ L_b$, where H_b is the building height and L_b is the lesser of the building height or projected width), the Schulman and Scire (1980) method is used. If this method is used, then direction-specific building dimensions are input for H_b and L_b for 36 radial directions, with each direction representing a 10-degree sector.

For cases where the physical stack is greater than $H_b + 0.5\ L_b$, the Huber-Snyder (1976) method is used. In the case of the proposed CC units, the HRSG structures are the dominant buildings of influence. The dimensions of the HRSG structures are 24.4 meters high (H_b) and 8.0 meters wide (M_W). Since the proposed stack height of 38.1 meters is more than $H_b + 0.5\ L_b$, only the Huber-Snyder downwash algorithm is used by the ISCST3 model.

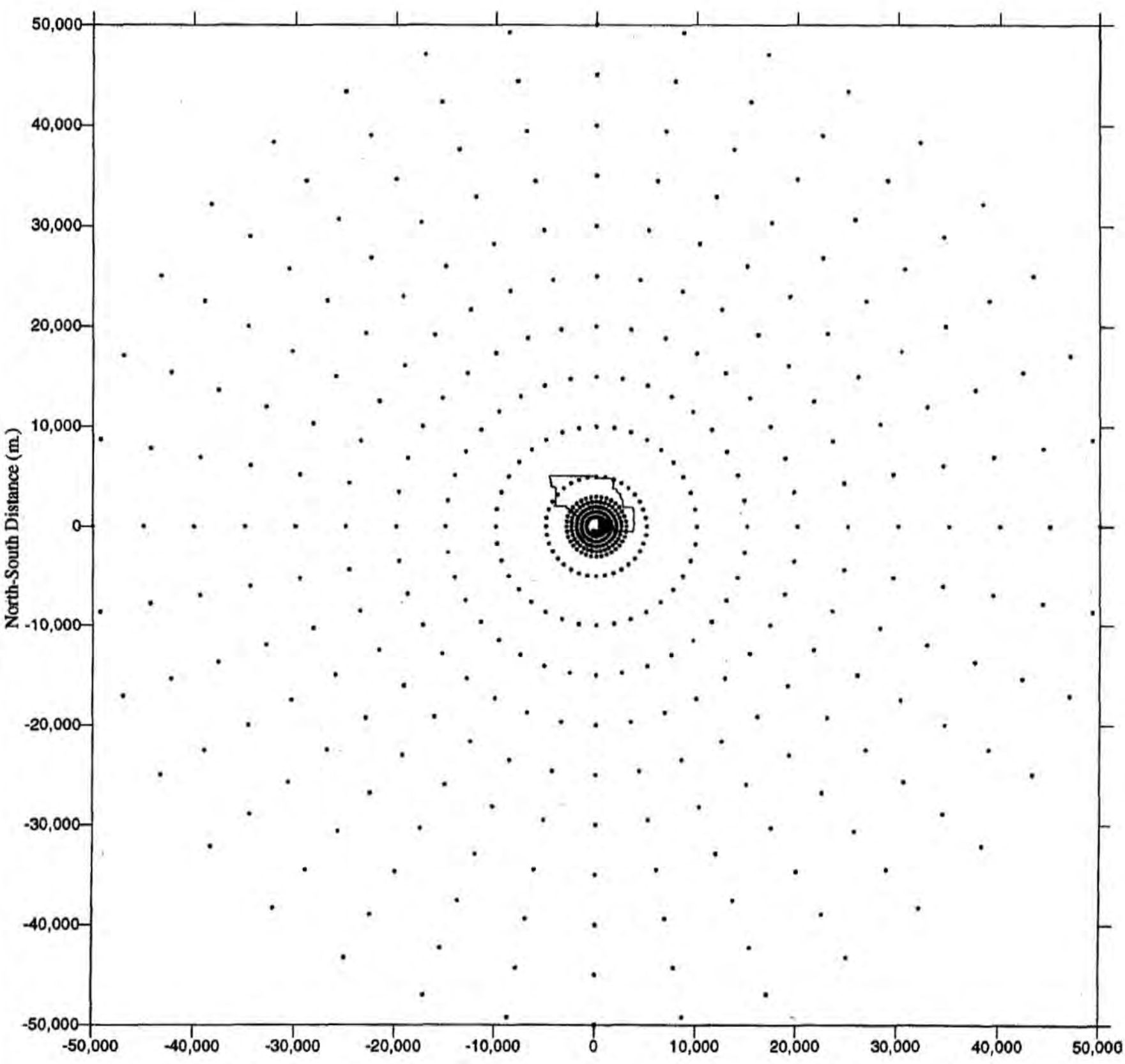
A summary of the BPIP model input and output files is provided in Appendix C.

TABLE 6-1
RECEPTOR GRID USED FOR PREDICTING CONCENTRATIONS AT THE PSD CLASS I AREA OF THE CHASSAHOWITZKA NWA

Point	UTM Coordinates		Distance from Polk County Site[(a)]		
	East (km)	North (km)	X (km)	Y (km)	Distance (km)
1	340.3	3,165.7	-74.0	91.82	117.9
2	340.3	3,167.7	-74.0	93.82	119.5
3	340.3	3,169.8	-74.0	95.92	121.1
4	340.7	3,171.9	-73.6	98.02	122.6
5	342.0	3,174.0	-72.3	100.12	123.5
6	343.0	3,176.2	-71.3	102.32	124.7
7	343.7	3,178.3	-70.6	104.42	126.0
8	342.4	3,180.6	-71.9	106.72	128.7
9	341.1	3,183.4	-73.2	109.52	131.7
10	339.0	3,183.4	-75.3	109.52	132.9
11	336.5	3,183.4	-77.8	109.52	134.3
12	334.0	3,183.4	-80.3	109.52	135.8
13	331.5	3,183.4	-82.8	109.52	137.3

[(a)] Location of "zero point" for Hines Energy Complex is 414.300 km East; 3,073.880 km North

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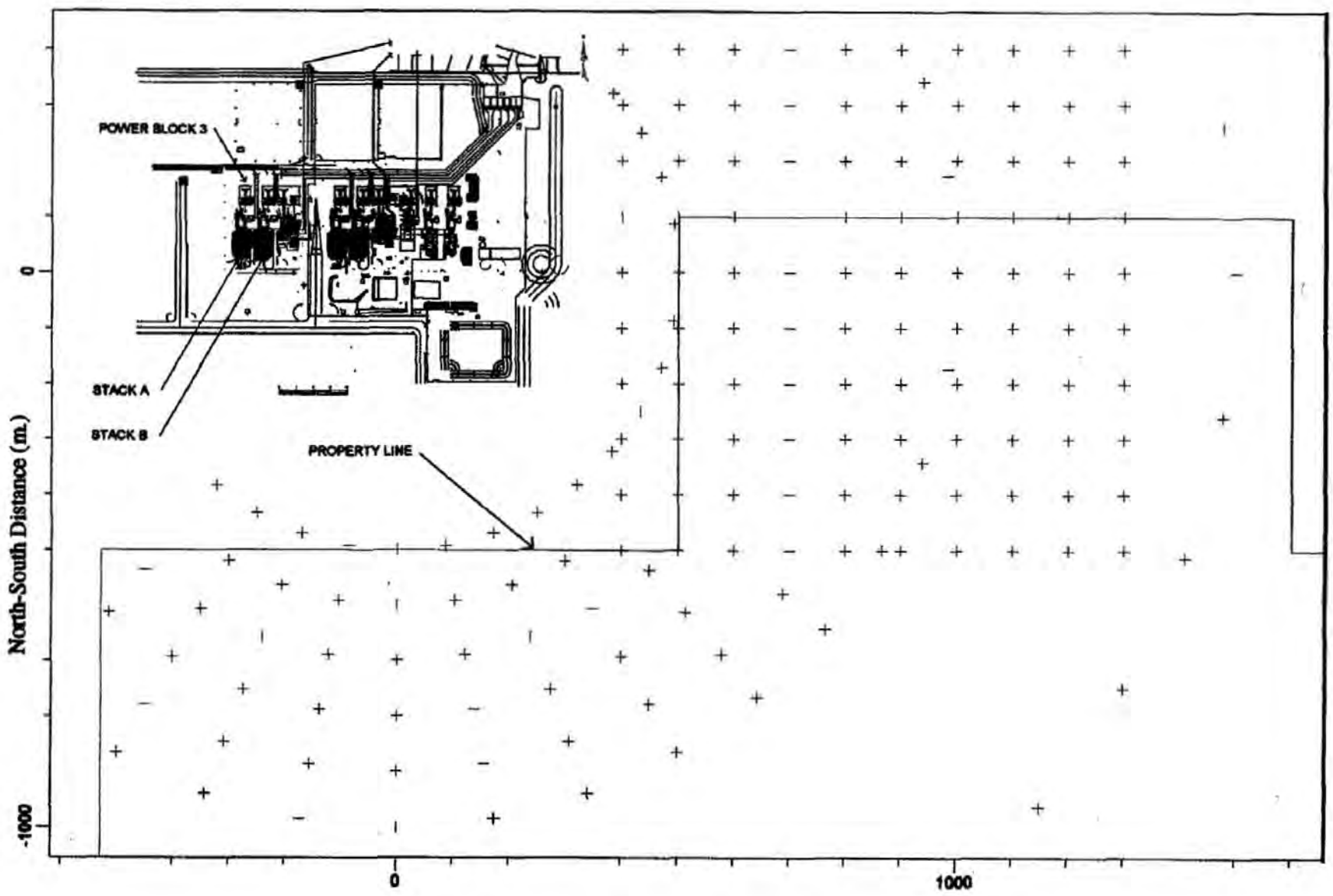


Florida Power
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Hines Energy Complex

FIGURE 6-1
RECEPTOR GRID FOR SINGIFICANT IMPACT ANALYSIS

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Florida Power
A Progress Energy Company

Hines Energy Complex

FIGURE 6-2
NEAR FIELD RECEPTOR GRID

7.0 AIR QUALITY IMPACT ANALYSIS RESULTS

This section summarizes the results of the modeling analyses conducted as described in Section 6.0.

7.1 POWER BLOCK 3

7.1.1 Worst-case Operation Analysis

As indicated in Section 6.4.1, the proposed Power Block 3 was evaluated for both the primary fuel, natural gas, and the back-up fuel, fuel oil, to determine the worst-case impacts. Based on the results of the ISCST3, the maximum ground-level impacts were produced for full load when firing fuel oil, except for CO emissions, which produced maximum impacts at 60% load when firing natural gas. A summary of the maximum concentrations predicted for the proposed source for the combinations of operating loads and ambient temperatures is provided in Appendix D.

Annual average concentrations were estimated by assuming that the proposed source would operate by firing fuel oil for a maximum of 1,000 hours per year and natural gas for 7,760 hours per year. The annual average concentrations were obtained by adding the maximum annual average impacts predicted for oil firing (multiplied by 1,000 hours divided by 8,760 hours) to the maximum impacts for natural gas firing (multiplied by 7,760 hours divided by 8,760 hours).

7.1.2 Significant Impact Analysis

Once the worst-case operating scenario was determined, the next step in the analysis was to determine whether the ambient air quality impact from the proposed Power Block 3 is considered significant under the PSD rules. The worst-case emissions scenario for each pollutant was modeled at the receptor locations described in Section 6.5.1.

The results of the significant impact analysis are presented in Table 7-1. As indicated in Table 7-1, there were no predicted impacts greater than the PSD significant impact levels. Thus, no further analysis is required to determine compliance with PSD increments and AAQS.

7.2 PSD INCREMENT ANALYSIS

7.2.1 Class II Area

Because the maximum predicted ambient air quality impacts for the Project are less than the PSD significance levels, no additional analysis is required to determine compliance with PSD Class II increments.

7.2.2 Class I Area

Because the proposed Project will be located approximately 118 km from the nearest boundary of the nearest Class I PSD area, the Chassahowitzka NWA, the impacts of the proposed Project were modeled at the Class I area. In its proposed New Source Review reform package, EPA has proposed PSD significance levels for Class I areas. FDEP has approved the use of these proposed values for purposes of assessing significant impacts at Class I areas in Florida (personal communication with Mr. Cleve Holladay, November 23, 1998). These values are listed in Table 7-2.

A summary of the Project's maximum predicted impact on the Class I area is presented in Table 7-2. As indicated, the maximum impacts are predicted to be below the EPA significance values for PM, PM_{10}, SO_2, and NO_2. These results are based on using the CALPUFF model. Because the maximum impact of Power Block 3 emissions are predicted to be below the EPA significance values, no further analysis is required to determine compliance with PSD Class I increments.

TABLE 7-1
SUMMARY OF MAXIMUM CONCENTRATIONS PREDICTED FOR POWER BLOCK 3 COMPARED TO THE PSD CLASS II SIGNIFICANT IMPACT LEVELS

Pollutant	Averaging Period	Maximum Predicted Concentration [a] ($\mu g/m^3$)	Polar Location [b] Dir. (deg.)	Polar Location [b] Dist. (m)	Year	Significant Impact Level ($\mu g/m^3$)	Distance to Significant Impact Level (km)	Predicted Impact Greater than the Significant Impact Level? (Yes/No)
Carbon Monoxide	1-Hour	80	76	412	1993	2,000	None	No
	8-Hour	25.6	117	447	1993	500	None	No
Nitrogen Dioxide	Annual	0.094	90	1500	1992	1	None	No
Sulfur Dioxide	3-Hour	17.1	130	500	1993	25	None	No
	24-Hour	4.1	117	447	1993	5	None	No
	Annual	0.037	90	1500	1992	1	None	No
Particulate Matter (PM_{10}) [c]	24-Hour	2.5	117	447	1993	5	None	No
	Annual	0.039	90	1500	1992	1	None	No

(a) Concentrations are highest values for this analysis; annual average concentrations based on firing natural gas and fuel oil for 7,760 and 1,000 hours, respectively.

(b) With respect to zero point of 414.30 km E; 3,073.88 km N.

(c) As a conservative approach, all project emissions of particulate matter were assumed to be in the form of PM_{10}.

N/A = Not applicable

Golder, 2002.

TABLE 7-2

SUMMARY OF MAXIMUM CONCENTRATIONS PREDICTED FOR POWER BLOCK 3 COMPARED TO THE PSD CLASS I SIGNIFICANT IMPACT LEVELS

Pollutant	Averaging Period	Maximum Concentration Predicted for Power Block 2 [(a)] ($\mu g/m^3$)	PSD Class I Significant Impact Level ($\mu g/m3$)	Predicted Impact Greater than the PSD Significant Impact Level? (Yes/No)
Sulfur Dioxide (SO_2)	3-Hour	0.39	1.0	NO
	24-Hour	0.15	0.2	NO
	Annual	0.0012	0.1	NO
Particulate Matter (PM_{10})	24-Hour	0.11	0.3	NO
	Annual	0.0014	0.2	NO
Nitrogen Dioxide (NO_2)	Annual	0.0014	0.1	NO

[(a] Concentrations are highest values for this analysis; annual average concentrations based on firing natural gas and fuel oil for 7,760 and 1,000 hours, respectively.

Source: Golder, 2002

8.0 ADDITIONAL IMPACTS ANALYSIS

8.1 INTRODUCTION

The PSD guidelines indicate that, in addition to demonstrating that the proposed source will neither cause nor contribute to violations of the applicable PSD increments and AAQS, an additional impacts analysis must be conducted for those pollutants subject to PSD review. As indicated in Table 2-3, those pollutants include CO, NO_X, SO_2, PM, VOC (O_3), and sulfuric acid mist. This additional impacts analysis includes an analysis of air quality impacts due to growth induced by the project, an analysis of air quality impacts on soils and vegetation, and an analysis of Project impacts on visibility.

As has been demonstrated in Section 7.0 of this application, the proposed Project will have an insignificant impact at the NWA, located from 118 to 135 km from the proposed source. In spite of this distance, FP is providing a general assessment of the impact of Power Block 3 on air quality-related values (AQRV) analysis as a part of this application.

8.2 IMPACTS DUE TO GROWTH

The growth analysis considers air quality impacts due to emissions resulting from the industrial, commercial, and residential growth associated with the Project. Only impacts related to permanent growth are considered; emissions from temporary sources and mobile sources are not addressed in the growth analysis. The analysis of socioeconomic effects presented in Chapter 7.0 of the Site Certification Application serves as the basis for this growth analysis.

Up to 500 people will be employed at the Hines Energy Complex site during any one year of the construction phase for Power Block 3, and approximately 4 new permanent jobs will be filled to operate the new facility. It is anticipated that the majority of the construction workers will commute from their current residences, whereas approximately 2 of the 4 new operational employees will migrate into the Polk County area. Based on the average household size of 2.53 persons, a total of 5 persons (workers and their families) are predicted to move into the area as a result of Power Block 3. This will have an insignificant impact on the population of Polk County.

Development of industries supporting the new CC facility are expected to be negligible. Raw materials consumed by the facility (fuels, supplies, etc.) will be delivered to the site in usable form from outside of the region. Further processing, such as water treatment, will be accomplished entirely onsite.

Electricity sales, on the other hand, will be spread out over a large region as part of FP's generating capacity that will serve to meet increasing residential, commercial, and industrial demand throughout its system, which covers a large portion of the state of Florida.

In summary, there will be little residential growth associated with the FP project, and there is little potential for new industrial development nearby as a result of the new facility. Impacts resulting from the new development are expected to be small and well distributed throughout the area.

8.3 VEGETATION, SOILS, AND WILDLIFE ANALYSES

As previously discussed, the predicted maximum impacts from Power Block 3 on the NWA are less than the PSD Class I and Class II significance levels. Therefore, the project will have a negligible impact on the soils, vegetation, wildlife, and visibility of the area surrounding the plant as well as the more distant Class I area. A general discussion of air quality-related values (AQRVs) of the NWA follows.

The U.S. Department of the Interior (National Park Service) in 1978 administratively defined AQRVs to be:

> All those values possessed by an area except those that are not affected by changes in air quality and include all those assets of an area whose vitality, significance, or integrity is dependent in some way upon the air environment. These values include visibility and those scenic, cultural, biological, and recreational resources of an area that are affected by air quality (Federal Register, 1978).
>
> Important attributes of an area are those values or assets that make an area significant as a national monument, preserve, or primitive area. They are assets that are to be preserved if the area is to achieve the purposes for which it was set aside.

In a November 1996 report entitled "Air Quality and Air Quality Related Values in Chassahowitzka National Wildlife Refuge and Wilderness Area," the US Fish and Wildlife Service discussed vegetation, soils, wildlife, visibility, and water quality as potential AQRVs in the NWA. Effects from air pollution on visibility have been evaluated in the NWA, but the other potential AQRVs have not been specifically evaluated by the Fish and Wildlife Service for Chassahowitzka. Since specific AQRVs have not been identified for the Chassahowitzka NWA, this AQRV analysis evaluates the effects of air quality on general vegetation types and wildlife found on the Chassahowitzka NWA.

Vegetation type AQRVs and their representative species types have been defined as:

- Marshlands - black needlerush, saw grass, salt grass, and salt marsh cordgrass
- Marsh Islands - cabbage palm and eastern red cedar
- Estuarine Habitat - black needlerush, salt marsh cordgrass, wax myrtle
- Hardwood Swamp - red maple, red bay, sweet bay and cabbage palm
- Upland Forests - live oak, scrub oak, longleaf pine, slash pine, wax myrtle and saw palmetto
- Mangrove Swamp - red, white and black mangrove

Wildlife AQRVs included: endangered species, waterfowl, marsh and waterbirds, shorebirds, reptiles and

mammals.

A screening approach was used which compared the maximum predicted ambient concentration of air pollutants of concern in the Chassahowitzka NWR with effect threshold limits for both vegetation and wildlife as reported in the scientific literature.

A literature search was conducted which specifically addressed the effects of air contaminants on plant species reported to occur in the NWR. While the literature search focused on such species as cabbage palm, eastern red cedar, lichens and species of the hardwood swamplands and mangrove forest, no specific citations that addressed these species were found. It was recognized that effect threshold information is not available for all species found in the Chassahowitzka NWR, although studies have been performed on a few of the common species and on other similar species which can be used as models. Maximum concentrations were predicted using the CALPUFF model as described in Sections 6.0 and 7.0.

8.3.1 Vegetation

The effects of air contaminants on vegetation occur primarily from sulfur dioxide, nitrogen dioxide, ozone, and particulates. Effects from minor air contaminants such as fluoride, chlorine, hydrogen chloride, ethylene, ammonia, hydrogen sulfide, carbon monoxide, and pesticides have been reported in the literature. However, most of these air contaminants have not resulted in major effects (i.e., crop damage). Some air contaminants, such as ethylene, are widely distributed but, due to low concentrations, do not result in injury to plants. Others such as CO do not cause damage at concentrations normally found under ambient concentrations. There are no predicted fluoride emissions from the proposed project.

Injury to vegetation from exposure to various levels of air contaminants can be termed acute, physiological or chronic. Acute injury occurs as a result of a short-term exposure to a high contaminant concentration and is typically manifested by visible injury symptoms ranging from chlorosis (discoloration) to necrosis (dead areas). Physiological or latent injury occurs as the result of a long-term exposure to contaminant concentrations below that which results in acute injury symptoms, while chronic injury results from repeated exposure to low concentrations over extended periods of time, often without any visible symptoms, but with some effect on the overall growth and productivity of the plant.

The concentrations of the pollutants, duration of exposure and frequency of exposures influence the response of vegetation to atmospheric pollutants. The pattern of pollutant exposure expected from the facility is that of a few episodes of relatively high ground-level concentration, which occur during certain meteorological conditions interspersed with long periods of extremely low ground-level concentrations. If there are any effects of stack emissions on plants, they will be from the short-term, higher doses. A dose is the product of the concentration of the pollutant and duration of the exposure.

Sulfur Dioxide

Sulfur is an essential plant nutrient usually taken up as sulfate ions by the roots from the soil solution. When sulfur dioxide in the atmosphere enters the foliage through pores in the leaves, it reacts with water in the leaf interior to form sulfite ions. Sulfite ions are highly toxic. They interact with enzymes, compete with normal metabolites, and interfere with a variety of cellular functions (Horsman and Wellburn, 1976). However, within the leaf, sulfite is oxidized to sulfate ions, which can then be used by the plant as a nutrient. Small amounts of sulfite may be oxidized before they prove harmful.

Observed SO_2 effect levels for several plant species and plant sensitivity groupings are presented in Tables 7-2 and 7-3, respectively. SO_2 gas at elevated levels has long been known to cause injury to plants. Acute SO_2 injury usually develops within a few hours or days of exposure, and symptoms include marginal, flecked, and/or intercostal necrotic areas that appear water-soaked and dullish green initially. This injury generally occurs to younger leaves. Chronic injury usually is evident by signs of chlorosis, bronzing, premature senescence, reduced growth, and possible tissue necrosis (EPA, 1982). Background levels of SO_2 range from 2.5 to 25 $\mu g/m^3$.

Many studies have been conducted to determine the effects of high-concentration, short-term SO_2 exposure on natural community vegetation. Sensitive plants include ragweed, legumes, blackberry, southern pine, and red and black oak. These species are injured by exposure to 3-hour SO_2 concentrations of 790 to 1,570 $\mu g/m^3$. Intermediate plants include locust and sweetgum. These species are injured by exposure to 3-hour SO_2 concentrations of 1,570 to 2,100 $\mu g/m^3$. Resistant species (injured at concentrations above 2,100 $\mu g/m^3$ for 3 hours) include white oak and dogwood (EPA, 1982).

A study of native Floridian species (Woltz and Howe, 1981) demonstrated that cypress, slash pine, live oak, and mangrove exposed to 1,300 $\mu g/m^3$ SO_2 for 8 hours were not visibly damaged. This finding support the levels cited by other researchers on the effects of SO_2 on vegetation. A corroborative study (McLaughlin and Lee, 1974) demonstrated that approximately 20 percent of a cross-section of plants ranging from sensitive to tolerant was visibly injured at 3-hour SO_2 concentrations of 920 $\mu g/m^3$.

Two lichen species indigenous to the park area exhibited signs of SO_2 damage in the form of decreased biomass gain and photosynthetic rate as well as membrane leakage when exposed to concentrations of 200 to 400 $\mu g/m^3$ for 6 hours/week for 10 weeks (Hart *et al.*, 1988).

Jack pine seedlings exposed to SO_2 concentrations of 470 to 520 $\mu g/m^3$ for 24 hours demonstrated inhibition of foliar lipid synthesis; however, this inhibition was reversible (Malhotra and Kahn, 1978). Black oak exposed to 1,310 $\mu g/m^3$ SO_2 for 24 hours a day for 1 week demonstrated a 48 percent reduction in photosynthesis (Carlson, 1979).

The maximum 3-, 8-, and 24-hour average SO_2 concentrations for the Project are predicted to be 0.389, 0.284, and 0.148 $\mu g/m^3$, respectively, at the Class I area. The maximum 3-hour average SO_2 concentrations predicted for the Project at the Class I areas are 0.19 percent or less of those that caused damage to the most sensitive lichens. The modeled annual incremental increase in SO_2 adds slightly to background levels of this gas and poses only a minimal threat to area vegetation.

Nitrogen Dioxide

Nitrogen dioxide (NO_2) is another emission of concern for the proposed plant expansion. This compound can injure plant tissue with symptoms usually appearing as irregular white to brown collapsed lesions between the leaf veins and near the margins. Conversely, non-injurious levels of NO_2 can be absorbed by plants, enzymatically transformed into ammonia, and incorporated into plant constituents such as amino acids (Matsumaru *et al.*, 1979).

Plant damage can occur through either acute (short-term, high concentration) or chronic (long-term, relatively low concentration) exposure. For plants that have been determined to be more sensitive to NO_2 exposure than others, acute (1, 4, 8 hours) exposure caused 5 percent predicted foliar injury at concentrations ranging from 3,800 to 15,000 $\mu g/m^3$ (Heck and Tingey, 1979). Chronic exposure of selected plants (some considered NO_2-sensitive) to NO_2 concentrations of 2,000 to 4,000 $\mu g/m^3$ for 213 to 1,900 hours caused reductions in yield of up to 37 percent and some chlorosis (Zahn, 1975).

The maximum 1-, 3-, and 8-hour average NO_2 concentrations due to the Project are predicted to be 0.44, 0.30, and 0.24 $\mu g/m^3$, respectively, at the Class I area. These concentrations are approximately 0.005 to 0.02 percent of the levels that could potentially injure 5 percent of the plant foliage. For a chronic exposure, the maximum annual NO_2 concentration due to the Project is predicted to be 0.004 $\mu g/m^3$ at the Class I area, which is 0.0001 to 0.0002 percent of the levels that caused minimal yield loss and chlorosis in plant tissue.

Although it has been shown that simultaneous exposure to SO_2 and NO_2 results in synergistic plant injury (Ashenden and Williams, 1980), the magnitude of this response is generally only 3 to 4 times greater than either gas alone and usually occurs at unnaturally high levels of each gas. Therefore, the concentrations within the park are still far below the levels that potentially cause plant injury for either acute or chronic exposure.

Particulate Matter

Although information pertaining to the effects of PM on plants is scarce, baseline concentrations are available (Mandoli and Dubey, 1988). Ten species of native Indian plants were exposed to levels of PM that ranged from 210 to 366 $\mu g/m^3$ for an 8-hour averaging period. Damage in the form of a higher leaf area/dry weight ratio was observed at varying degrees for most plants tested. Concentrations of PM

lower than 163 $\mu g/m^3$ did not appear to be injurious to the tested plants.

The maximum 8-hour PM concentration due to the Project is predicted to be 0.18 $\mu g/m^3$ at the Class I area. This concentration is approximately 0.04 to 0.08 percent of the values that affected plant foliage. As a result, no significant effects to vegetative AQRVs are expected from the Project's emissions.

Carbon Monoxide

As with PM, information pertaining to the effects of CO on plants is scarce. The main effect of high concentrations of CO is the inhibition of cytochrome *c* oxidase, the terminal oxidase in the mitochondrial electron transfer chain. Inhibition of cytochrome *c* oxidase depletes the supply of ATP, the principal donor of free energy required for cell functions. However, this inhibition only occurs at extremely high concentrations of CO. Pollok *et al.* (1989) reported that exposure to $CO:O_2$ ratio of 25 (equivalent to an ambient CO concentration of 6.85×10^6 $\mu g/m^3$) resulted in stomatal closure in the leaves of the sunflower (*Helianthus annuus*). Naik *et al.* (1992) reported cytochrome *c* oxidase inhibition in corn, sorghum, millet, and Guinea grass at $CO:O_2$ ratios of 2.5 (equivalent to an ambient CO concentration of 6.85×10^5 $\mu g/m^3$). These plants were considered the species most sensitive to CO-induced inhibition of cytochrome *c* oxidase.

The maximum 1-hour average concentration due to the Project is 0.660 $\mu g/m^3$ in the Class I area which is less than 0.001 percent of the minimum value that caused inhibition in laboratory studies. The amount of damage sustained at this level, if any, for 1 hour would have negligible effects over an entire growing season. The maximum predicted annual concentration of 0.012 $\mu g/m^3$ reflects a more realistic, yet conservative, CO level for the Class I areas. This maximum concentration is predicted to be less than 0.00001 percent of the value that caused cytochrome *c* oxidase inhibition.

Sulfuric Acid Mist

Acidic precipitation or acid rain is coupled to SO_2 emissions mainly formed during the burning of fossil fuels. This pollutant is oxidized in the atmosphere and dissolves in rain forming sulfuric acid mist which falls as acidic precipitation (Ravera, 1989). Although concentration data are not available, sulfuric acid mist has been reported to yield necrotic spotting on the upper surfaces of leaves (Middleton *et al.*, 1950).

No significant adverse effects on vegetation are expected from the project's emissions because SO_2 concentrations, which lead directly to the formation of sulfuric acid mist concentrations, are predicted to be well below levels, that have been documented as negatively affecting vegetation. During the last decade, much attention has been focused on acid rain. Acidic deposition is an ecosystem-level problem that affects vegetation because of some alterations of soil conditions such as increased leaching of essential base cations or elevated concentrations of aluminum in the soil water (Goldstein *et al.*, 1985). Although effects of acid rain in eastern North America have been well published and publicized,

detrimental effects of acid rain on Florida vegetation are lacking documentation.

Summary

In summary, the phytotoxic effects on the Chassahowitzka NWA from the proposed project's emissions are expected to be minimal. It is important to note that the substances were evaluated with the assumption that 100 percent was available for plant uptake. This is rarely the case in a natural ecosystem.

8.3.2 Soils

For soils, the potential and hypothesized effects of atmospheric deposition include:

- Increased soil acidification,
- Alteration in cation exchange,
- Loss of base cations, and
- Mobilization of trace metals.

The potential sensitivity of specific soils to atmospheric inputs is related to two factors. First, the physical ability of a soil to conduct water vertically through the soil profile is important in influencing the interaction with deposition. Second, the ability of the soil to resist chemical changes, as measured in terms of pH and soil cation exchange capacity (CEC), is important in determining how a soil responds to atmospheric inputs.

According to the USDA Soil Surveys of Citrus and Hernando Counties, nine soil complexes are found in the Chassahowitzka NWA. These include Aripeka fine sand, Aripeka-Okeelanta-Lauderhill, Hallendale-Rock outcrop, Homosassa mucky fine sandy loam, Lacooche, Okeelanta mucks, Okeelanta-Lauderdale-Terra Ceia mucks, Rock outcrop-Homosassa-Lacoochee, and Weekiwachee-Durbin mucks (Porter, 1996). The majority of the soil complexes found in the NWA are inundated by tidal waters, contain a relatively high organic matter content, and have high buffering capacities based on their CEC, base saturation, and bulk density. The regular flooding of these soils by the Gulf of Mexico regulates the pH and any change in acidity in the soil would be buffered by this activity. Therefore, they would be relatively insensitive to atmospheric inputs. However, Terra Ceia, Okeelanta, and Lauderdale freshwater mucks are present along the eastern border of the NWA, and may be more sensitive to atmospheric sulfur deposition (Porter, 1996). Although not tidally influenced, these freshwater mucks are highly organic and therefore have a relatively high intrinsic buffering capacity.

The relatively low sensitivity of the soils to acid inputs coupled with the extremely low ground-level concentrations of contaminants projected for the Chassahowitzka NWA from the Project emissions

precludes any significant impact on soils.

8.3.2.1 Lead

Lead (Pb) is found naturally occurring in all plants, although it is nonessential for growth (Chapman, 1966; Valkovic, 1975; Gough and Shacklette, 1976). Plants vary in their sensitivity to lead. Many plants tolerate high concentrations of lead, while others exhibit retarded growth at 10 ppm in solution culture (Valkovic, 1975). Orange seedlings grown on soils with lead concentrations ranging from 150-200 ppm did not exhibit adverse effects (Chapman, 1966). Gough et al. (1979) reported that a lead soil concentration of 30 to 100 g/g generally retarded the growth of plants. The negligible amount of lead emissions from Power Block 3 will not contribute to a soil concentration toxic to plants.

8.3.2.2 Mercury

Mercury (Hg) is not an essential element for plant growth. It is typically used as a seed fungicide. In general, Hg is not concentrated in plants grown on soils containing normal levels of Hg. Soil bound Hg is typically not available for plant uptake, although many plants cannot prevent the uptake of gaseous Hg through the roots (Huckabee and Jansen, 1975). Most higher vascular plants are resistant to toxicity from high Hg concentrations even though high concentrations are present in plant tissue. Concentrations of 0.5-50 ppm ($HgCl_2$) were found to inhibit the growth of cauliflower, lettuce, potato, and carrots (Bell and Rickard, 1974). Gough et al. (1979) noted apparently healthy Spanish moss plants with a mercury content of 0.5 mg/kg. The extremely small amount of mercury emissions from the proposed power block will not contribute to concentrations toxic to plants.

8.3.3 Wildlife

Compared with other threats to wildlife, such as pesticides, the toxicological relationships between air pollution and effects on wildlife are not well understood (Newman and Schreiber, 1988). The limited understanding is based primarily on reports of symptoms observed in the field and on information extrapolated from laboratory studies. Information on controlled wildlife studies is limited in the scientific literature. Most studies report symptoms of various air pollutants but do not provide toxicity levels. Those studies that do provide toxicity levels are limited to four air contaminants, SO_2, NO_2, O_3, and particulates.

Since the predicted maximum pollutant impacts are less than Class I significance levels, no adverse impacts to wildlife will occur from the proposed Power Block 3 emissions.

In addition to the impacts on wildlife from the primary pollutants, the Fish and Wildlife Service is

concerned about the effects on wildlife resulting from acid deposition (FWS, 1992). Existing acid deposition conditions in Florida were investigated during the five year Florida Acid Deposition Study (ESE, 1986 and 1987) and the two year follow-up program called the Florida Acid Deposition Monitoring Program (ESE, 1988 and 1989). The data collected in these programs indicate that Florida precipitation is only about two-thirds as acidic as precipitation across the southeastern United States and less than half as acidic as precipitation in the midwestern and northeastern United States (ESE, 1988). There is no evidence of a temporal trend in precipitation acidity since the late 1970s (ESE, 1989). The Clean Air Act Amendments of 1990 require significant reductions in SO_2 and NO_2 emissions from existing uncontrolled utility plants nationwide and some of these reductions will occur at plants in the general vicinity of the NWA. These emission reductions will undoubtedly improve on the already good estimated acid deposition conditions in the NWA.

Due to the small emission increases that will be caused by the proposed project and the resulting insignificant concentrations, increase, if any in acid deposition will be negligible.

8.4 IMPACTS UPON VISIBILITY

8.4.1 Introduction

The CAA Amendments of 1977 provide for implementation of guidelines to prevent visibility impairment in mandatory Class I areas. The guidelines are intended to protect the aesthetic quality of these pristine areas from reduction in visual range and atmospheric discoloration due to various pollutants. Sources of air pollution can cause visible plumes if emissions of PM_{10} and NO_x are sufficiently large. A plume will be visible if its constituents scatter or absorb sufficient light so that the plume is brighter or darker than its viewing background (e.g., the sky or a terrain feature, such as a mountain). PSD Class I areas, such as national parks and wilderness areas, are afforded special visibility protection designed to prevent plume visual impacts to observers within a Class I area.

Visibility is an AQRV for the Chassahowitzka NWA. Visibility can take the form of plume blight for nearby areas or regional haze for long distances (e.g., distances beyond 50 km). Because the Chassahowitzka NWA is more than 50 km from the Project, the change in visibility is analyzed as regional haze.

Currently, there are several air quality modeling approaches recommended by the Interagency Workgroup on Air Quality Models (IWAQM) to perform these analyses. The IWAQM consists of EPA and FLM of Class I areas who are responsible for ensuring that AQRVs are not adversely impacted by new and existing sources. These recommendations have been summarized in two documents:

- *Interagency Workgroup on Air Quality Models (IWAQM), Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts* (EPA, 1998), referred to as the IWAQM Phase 2 report; and

- *Federal Land Managers' Air Quality Related Values Workgroup (FLAG), Phase I Report,* USFS, NPS, USFWS (December, 2000), referred to as the FLAG document.

The methods and assumptions recommended in these documents were used to assess visibility impairment due to the project.

8.4.2 Analysis Methodology

8.4.3 Methodology

Based on the FLAG document, current regional haze guidelines characterize a change in visibility by the change in the light-extinction coefficient (b_{ext}). The b_{ext} is the attenuation of light per unit distance due to the scattering and absorption by gases and particles in the atmosphere. A change in the extinction coefficient produces a perceived visual change. An index that simply quantifies the percent change in visibility due to the operation of a source is calculated as:

$$\Delta\% = (b_{exts} / b_{extb}) \times 100$$

where: b_{exts} is the extinction coefficient calculated for the source, and
b_{extb} is the background extinction coefficient.

The purpose of the visibility analysis is to calculate the extinction at each receptor for each day (24-hour period) of the year due to the proposed Project. The criteria to determine if the Project's impacts are potentially significant are based on a change in extinction of 5 percent or greater for any day of the year.

Processing of visibility impairment for this study was performed with the CALPUFF model (see Appendix C) and the CALPUFF post-processing program CALPOST. The analysis was conducted in accordance with the most recent guidance from the FLAG report (December 2000). The CALPUFF postprocessor model CALPOST is used to calculate the combined visibility effects from the different pollutants that are emitted from the Project. Daily background extinction coefficients are calculated on an hour-by-hour basis using hourly relative humidity data from CALMET and hygroscopic and non-hygroscopic extinction components specified in the FLAG document. For the Class I area evaluated, the hygroscopic and non-hygroscopic components are 0.9 and 8.5 inverse mega meter (Mm^{-1}). CALPOST then predicts the percent extinction change for each day of the year.

8.4.4 Results

The results of the regional haze analysis are presented in Table 8-5. The results indicate that the proposed Project's maximum predicted impact on visibility at the Chassahowitzka NWA is 0.63 percent for the natural gas operation and 6.2 percent for fuel oil operation. The values are below the FLM's screening criteria of 5 percent for natural gas operation and predicted to be greater than the screening level for fuel oil operation for only one day. The change in visibility due to the Project's emissions is not

expected to be greater than the 5-percent criteria for several reasons. First, as discussed in Section 2.0, the Project will be limited to 1,000 hours when firing fuel oil. Since the Project will be firing oil as a backup fuel for a limited number of hours and the analysis is based on the maximum hourly emissions occurring with worst-case meteorology, the probability is low that all these conditions would occur at the same time.

Second, visibility was already impaired during the day (November 29, 1990) that the Project was predicted to be greater than the 5-percent criteria. Based on surface observations recorded for that day at Tampa International Airport, fog was reported in the area for 7 hours.

For fog to occur, the air must be saturated with moisture, resulting in high humidity. Based on the procedures in the CALPUFF model, visibility impairment for a project will be greatest when the humidity is high, such as for those hours when fog occurs. Since visibility was already impaired due to fog when the Project's emissions were predicted to produce its greatest change to visibility, it is unrealistic to expect that the Project's impacts would be noticeable during that day. The change in visibility due to the Project's emissions was predicted to be less than the 5-percent criteria.

Since the next highest visibility change due to the Project is 3.6 percent when firing oil and the Project will be firing primarily natural gas, the Project is not expected to have an adverse impact on the existing regional haze in the Chassahowitzka NWA.

8.5 SULFUR AND NITROGEN DEPOSITION

8.5.1 General Methods

As part of the AQRV analyses, total nitrogen (N) and sulfur (S) deposition rates were predicted at the Chassahowitzka NWA Class I area. The deposition analysis thresholds (DAT) are based on the annual averaging period. The total deposition is estimated in units of kilogram per hectare per year (kg/ha/yr) of nitrogen or sulfur. The CALPUFF model is used to predict wet and dry deposition fluxes of various oxides of these elements.

For N deposition, the species include:

- Particulate ammonium nitrate (from species NO_3), wet and dry deposition;
- Nitric acid (species HNO_3), wet and dry deposition;
- NO_x, dry deposition; and
- Ammonium sulfate (species SO_4), wet and dry deposition.

For S deposition, the species include:

- SO_2, wet and dry deposition; and
- SO_4, wet and dry deposition.

The CALPUFF model produces results in units of $\mu g/m^2/s$. The modeled deposition rates are then converted to N or S deposition in kg/ha respectively, by using a multiplier equal to the ratio of the molecular weights of the substances (IWAQM Phase II report Section 3.3).

Deposition analysis thresholds (DAT) for nitrogen and sulfur deposition of 0.01 kg/ha/yr were provided by the U.S. Fish and Wildlife Service (January 2002). A DAT is the additional amount of N or S deposition within a Class I area, below which estimated impacts from a proposed new or modified source are considered insignificant. The maximum N and S depositions predicted for the Project are, therefore, compared to these DAT or significant impact levels.

8.5.2 Results

The maximum predicted N and S depositions predicted for the Project in the PSD Class I area of the Chassahowitzka NWA are summarized in Table 8-6. The maximum N and S deposition rates for the Project are predicted to be 5.18E-4 and 9.62E-4 kg/ha/yr, respectively. These maximum deposition rates are below the significant impact levels for N and S of 0.01 kg/ha/yr. As a result, the Project's emissions are not expected to have a significant adverse effect on N and S deposition at the Class I area.

Table 8-1. Maximum Pollutant Concentrations Predicted for the Project at the PSD Class I Area of the Chassahowitzka NWA

Pollutant	Averaging Time	Maximum Concentrations ($\mu g/m^3$) [a]
Natural Gas		
SO_2	Annual [c]	0.0004
	24-Hour	0.008
	8-Hour	0.016
	3-Hour	0.022
	1-Hour	0.026
PM_{10}	Annual [c]	0.0008
	24-Hour	0.014
	8-Hour	0.029
	3-Hour	0.042
	1-Hour	0.046
NO_2	Annual [c]	0.001
	24-Hour	0.031
	8-Hour	0.068
	3-Hour	0.088
	1-Hour	0.106
CO	Annual [c]	0.005
	24-Hour	0.084
	8-Hour	0.170
	3-Hour	0.231
	1-Hour	0.251
Backup Fuel Oil		
SO_2	Annual [c]	0.007
	24-Hour	0.148
	8-Hour	0.284
	3-Hour	0.389
	1-Hour	0.573
PM_{10}	Annual [c]	0.006
	24-Hour	0.106
	8-Hour	0.180
	3-Hour	0.285
	1-Hour	0.381
NO_2	Annual [c]	0.004
	24-Hour	0.109
	8-Hour	0.237
	3-Hour	0.304
	1-Hour	0.438
CO	Annual [c]	0.012
	24-Hour	0.195
	8-Hour	0.338
	3-Hour	0.495
	1-Hour	0.660

[a] Concentrations are highest predicted using CALPUFF model and 1990 CALMET wind field for central Florida.

[b] Concentrations predicted are based the combustion turbines operating or baseload conditions at an ambient temperature of 20oF.

[c] Annual average concentrations are based on full year operation of each operating mode.

Table 8-2. SO_2 Effects Levels for Various Plant Species

Plant Species	Observed Effect Level ($\mu g/m^3$)	Exposure (Time)	Reference
Sensitive to tolerant	920 (20 percent displayed visible injury)	3 hours	McLaughlin and Lee, 1974
Lichens	200-400	6 hr/wk for 10 weeks	Hart *et al.*, 1988
Cypress, slash pine, live oak, mangrove	1,300	8 hours	Woltz and Howe, 1981
Jack pine seedlings	470-520	24 hours	Malhotra and Kahn, 1978
Black oak	1,310	Continuously for 1 week	Carlson, 1979

Table 8-3. Sensitivity Groupings of Vegetation Based on Visible Injury at Different SO_2 Exposures[a]

Sensitivity Grouping	SO_2 Concentration		Plants
	1-Hour	3-Hour	
Sensitive	1,310 - 2,620 $\mu G/m^3$ (0.5 - 1.0 ppm)	790 - 1,570 $\mu G/m^3$ (0.3 - 0.6 ppm)	Ragweeds Legumes Blackberry Southern pines Red and black oaks White ash Sumacs
Intermediate	2,620 - 5,240 $\mu G/m^3$ (1.0 - 2.0 ppm)	1,570 - 2,100 $\mu G/m^3$ (0.6 - 0.8 ppm)	Maples Locust Sweetgum Cherry Elms Tuliptree Many crop and garden species
Resistant	>5,240 $\mu G/m^3$ (>2.0 ppm)	>2,100 $\mu G/m^3$ (>0.8 ppm)	White oaks Potato Upland cotton Corn Dogwood Peach

[a] Based on observations over a 20-year period of visible injury occurring on over 120 species growing in the vicinities of coal-fired power plants in the southeastern United States.

Source: EPA, 1982a.

Table 8-4. Examples of Reported Effects of Air Pollutants at Concentrations Below National Secondary Ambient Air Quality Standards

Pollutant	Reported Effect	Concentration ($\mu g/m^3$)	Exposure
Sulfur Dioxide[a]	Respiratory stress in guinea pigs	427 to 854	1 hour
	Respiratory stress in rats	267	7 hours/day; 5 day/week for 10 weeks
	Decreased abundance in deer mice	13 to 157	continually for 5 months
Nitrogen Dioxide[b,c]	Respiratory stress in mice	1,917	3 hours
	Respiratory stress in guinea pigs	96 to 958	8 hours/day for 122 days
Particulates[a]	Respiratory stress, reduced respiratory disease defenses	120 PbO_3	continually for 2 months
	Decreased respiratory disease defenses in rats, same with hamsters	100 $NiCl_2$	2 hours

Source: [a] Newman and Schreiber, 1988.
[b] Gardner and Graham, 1976.
[c] Trzeciak et al., 1977.

Table 8-5. Maximum 24-hour Average Visibility Impairment Predicted for the Project at the PSD Class I Area of the Chassahowitzka NWA

Operating Mode	Visibility Impairment (%)[a]			Visibility Impairment Criteria (%)
	High	2nd High	3rd High	
Natural Gas	0.63	0.48	0.40	5.0
Backup Fuel Oil	6.15[b]	3.57	3.29	5.0

[a] Concentrations are highest predicted using CALPUFF model and 1990 CALMET wind field for central Florida. Background extinctions calculated using FLAG Document (December 2000) values and hourly relative humidity data. Concentrations predicted are based the combustion turbines operating or baseload conditions at an ambient temperature of 20oF.

[b] Due to the presense of fog on the one day visibility impairment was greater than 5%, visibility was already impaired and therefore it is unrealistic to expect that the Project's ipacts would be noticeable. Therefore the change in visibility due to the Project's emissions was predicted to be less than the 5-percent criteria.

Table 8-6. Maximum Sulfur and Nitrogen Annual Deposition Predicted for the Project at the PSD Class I Area of the Chassahowitzka NWA

	Total Deposition (Wet & Dry)		Deposition Analysis Threshold
Species/Operating Mode	(µg/m2/s)[c]	(kg/ha/yr)[b]	(kg/ha/yr)
Nitrogen (N) Deposition			
Natural Gas	1.64E-06	5.18E-04	0.01
Backup Fuel Oil	1.19E-06	3.74E-04	0.01
Sulfur (S) Deposition			
Natural Gas	1.32E-06	4.15E-04	0.01
Backup Fuel Oil	3.05E-06	9.62E-04	0.01

[a] Conversion factor is used to convert µg/m^2/s to kg/hectare (ha)/yr using following units:

µg/m2/s	x	0.000001 g/µg
	x	0.001 kg/g
	x	10000 m^2/hectare
	x	3600 sec/hr
	x	8760 hr/yr =kg/ha/yr
	or	
µg/m^2/s	x	315.36 = kg/ha/yr

[b] Deposition analysis thresholds (DAT) for nitrogen and sulfur deposition provided by the U.S. Fish and Wildlife Service, January 2002. A DAT is the additional amount of N or S deposition within a Class I area, below which estimated impacts from a proposed new or modified source are considered insignificant.

[c] Total Deposition impacts are based on firing natural gas and fuel oil for 7,760 and 1,000 hours, respectively.

9.0 REFERENCES

Allaway, W. H. 1968. Agronomic Controls over the Environmental Cycling of Trace Elements. In: Norman, A. G. (ed.). Advances in Agronomy. Vol. 20, Academic Press, New York.

Aller, A. Javier, J. Luis Bernal, M. Jesus del Nozal, and Luis De ban. 1990. Effects of Selected Trace Elements in Plant Growth. J Sci Food Agric 51:447-479.

Barrett, T. W. and H. M. Benedict. 1970. Sulfur Dioxide. In: Recognition of Air Pollution Injury to Vegetation: A Pictorial Atlas. Jackobsen, J. S. and A. C. Hill (eds.). Air Pollution Control Association. Pittsburgh, Pennsylvania.

Bazzay, F. A., G. L. Rolfe, and R. W. Carlson. 1974. Effects of Cadmium on Photosynthesis and Transpiration of Excised Leaves of Corn and Sunflower. Physiologic Plantarum. 32:373-376.

Bell, D. E. and W. H. Rickard. 1974. Environmental Impact Monitoring of Nuclear Power Plants. Part 7 - Terrestrial Ecology. Battelle Pacific Northwest Laboratories. Richland, Washington.

Black & Veatch. 1992. Technical Data on Emissions in support of FP Polk County Site Project. Kansas City, Missouri.

Boericke, R. R. 1990. Emission Controls and Costs for Gas Turbine Applications. In: 34th General Electric Turbine State-of-the-Art Technology Seminar for Architect-Engineers and Engineer Constructors.

Bowen, H.J.M. 1966. Trace Elements in Biochemistry. Academic Press, New York.

Chapman, H.D. (ed) 1966. Diagnostic Criteria for Plants and Soils. University of California, Riverside. Division of Agricultural Sciences.

Chappelka, A.H., B.I. Chevone, and T.E. Burk. 1988. Growth Response of Green and White Ash Seedlings to Ozone, Sulfur Dioxide and Simulated Acid Rain. Forest Science 34:1016-1029.

Davis, Donald D., and John M. Shelly. 1992. Growth Response of Four Species of Eastern Hardwood Tree Seedlings Exposed to Ozone, Acidic Precipitation and Sulfur Dioxide. J. Air Waste Management Assoc 42:309-311.

deSteiguer, J.E., John M. Pye, and Carolyn S. Love. 1990. Air Pollution Damage to U.S. Forests. A Survey of Perceptions and Estimates by Scientists. Journal of Forestry 17-22.

Dvorak, A. J. and E. D. Pentecost, et al. 1977. Assessment of the Health and Environmental Effects of Power Generation in the Midwest. Vol. II, Ecological Effects (Draft Report) Argonne National Laboratory. Argonne, Illinois. As cited in FWS, 1978.

Edgerton, E.S. and T.F. Lavery. 1990. Wet and Dry Deposition Across the Southeastern United States. In: Proceeding of the Florida Acidic Deposition Conference, Catis E. Watkins, ed. Tampa, Florida.

EPA (U.S. Environmental Protection Agency). 1991. New Source Review (NSR) Program Transition Guidance. Memorandum from John S. Seitz, Director, Office of Air Quality Planning and Standards, Research Triangle Park, NC. March 11.

EPA. 1990. BACT/LAER Clearinghouse - A Compilation of Control Technology Determinations. EPA 450/3-90-015b. Prepared for the Office of Air Quality by PEI Associates Inc., Cincinnati, Ohio.

EPA. 1990b. New Source Review Workshop Manual (Draft). Office of Air Quality Planning and Standards. October.

EPA. 1990c. "Top Down" Best Available Control Technology Guidance Document (Draft). Office of Air Quality Planning and Standards. March 15.

EPA. 1988. Toxic Air Pollutant Emission Factors - A Compilation for Selected Air Toxic Compounds and Sources. EPA-450/2-88-006a. Prepared for the EPA by Radian Corporation. Research Triangle Park, North Carolina.

EPA. 1988a. Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, AP-42, Supplement B. September.

EPA. 1998 Industrial Source Complex (ISC) Dispersion Model User's Guide Volumes I and II.

EPA. 1985. BACT/LAER Clearinghouse - A Compilation of Control Technology Determinations. EPA 450/3-85-016b. Prepared for the Office of Air Quality by PEI Associates Inc., Cincinnati, Ohio.

EPA. 1985a. Final Stack Height Regulation. Federal Register, Volume 50. Page 27892. July 8.

EPA. 1976. Diagnosing Vegetation Injury Caused by Air Pollution. Developed for EPA by Applied Science Associates, Inc., EPA Contract No. 68-02-1344.

EPA. 1973. Air Pollution Engineering Manual (AP-40). Research Triangle Park, NC.

ESE (Environmental Science & Engineering). 1989. Florida Acid Deposition Monitoring Program - 1988 Summary Report. PB91-100305. Gainesville, Florida.

ESE. 1988. Florida Acid Deposition Monitoring Program - 1987 Summary Report. PB89-152532. Gainesville, Florida.

ESE. 1987. Florida Acid Deposition Study: Five Year Data Summary; PB88-158779. Gainesville, Florida.

ESE. 1986. Florida Acid Deposits Study, Final Report, A Synthesis of the Florida Acid Deposition Study; PB86-243359. Gainesville, Florida.

Federation of American Societies for Experimental Biology. 1973. Effects of Low Concentrations of Sulfur Concentrations of Sulfur Dioxide on Vascular Plants. (Table). Biology Data Book, pp. 995-1015.

FDEP (Florida Department of Environmental Protection). 1998. Air Quality Database.

FP (Florida Power Corporation). 1992. Site Certification Application for Engineering and Licensing of the Polk County Site.

Foy, C.D. 1964. Toxic Factors in Acid Soils of the Southwestern United States as Related to the Response of Alfalfa to Lime. U.S. Dept. Agric. Prod. Res. Report 80.

Gough, L.P., H.T. Schacklette, and A.A. Case. 1979. Element Concentrations Toxic to Plants, Animals, and Man. Geological Survey Bulletin 1466, U.S. Department of Interior, Washington, D.C.

Gough, P., and H.T. Shacklette. 1976. Toxicity of Selected Elements to Plants, Animals, and Man - An Outline. In: Geochemical Survey of the Western Energy Regions, Third Annual Progress Report, July. Appendix IV. U.S. Dept. of Interior. Geological Survey.

Hart, Robin, Patricia G. Webb, R. Hilton Biggs, and Kenneth M. Portier. 1988. The Use of Lichen Fumigation Studies to Evaluate the Effects on New Emission Sources or Class I Areas. J. Air Pollut Control Assoc. 38:144-147.

Heggestad, H. E. and W. W. Heck. 1971. Nature, Extent, and Variations of Plant Responses to Air Pollutants. Advances in Agronomy 23:111-145.

Hogsett, W.E., M. Plocher, V. Wildman, D.T. Tingey, and J.P. Bennett. 1985. Growth Responses of Two Varieties of Slash Pine Seedlings to Chronic Ozone Exposures. Canada Journal of Botany 63:2369-2376.

Huber, A. H. and W. H. Snyder. 1976. Building Wake Effects on Short Stack Effluents. Preprint Volume for the Third Symposium on Atmospheric Diffusion and Air Quality. American Meteorological Society, pp 235-242.

Hyde, Adam G., Lloyd Law, Jr., Robert L. Weatherspoon, Melvin D. Cheyney, and Joseph J. Echenrode. 1977. Soil Survey of Hernando County, Florida. U.S. Department of Agriculture Soil Conservation Service.

Jacobsen, J.S. 1977. Sulfur Dioxide Air Quality Standards for the Prevention of Losses to Agriculture and Forestry in California. Report to the State of California Air Resources Board (CARB). The Boyce Thompson Institute. Yonkers, New York.

Jensen, Keith F. and Leon S. Dochinger. 1989. Response of Eastern Hardwood Species to Ozone, Sulfur Dioxide and Acid Precipitation. Journal of the Air Pollutant Control Assoc 39:852-855.

Jones, H.C., D. Weber, and D. Balsillie. 1974. Acceptable Limits for Air Pollution Dosages and Vegetation Effects: Sulfur Dioxide. Presented at the 65th Annual Meeting of the Air Pollution Control Association. Denver, Colorado. Paper No. 74-225.

Kamprath, E. J. 1972. Possible Benefits from Sulfur in the Atmosphere. Combustion. 16-17.

Kothny, E.L. 1973. Trace Elements in the Environment. American Chemical Society. Washington, D.C.

Krause, G.H.M. and H. Kaiser. 1977. Plant Response to Heavy Metal and Sulfur Dioxide. Environmental Pollution 12:63-71.

Ledbetter, M.C., P.W. Zimmerman, and A.E. Hitchcock. 1959. The Histopathological Effects of Ozone on Plant Foliage. Contrib. Boyce Thompson Inst. 20:275-282.

Linzon, S.N. 1973. Sulfur Dioxide Air Quality Standards for Vegetation. Presented at the 60th Annual Meeting of the Air Pollution Control Association. Chicago, Illinois. Paper No. 73-107.

Lisk, D. 1972. Trace Metals in Soils, Plants, and Animals. Advances in Agronomy 24:267-325.

Loomis, R.C. and W.H. Padgett. 1973. Air Pollution and Trees in the East. U.S. Department of Agriculture, Forest Service.

MacLean, David C., Delbert C. McCune, Leonard H. Weinstein, Richard H. Maudl, and George N. Woodruff. 1968. Effects of Acute Hydrogen Fluoride and Nitrogen Dioxide Exposures on Citrus and Ornamental Plants of Central Florida. Environmental Science and Technology 2:444-449.

Matsushima, J. and R.F. Brewer. 1972. Influence of Sulfur Dioxide and Hydrogen Fluoride as a Mix or Reciprocal Exposure on Citrus Growth and Development. J. Air Pollution Control Assoc 22:710-713.

Moore/Bowers Group. 1992. Polk County Site, Socioeconomic and Demographic Support Data. Tampa, Florida.

NAPAP. 1991. The U.S. National Acid Precipitation Assessment Program - 1990 Integrated Assessment Report. The NAPAP Office of the Director. Washington, D.C.

NAPAP. 1991a. Acid Deposition: State of the Science and Technology. Summary Report of the U.S. National Acid Precipitation Assessment Program. Office of the Director. Washington, D.C.

NAS (National Academy of Science). 1974. Committee on Biological Effects of Atmospheric Pollutants. Medical and Biological Effects of Environmental Pollutants - Chromium. NAS. Washington, D.C.

Newman, James R. and R.K. Schreiber. 1988. Air Pollution and Wildlife Toxicology: An Overlooked Problem. Environmental Toxicology and Chemistry 7:381-390.

Newman, James R. 1980. Effects of Air Emissions on Wildlife Resources U.S. Fish and Wildlife Report FWS/OBS-80/40.1. U.S. Fish and Wildlife Service. Biological Services Program, National Power Plant Team. 32 pp.

North Carolina DNR (Department of Natural Resources and Community Development). 1985. A Screening Method for PSD. Letter from Mr. Eldewins Haynes, North Carolina DNR to Mr. Lewis Nagler, U.S. Environmental Protection Agency, Region IV. July 22.

Okano, K., T. Machicla, and T. Toxsuka. 1989. Differences in Ability of NO_2 Absorption in Various Broad-leaved Tree Species. Environmental Pollution 58:1-17.

Olsen, R. A. 1957. Absorption of Sulfur Dioxide from the Atmosphere by Cotton Plants. Soil Science 84:107-111.

Pilny, Paul E., Charles T. Grantham, Joseph N. Seluister, and Daniel L. Stanley. 1988. Soil Survey of Citrus County Florida. U.S. Department of Agriculture Soil Conservation Service.

Radian Corporation. 1991. Gas Turbine Selective Catalytic Reduction Procurement Guidelines. In: Electric Power Research Institute (EPRI) Publication 65-7254.

Ragput, C.B.S., D.P. Ormrod, and W.D. Evans. 1977. The Resistance of Strawberry to Ozone and Sulfur Dioxide. Plant Disease Reporter 61:222-225.

Reuther, W., P.F. Smith, and A. W. Specht. 1949. A Comparison of the Mineral Composition of Valencia Orange Leaves from the Major Producing Areas of the U.S. Proc. Fla. State Hortic. Soc. 62:38-45.

Shackelette, Hansford T. and Josephine G. Boerngen. 1984. Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States. U.S. Geological Survey Professional Paper 1270. U.S. Geological Survey. Washington, D.C. 105 pp.

Shanklin, J. and T.T. Kozlowski. 1985. Effect of Flooding of Soil on Growth and Subsequent Responses of Taxodium distichum Seedlings to SO_2. Environmental Pollution 38:199-212.

Shorr, Marvin M. 1991. NO_X Control for Gas Turbines: Regulations and Technology. The Cogeneration Journal 6(2):20-52.

Sucoff, E. and W. Baily. 1971. Relative Tolerance of Woody Plants Grown in Minnesota to Five Air Pollutants - Air Compilation of Ratings. Minnesota Forestry Research Notes. No. 227.

Taylor, O.C. and D.C. MacLean. 1970. Nitrogen Oxides and the Peroxyacyl Nitrates. In: Recognition of Air Pollution Injury to Vegetation: A Pictorial Atlas. Jacobsen, J.S. and A.C. Hill (eds). Air Pollution control Association. Pittsburgh, Pennsylvania.

Terman, G.L. 1978. Atmospheric Sulphur - The Agronomic Aspects. Technical Bulletin Number 23. The Sulphur Institute. Washington, D.C.

Thompson, C.R., E.G. Hensel, G. Kats, and O.C. Taylor. 1970. Effects of Continuous Exposure of Navel Oranges to Nitrogen Dioxide. Atmospheric Erosion 4:349-355.

Thompson, C. Ray, and O.C. Taylor. 1969. Effects of Air Pollutants on Growth, Leaf Drop, Fruit Drop and Yield of Citrus Trees. Environmental Science and Technology 3:934-940.

Thompson, C. Ray, O.C. Taylor, M.D. Thomas, and J.O. Ivie. 1967. Effects of Air Pollutants on Apparent Photosynthesis and Water Use by Citrus Trees. Environmental Science and Technology 1:644-650.

Thompson, C.R., D.T. Tingey, and R.A. Reinert. 1974. Acceptable Limits for Air Pollution Dosages and Vegetation Effects: Nitrogen Dioxide. Presented at 67th Annual Meeting of Air Pollution Control Association. Denver, Colorado. Paper No. 74-227.

Tingey, D.T., R.A. Reinert, J.A. Dunning, and W.W. Heck. 1971. Vegetation Injury from the Interaction of Nitrogen Dioxide and Sulfur Dioxide. Phytopathology 61:1506-1511.

Tingey, D.T., R.A. Reinert, C. Wickliff, and W.W. Heck. 1973a. Chronic Ozone and/or Sulfur Dioxide Exposures Affect the Early Vegetation Growth of Soybean. Canadian Journal of Plant Science 53:875-879.

Tingey, D.T., R.A. Reinert, J.A. Dunning, and W.W. Heck. 1973b. Foliar Injury Responses of Eleven Plant Species to Ozone/Sulfur Dioxide Mixtures. Atmospheric Environment 7:201-208.

Treshow, M. 1970. Ozone Damage to Plants. Environmental Pollution 1:155-161.

Turner, D. B. 1970. Workbook of Atmospheric Dispersion Estimates. U.S. Environmental Protection Agency. AP-26.

U.S. Fish and Wildlife Service. 1996. Air Quality and Air Quality Related Values in Chassahowitzka National Wildlife Refuge and Wilderness Area. Department of the Interior. Denver, Colorado.

Valkovic, V. 1975. Trace Element Analysis. Halsted Press. New York. 229 pp.

White, K.L., A.C. Hill, and J.H. Bennett. 1974. Synergistic Inhibition of Apparent Photosynthesis Rate of Alfalfa by Combinations of Sulfur Dioxide and Nitrogen Dioxide. Environmental Science and Technology 6:574-576.

Woodman, James N. 1987. Pollution-induced Injury in North American Forests: Facts and Suspicions. Tree Physiology 3:1-5.

Zeevaert, A.J. 1976. Some Effects of Fumigating Plants for Short Periods with NO_2. Environmental Pollution 11:97-107.

APPENDIX A

IMAGE QUALITY

AS YOU REVIEW THE NEXT GROUP OF IMAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENTS WERE OF POOR QUALITY.

Table A-1. Design Information and Stack Parameters for the FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NO_X Combustor, Natural Gas, 100 % Load

Parameter	Ambient/Compressor Inlet Temperature 20 °F	59 °F	72°F	90°F
Combustion Turbine Performance				
Evaporative cooler status/ efficiency (%)	Off	Off	Off	Off
Ambient Relative Humidity (%)	60	60	60	55
Gross power output (MW) - Estimated	200.88	181.74	174.22	157.91
Gross heat rate (Btu/kWh, LHV) - Estimated	8,835	9,100	9,180	9,510
(Btu/kWh, HHV)	9,915	10,085	10,195	10,550
Heat Input (MMBtu/hr, LHV)- calculated	1,775	1,654	1,599	1,502
- provided	1,813	1,649	1,596	1,537
(MMBtu/hr, HHV) - calculated	2,012	1,830	1,771	1,705
(HHV/LHV)	1.110	1.110	1.110	1.110
Fuel heating value (Btu/lb, LHV)	21,039	21,039	21,039	21,039
(Btu/lb, HHV)	23,345	23,345	23,345	23,345
(HHV/LHV)	1.110	1.110	1.110	1.110
CT Exhaust Flow				
Mass Flow (lb/hr)	3,885,997	3,624,720	3,504,549	3,353,000
Temperature (°F)	1,086	1,107	1,118	1,148
Moisture (% Vol.)	7.77	8.39	9.45	11.64
Oxygen (% Vol.)	12.52	12.53	12.32	11.99
Molecular Weight - calculated	28.46	28.39	28.27	28.04
- provided	28.46	28.39	28.27	28.03
Volume Flow (acfm)= [(Mass Flow (lb/hr) x 1,545 x (Temp. (°F)+ 460°F)] / [Molecular weight x 2116.8] / 60 min/hr				
Mass flow (lb/hr)	3,885,997	3,624,720	3,504,549	3,353,000
Temperature (°F)	1,086	1,107	1,118	1,148
Molecular weight	28.46	28.39	28.27	28.04
Volume flow (acfm)- calculated	2,567,660	2,433,641	2,379,291	2,339,045
- provided				
Fuel Usage				
Fuel usage (lb/hr)= Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu (Fuel Heat Content, Btu/lb (LHV))				
Heat input (MMBtu/hr, LHV)	1,813	1,649	1,596	1,537
Heat content (Btu/lb, LHV)	21,039	21,039	21,039	21,039
Fuel usage (lb/hr)- calculated	86,180	78,380	75,850	73,050
- provided	86,180	78,380	75,850	73,050
Heat content (Btu/cf, LHV)- assumed	920	920	920	920
Fuel density (lb/ft^3)	0.0437	0.0437	0.0437	0.0437
Fuel usage (cf/hr)- calculated	1,970,805	1,792,431	1,734,574	1,670,542
Stack and Exit Gas Conditions- HRSG				
Stack height (ft)	125	125	125	125
Diameter (ft)	19.0	19.0	19.0	19.0
Temperature (°F)	190	190	190	190
HRSG- Volume flow (acfm)= CT Volume flow (acfm) x [(HRSG Temp. (°F) + 460 K) / (CT Temp. (°F) + 460)]				
CT Volume flow (acfm)	2,567,660	2,433,641	2,379,291	2,339,045
CT Temperature (°F)	1,086	1,107	1,118	1,148
HRSG Temperature (°F)	190	190	190	190
HRSG Volume flow (acfm)	1,079,547	1,009,487	980,063	945,509
Velocity (ft/sec)= Volume flow (acfm) / [((diameter)^2 /4) x 3.14159] / 60 sec/min				
Volume flow (acfm)	1,079,547	1,009,487	980,063	945,509
Diameter (ft)	19.0	19.0	19.0	19.0
Velocity (ft/sec)- calculated	63.3	59.2	57.4	55.4

Source: Siemens-Westinghouse, 2000

Note: Universal gas constant= 1,545 ft-lb(force)/°R; atmospheric pressure= 2,116.8 lb(force)/ft²

Table A-2. Maximum Emissions for Criteria and Other Regulated Pollutants for the FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NO_X Combustor, Natural Gas, 100 % Load

Parameter	Ambient/Compressor Inlet Temperature 20 °F	59 °F	72°F	90°F
Hours of Operation	8,760	8,760	8,760	8,760
Particulate from CT and SCR				
Particulate from CT= Emission rate (lb/hr) from CT manufacturer (front- and back-half)				
Basis, lb/hr - provided [a]	7.3	6.8	6.5	6.2
Particulate from SCR= Sulfur trioxide (formed from conversion of SO_2) converts to ammonium sulfate (=PM10)				
Particulate from conversion of SO_2= SO_2 emissions (lb/hr) x Conversion SO_2 to SO_3 x lb SO_3/lb SO_2 x Conversion of SO_3 x lb SO_3 to $(NH_4)_2SO_4$ x $(NH_4)_2$ SO_4/ lb SO_3				
SO_2 emission rate (lb/hr)- calculated	5.6	5.1	5.0	4.8
Conversion (%) from SO_2 to SO_3	10	10	10	10
MW SO_3/ SO_2 (80/64)	1.3	1.3	1.3	1.3
Conversion (%) from SO_2 to $(NH_4)_2(SO_4)$	100	100	100	100
MW $(NH_4)_2$ SO_4/ SO_3 (132/80)	1.7	1.7	1.7	1.7
Particulate (lb/hr)- calculated	1.16	1.06	1.02	0.98
Particulate (lb/hr) from CT + SCR	8.5	7.9	7.5	7.2
(TPY)	37.1	34.4	32.9	31.5
Sulfur Dioxide (lb/hr)= Natural gas (cf/hr) x sulfur content(gr/100 cf) x 1 lb/7000 gr x (lb SO_2 /lb S)/100				
Fuel use (cf/hr)	1,970,805	1,792,431	1,734,574	1,670,542
Sulfur content (grains/ 100 cf) - assumed [b]	1	1	1	1
lb SO_2 /lb S (64/32)	2	2	2	2
Emission rate (lb/hr)- calculated	5.6	5.1	5.0	4.8
(lb/hr)- provided (1 gr/100 cf)	5.5	5.1	5.0	4.7
(TPY)	24.7	22.4	21.7	20.9
Nitrogen Oxides (lb/hr)= NOx(ppm) x {[20.9 x (1 - Moisture(%)/100)] - Oxygen(%)} x 2116.8 x Volume flow (acfm) x 46 (mole. wgt NOx) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 5.9 x 1,000,000 (adj. for ppm)]				
Basis, ppmvd @15% O_2 [a,d]	3.5	3.5	3.5	3.5
Moisture (%)	7.77	8.39	9.45	11.64
Oxygen (%)	12.52	12.53	12.32	11.99
Volume Flow (acfm)	2,567,660	2,433,641	2,379,291	2,339,045
Temperature (°F)	1,086	1,107	1,118	1,148
Emission rate (lb/hr)- calculated	25.2	23.1	22.3	21.1
(lb/hr)- provided	25.0	23.1	22.3	21.2
(TPY)	109.5	101.2	97.7	92.9
[Ratio lb/hr provided/calculated]	0.993	1.002	0.998	1.003
Carbon Monoxide (lb/hr)= CO(ppm) x {[20.9 x (1 - Moisture(%)/100)] - Oxygen(%)} x 2116.8 lb/ft2 x Volume flow (acfm) x 28 (mole. wgt CO) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 1,000,000 (adj. for ppm)]				
Basis, ppmvd- calculated	12.4	12.2	12.4	12.4
Basis, ppmvd @ 15% O2- calculated	10	10	10	10
- provided [a]	10	10	10	10
Moisture (%)	7.77	8.39	9.45	11.64
Oxygen (%)	12.52	12.53	12.32	11.99
Volume Flow (acfm)	2,567,660	2,433,641	2,379,291	2,339,045
Temperature (°F)	1,086	1,107	1,118	1,148
Emission rate (lb/hr)- calculated from given ppmvd	43.8	40.1	38.9	36.8
(lb/hr)- provided	46.0	42.0	41.0	37.0
(TPY)	201.5	184.0	179.6	162.1
[Ratio lb/hr provided/calculated]	1.051	1.048	1.055	1.007
VOCs (lb/hr)= VOC(ppm) x [1 - Moisture(%)/100] x 2116.8 lb/ft2 x Volume flow (acfm) x 16 (mole. wgt as methane) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 1,000,000 (adj. for ppm)]				
Basis, ppmvd (as CH_4)- calculated	2.2	2.2	2.2	2.2
Basis, ppmvd @ 15% O_2- calculated	1.8	1.8	1.8	1.8
- provided [a,e]	1.8	1.8	1.8	1.8
Moisture (%)	7.77	8.39	9.45	11.64
Oxygen (%)	12.52	12.53	12.32	11.99
Volume Flow (acfm)	2,567,660	2,433,641	2,379,291	2,339,045
Temperature (°F)	1,086	1,107	1,118	1,148
Emission rate (lb/hr)- calculated	4.5	4.1	4.0	3.8
(lb/hr)- provided	4.7	4.4	4.2	3.8
(TPY)	20.4	19.1	18.4	16.4
[Ratio lb/hr provided/calculated]	1.033	1.055	1.051	0.992
Lead (lb/hr)= NA				
Emission Rate Basis	NA	NA	NA	NA
Emission rate (lb/hr)	NA	NA	NA	NA
(TPY)	NA	NA	NA	NA
Mercury (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis, lb/10^{12} Btu [c]	8.00E-04	8.00E-04	8.00E-04	8.00E-04
Heat Input Rate (MMBtu/hr), HHV- CT	2,012	1,830	1,771	1,705
- Duct Burner	0	0	0	0
Total	2,012	1,830	1,771	1,705
Emission Rate (lb/hr)	1.61E-06	1.46E-06	1.42E-06	1.36E-06
(TPY)	7.05E-06	6.41E-06	6.20E-06	5.98E-06
Sulfuric Acid Mist = SO_2 emission rate (lb/hr) x conversion rate of SO_2 to H_2SO_4 (%) x MW H_2SO_4 /MW SO_2 (98/64)				
SO_2 emission rate (lb/hr)	5.6	5.1	5.0	4.8
lb H_2SO_4 /lb SO_2 (98/64)	1.53	1.53	1.53	1.53
Conversion to H_2SO_4 (%) (b)	10	10	10	10
Emission Rate (lb/hr)	0.86	0.78	0.76	0.73
(TPY)	3.78	3.43	3.32	3.20

Source: [a] Siemens-Westinghouse, 2000 .
[b] Golder Associates Inc. 1999 .
[c] Electric Power Research Institute (EPRI), Electric Utility Trace Substances Report, 1994 (Table B-12) .
[d] For NO_X emissions, data originally provided at 25 ppmvd at 15% oxygen.
[e] For VOC emissions, data originally provided at 1.5 ppmvd at 15% oxygen.

Note: ppmvd= parts per million, volume dry; O_2 = oxygen.

Table A-3. Maximum Emissions for Other Regulated PSD Pollutants for the FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NO_x Combustor, Natural Gas, 100 % Load

Parameter	Ambient/Compressor Inlet Temperature 20 °F	59 °F	72°F	90°F
Hours of Operation	8,760	8,760	8,760	0
Heat Input Rate (MMBtu/hr), HHV- CT	2,012	1,830	1,771	1,705
Duct burner	0	0	0	0
Total	2,012	1,830	1,771	1,705
2,3,7,8 TCDD Equivalents (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis, lb/10^{12} Btu	1.20E-06	1.20E-06	1.20E-06	1.20E-06
Heat Input Rate (MMBtu/hr)	2,012	1,830	1,771	1,705
Emission Rate (lb/hr)	2.41E-09	2.20E-09	2.12E-09	2.05E-09
(TPY)	1.06E-08	9.62E-09	9.31E-09	0.00E+00
Beryllium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	2,012	1,830	1,771	1,705
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fluoride (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	2,012	1,830	1,771	1,705
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Source: Electric Power Research Institute (EPRI), Electric Utility Trace Substances Report, 1994 (Table B-12) .
Emission factors for metals are questionable and not used .

Note: No emission factors for hydrogen chloride (HCl) from natural gas-firing.

Table A-4. Maximum Emissions for Hazardous Air Pollutants for the FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NO_x Combustor, Natural Gas, 100 % Load

Parameter	Ambient/Compressor Inlet Temperature 20 °F	59 °F	72°F	90°F
Hours of Operation	8,760	8,760	8,760	8,760
Heat Input Rate (MMBtu/hr), HHV- CT	2,012	1,830	1,771	1,705
Duct burner	0	0	0	0
Total	2,012	1,830	1,771	1,705
Antimony (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	2,012	1,830	1,771	1,705
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzene (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis, lb/10^{12} Btu	8.00E-01	8.00E-01	8.00E-01	8.00E-01
Heat Input Rate (MMBtu/hr)	2,012	1,830	1,771	1,705
Emission Rate (lb/hr)	1.61E-03	1.46E-03	1.42E-03	1.36E-03
(TPY)	7.05E-03	6.41E-03	6.20E-03	5.98E-03
Cadmium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	2,012	1,830	1,771	1,705
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chromium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	2,012	1,830	1,771	1,705
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Formaldehyde (lb/hr) = 10% of VOC lb/hr				
Emission Rate, lb/10^{12} Btu	2.31E+02	2.31E+02	2.31E+02	2.31E+02
Heat Input Rate (MMBtu/hr)	2,012	1,830	1,771	1,705
Emission Rate (lb/hr)	4.65E-01	4.23E-01	4.09E-01	3.94E-01
(TPY)	2.04E+00	1.85E+00	1.79E+00	1.73E+00
Cobalt (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	2,012	1,830	1,771	1,705
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Manganese (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	2,012	1,830	1,771	1,705
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nickel (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	2,012	1,830	1,771	1,705
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Phosphorous (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	2,012	1,830	1,771	1,705
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Selenium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	2,012	1,830	1,771	1,705
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Toluene (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis, lb/10^{12} Btu	1.00E+01	1.00E+01	1.00E+01	1.00E+01
Heat Input Rate (MMBtu/hr)	2,012	1,830	1,771	1,705
Emission Rate (lb/hr)	2.01E-02	1.83E-02	1.77E-02	1.71E-02
(TPY)	8.81E-02	8.01E-02	7.76E-02	7.47E-02

Source: Electric Power Research Institute (EPRI), Electric Utility Trace Substances Report, 1994 (Table B-12).
Emission factors for metals are questionable and not used.

Table A-5. Design Information and Stack Parameters for the FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NO_X Combustor, Natural Gas, 80 % Load

Parameter	Ambient/Compressor Inlet Temperature 20 °F	59 °F	90 °F
Combustion Turbine Performance			
Evaporative cooler status/ efficiency (%)	Off	Off	Off
Ambient Relative Humidity (%)	60	60	55
Gross power output (MW) - Estimated	160.80	145.19	127.40
Gross heat rate (Btu/kWh, LHV) - Estimated	9,255	9,516	10,065
(Btu/kWh, HHV)	10,270	10,555	11,170
Heat Input (MMBtu/hr, LHV)- calculated	1,488	1,382	1,282
- provided	1,385	1,382	1,279
(MMBtu/hr, HHV) - calculated	1,537	1,534	1,419
(HHV/LHV)	1.110	1.110	1.110
Fuel heating value (Btu/lb, LHV)	21,039	21,039	21,039
(Btu/lb, HHV)	23,345	23,345	23,345
(HHV/LHV)	1.110	1.110	1.110
CT Exhaust Flow			
Mass Flow (lb/hr)	3,497,411	3,302,475	3,118,517
Temperature (°F)	1,006	1,032	1,083
Moisture (% Vol.)	7.10	7.75	9.14
Oxygen (% Vol.)	13.27	13.25	13.12
Molecular Weight - calculated	28.50	28.43	28.27
- provided	28.51	28.43	28.27
Volume Flow (acfm)= [(Mass Flow (lb/hr) x 1,545 x (Temp. (°F)+ 460°F)] / [Molecular weight x 2116.8] / 60 min/hr			
Mass flow (lb/hr)	3,497,411	3,302,475	3,118,517
Temperature (°F)	1,006	1,032	1,083
Molecular weight	28.50	28.43	28.27
Volume flow (acfm)- calculated	2,188,271	2,108,318	2,070,770
Fuel Usage			
Fuel usage (lb/hr)= Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu (Fuel Heat Content, Btu/lb (LHV))			
Heat input (MMBtu/hr, LHV)	1,385	1,382	1,279
Heat content (Btu/lb, LHV)	21,039	21,039	21,039
Fuel usage (lb/hr)- calculated	65,830	65,710	60,790
- provided	65,830	65,710	60,790
Heat content (Btu/cf, LHV)	920	920	920
Fuel density (lb/ft^3)	0.0437	0.0437	0.0437
Fuel usage (cf/hr)- calculated	1,505,432	1,502,688	1,390,175
Stack and Exit Gas Conditions- HRSG			
Stack height (ft)	125	125	125
Diameter (ft)	19.0	19.0	19.0
Temperature (°F)	190	190	190
HRSG- Volume flow (acfm)= CT Volume flow (acfm) x [(HRSG Temp. (°F) + 460 K) / (CT Temp. (°F) + 460)]			
CT Volume flow (acfm)	2,188,271	2,108,318	2,070,770
CT Temperature (°F)	1,006	1,032	1,083
HRSG Temperature (°F)	190	190	190
HRSG Volume flow (acfm)	970,243	918,503	872,327
Velocity (ft/sec)= Volume flow (acfm) / [((diameter)²/4) x 3.14159] / 60 sec/min			
Volume flow (acfm)	970,243	918,503	872,327
Diameter (ft)	19.0	19.0	19.0
Velocity (ft/sec)- calculated	57.0	54.0	51.3

Source: Siemens-Westinghouse, 2000.

Note: Universal gas constant= 1,545 ft-lb(force)/°R; atmospheric pressure= 2,116.8 lb(force)/ft^2

Table A-6. Maximum Emissions for Criteria and Other Regulated Pollutants for the FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NO_x Combustor, Natural Gas, 80 % Load

Parameter	Ambient/Compressor Inlet Temperature 20 °F	59 °F	90 °F
Hours of Operation	8,760	8,760	8,760
Particulate from CT and SCR			
Particulate (lb/hr)= Emission rate (lb/hr) from manufacturer (front- and back-half)			
Basis, lb/hr - provided [a]	6.6	6.2	5.5
Particulate from SCR= Sulfur trioxide (formed from conversion of SO_2) converts to ammonium sulfate (=PM_{10})			
Particulate from conversion of SO_2= SO_2 emissions (lb/hr) x Conversion SO_2 to SO_3 x lb SO_3/lb SO_2 x Conversion of SO_3 x lb SO_3 to $(NH_4)_2SO_4$ x $(NH_4)_2SO_4$/ lb SO_2			
SO_2 emission rate (lb/hr)- calculated	4.3	4.3	4.0
Conversion (%) from SO_2 to SO_3	10	10	10
MW SO_3/ SO_2 (80/64)	1.3	1.3	1.3
Conversion (%) from SO_3 to $(NH_4)_2(SO_4)$	100	100	100
MW $(NH_4)_2$ SO_4/ SO_2 (132/80)	1.7	1.7	1.7
Particulate (lb/hr)- calculated	0.89	0.89	0.82
Particulate (lb/hr) from CT + SCR	7.5	7.1	6.3
(TPY)	32.8	31.0	27.7
Sulfur Dioxide (lb/hr)= Natural gas (cf/hr) x sulfur content(gr/100 cf) x 1 lb/7000 gr x (lb SO_2/lb S)/100			
Fuel use (cf/hr)	1,505,432	1,502,688	1,390,175
Sulfur content (grains/ 100 cf) - assumed [b]	1	1	1
lb SO_2/lb S (64/32)	2	2	2
Emission rate (lb/hr)- calculated	4.3	4.3	4.0
(lb/hr)- provided (1 gr/100 cf)	4.60	4.30	3.80
(TPY)	18.8	18.8	17.4
Nitrogen Oxides (lb/hr)= NO_x(ppm) x {[20.9 x (1 - Moisture(%)/100)] - Oxygen(%)} x 2116.8 x Volume flow (acfm) x 46 (mole. wgt NO_2) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 5.9 x 1,000,000 (adj. for ppm)]			
Basis, ppmvd @15% O_2 [a,d]	3.5	3.5	3.5
Moisture (%)	7.10	7.75	9.14
Oxygen (%)	13.27	13.25	13.12
Volume Flow (acfm)	2,188,271	2,108,318	2,070,770
Temperature (°F)	1,006	1,032	1,083
Emission rate (lb/hr)- calculated	20.6	19.1	17.7
(lb/hr)- provided	20.6	19.1	17.7
(TPY)	90.2	83.7	77.5
[Ratio lb/hr provided/calculated]	1.001	0.999	1.002
Carbon Monoxide (lb/hr)= CO(ppm) x {[20.9 x (1 - Moisture(%)/100)] - Oxygen(%)} x 2116.8 lb/ft2 x Volume flow (acfm) x 28 (mole. wgt CO) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 1,000,000 (adj. for ppm)]			
Basis, ppmvd- calculated	11.2	11.1	10.9
Basis, ppmvd @ 15% O_2- calculated	10	10	10
- provided [a]	10	10	10
Moisture (%)	7.10	7.75	9.14
Oxygen (%)	13.27	13.25	13.12
Volume Flow (acfm)	2,188,271	2,108,318	2,070,770
Temperature (°F)	1,006	1,032	1,083
Emission rate (lb/hr)- calculated from given ppr	35.8	33.2	30.7
(lb/hr)- provided	38.0	35.0	33.0
(TPY)	166.4	153.3	144.5
[Ratio lb/hr provided/calculated]	1.062	1.053	1.074
VOCs (lb/hr)= VOC(ppm) x [1 - Moisture(%)/ 100] x 2116.8 lb/ft2 x Volume flow (acfm) x 16 (mole. wgt as methane) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 1,000,000 (adj. for ppm)]			
Basis, ppmvd (as CH_4)- calculated	2.6	2.5	2.5
Basis, ppmvd @ 15% O_2 - calculated	2.3	2.3	2.3
- provided [e]	2.3	2.3	2.3
Moisture (%)	7.10	7.75	9.14
Oxygen (%)	13.27	13.25	13.12
Volume Flow (acfm)	2,188,271	2,108,318	2,070,770
Temperature (°F)	1,006	1,032	1,083
Emission rate (lb/hr)- calculated	4.7	4.4	4.0
(lb/hr)- provided	4.9	4.6	4.2
(TPY)	21.5	20.1	18.4
[Ratio lb/hr provided/calculated]	1.042	1.053	1.040
Lead (lb/hr)= NA			
Emission Rate Basis	NA	NA	NA
Emission rate (lb/hr)	NA	NA	NA
(TPY)	NA	NA	NA
Mercury (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu [c]	8.00E-04	8.00E-04	8.00E-04
Heat Input Rate (MMBtu/hr)	1,537	1,534	1,419
Emission Rate (lb/hr)	1.23E-06	1.23E-06	1.14E-06
(TPY)	5.38E-06	5.38E-06	4.97E-06
Sulfuric Acid Mist = SO_2 emission rate (lb/hr) x conversion rate of SO_2 to H_2SO_4 (%) x MW H_2SO_4/MW SO_2 (98/64)			
SO_2 emission rate (lb/hr)	4.3	4.3	4.0
lb H_2SO_4/lb SO_2 (98/64)	1.53	1.53	1.53
Conversion to H_2SO_4 (%) [b]	10	10	10
Emission Rate (lb/hr)	0.66	0.66	0.61
(TPY)	2.88	2.88	2.66

Source: [a] Siemens-Westinghouse,2000.
[b] Golder Associates Inc. 2000 .
[c] Electric Power Research Institute (EPRI), Electric Utility Trace Substances Report, 1994 (Table B-12) .
[d] For NO_x emissions, data originally provided at 25 ppmvd at 15% oxygen.
[e] For VOC emissions, data originally provided at 2.8 ppmvd at 15% oxygen.

Table A-7. Maximum Emissions for Other Regulated PSD Pollutants for the FPC HInes Energy Center
Siemens-Westinghouse 501F, Dry Low NO_x Combustor, Natural Gas, 80 % Load

Parameter	Ambient/Compressor Inlet Temperature 20 °F	59 °F	90 °F
Hours of Operation	8,760	8,760	8,760
2,3,7,8 TCDD Equivalents (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	1.20E-06	1.20E-06	1.20E-06
Heat Input Rate (MMBtu/hr)	1,537	1,534	1,419
Emission Rate (lb/hr)	1.84E-09	1.84E-09	1.70E-09
(TPY)	8.08E-09	8.06E-09	7.46E-09
Beryllium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0	0
Heat Input Rate (MMBtu/hr)	1,537	1,534	1,419
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00
Fluoride (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0	0
Heat Input Rate (MMBtu/hr)	1,537	1,534	1,419
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00

Source: Electric Power Research Institute (EPRI), Electric Utility Trace Substances Report, 1994 (Table B-12) .
Emission factors for metals are questionable and not used .

Note: No emission factors for hydrogen chloride (HCl) from natural gas-firing.

Table A-8. Maximum Emissions for Hazardous Air Pollutants for the FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NO_x Combustor, Natural Gas, 80 % Load

Parameter	Ambient/Compressor Inlet Temperature 20 °F	59 °F	90 °F
Hours of Operation	8,760	8,760	8,760
Antimony (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,537	1,534	1,419
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00
Benzene (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	8.00E-01	8.00E-01	8.00E-01
Heat Input Rate (MMBtu/hr)	1,537	1,534	1,419
Emission Rate (lb/hr)	1.23E-03	1.23E-03	1.14E-03
(TPY)	5.38E-03	5.38E-03	4.97E-03
Cadmium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,537	1,534	1,419
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00
Chromium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,537	1,534	1,419
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00
Formaldehyde (lb/hr) = 10% of VOC lb/hr			
Emission Rate, lb/10^{12} Btu	3.19E+02	3.19E+02	3.19E+02
Heat Input Rate (MMBtu/hr)	1,537	1,534	1,419
Emission Rate (lb/hr)	4.90E-01	4.89E-01	4.52E-01
(TPY)	2.15E+00	2.14E+00	1.98E+00
Cobalt (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,537	1,534	1,419
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00
Manganese (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,537	1,534	1,419
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00
Nickel (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,537	1,534	1,419
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00
Phosphorous (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,537	1,534	1,419
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00
Selenium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,537	1,534	1,419
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00
Toluene (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	1.00E+01	1.00E+01	1.00E+01
Heat Input Rate (MMBtu/hr)	1,537	1,534	1,419
Emission Rate (lb/hr)	1.54E-02	1.53E-02	1.42E-02
(TPY)	6.73E-02	6.72E-02	6.22E-02

Source: Electric Power Research Institute (EPRI), Electric Utility Trace Substances Report, 1994 (Table B-12).
Emission factors for metals are questionable and not used.

Table A-9. Design Information and Stack Parameters for the FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, 60% Load

Parameter	Ambient/Compressor Inlet Temperature 20 °F	59 °F	90 °F	Comment
Combustion Turbine Performance				
Evaporative cooler status/ efficiency (%)	Off	Off	Off	
Ambient Relative Humidity (%)	80	60	55	
Gross power output (MW)	120.13	108.54	93.99	
Gross heat rate (Btu/kWh, LHV)	10,125	10,610	11,075	
(Btu/kWh, HHV)	11,230	11,775	12,295	
Heat Input (MMBtu/hr, LHV)- calculated	1,216	1,152	1,041	
- provided	1,214	1,154	1,061	
(MMBtu/hr, HHV) - estimated	1,347	1,280	1,178	
(HHV/LHV)	1.110	1.110	1.110	
Fuel heating value (Btu/lb, LHV)	21,038	21,038	21,038	
(Btu/lb, HHV)	23,345	23,345	23,345	
(HHV/LHV)	1.110	1.110	1.110	
CT Exhaust Flow				
Mass Flow (lb/hr)	2,821,309	2,687,524	2,572,306	
Temperature (°F)	1,088	1,112	1,083	
Moisture (% Vol.)	7.18	7.89	9.17	
Oxygen (% Vol.)	13.18	13.08	13.08	
Molecular Weight - calculated	28.50	28.42	28.26	
- provided	28.50	28.42	28.27	
Volume Flow (acfm)= [(Mass Flow (lb/hr) x 1,545 x (Temp. (°F)+ 460°F)] / [Molecular weight x 2116.8] / 60 min/hr				
Mass flow (lb/hr)	2,821,309	2,687,524	2,572,306	
Temperature (°F)	1,088	1,112	1,083	
Molecular weight	28.50	28.42	28.26	
Volume flow (acfm)- calculated	1,864,103	1,808,271	1,708,519	
- provided				
Fuel Usage				
Fuel usage (lb/hr)= Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu (Fuel Heat Content, Btu/lb (LHV))				
Heat input (MMBtu/hr, LHV)	1,214	1,154	1,061	
Heat content (Btu/lb, LHV)	21,038	21,038	21,038	
Fuel usage (lb/hr)- calculated	57,690	54,830	50,440	
- provided	57,690	54,830	50,440	
Heat content (Btu/cf, LHV)	920	920	920	
Fuel density (lb/ft^3)	0.0437	0.0437	0.0437	
Fuel usage (cf/hr)- calculated	1,319,220	1,253,819	1,153,431	
Stack and Exit Gas Conditions- HRSG				
Stack height (ft)	125	125	125	
Diameter (ft)	19.0	19.0	19.0	
Temperature (°F)	190	190	190	
HRSG- Volume flow (acfm)= CT Volume flow (acfm) x [(HRSG Temp. (°F) + 460 K) / (CT Temp. (°F) + 460)]				
CT Volume flow (acfm)	1,864,103	1,808,271	1,708,519	
CT Temperature (°F)	1,088	1,112	1,083	
HRSG Temperature (°F)	190	190	190	
HRSG Volume flow (acfm)	782,731	747,695	719,726	
Velocity (ft/sec)= Volume flow (acfm) / [((diameter)^2 /4) x 3.14159] / 60 sec/min				
Volume flow (acfm)	782,731	747,695	719,726	
Diameter (ft)	19.0	19.0	19.0	
Velocity (ft/sec)- calculated	46.0	44.0	42.3	

Source: Siemens-Westinghouse, 2000.

Note: Universal gas constant= 1,545 ft-lb(force)/°R; atmospheric pressure= 2,116.8 lb(force)/ft^2

Table A-10. Maximum Emissions for Criteria and Other Regulated Pollutants for the FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, 60% Load

Parameter	Ambient/Compressor Inlet Temperature 20 °F	59 °F	90 °F
Hours of Operation	3,000	3,000	3,000
Particulate from CT and SCR			
Particulate (lb/hr)= Emission rate (lb/hr) from manufacturer (front- and back-half)			
Basis, lb/hr (a)	5.3	5.1	4.8
Particulate from SCR= Sulfur trioxide (formed from conversion of SO_2) converts to ammonium sulfate (=PM10)			
Particulate from conversion of SO_2= SO_2 emissions (lb/hr) x Conversion SO_2 to SO_3 x lb SO_3/lb SO_2 x Conversion of SO_3 x lb SO_3 to $(NH_4)_2SO_4$ x $(NH_4)_2SO_4$/ lb SO_3			
SO_2 emission rate (lb/hr)- calculated	3.8	3.6	3.3
Conversion (%) from SO_2 to SO_3	10	10	10
MW SO_3/ SO_2(80/64)	1.3	1.3	1.3
	100	100	100
MW $(NH_4)_2SO_4$/ SO_3 (132/80)	1.7	1.7	1.7
Particulate (lb/hr)- calculated	0.78	0.74	0.68
Particulate (lb/hr) from CT + SCR	6.1	5.8	5.5
(TPY)	9.1	8.8	8.2
Sulfur Dioxide (lb/hr)= Natural gas (cf/hr) x sulfur content(gr/100 cf) x 1 lb/7000 gr x (lb SO_2/lb S)/100			
Fuel use (cf/hr)	1,319,220	1,253,819	1,153,431
Sulfur content (grains/ 100 cf) - assumed (b)	1	1	1
lb SO_2/lb S (64/32)	2	2	2
Emission rate (lb/hr)- calculated	3.8	3.6	3.3
(lb/hr)- provided (1 gr/100 cf)	3.75	3.56	3.27
(TPY)	5.7	5.4	4.9
Nitrogen Oxides (lb/hr)= NOx(ppm) x ([20.9 x (1 - Moisture(%)/100)] - Oxygen(%)) x 2116.8 x Volume flow (acfm) x 46 (mole. wgt NOx) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 5.9 x 1,000,000 (adj. for ppm)]			
Basis, ppmvd @15% O_2 (a) (d)	3.5	3.5	3.5
Moisture (%)	7.18	7.89	9.17
Oxygen (%)	13.18	13.08	13.08
Volume Flow (acfm)	1,864,103	1,808,271	1,708,519
Temperature (°F)	1,088	1,112	1,083
Emission rate (lb/hr)- calculated	16.8	15.9	14.7
(lb/hr)- provided	16.8	15.9	14.6
(TPY)	25.2	23.9	21.9
[Ratio lb/hr provided/calculated]	1.000	0.999	0.996
Carbon Monoxide (lb/hr)= CO(ppm) x ([20.9 x (1 - Moisture(%)/100)] - Oxygen(%)) x 2116.8 lb/ft2 x Volume flow (acfm) x 28 (mole. wgt CO) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 1,000,000 (adj. for ppm)]			
Basis, ppmvd- calculated	56.8	56.8	55.1
Basis, ppmvd @ 15% O2- calculated	50	50	50
- provided (a)	50	50	50
Moisture (%)	7.18	7.89	9.17
Oxygen (%)	13.18	13.08	13.08
Volume Flow (acfm)	1,864,103	1,808,271	1,708,519
Temperature (°F)	1,088	1,112	1,083
Emission rate (lb/hr)- calculated from given ppm	146.1	138.5	127.5
(lb/hr)- provided	154.0	146.0	134.0
(TPY)	231.0	219.0	201.0
[Ratio lb/hr provided/calculated]	1.054	1.054	1.051
VOCs (lb/hr)= VOC(ppm) x [1 - Moisture(%)/ 100] x 2116.8 lb/ft2 x Volume flow (acfm) x 16 (mole. wgt as methane) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 1,000,000 (adj. for ppm)]			
Basis, ppmvd (as CH_4)- calculated	3.4	3.4	3.3
Basis, ppmvd @ 15% O2- calculated	3.0	3.0	3.0
- provided (a) (c)	3.0	3.0	3.0
Moisture (%)	7.18	7.89	9.17
Oxygen (%)	13.18	13.08	13.08
Volume Flow (acfm)	1,864,103	1,808,271	1,708,519
Temperature (°F)	1,088	1,112	1,083
Emission rate (lb/hr)- calculated	5.0	4.7	4.4
(lb/hr)- provided	5.3	5.0	4.6
(TPY)	8.0	7.5	6.9
[Ratio lb/hr provided/calculated]	1.058	1.053	1.052
Lead (lb/hr)= NA			
Emission Rate Basis	NA	NA	NA
Emission rate (lb/hr)	NA	NA	NA
(TPY)	NA	NA	NA
Mercury (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu (c)	8.00E-04	8.00E-04	8.00E-04
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	1.08E-06	1.02E-06	9.42E-07
(TPY)	1.62E-06	1.54E-06	1.41E-06
Sulfuric Acid Mist = SO2 emission rate (lb/hr) x conversion rate of SO2 to H_2SO_4 (%) x MW H_2SO_4/MW SO_3 (98/64)			
SO2 emission rate (lb/hr)	3.8	3.6	3.3
lb H_2SO_4/lb SO_2 (98/64)	1.53	1.53	1.53
Conversion to H_2SO_4 (%) (b)	10	10	10
Emission Rate (lb/hr)	0.58	0.55	0.50
(TPY)	0.87	0.82	0.76

Source: (a) Siemens-Westinghouse, 2000.
(b) Golder Associates Inc. 2000 .
(c) Electric Power Research Institute (EPRI), Electric Utility Trace Substances Report, 1994 (Table B-12) .
(d) For NOx emissions, data originally provided at 25 ppmvd at 15% oxygen.

Table A-11. Maximum Emissions for Other Regulated PSD Pollutants for the FPC HInes Energy Center
Siemens-Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, 60% Load

Parameter	Ambient/Compressor Inlet Temperature 20 °F	59 °F	90 °F
Hours of Operation	3,000	3,000	3,000
2,3,7,8 TCDD Equivalents (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	1.20E-06	1.20E-06	1.20E-06
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	1.62E-09	1.54E-09	1.41E-09
(TPY)	2.42E-09	2.30E-09	2.12E-09
Beryllium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00
Fluoride (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00

Source: Electric Power Research Institute (EPRI), Electric Utility Trace Substances Report, 1994 (Table B-12) .
Emission factors for metals are questionable and not used .

Table A-12. Maximum Emissions for Hazardous Air Pollutants for the FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NOx Combustor, Natural Gas, 60% Load

Parameter	Ambient/Compressor Inlet Temperature 20 °F	59 °F	90 °F
Hours of Operation	3,000	3,000	3,000
Antimony (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00
Benzene (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	8.00E-01	8.00E-01	8.00E-01
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	1.08E-03	1.02E-03	9.42E-04
(TPY)	1.62E-03	1.54E-03	1.41E-03
Cadmium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00
Chromium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00
Formaldehyde (lb/hr) = 10% of VOC lb/hr			
Emission Rate, lb/10^{12} Btu	3.94E+02	3.94E+02	3.94E+02
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	5.30E-01	5.04E-01	4.63E-01
(TPY)	7.95E-01	7.56E-01	6.95E-01
Cobalt (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00
Manganese (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00
Nickel (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00
Phosphorous (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00
Selenium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	0.00E+00	0.00E+00	0.00E+00
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	0.00E+00	0.00E+00	0.00E+00
(TPY)	0.00E+00	0.00E+00	0.00E+00
Toluene (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu			
Basis, lb/10^{12} Btu	1.00E+01	1.00E+01	1.00E+01
Heat Input Rate (MMBtu/hr)	1,347	1,280	1,178
Emission Rate (lb/hr)	1.35E-02	1.28E-02	1.18E-02
(TPY)	2.02E-02	1.92E-02	1.77E-02

Source: Electric Power Research Institute (EPRI), Electric Utility Trace Substances Report, 1994 (Table B-12).
Emission factors for metals are questionable and not used.

Table A-13. Design Information and Stack Parameters for FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NO_X Combustor, Distillate, 100 % Load

Parameter		Turbine Inlet Temperature 20 °F	59 °F	72 °F	105 °F
Combustion Turbine Performance					
Gross power output (MW) - Estimated		191.9	184.5	178.4	163.1
Gross heat rate (Btu/kWh, LHV) - Calculated		9,513	9,101	9,109	9,094
(Btu/kWh, HHV) - Calculated		10,945	10,470	10,480	10,463
Heat Input (MMBtu/hr, LHV) - Calculated		1,825	1,679	1,625	1,483
(MMBtu/hr, HHV) - Calculated		2,100	1,932	1,870	1,707
(MMBtu/hr, HHV) - Provided		2,100	1,932	1,870	1,707
Fuel heating value (Btu/lb, LHV)		17,290	17,290	17,290	17,290
(Btu/lb, HHV)		19,892	19,892	19,892	19,892
(HHV/LHV)		1.150	1.150	1.150	1.150
CT Exhaust Flow					
Mass Flow (lb/hr)		3,826,829	3,680,420	3,558,433	3,253,093
		3,826,829	3,680,420	3,558,433	3,253,093
Temperature (°F) - Estimated		1,070	1,100	1,110	1,130
Moisture (% Vol.)		7.12	7.74	8.79	11.04
Oxygen (% Vol.)		11.99	11.99	11.78	11.40
Molecular Weight		28.78	28.68	28.56	28.32
Fuel Usage					
Fuel usage (lb/hr) = Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu (Fuel Heat Content, Btu/lb (LHV))					
Heat input (MMBtu/hr, LHV)		1,825	1,679	1,625	1,483
Heat content (Btu/lb, LHV)		17,290	17,290	17,290	17,290
Fuel usage (lb/hr)- calculated		105,570	97,130	94,000	85,790
- provided		105,570	97,130	94,000	85,790
(gallons/hr) - calculated lb/gal=	7.1	14,869	13,680	13,239	12,083
HRSG Stack					
CT - Stack height (ft)		125	125	125	125
Diameter (ft)		19	19	19	19
Turbine Flow Conditions					
Turbine Flow (acfm) = [(Mass Flow (lb/hr) x 1,545 x (Temp. (°F)+ 460°F)] / [Molecular weight x 2116.8] / 60 min/hr					
Mass flow (lb/hr)		3,826,829	3,680,420	3,558,433	3,253,093
Temperature (°F)		1,070	1,100	1,110	1,130
Molecular weight		28.78	28.68	28.56	28.32
Volume flow (acfm)- calculated		2,475,210	2,434,870	2,379,489	2,222,073
(ft3/s)- calculated		41,254	40,581	39,658	37,035
HRSG Stack Flow Conditions					
Velocity (ft/sec) = Volume flow (acfm) / [((diameter)^2 /4) x 3.14159] / 60 sec/min					
CT Temperature (°F)		270	270	270	270
CT volume flow (acfm)		1,180,983	1,139,394	1,106,387	1,020,197
Diameter (ft)		19	19	19	19
Velocity (ft/sec)- calculated		69.4	67.0	65.0	60.0

Note: Universal gas constant = 1,545 ft-lb(force)/°R; atmospheric pressure = 2,116.8 lb(force)/ft^2; 14.7 lb/ft^3
Turbine inlet relative humidity is 20% at 35 °F, 60% at 59 and 75 °F, and 50% at 95 °F.
Source: Siemens/Westinghouse 2000,

Table A-14. Maximum Emissions for Criteria Pollutants for FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NO_X Combustor, Distillate, 100 % Load

Parameter	Turbine Inlet Temperature 20 °F	59 °F	72 °F	105 °F
Hours of Operation	1,000	1,000	1,000	1,000
Particulate (lb/hr) = Emission rate (lb/hr) from manufacturer				
Basis (excludes H_2SO_4), lb/hr	43	39.6	38.3	34.8
Emission rate (lb/hr)- provided	43.0	39.6	38.3	34.8
Particulate from SCR= Sulfur trioxide (formed from conversion of SO_2) converts to ammonium sulfate (=PM_{10})				
Particulate from conversion of SO_2= SO_2 emissions (lb/hr) x Conversion SO_2 to SO_3 x lb SO_3/lb SO_2 x Conversion of SO_3 x lb SO_3 to $(NH_4)_2SO_4$ x $(NH_4)_2SO_4$/ lb SO_3				
SO_2 emission rate (lb/hr)- calculated	105.6	97.1	94.0	85.8
Conversion (%) from SO_2 to SO_3	10	10	10	10
MW SO_3/ SO_2 (80/64)	1.3	1.3	1.3	1.3
Conversion (%) from SO_3 to $(NH_4)_2(SO_4)$	100	100	100	100
MW $(NH_4)_2SO_4$/ SO_3 (132/80)	1.7	1.7	1.7	1.7
Particulate (lb/hr)- calculated	21.77	20.03	19.39	17.69
Particulate (lb/hr) from CT + SCR	64.8	59.6	57.7	52.5
Particulate (tons/year) from CT + SCR	32.4	29.8	28.8	26.2
Sulfur Dioxide (lb/hr) = Natural gas (lb/hr) x sulfur content (%/100) x (lb SO_2/lb S)				
Fuel Sulfur Content	0.05%	0.05%	0.05%	0.05%
Fuel use (lb/hr)	105,570	97,130	94,000	85,790
lb SO_2/lb S (64/32)	2	2	2	2
Emission rate (lb/hr) - calculated	105.6	97.1	94.0	85.8
- provided	95	95	94	86
(TPY)	52.79	48.57	47.00	42.90
Nitrogen Oxides (lb/hr) = NO_X(ppm) x {[20.9 x (1 - Moisture(%)/100)] - Oxygen(%)} x 2116.8 x Volume flow (acfm) x 46 (mole. wgt NOx) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 5.9 x 1,000,000 (adj. for ppm)]				
Basis, ppmvd @15% O_2	12	12	12	12
Moisture (%)	7.12	7.74	8.79	11.04
Oxygen (%)	11.99	11.99	11.78	11.4
Turbine Flow (acfm)	1,180,983	1,139,394	1,106,387	1,020,197
Turbine Exhaust Temperature (°F)	270	270	270	270
Emission rate (lb/hr) - calculated	92.3	87.5	84.9	77.3
- provided	92.3	87.5	84.9	77.3
(TPY)	46.2	43.8	42.4	38.7
Carbon Monoxide (lb/hr) = CO(ppm) x [1 - Moisture(%)/100] x 2116.8 lb/ft2 x Volume flow (acfm) x 28 (mole. wgt CO) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 1,000,000 (adj. for ppm)]				
Basis, ppmvd	30	30	30	30
Moisture (%)	7.12	7.74	8.79	11.04
Turbine Flow (acfm)	1,180,983	1,139,394	1,106,387	1,020,197
Turbine Exhaust Temperature (°F)	270	270	270	270
Emission rate (lb/hr) - calculated	103.8	99.4	95.5	85.8
- provided	112.0	106.0	102.0	91.0
(TPY)	56.0	53.0	51.0	45.5
VOCs (lb/hr) = VOC(ppmvw) x 2116.8 lb/ft2 x Volume flow (acfm) x 16 (mole. wgt as methane) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 1,000,000 (adj. for ppm)]				
Basis, ppmvw	10	10	10	10
Turbine Flow (acfm)	1,180,983	2,434,870	2,379,489	2,222,073
Turbine Exhaust Temperature (°F)	270	1,100	1,110	1,130
Emission rate (lb/hr) - calculated	21.28	20.53	19.93	18.38
- provided	22.0	21.0	21.0	19.0
(TPY)	11.0	10.5	10.5	9.5
Lead (lb/hr)= NA				
Emission Rate Basis (lb/10^{12} Btu)	10.8	10.8	10.8	10.8
Emission rate (lb/hr)	0.0227	0.0209	0.0202	0.0184
(TPY)	0.0113	0.0104	0.0101	0.0092

Note: ppmvd= parts per million, volume dry; O_2= oxygen.

Source: Siemens/Westinghouse, 2000; Golder Associates, 2000; EPA, 1996 (AP-42 draft revisions)

Table A-15. Maximum Emissions for Other Regulated PSD Pollutants for FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NO_X Combustor, Distillate, 100 % Load

Hours of Operation	1,000	1,000	1,000	1,000
2,3,7,8 TCDD Equivalents (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a] , lb/10^{12} Btu	3.80E-04	3.80E-04	3.80E-04	3.80E-04
Heat Input Rate (MMBtu/hr)	2.10E+03	1.93E+03	1.87E+03	1.87E+03
Emission Rate (lb/hr)	7.98E-07	7.34E-07	7.11E-07	7.11E-07
(TPY)	3.99E-07	3.67E-07	3.55E-07	3.55E-07
Beryllium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a] , lb/10^{12} Btu	0.331	0.331	0.331	0.331
Heat Input Rate (MMBtu/hr)	2,100	1,932	1,870	1,870
Emission Rate (lb/hr)	6.95E-04	6.40E-04	6.19E-04	6.19E-04
(TPY)	3.48E-04	3.20E-04	3.09E-04	3.09E-04
Fluoride (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [b] , lb/10^{12} Btu	32.54	32.54	32.54	32.54
Heat Input Rate (MMBtu/hr)	2,100	1,932	1,870	1,870
Emission Rate (lb/hr)	6.83E-02	6.29E-02	6.08E-02	6.08E-02
(TPY)	3.42E-02	3.14E-02	3.04E-02	3.04E-02
Hydrogen Chloride (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [c] , lb/10^{12} Btu	2.07E+02	2.07E+02	2.07E+02	2.07E+02
Heat Input Rate (MMBtu/hr)	2,100	1,932	1,870	1,870
Emission Rate (lb/hr)	4.34E-01	3.99E-01	3.87E-01	3.87E-01
(TPY)	2.17E-01	2.00E-01	1.93E-01	1.93E-01
Mercury (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a] , lb/10^{12} Btu	6.26E-01	6.26E-01	6.26E-01	6.26E-01
Heat Input Rate (MMBtu/hr)	2,100	1,932	1,870	1,870
Emission Rate (lb/hr)	1.31E-03	1.21E-03	1.17E-03	1.17E-03
(TPY)	6.57E-04	6.05E-04	5.85E-04	5.85E-04
Sulfuric Acid Mist = Fuel Use (lb/hr) x sulfur (S) content (fraction) x conversion of S to H_2SO_4 (%) x MW H_2SO_4 /MW S (98/32)				
Fuel Usage (cf/hr)	105,570	97,130	94,000	85,790
Sulfur (lb/hr)	52.79	48.57	47.00	42.90
lb H_2SO_4 /lb S (98/32)	3.0625	3.0625	3.0625	3.0625
Conversion to H_2SO_4 (%) (d)	10	10	10	10
Emission Rate (lb/hr)	16.17	14.87	14.39	13.14
(TPY)	8.08	7.44	7.20	6.57

Sources: [a] EPA, 1998 (AP-42 draft revisions)
[b] EPA, 1981
[c] 4 ppm assumed based on ASTM D2880
[d] assumed based on combustion estimates from GE

Table A-16. Maximum Emissions for Hazardous Air Pollutants for FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NO_X Combustor, Distillate, 100 % Load

Parameter	0 0	0	0	0
Hours of Operation	1,000	1,000	1,000	1,000
Arsenic (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	7.91E+00	7.91E+00	7.91E+00	7.91E+00
Heat Input Rate (MMBtu/hr)	2,100	1,932	1,870	1,870
Emission Rate (lb/hr)	1.66E-02	1.53E-02	1.48E-02	1.48E-02
(TPY)	8.31E-03	7.64E-03	7.40E-03	7.40E-03
Benzene (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	1.1	1.1	1.1	1.1
Heat Input Rate (MMBtu/hr)	2,100	1,932	1,870	1,870
Emission Rate (lb/hr)	2.31E-03	2.13E-03	2.06E-03	2.06E-03
(TPY)	1.15E-03	1.06E-03	1.03E-03	1.03E-03
Cadmium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	3.24	3.24	3.24	3.24
Heat Input Rate (MMBtu/hr)	2,100	1,932	1,870	1,870
Emission Rate (lb/hr)	6.80E-03	6.26E-03	6.06E-03	6.06E-03
(TPY)	3.40E-03	3.13E-03	3.03E-03	3.03E-03
Chromium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	6.76	6.76	6.76	6.76
Heat Input Rate (MMBtu/hr)	2,100	1,932	1,870	1,870
Emission Rate (lb/hr)	1.42E-02	1.31E-02	1.26E-02	1.26E-02
(TPY)	7.10E-03	6.53E-03	6.32E-03	6.32E-03
Formaldehyde (lb/hr) = 10% of VOC lb/hr				
Emission Rate, lb/10^{12} Btu	1.05E+03	1.05E+03	1.05E+03	1.05E+03
Heat Input Rate (MMBtu/hr)	2,100	1,932	1,870	1,870
Emission Rate (lb/hr)	2.20E+00	2.02E+00	1.96E+00	1.96E+00
(TPY)	1.10E+00	1.01E+00	9.79E-01	9.79E-01
Cobalt (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [b], lb/10^{12} Btu	37	37	37	37
Heat Input Rate (MMBtu/hr)	2.10E+03	1.93E+03	1.87E+03	1.87E+03
Emission Rate (lb/hr)	7.77E-02	7.15E-02	6.92E-02	6.92E-02
(TPY)	3.88E-02	3.57E-02	3.46E-02	3.46E-02
Manganese (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	432	432	432	432
Heat Input Rate (MMBtu/hr)	2,100	1,932	1,870	1,870
Emission Rate (lb/hr)	9.07E-01	8.35E-01	8.08E-01	8.08E-01
(TPY)	4.54E-01	4.17E-01	4.04E-01	4.04E-01
Nickel (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [b], lb/10^{12} Btu	86.3	86.3	86.3	86.3
Heat Input Rate (MMBtu/hr)	2,100	1,932	1,870	1,870
Emission Rate (lb/hr)	1.81E-01	1.67E-01	1.61E-01	1.61E-01
(TPY)	9.06E-02	8.34E-02	8.07E-02	8.07E-02
Phosphorous (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [b], lb/10^{12} Btu	3.00E+02	3.00E+02	3.00E+02	3.00E+02
Heat Input Rate (MMBtu/hr)	2,100	1,932	1,870	1,870
Emission Rate (lb/hr)	0.629999532	0.579632988	0.5609544	0.5609544
(TPY)	0.314999766	0.289816494	0.2804772	0.2804772
Selenium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	23	23	23	23
Heat Input Rate (MMBtu/hr)	2,100	1,932	1,870	1,870
Emission Rate (lb/hr)	4.83E-02	4.44E-02	4.30E-02	4.30E-02
(TPY)	2.41E-02	2.22E-02	2.15E-02	2.15E-02
Toluene (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	237	237	237	237
Heat Input Rate (MMBtu/hr)	2,100	1,932	1,870	1,870
Emission Rate (lb/hr)	4.98E-01	4.58E-01	4.43E-01	4.43E-01
(TPY)	2.49E-01	2.29E-01	2.22E-01	2.22E-01

Sources: [a] EPA, 1998 (AP-42 draft revisions)
[b] EPA,1996 (AP-42,Table 3.1-4)

Table A-17. Design Information and Stack Parameters for FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NO_X Combustor, Distillate, 80 % Load

Parameter		Turbine Inlet Temperature 20 °F	59 °F	72 °F	105 °F
Combustion Turbine Performance					
Gross power output (MW) - Estimated		153.5	147.6	142.7	130.5
Gross heat rate (Btu/kWh, LHV) - Calculated		9,642	9,295	9,335	9,412
(Btu/kWh, HHV) - Calculated		10,707	10,321	10,366	10,452
Heat Input (MMBtu/hr, LHV) - Calculated		1,480	1,372	1,332	1,228
(MMBtu/hr, HHV) - Calculated		1,644	1,524	1,480	1,364
(MMBtu/hr, HHV) - Provided		1,644	1,524	1,480	1,364
Fuel heating value (Btu/lb, LHV)		17,290	17,290	17,290	17,290
(Btu/lb, HHV)		19,200	19,200	19,200	19,200
(HHV/LHV)		1.110	1.110	1.110	1.110
CT Exhaust Flow					
Mass Flow (lb/hr)		3,800,715	3,589,967	3,459,546	3,179,611
		3,800,715	3,589,967	3,459,546	3,179,611
Temperature (°F) - Estimated		1,120	1,140	1,150	1,170
Moisture (% Vol.)		5.85	6.53	7.6	9.9
Oxygen (% Vol.)		13.42	13.38	13.17	12.73
Molecular Weight		28.81	28.73	28.61	28.36
Fuel Usage					
Fuel usage (lb/hr) = Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu (Fuel Heat Content, Btu/lb (LHV))					
Heat input (MMBtu/hr, LHV)		1,480	1,372	1,332	1,228
Heat content (Btu/lb, LHV)		17,290	17,290	17,290	17,290
Fuel usage (lb/hr)- calculated		85,600	79,360	77,060	71,030
- provided		85,600	79,360	77,060	71,030
(gallons/hr) - calculated lb/gal=	7.1	12,056	11,177	10,854	10,004
HRSG Stack					
CT - Stack height (ft)		125	125	125	125
Diameter (ft)		19	19	19	19
Turbine Flow Conditions					
Turbine Flow (acfm) = [(Mass Flow (lb/hr) x 1,545 x (Temp. (°F)+ 460°F)] / [Molecular weight x 2116.8] / 60 min/hr					
Mass flow (lb/hr)		3,800,715	3,589,967	3,459,546	3,179,611
Temperature (°F)		1,120	1,140	1,150	1,170
Molecular weight		28.81	28.73	28.61	28.36
Volume flow (acfm)- calculated		2,535,697	2,431,994	2,368,159	2,223,331
(ft3/s)- calculated		42,262	40,533	39,469	37,056
HRSG Stack Flow Conditions					
Velocity (ft/sec) = Volume flow (acfm) / [((diameter)^2 /4) x 3.14159] / 60 sec/min					
CT Temperature (°F)		270	270	270	270
CT volume flow (acfm)		1,171,556	1,109,597	1,073,761	995,725
Diameter (ft)		19	19	19	19
Velocity (ft/sec)- calculated		68.9	65.2	63.1	58.5

Note: Universal gas constant = 1,545 ft-lb(force)/°R; atmospheric pressure = 2,116.8 lb(force)/ft^2; 14.7 lb/ft^3
Turbine inlet relative humidity is 20% at 35 °F, 60% at 59 and 75 °F, and 50% at 95 °F.
Source: Siemens/Westinghouse 2000,

Table A-18. Maximum Emissions for Criteria Pollutants for FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NO_x Combustor, Distillate, 80 % Load

Parameter	Turbine Inlet Temperature 20 °F	59 °F	72 °F	105 °F
Hours of Operation	1,000	1,000	1,000	1,000
Particulate (lb/hr) = Emission rate (lb/hr) from manufacturer				
Basis (excludes H_2SO_4), lb/hr	34.7	32.2	31.2	29.7
Emission rate (lb/hr)- provided	34.7	32.2	31.2	29.7
Particulate from SCR= Sulfur trioxide (formed from conversion of SO_2) converts to ammonium sulfate (=PM_{10})				
Particulate from conversion of SO_2= SO_2 emissions (lb/hr) x Conversion SO_2 to SO_3 x lb SO_3/lb SO_2 x Conversion of SO_3 x lb SO_3 to $(NH_4)_2SO_4$ x $(NH_4)_2SO_4$/ lb SO_3				
SO_2 emission rate (lb/hr)- calculated	85.6	79.4	77.1	71.0
Conversion (%) from SO_2 to SO_3	10	10	10	10
MW SO_3/ SO_2 (80/64)	1.3	1.3	1.3	1.3
Conversion (%) from SO_3 to $(NH_4)_2(SO_4)$	100	100	100	100
MW $(NH_4)_2SO_4$/ SO_3 (132/80)	1.7	1.7	1.7	1.7
Particulate (lb/hr)- calculated	17.66	16.37	15.89	14.65
Particulate (lb/hr) from CT + SCR	52.4	48.6	47.1	44.3
Particulate (tons/year) from CT + SCR	26.2	24.3	23.5	22.2
Sulfur Dioxide (lb/hr) = Natural gas (lb/hr) x sulfur content (%/100) x (lb SO_2/lb S)				
Fuel Sulfur Content	0.05%	0.05%	0.05%	0.05%
Fuel use (lb/hr)	85,600	79,360	77,060	71,030
lb SO_2/lb S (64/32)	2	2	2	2
Emission rate (lb/hr) - calculated	85.6	79.4	77.1	71.0
- provided	86	79	77	71
(TPY)	42.80	39.68	38.53	35.52
Nitrogen Oxides (lb/hr) = NOx(ppm) x {[20.9 x (1 - Moisture(%)/100)] - Oxygen(%)} x 2116.8 x Volume flow (acfm) x 46 (mole. wgt NOx) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 5.9 x 1,000,000 (adj. for ppm)]				
Basis, ppmvd @15% O_2	12	12	12	12
Moisture (%)	5.85	6.53	7.6	9.9
Oxygen (%)	13.42	13.38	13.17	12.73
Turbine Flow (acfm)	1,171,556	1,109,597	1,073,761	995,725
Turbine Exhaust Temperature (°F)	270	270	270	270
Emission rate (lb/hr) - calculated	77.2	72.0	69.5	64.0
- provided	77.2	72.0	69.5	64.0
(TPY)	38.6	36.0	34.7	32.0
Carbon Monoxide (lb/hr) = CO(ppm) x [1 - Moisture(%)/100] x 2116.8 lb/ft2 x Volume flow (acfm) x 28 (mole. wgt CO) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 1,000,000 (adj. for ppm)]				
Basis, ppmvd	30	30	30	30
Moisture (%)	5.85	6.53	7.6	9.9
Turbine Flow (acfm)	1,171,556	1,109,597	1,073,761	995,725
Turbine Exhaust Temperature (°F)	270	270	270	270
Emission rate (lb/hr) - calculated	104.3	98.1	93.9	84.9
- provided	111.0	103.0	100.0	89.0
(TPY)	55.5	51.5	50.0	44.5
VOCs (lb/hr) = VOC(ppmvw) x 2116.8 lb/ft2 x Volume flow (acfm) x 16 (mole. wgt as methane) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 1,000,000 (adj. for ppm)]				
Basis, ppmvw	10	10	10	10
Turbine Flow (acfm)	1,171,556	2,431,994	2,368,159	2,223,331
Turbine Exhaust Temperature (°F)	270	1,140	1,150	1,170
Emission rate (lb/hr) - calculated	21.11	19.99	19.35	17.94
- provided	21.0	22.0	21.0	19.0
(TPY)	10.5	11.0	10.5	9.5
Lead (lb/hr)= NA				
Emission Rate Basis (lb/10^{12} Btu)	10.8	10.8	10.8	10.8
Emission rate (lb/hr)	0.0178	0.0165	0.0160	0.0147
(TPY)	0.0089	0.0082	0.0080	0.0074

Note: ppmvd= parts per million, volume dry; O_2= oxygen.

Source: Siemens/Westinghouse, 2000; Golder Associates, 2000; EPA, 1996 (AP-42 draft revisions)

Table A-19. Maximum Emissions for Other Regulated PSD Pollutants for FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NO_X Combustor, Distillate, 80 % Load

Parameter	Turbine Inlet Temperature 20 °F	59 °F	72 °F	105 °F
Hours of Operation	1,000	1,000	1,000	1,000
2,3,7,8 TCDD Equivalents (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	3.80E-04	3.80E-04	3.80E-04	3.80E-04
Heat Input Rate (MMBtu/hr)	1.64E+03	1.52E+03	1.48E+03	1.48E+03
Emission Rate (lb/hr)	6.25E-07	5.79E-07	5.62E-07	5.62E-07
(TPY)	3.12E-07	2.90E-07	2.81E-07	2.81E-07
Beryllium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	0.331	0.331	0.331	0.331
Heat Input Rate (MMBtu/hr)	1,644	1,524	1,480	1,480
Emission Rate (lb/hr)	5.44E-04	5.04E-04	4.90E-04	4.90E-04
(TPY)	2.72E-04	2.52E-04	2.45E-04	2.45E-04
Fluoride (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [b], lb/10^{12} Btu	32.54	32.54	32.54	32.54
Heat Input Rate (MMBtu/hr)	1,644	1,524	1,480	1,480
Emission Rate (lb/hr)	5.35E-02	4.96E-02	4.81E-02	4.81E-02
(TPY)	2.67E-02	2.48E-02	2.41E-02	2.41E-02
Hydrogen Chloride (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [c], lb/10^{12} Btu	2.14E+02	2.14E+02	2.14E+02	2.14E+02
Heat Input Rate (MMBtu/hr)	1,644	1,524	1,480	1,480
Emission Rate (lb/hr)	3.52E-01	3.26E-01	3.17E-01	3.17E-01
(TPY)	1.76E-01	1.63E-01	1.58E-01	1.58E-01
Mercury (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	6.26E-01	6.26E-01	6.26E-01	6.26E-01
Heat Input Rate (MMBtu/hr)	1,644	1,524	1,480	1,480
Emission Rate (lb/hr)	1.03E-03	9.54E-04	9.26E-04	9.26E-04
(TPY)	5.14E-04	4.77E-04	4.63E-04	4.63E-04
Sulfuric Acid Mist = Fuel Use (lb/hr) x sulfur (S) content (fraction) x conversion of S to H_2SO_4 (%) x MW H_2SO_4 /MW S (98/32)				
Fuel Usage (cf/hr)	85,600	79,360	77,060	71,030
Sulfur (lb/hr)	42.80	39.68	38.53	35.52
lb H_2SO_4 /lb S (98/32)	3.0625	3.0625	3.0625	3.0625
Conversion to H_2SO_4 (%) [d]	10	10	10	10
Emission Rate (lb/hr)	13.11	12.15	11.80	10.88
(TPY)	6.55	6.08	5.90	5.44

Sources: [a] EPA, 1998 (AP-42 draft revisions)
[b] EPA, 1981
[c] 4 ppm assumed based on ASTM D2880
[d] assumed based on combustion estimates from GE

Table A-20. Maximum Emissions for Hazardous Air Pollutants for FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NO_X Combustor, Distillate, 80 % Load

Parameter	Turbine Inlet Temperature 20 °F	59 °F	72 °F	105 °F
Hours of Operation	1,000	1,000	1,000	1,000
Arsenic (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	7.91E+00	7.91E+00	7.91E+00	7.91E+00
Heat Input Rate (MMBtu/hr)	1,644	1,524	1,480	1,480
Emission Rate (lb/hr)	1.30E-02	1.21E-02	1.17E-02	1.17E-02
(TPY)	6.50E-03	6.03E-03	5.85E-03	5.85E-03
Benzene (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	1.1	1.1	1.1	1.1
Heat Input Rate (MMBtu/hr)	1,644	1,524	1,480	1,480
Emission Rate (lb/hr)	1.81E-03	1.68E-03	1.63E-03	1.63E-03
(TPY)	9.04E-04	8.38E-04	8.14E-04	8.14E-04
Cadmium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	3.24	3.24	3.24	3.24
Heat Input Rate (MMBtu/hr)	1,644	1,524	1,480	1,480
Emission Rate (lb/hr)	5.33E-03	4.94E-03	4.79E-03	4.79E-03
(TPY)	2.66E-03	2.47E-03	2.40E-03	2.40E-03
Chromium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	6.76	6.76	6.76	6.76
Heat Input Rate (MMBtu/hr)	1,644	1,524	1,480	1,480
Emission Rate (lb/hr)	1.11E-02	1.03E-02	1.00E-02	1.00E-02
(TPY)	5.56E-03	5.15E-03	5.00E-03	5.00E-03
Formaldehyde (lb/hr) = 10% of VOC lb/hr				
Emission Rate, lb/10^{12} Btu	1.28E+03	1.28E+03	1.28E+03	1.28E+03
Heat Input Rate (MMBtu/hr)	1,644	1,524	1,480	1,480
Emission Rate (lb/hr)	2.10E+00	1.95E+00	1.89E+00	1.89E+00
(TPY)	1.05E+00	9.73E-01	9.45E-01	9.45E-01
Cobalt (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [b], lb/10^{12} Btu	37	37	37	37
Heat Input Rate (MMBtu/hr)	1.64E+03	1.52E+03	1.48E+03	1.48E+03
Emission Rate (lb/hr)	6.08E-02	5.64E-02	5.47E-02	5.47E-02
(TPY)	3.04E-02	2.82E-02	2.74E-02	2.74E-02
Manganese (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	432	432	432	432
Heat Input Rate (MMBtu/hr)	1,644	1,524	1,480	1,480
Emission Rate (lb/hr)	7.10E-01	6.58E-01	6.39E-01	6.39E-01
(TPY)	3.55E-01	3.29E-01	3.20E-01	3.20E-01
Nickel (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	86.3	86.3	86.3	86.3
Heat Input Rate (MMBtu/hr)	1,644	1,524	1,480	1,480
Emission Rate (lb/hr)	1.42E-01	1.31E-01	1.28E-01	1.28E-01
(TPY)	7.09E-02	6.57E-02	6.38E-02	6.38E-02
Phosphorous (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [b], lb/10^{12} Btu	3.00E+02	3.00E+02	3.00E+02	3.00E+02
Heat Input Rate (MMBtu/hr)	1,644	1,524	1,480	1,480
Emission Rate (lb/hr)	0.493056	0.4571136	0.4438656	0.4438656
(TPY)	0.246528	0.2285568	0.2219328	0.2219328
Selenium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	23	23	23	23
Heat Input Rate (MMBtu/hr)	1,644	1,524	1,480	1,480
Emission Rate (lb/hr)	3.78E-02	3.50E-02	3.40E-02	3.40E-02
(TPY)	1.89E-02	1.75E-02	1.70E-02	1.70E-02
Toluene (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	237	237	237	237
Heat Input Rate (MMBtu/hr)	1,644	1,524	1,480	1,480
Emission Rate (lb/hr)	3.90E-01	3.61E-01	3.51E-01	3.51E-01
(TPY)	1.95E-01	1.81E-01	1.75E-01	1.75E-01

Sources: [a] EPA, 1998 (AP-42 draft revisions)
[b] EPA,1996 (AP-42,Table 3.1-4)

Table A-21. Design Information and Stack Parameters for FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NO_X Combustor, Distillate, 65 % Load

Parameter		Turbine Inlet Temperature 20 °F	59 °F	72 °F	105 °F
Combustion Turbine Performance					
Gross power output (MW) - Estimated		124.7	119.9	116.0	106.0
Gross heat rate (Btu/kWh, LHV) - Calculated		9,997	9,733	9,834	10,036
(Btu/kWh, HHV) - Calculated		11,101	10,808	10,920	11,145
Heat Input (MMBtu/hr, LHV) - Calculated		1,247	1,167	1,140	1,064
(MMBtu/hr, HHV) - Calculated		1,385	1,296	1,266	1,182
(MMBtu/hr, HHV) - Provided		1,385	1,296	1,266	1,182
Fuel heating value (Btu/lb, LHV)		17,290	17,290	17,290	17,290
(Btu/lb, HHV)		19,200	19,200	19,200	19,200
(HHV/LHV)		1.110	1.110	1.110	1.110
CT Exhaust Flow					
Mass Flow (lb/hr)		3,491,217	3,298,903	3,219,964	3,009,818
		3,491,217	3,298,903	3,219,964	3,009,818
Temperature (°F) - Estimated		1,170	1,180	1,190	1,200
Moisture (% Vol.)		4.99	5.71	6.78	9.08
Oxygen (% Vol.)		14.12	14.04	13.83	13.41
Molecular Weight		28.87	28.79	28.66	28.41
Fuel Usage					
Fuel usage (lb/hr) = Heat Input (MMBtu/hr) x 1,000,000 Btu/MMBtu (Fuel Heat Content, Btu/lb (LHV))					
Heat input (MMBtu/hr, LHV)		1,247	1,167	1,140	1,064
Heat content (Btu/lb, LHV)		17,290	17,290	17,290	17,290
Fuel usage (lb/hr)- calculated		72,110	67,520	65,960	61,540
- provided		72,110	67,520	65,960	61,540
(gallons/hr) - calculated lb/gal=	7.1	10,156	9,510	9,290	8,668
HRSG Stack					
CT - Stack height (ft)		125	125	125	125
Diameter (ft)		19	19	19	19
Turbine Flow Conditions					
Turbine Flow (acfm) = [(Mass Flow (lb/hr) x 1,545 x (Temp. (°F)+ 460°F)] / [Molecular weight x 2116.8] / 60 min/hr					
Mass flow (lb/hr)		3,491,217	3,298,903	3,219,964	3,009,818
Temperature (°F)		1,170	1,180	1,190	1,200
Molecular weight		28.87	28.79	28.66	28.41
Volume flow (acfm)- calculated		2,397,803	2,286,301	2,255,019	2,139,484
(ft3/s)- calculated		39,963	38,105	37,584	35,658
HRSG Stack Flow Conditions					
Velocity (ft/sec) = Volume flow (acfm) / [((diameter)^2 /4) x 3.14159] / 60 sec/min					
CT Temperature (°F)		270	270	270	270
CT volume flow (acfm)		1,073,863	1,017,683	997,675	940,858
Diameter (ft)		19	19	19	19
Velocity (ft/sec)- calculated		63.1	59.8	58.6	55.3

Note: Universal gas constant = 1,545 ft-lb(force)/°R; atmospheric pressure = 2,116.8 lb(force)/ft^2; 14.7 lb/ft^3
Turbine inlet relative humidity is 20% at 35 °F, 60% at 59 and 75 °F, and 50% at 95 °F.
Source: Siemens/Westinghouse 2000,

Table A-22. Maximum Emissions for Criteria Pollutants for FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NO_x Combustor, Distillate, 65 % Load

Parameter	Turbine Inlet Temperature 20 °F	59 °F	72 °F	105 °F
Hours of Operation	1,000	1,000	1,000	1,000
Particulate (lb/hr) = Emission rate (lb/hr) from manufacturer				
Basis (excludes H_2SO_4), lb/hr	28.6	27	26.3	24.5
Emission rate (lb/hr)- provided	28.6	27.0	26.3	24.5
Particulate from SCR= Sulfur trioxide (formed from conversion of SO_2) converts to ammonium sulfate (=PM_{10})				
Particulate from conversion of SO_2= SO_2 emissions (lb/hr) x Conversion SO_2 to SO_3 x lb SO_3/lb SO_2 x Conversion of SO_3 x lb SO_3 to $(NH_4)_2SO_4$ x $(NH_4)_2SO_4$/ lb SO_3				
SO_2 emission rate (lb/hr)- calculated	72.1	67.5	66.0	61.5
Conversion (%) from SO_2 to SO_3	10	10	10	10
MW SO_3/ SO_2 (80/64)	1.3	1.3	1.3	1.3
Conversion (%) from SO_3 to $(NH_4)_2(SO_4)$	100	100	100	100
MW $(NH_4)_2SO_4$/ SO_3 (132/80)	1.7	1.7	1.7	1.7
Particulate (lb/hr)- calculated	14.87	13.93	13.60	12.69
Particulate (lb/hr) from CT + SCR	43.5	40.9	39.9	37.2
Particulate (tons/year) from CT + SCR	21.7	20.5	20.0	18.6
Sulfur Dioxide (lb/hr) = Natural gas (lb/hr) x sulfur content (%/100) x (lb SO_2 /lb S)				
Fuel Sulfur Content	0.05%	0.05%	0.05%	0.05%
Fuel use (lb/hr)	72,110	67,520	65,960	61,540
lb SO_2/lb S (64/32)	2	2	2	2
Emission rate (lb/hr) - calculated	72.1	67.5	66.0	61.5
- provided	72	68	66	62
(TPY)	36.06	33.76	32.98	30.77
Nitrogen Oxides (lb/hr) = NO_X(ppm) x {[20.9 x (1 - Moisture(%)/100)] - Oxygen(%)} x 2116.8 x Volume flow (acfm) x 46 (mole. wgt NO_X) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 5.9 x 1,000,000 (adj. for ppm)]				
Basis, ppmvd @15% O_2	12	12	12	12
Moisture (%)	4.99	5.71	6.78	9.08
Oxygen (%)	14.12	14.04	13.83	13.41
Turbine Flow (acfm)	1,073,863	1,017,683	997,675	940,858
Turbine Exhaust Temperature (°F)	270	270	270	270
Emission rate (lb/hr) - calculated	64.9	60.8	59.4	55.4
- provided	64.9	60.8	59.4	55.4
(TPY)	32.5	30.4	29.7	27.7
Carbon Monoxide (lb/hr) = CO(ppm) x [1 - Moisture(%)/100] x 2116.8 lb/ft2 x Volume flow (acfm) x 28 (mole. wgt CO) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 1,000,000 (adj. for ppm)]				
Basis, ppmvd	30	30	30	30
Moisture (%)	4.99	5.71	6.78	9.08
Turbine Flow (acfm)	1,073,863	1,017,683	997,675	940,858
Turbine Exhaust Temperature (°F)	270	270	270	270
Emission rate (lb/hr) - calculated	96.5	90.8	88.0	80.9
- provided	101.0	94.0	92.0	86.0
(TPY)	50.5	47.0	46.0	43.0
VOCs (lb/hr) = VOC(ppmvw) x 2116.8 lb/ft2 x Volume flow (acfm) x 16 (mole. wgt as methane) x 60 min/hr / [1545 x (CT temp.(°F) + 460°F) x 1,000,000 (adj. for ppm)]				
Basis, ppmvw	10	10	10	10
Turbine Flow (acfm)	1,073,863	2,286,301	2,255,019	2,139,484
Turbine Exhaust Temperature (°F)	270	1,180	1,190	1,200
Emission rate (lb/hr) - calculated	19.35	18.34	17.98	16.95
- provided	20.0	19.0	18.0	19.0
(TPY)	10.0	9.5	9.0	9.5
Lead (lb/hr)= NA				
Emission Rate Basis (lb/10^{12} Btu)	10.8	10.8	10.8	10.8
Emission rate (lb/hr)	0.0150	0.0140	0.0137	0.0128
(TPY)	0.0075	0.0070	0.0068	0.0064

Note: ppmvd= parts per million, volume dry; O_2= oxygen.

Source: Siemens/Westinghouse, 2000; Golder Associates, 2000; EPA, 1996 (AP-42 draft revisions)

Table A-23. Maximum Emissions for Other Regulated PSD Pollutants for FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NO_X Combustor, Distillate, 65 % Load

Parameter	Turbine Inlet Temperature 20 °F	59 °F	72 °F	105 °F
Hours of Operation	1,000	1,000	1,000	1,000
2,3,7,8 TCDD Equivalents (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	3.80E-04	3.80E-04	3.80E-04	3.80E-04
Heat Input Rate (MMBtu/hr)	1.38E+03	1.30E+03	1.27E+03	1.27E+03
Emission Rate (lb/hr)	5.26E-07	4.93E-07	4.81E-07	4.81E-07
(TPY)	2.63E-07	2.46E-07	2.41E-07	2.41E-07
Beryllium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	0.331	0.331	0.331	0.331
Heat Input Rate (MMBtu/hr)	1,385	1,296	1,266	1,266
Emission Rate (lb/hr)	4.58E-04	4.29E-04	4.19E-04	4.19E-04
(TPY)	2.29E-04	2.15E-04	2.10E-04	2.10E-04
Fluoride (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [b], lb/10^{12} Btu	32.54	32.54	32.54	32.54
Heat Input Rate (MMBtu/hr)	1,385	1,296	1,266	1,266
Emission Rate (lb/hr)	4.51E-02	4.22E-02	4.12E-02	4.12E-02
(TPY)	2.25E-02	2.11E-02	2.06E-02	2.06E-02
Hydrogen Chloride (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [c], lb/10^{12} Btu	2.14E+02	2.14E+02	2.14E+02	2.14E+02
Heat Input Rate (MMBtu/hr)	1,385	1,296	1,266	1,266
Emission Rate (lb/hr)	2.97E-01	2.78E-01	2.71E-01	2.71E-01
(TPY)	1.48E-01	1.39E-01	1.36E-01	1.36E-01
Mercury (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	6.26E-01	6.26E-01	6.26E-01	6.26E-01
Heat Input Rate (MMBtu/hr)	1,385	1,296	1,266	1,266
Emission Rate (lb/hr)	8.67E-04	8.12E-04	7.93E-04	7.93E-04
(TPY)	4.33E-04	4.06E-04	3.96E-04	3.96E-04
Sulfuric Acid Mist = Fuel Use (lb/hr) x sulfur (S) content (fraction) x conversion of S to H_2SO_4 (%) x MW H_2SO_4 /MW S (98/32)				
Fuel Usage (cf/hr)	72,110	67,520	65,960	61,540
Sulfur (lb/hr)	36.06	33.76	32.98	30.77
lb H_2SO_4 /lb S (98/32)	3.0625	3.0625	3.0625	3.0625
Conversion to H_2SO_4 (%) [d]	10	10	10	10
Emission Rate (lb/hr)	11.04	10.34	10.10	9.42
(TPY)	5.52	5.17	5.05	4.71

Sources: [a] EPA, 1998 (AP-42 draft revisions)
[b] EPA, 1981
[c] 4 ppm assumed based on ASTM D2880
[d] assumed based on combustion estimates from GE

Table A-24. Maximum Emissions for Hazardous Air Pollutants for FPC Hines Energy Center
Siemens-Westinghouse 501F, Dry Low NO_x Combustor, Distillate, 65 % Load

Parameter	Turbine Inlet Temperature 20 °F	59 °F	72 °F	105 °F
Hours of Operation	1,000	1,000	1,000	1,000
Arsenic (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	7.91E+00	7.91E+00	7.91E+00	7.91E+00
Heat Input Rate (MMBtu/hr)	1,385	1,296	1,266	1,266
Emission Rate (lb/hr)	1.10E-02	1.03E-02	1.00E-02	1.00E-02
(TPY)	5.48E-03	5.13E-03	5.01E-03	5.01E-03
Benzene (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	1.1	1.1	1.1	1.1
Heat Input Rate (MMBtu/hr)	1,385	1,296	1,266	1,266
Emission Rate (lb/hr)	1.52E-03	1.43E-03	1.39E-03	1.39E-03
(TPY)	7.61E-04	7.13E-04	6.97E-04	6.97E-04
Cadmium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	3.24	3.24	3.24	3.24
Heat Input Rate (MMBtu/hr)	1,385	1,296	1,266	1,266
Emission Rate (lb/hr)	4.49E-03	4.20E-03	4.10E-03	4.10E-03
(TPY)	2.24E-03	2.10E-03	2.05E-03	2.05E-03
Chromium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	6.76	6.76	6.76	6.76
Heat Input Rate (MMBtu/hr)	1,385	1,296	1,266	1,266
Emission Rate (lb/hr)	9.36E-03	8.76E-03	8.56E-03	8.56E-03
(TPY)	4.68E-03	4.38E-03	4.28E-03	4.28E-03
Formaldehyde (lb/hr) = 10% of VOC lb/hr				
Emission Rate, lb/10^{12} Btu	1.44E+03	1444.552304	1444.552304	1444.552304
Heat Input Rate (MMBtu/hr)	1,385	1,296	1,266	1,266
Emission Rate (lb/hr)	2.00E+00	1.87E+00	1.83E+00	1.83E+00
(TPY)	1.00E+00	9.36E-01	9.15E-01	9.15E-01
Cobalt (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [b], lb/10^{12} Btu	37	37	37	37
Heat Input Rate (MMBtu/hr)	1.38E+03	1.30E+03	1.27E+03	1.27E+03
Emission Rate (lb/hr)	5.12E-02	4.80E-02	4.69E-02	4.69E-02
(TPY)	2.56E-02	2.40E-02	2.34E-02	2.34E-02
Manganese (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	432	432	432	432
Heat Input Rate (MMBtu/hr)	1,385	1,296	1,266	1,266
Emission Rate (lb/hr)	5.98E-01	5.60E-01	5.47E-01	5.47E-01
(TPY)	2.99E-01	2.80E-01	2.74E-01	2.74E-01
Nickel (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	86.3	86.3	86.3	86.3
Heat Input Rate (MMBtu/hr)	1,385	1,296	1,266	1,266
Emission Rate (lb/hr)	1.19E-01	1.12E-01	1.09E-01	1.09E-01
(TPY)	5.97E-02	5.59E-02	5.46E-02	5.46E-02
Phosphorous (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [b], lb/10^{12} Btu	3.00E+02	3.00E+02	3.00E+02	3.00E+02
Heat Input Rate (MMBtu/hr)	1,385	1,296	1,266	1,266
Emission Rate (lb/hr)	0.4153536	0.3889152	0.3799296	0.3799296
(TPY)	0.2076768	0.1944576	0.1899648	0.1899648
Selenium (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	23	23	23	23
Heat Input Rate (MMBtu/hr)	1,385	1,296	1,266	1,266
Emission Rate (lb/hr)	3.18E-02	2.98E-02	2.91E-02	2.91E-02
(TPY)	1.59E-02	1.49E-02	1.46E-02	1.46E-02
Toluene (lb/hr) = Basis (lb/10^{12} Btu) x Heat Input (MMBtu/hr) / 1,000,000 MMBtu/10^{12} Btu				
Basis [a], lb/10^{12} Btu	237	237	237	237
Heat Input Rate (MMBtu/hr)	1,385	1,296	1,266	1,266
Emission Rate (lb/hr)	3.28E-01	3.07E-01	3.00E-01	3.00E-01
(TPY)	1.64E-01	1.54E-01	1.50E-01	1.50E-01

Sources: [a] EPA, 1998 (AP-42 draft revisions)
[b] EPA,1996 (AP-42,Table 3.1-4)

Table A-25 Summary of Maximum Potential Annual Emissions for the CT/HRSG

Pollutant	Annual Emissions (tons/year)[a] Natural Gas Load: 100% Hours: 8,760	Natural Gas 60% 3,000	Distillate Oil 100% 1,000	Maximum Emissions (tons/year)[b] Case A	Case B	Case C	Case D	PSD Significant Emission Rates
One Combustion Turbine- Combined Cycle								
SO_2	22.4	5.4	48.6	22.4	20.1	68.4	66.1	40
PM/PM_{10}	34.4	8.8	29.8	34.4	31.4	60.3	57.3	25/15
NO_x	101	24	44	101.2	90.4	133.4	122.6	40
CO	184	219	53	184.0	340.0	216.0	372.0	100
VOC (as methane)	19.1	7.5	10.5	19.1	20.0	27.4	28.4	40
Sulfuric Acid Mist	3.4	0.8	7.4	3.4	3.1	10.5	10.1	7
Lead	0	0.00E+00	1.04E-02	0.0E+00	0.0E+00	1.0E-02	1.0E-02	0.6
Mercury	6.41E-06	1.54E-06	6.05E-04	6.4E-06	5.8E-06	6.1E-04	6.1E-04	0.1
Total HAPs	1.93	0.77	1.80	1.9	2.0	3.5	3.6	25
Two Combustion Turbines- Combined Cycle								
SO_2	44.9	10.7	97.1	44.9	40.2	136.9	132.3	40
PM/PM_{10}	69	18	60	69	63	121	115	25/15
NO_x	202	48	88	202	181	267	245	40
CO	368	438	106	368	680	432	744	100
VOC (as methane)	38.1	15.0	21.0	38.1	40.1	54.8	56.7	40
Sulfuric Acid Mist	6.9	1.65	14.87	6.87	6.16	20.96	20.25	7
Lead	0.00E+00	0.00E+00	2.09E-02	0.00E+00	0.00E+00	2.09E-02	2.09E-02	0.6
Mercury	1.28E-05	3.07E-06	1.21E-03	1.28E-05	1.15E-05	1.22E-03	1.22E-03	0.1
Total HAPs	3.9	1.55	3.60	3.87	4.09	7.02	7.25	25

[a] Based on 59 °F compressor inlet air temperature

APPENDIX B

B.1 NEW SOURCE PERFORMANCE STANDARDS

BACT is a case-by-case emission limitation for each applicable pollutant, based on the maximum degree of emission reduction after taking into account the energy, environmental, and economic impacts, and other costs. The BACT cannot be any less stringent than any applicable new source performance standards (NSPS) and consideration must be given to the applicable NSPS in the determination of BACT. This requirement also applies for any applicable National Emission Standard for Hazardous Air Pollutants promulgated under 40 CFR Part 61. For combustion turbines the applicable NSPS is 40 CFR Part 60, Subpart GG Standards of Performance for Stationary Gas Turbines.

B.1.1 SUBPART GG

The NSPS regulations (40 CFR, Subpart GG) applicable to gas turbines apply to:

1. Electric utility stationary gas turbines with a heat input at peak load of greater than 100×10^6 Btu/hr [40 CFR 60.332 (b)];

2. Stationary gas turbines with a heat input at peak load between 10 and 100×10^6 Btu/hr [40 CFR 60.332 (c)]; or

3. Stationary gas turbines with a manufacturer's rate base load at ISO conditions of 30 MW or less [40 CFR 60.332 (d)].

The electric utility stationary gas turbine provisions apply to stationary gas turbines constructed for the purpose of supplying more than one-third of their potential electric output capacity for sale to any utility power distribution system [40 CFR 60.331 (q)]. The requirements for electric utility stationary gas turbines are applicable to the combustion turbines proposed for the project and are the most stringent provision of the NSPS. These requirements are summarized in Table B-1 and were considered in the BACT analysis.

As noted from Table B-1, the NSPS NO_x emission limit can be adjusted upward to allow for fuel-bound nitrogen (FBN). For a fuel-bound nitrogen concentration of 0.015 percent or less, no increase in the NSPS is provided; for a fuel-bound nitrogen concentration of 0.03 percent, the NSPS is increased by 0.0012 percent or 12 parts per million (ppm). The NSPS NO_x emission limit adjustment is not affected by natural gas combustion.

B.2 BEST AVAILABLE CONTROL TECHNOLOGY

The "top-down" analysis for determining BACT, as provided for in EPA's Draft 1990 New Source Review Workshop Manual was considered in evaluating BACT for the Project. The procedure

involves 5 steps: identification of control technologies, elimination of technically infeasible control technologies, a ranking of the control technologies, an evaluation of the effective control technologies and the selection of BACT.

The identification of control technologies is developed from the information obtained from BACT/LAER Information System (BLIS) database maintained at EPA's National Computer Center located at Research Triangle Park, North Carolina. While these data are comprehensive it is often not up to date with the most recent BACT/LAER decisions and separate contact with state agencies is required. LAER is distinctly different from BACT in that there is no consideration of economic, energy, or environmental impacts; if a control technology has previously been installed, it must be required as LAER. LAER is defined as follows:

> Lowest achievable emission rate means, for any source, the more stringent rate of emissions based on the following: (i) The most stringent emissions limitation which is contained in the implementation plan of any State of such class or category of stationary source, unless the owner or operator of the proposed stationary source demonstrates that such limitations are not achievable; or (ii) The most stringent emissions limitation which is achieved in practice by such class or category of stationary source. This limitation, when applied to a modification, means the lowest achievable emissions rate for the new or modified emissions units within the stationary source. In no event shall the application of this term permit a proposed new modified stationary source to emit any pollutant in excess of the amount allowable under applicable new source standards of performance (40 CFR 51, Appendix S.II, A.18).

The elimination of infeasible technologies is based on those engineering aspects that would preclude a technology's use due to physical, chemical or other engineering consideration. Control technologies that are technically feasible are ranked by control effectiveness, with determination of the environmental, economic and energy costs and benefits of the control technologies. This information forms the basis for the case-by-case consideration of environmental, energy and economic impacts. The "top" feasible control alterable is selected unless it can be rejected based on economic, environmental or energy considerations. This section of Appendix B presents information related to the proposed BACT emission limitation.

B.2.1 NITROGEN OXIDES

Identification of NO_x Control Technologies

NO_x emissions from combustion of fossil fuels consist of thermal NO_x and fuel-bound NO_x. Thermal NO_x is formed from the reaction of oxygen and nitrogen in the combustion air at combustion temperatures. Formation of thermal NO_x depends on the flame temperature, residence time, combustion pressure, and air-to-fuel ratios in the primary combustion zone. The design and operation of the combustion chamber dictates these conditions. Fuel-bound NO_x is created by the oxidation of volatilized nitrogen in the fuel. Nitrogen content in the fuel is the primary factor in its formation.

Table B-2 presents a listing of the lowest achievable emission rates/best available control technology (LAER/BACT) decisions made by state environmental agencies and EPA regional offices for gas turbines including duct firing. This table was developed from the information obtained from BACT/LAER Information System (BLIS) database maintained at EPA's National Computer Center located at Research Triangle Park, North Carolina, and EPA Region 4's summary of recent national CT BACT projects. EPA Region 4's summary data was pulled from the following internet site: http://www.epa.gov/region4/air/permits/national_ct_list.xls (2001).

Historically, the most stringent NO_x controls for CTs established as LAER/BACT by state agencies were combustion controls with selective catalytic reduction (SCR) and combustion controls alone. SCR is a post-combustion control, while advanced dry low-NO_x combustors minimize the formation of NO_x in the combustion process. When SCR has been employed, dry low-NO_x combustion technology is used to minimize the NO_x emissions formed in the combustion process.

Wet injection was the first combustion technology introduced for combustion turbines (pre-1980's) and was the primary method of reducing NO_x emissions from CTs prior to the 1990's. Indeed, this method of control was first mandated by the NSPS to reduce NO_x levels to 75 parts per million by volume, dry (ppmvd) (corrected to 15 percent O_2 and heat rate). Development of improved wet injection combustors reduced NO_x concentrations to 25 ppmvd (corrected to 15-percent O_2) when burning natural gas. Wet injection is still the only means of reducing NO_x formation in the combustion process when firing oil.

The dry low-NO_x combustion technology has been developed and made available since the early 1990's for gas turbines to achieve emission levels of 25 ppmvd corrected to 15-percent O_2. More recently, however, CT manufacturers have developed dry low-NO_x combustors that can reduce NO_x concentrations to 9ppmvd (corrected to 15-percent O_2) when firing natural gas.

SCR is an available and demonstrated control technology for NO_x control or combined cycle units, which has been installed or permitted in over 100 projects. Beginning in the late 1980s and early 1990s, SCR was initially installed on cogeneration facilities with capacities of 50 MW or less. Most of these projects were in California. Many of these initial SCR projects were located in the Southern California NO_2 nonattainment area where SCR was required not as BACT but as LAER, a more stringent requirement. As noted previously, there are distinct regulatory and policy differences between LAER and BACT. As discussed in Section 3.0, BACT involves an evaluation of the economic, environmental, and energy impacts of alternative control technologies. In contrast, LAER only considers the technical aspects of control.

More recently, projects with SCR have been installed throughout the US. A majority of these projects are natural gas-fired combined cycle facilities. The size of these projects ranges from 22 MW to over 500 MW. While many of the facilities have distillate oil as backup fuel, distillate oil generally is restricted by permit to 1,000 hours or less per CT.

Reported and permitted NO_x removal efficiencies of SCR range from 40 to over 80 percent of NO_x in the exhaust gas stream. The most common BACT emission limiting standard over the last two years is 3.5 ppmvd corrected to 15-percent O_2 or less for natural gas firing when using DLN and SCR. The most common emission limiting standard established as LAER is 2.5 ppmvd corrected to 15 percent O_2 or less for natural gas firing and using SCR.

Other available control technologies that have become available for controlling NO_x emissions from combustion turbines for include SCONO$_x$™ and XONON™. SCONO$_x$™ is an add-on control using absorption and chemical conversion to remove NO_x formed from combustion, while XONON™ is a catalytic combustion system integral to the turbine. Other potential technologies used in combustion process for NO_x removal include: NO_xOUT, Thermal DeNO_x, and NSCR.

Technology Descriptions and Feasibility

Wet Injection

The injection of water or steam in the combustion zone of CTs reduces the flame temperature with a corresponding decrease of NO_x emissions. The amount of NO_x reduction possible depends on the combustor design and the water-to-fuel ratio employed. An increase in the water-to-fuel ratio will cause a concomitant decrease in NO_x emissions until flame instability occurs. At this point, operation of the CT becomes inefficient and unreliable, and significant increases in products of incomplete combustion results (i.e., CO and VOC emissions). In "F" Class turbines using wet injection with gas firing, the NO_x emission rates in the range of 30 ppm have been demonstrated. However, wet injection is no longer offered for gas firing in "F" Class turbines. Wet injection is the only current feasible means of reducing NO_x emissions in the combustion process when firing oil.

Dry Low-NO_x Combustor

In the past several years, CT manufacturers have offered and installed machines with dry low-NO_x combustors. These combustors, which are offered on conventional machines manufactured by General Electric (GE), Siemens Westinghouse, Mitsubishi Heavy Industries (MHI) and ABB, can achieve NO_x concentrations of 25 ppmvd or less when firing natural gas. All these vendors have offered dry low-NO_x combustors on advanced heavy-duty industrial machines. Thermal NO_x formation is inhibited by using combustion techniques where the natural gas and combustion air are premixed before ignition. For the CT being considered for the project, the combustion chamber design includes the use of dry low-NO_x combustor technology. The NO_x emission level when firing natural gas at baseload conditions is 25 ppmvd (corrected to 15-percent O_2), a level which is guaranteed by the selected vendor for the project.

Selective Catalytic Reduction (SCR)

Selective Catalytic Reduction (SCR) uses ammonia (NH_3) to react with NO_x in the gas stream in the presence of a catalyst. NH_3, which is diluted with air to about 5 percent by volume, is introduced into the gas stream at reaction temperatures between 600°F and 750°F. The reactions are as follows:

$$4NH_3 + 4NO + O_2 = 4N_2 + 6H_2O$$
$$4NH_3 + 2NO_2 + O_2 = 3N_2 + 6H_2O$$

SCR operating experience, as applied to gas turbines, consists primarily of baseload natural-gas-fired installations either of cogeneration or combined cycle configuration. Exhaust gas temperatures of simple cycle CTs generally are in the range of 1,000°F, which exceeds the optimum range for SCR with base metal catalysts. All current SCR applications have the catalyst placed in the HRSG to achieve proper reaction conditions. This allows a relatively constant temperature for the reaction of NH_3 and NO_x on the catalyst surface.

The use of SCR has been primarily limited to combined-cycle facilities that burn natural gas with small amounts of fuel oil. Initially, the traditional metal catalysts used in SCR systems were contaminated by sulfur-containing fuels. For most fuel-oil-burning facilities, catalyst operation was discontinued, or the exhaust bypasses the SCR system. This was due to the formation of ammonium salts (ammonium sulfate and bisulfate) resulting from the reaction of NH_3 and sulfur combustion products. Ammonium bisulfate can be corrosive and could cause damage to the HRSG surfaces that follow the catalyst, as well as to the stack. Corrosion protection for these areas would be required with concomitant cost and technical requirements. Ammonium sulfate is emitted as particulate matter. While the formation of ammonium salts is primarily associated with oil firing, sulfur combustion products from natural gas also could form small amounts of ammonium salts. Ceramic and specially designed catalysts have been designed to overcome the problems with base-metal catalysts. The sulfur in No. 2 distillate oil has also been reduced from 0.5 percent available in the early 1990's to 0.05 percent. In addition, HRSG designs can accommodate the impacts of the formation of ammonium salts.

For combined cycle units, SCR is an available, technically feasible and demonstrated technology.

$SCONO_x$™ Process

$SCONO_x$™ is a NO_x and CO control system exclusively offered by Goal Line Environmental Technologies (GLET). GLET is a partnership formed by Sunlaw Energy Corporation and Advanced Catalyst Systems, Inc. In 1998, ABB acquired the exclusive license for the technology in the United States for control applications larger than 100 MW.

The $SCONO_x$™ system employs a single catalyst to simultaneously oxidize CO to CO_2 and NO to NO_2. NO_2 formed by the oxidation of NO is subsequently absorbed onto the catalyst surface through the use of a potassium carbonate absorber coating.

The $SCONO_x$™ oxidation/absorption cycle reactions are:

$$CO + \tfrac{1}{2} O_2 \rightarrow CO_2 \quad (1)$$

$$NO + \tfrac{1}{2} O_2 \rightarrow NO_2 \quad (2)$$

$$2NO_2 + K_2CO_3 \rightarrow CO_2 + KNO_2 + KNO_3 \quad (3)$$

CO_2 produced by reaction (1) and (2) is released to the atmosphere as part of the CT/HRSG exhaust gas stream.

As shown in Reaction (3), the potassium carbonate catalyst coating reacts with NO_2 to form potassium nitrites and nitrates. Prior to saturation of the potassium carbonate coating, the catalyst must be regenerated. This regeneration is accomplished by passing a dilute hydrogen-reducing gas across the surface of the catalyst in the absence of O_2. Hydrogen in the reducing gas reacts with the nitrites and nitrates to form water and elemental nitrogen. CO_2 in the regeneration gas reacts with potassium nitrites and nitrates to form potassium carbonate; this compound is the catalyst absorber coating present on the surface of the catalyst at the start of the oxidation/absorption cycle. The $SCONO_x$™ regeneration cycle reaction is:

$$KNO_2 + KNO_3 + 4\,H_2 + CO_2 \rightarrow K_2CO_3 + 4\,H_2O_{(g)}) + N_2 \quad (4)$$

Water vapor and elemental nitrogen are released to the atmosphere as part of the CT/HRSG exhaust stream. Following regeneration, the $SCONO_x$™ catalyst has a fresh coating of potassium carbonate, allowing the oxidation/absorption cycle to begin again. There is no net gain or loss of potassium carbonate after both the oxidation/absorption and regeneration cycles have been completed.

Since the regeneration cycle must take place in an oxygen-free environment, the section of catalyst undergoing regeneration is isolated from the exhaust gas stream using a set of louvers. Each catalyst section is equipped with a set of upstream and downstream louvers. During the regeneration cycle, these louvers close and valves open allowing fresh regeneration gas to enter and spent regeneration gas to exit the catalyst section being regenerated. At any given time, 75 percent of the catalyst sections will be in the oxidation/absorption cycle, while 25 percent will be in regeneration mode. A regeneration cycle is typically set to last for 3 to 5 minutes.

Regeneration gas is produced by reacting natural gas with O_2 present in ambient air. The $SCONO_x$™ system uses a gas generator produced by Surface Combustion. This unit uses a two-stage process to produce hydrogen and carbon dioxide. In the first stage, natural gas and ambient air are reacted across a partial oxidation catalyst at 1,900°F to form CO and hydrogen. Steam is added and the gas mixture

is then passed across a low temperature shift catalyst, forming CO_2 and additional hydrogen. The resulting gas stream is diluted to less than 4 percent hydrogen using steam or another inert gas. The regeneration gas reactions are:

$$CH_4 + ½\ O_2 + 1.88\ N_2 \rightarrow CO + 2\ H_2 + 1.88\ N_2 \quad (5)$$
$$CO + 2\ H_2 + H_2O + 1.88\ NO_2 \rightarrow CO_2 + 3\ H_2 + 1.88\ N_2 \quad (6)$$

The SCONO$_x$™ operates at a temperature range of 300 to 700°F and, therefore, must be installed in the appropriate temperature section of a HRSG. For SCONO$_x$™ systems installed in locations of the HRSG above 500°F, a separate regeneration gas generator is not required. Instead, regeneration gas is produced by introducing natural gas directly across the SCONO$_x$™ catalyst that reforms the natural gas.

The SCONO$_x$™ system catalyst is subject to reduced performance and deactivation due to exposure to sulfur oxides. For this reason, an additional catalytic oxidation/absorption system (SCOSO$_x$™) to remove sulfur compounds is installed upstream of the SCONO$_x$™ catalyst. During regeneration of the SCONO$_x$™ catalyst, either hydrogen sulfide or SO_2 is released to the atmosphere as part of the CT/HRSG exhaust gas stream. The absorption portion of the SCOSO$_x$™ process is proprietary. SCOSO$_x$™ oxidation/absorption and regeneration reactions are:

$$CO + ½\ O_2 \rightarrow CO_2 \quad (7)$$
$$SO_2 + ½\ O_2 \rightarrow SO_3 \quad (8)$$
$$SO_3 + \text{SORBER} \rightarrow [SO_3 + \text{SORBER}] \quad (9)$$
$$[SO_3 + \text{SORBER}] + 4\ H_2 \rightarrow H_2S + 3\ H_2O \quad (10)$$

Utility materials needed for the operation of the SCONO$_x$™ control system include ambient air, natural gas, water, steam, and electricity. The primary utility material is natural gas used for regeneration gas production. Steam is used as the carrier/dilution gas for the regeneration gas. Electricity is required to operate the computer control system, control valves, and louver actuators.

Commercial experience to date with the SCONO$_x$™ control system is limited to one small combined cycle (CC) power plant located in Los Angeles. This power plant, owned by GLET partner Sunlaw Energy Corporation, utilizes a GE LM2500 turbine (30 MW size) equipped with water injection to control NO_x emissions to approximately 25 ppmvd. The SCONO$_x$™ control system was installed at the Sunlaw Energy facility in December 1996 and has achieved a NO_x exhaust concentration of 3.5 ppmv resulting in an approximate 85 percent NO_x removal efficiency.

A second SCONO$_x$™ system was installed at the Genetics Institute Facility in Andover, Massachusetts in late 1998. The system is installed on a 5-MW Caterpillar Solar Turbine with a Deltak boiler. The NO_x emission limit is 2.5 ppmvd at 15-percent O_2. ABB Environmental reports

that the system is operating successfully, although there have been incidents of high NO_x emissions that ABB Environmental attributes to combustion control problems and not to the SCONO$_x$™ system.

XONON™ Catalytic Combustor

Catalytic combustors are being developed for low emission applications on turbines where the catalyst is internal to the combustion system. The XONON™ Combustion System is a catalytic combustion system developed by Catalytica Combustion Systems, Inc. that can achieve low emission levels of NO_x, CO and VOCs. The XONON" system combusts the fuel over a catalyst, reducing the temperature of combustion and providing for more complete combustion of the fuel. The system is referred to as "flameless combustion" where temperatures are below those where limited NO_x formation occurs. However, the exhaust temperatures from a combustion turbine standpoint are still sufficient for the expansion of the gases through the turbine for power generation. Emission levels of NO_x at less than 2 ppm have been reported for the 1.5 MW Kawasaki gas turbine located at Sun Valley Power. Recently, this technology has been proposed for a 750 MW combined cycle facility. This facility, the Pastoria Energy Facility, is a project proposed by affiliates of Enron Corporation, which has a 15 percent interest in Catalytica Combustion Systems, Inc. Commercial operation is scheduled for the summer of 2003. Catalytica is currently working in collaboration with several gas turbine manufacturers including General Electric, Pratt & Whitney, Rolls Royce Allison and Solar.

NO$_x$OUT Process

The NO$_x$OUT process originated from the initial research by the Electric Power Research Institute (EPRI) in 1976 on the use of urea to reduce NO_x. EPRI licensed the proprietary process to Fuel Tech, Inc., for commercialization. In the NO$_x$OUT process, aqueous urea is injected into the flue gas stream ideally within a temperature range of 1,600°F to 1,900°F. In the presence of oxygen, the following reaction results:

$$CO(NH_2)_2 + 2NO + \tfrac{1}{2}\, O_2 \rightarrow 2N_2 + CO_2 + 2H_2O$$

The amount of urea required is most cost-effective when the treatment rate is 0.5 to 2 moles of urea per mole of NO_x. In addition to the original EPRI urea patents, Fuel Tech claims to have a number of proprietary catalysts capable of expanding the effective temperature range of the reaction to between 1,600°F and 1,950°F. Advantages of the system are as follows:

1. Low capital and operating costs as a result of use of urea injection, and
2. The proprietary catalysts used are nontoxic and nonhazardous, thus eliminating potential disposal problems.

Disadvantages of the system are as follows:

1. Formation of ammonia from excess urea treatment rates and/or improper use of reagent catalysts, and

2. Sulfur trioxide (SO_3), if present, will react with ammonia created from the urea to form ammonium bisulfate, potentially plugging the cold end equipment downstream.

Commercial application of the NO_xOUT system is limited and the NO_xOUT system has not been demonstrated on any combustion turbine/HRSG unit.

The NO_xOUT process is not technically feasible for the proposed project because of the high application temperature of 1,600°F to 1,950°F. The maximum exhaust gas temperature of the "F" Class CT is about 1,100°F. Raising the exhaust temperature the required amount essentially would require installation of a heater. This would be economically prohibitive and would result in an increase in fuel consumption, an increase in the volume of gases that must be treated by the control system, and an increase in uncontrolled air emissions, including NO_x.

Thermal $DeNO_x$

Thermal $DeNO_x$ is Exxon Research and Engineering Company's patented process for NO_x reduction. The process is a high temperature selective noncatalytic reduction (SNCR) of NO_x using ammonia as the reducing agent. Thermal $DeNO_x$ requires the exhaust gas temperature to be above 1,800°F. However, use of ammonia plus hydrogen lowers the temperature requirement to about 1,000°F. For some applications, this must be achieved by additional firing in the exhaust stream before ammonia injection.

The only known commercial applications of Thermal $DeNO_x$ are on heavy industrial boilers, large furnaces, and incinerators that consistently produce exhaust gas temperatures above 1,800°F. There are no known applications on or experience with CTs. Temperatures of 1,800°F require alloy materials constructed with very large piping and components since the exhaust gas volume would be increased by several times. As with the NO_xOUT process, high capital, operating, and maintenance costs are expected because of material requirements, an additional duct burner system, and fuel consumption. Uncontrolled emissions would increase because of the additional fuel burning.

Thus, the Thermal $DeNO_x$ process will not be considered for the proposed project since its high application temperature makes it technically infeasible. The maximum exhaust gas temperature of an "F" Class combustion turbine is typically 1,100°F; the cost to raise the exhaust gas to such a high temperature is prohibitively expensive.

Nonselective Catalytic Reduction

Certain manufacturers, such as Engelhard, market a nonselective catalytic reduction system (NSCR) for NO_x control on reciprocating engines. The NSCR process requires a low oxygen content in the exhaust gas stream and high temperature (700°F to 1,400°F) in order to be effective. CTs have the required temperature but also have high oxygen levels (greater than 12 percent) and, therefore, cannot

use the NSCR process. As a result, NSCR is not a technically feasible add-on NO_x control device for CTs.

Technology Demonstration and Feasibility

The combustion controls using dry low-NO_x combustors for the combustion turbine and low-NO_x burners for duct firing are available, demonstrated and technically feasible for combustion turbines in either simple cycle or combined cycle configuration. The dry low-NO_x combustion technology alone can achieve 25 ppm (corrected to 15 percent O_2 dry conditions) when firing natural gas.

The technical evaluation of post-combustion gas controls that include NO_xOUT, Thermal DeNO_x, and NSCR, and indicate that these processes have not been applied to either simple cycle combustion turbines or combined cycle systems and are technically infeasible for the project because of process constraints (e.g., temperature). The SCONO$_x$™ control technology is available but not considered to be technically feasible because it has not been commercially demonstrated on large "F" Class CTs. The CTs planned for the project, Siemens Westinghouse 501F units, each have a nominal generating capacity of 185 MW which are more than seven times larger than the nominal 25-MW GE LM2500 utilized at the Sunlaw Energy Corporation Los Angeles facility. Technical problems associated with scale-up of the SCONO$_x$™ technology given the large differences in machine flow rates are unknown. Additional concerns with the SCONO$_x$™ control technology include process complexity (multiple catalytic oxidation/absorption/regeneration systems), reliance on only one supplier, relatively brief operating history of the technology, and distillate oil firing. While the XONON" catalytic combustion system is applied directly to the combustion turbine, application on a large combined cycle unit has not been demonstrated. For these reasons, the SCONO$_x$™ and XONON" are still considered in the commercial demonstration stage. SCR is commercially available, technically feasible and demonstrated for combined cycle units.

For combined cycle operation, the combination of dry low-NO_x combustion technology and water injection with SCR is a technically feasible alternative that can achieve a maximum degree of emission reduction. The combined technology is capable of achieving a NO_x emission levels of 3.5 ppm when firing natural gas (corrected to 15 percent O_2 dry conditions), and 12 ppm when firing distillate oil (corrected to 15 percent O_2 dry conditions).

Below is a summary of the technical availability, demonstration and feasibility for the proposed project.

Technology	Combined Cycle Status
Selective Catalytic Reduction	Available, Demonstrated and Feasible
Dry Low-NO_x Combustors	Available, Demonstrated and Feasible for gas firing
Wet Injection	Available, Demonstrated or Feasible for oil firing
$SCONO_x$	Available, Not Demonstrated
XOXON™	Not Demonstrated
Thermal De NO_x	Not Available or Feasible
NO_x Out	Not Available or Feasible
NSCR	Not Available or Feasible

SCR Cost Estimates

Tables B-3 and B-4 present the total capital and annualized cost to achieve 3.5 ppmvd corrected to 15 percent oxygen when firing natural gas using SCR and $SCONO_x$™ applied to combined cycle operation, respectively. The emission rate for oil firing for both SCR and $SCONO_x$™ is based on 12 ppmvd corrected to 15 percent oxygen. The costs were developed using EPA Cost Control Manual (EPA, 1990 & 1993) and vendor based estimates for each control system. Standard EPA recommended cost factors were used. A capital recovery period of 15 years was used for the capital costs. Tables B-3b and B-4b present the total capital and annualized cost to achieve 2.5 ppmvd corrected to 15 percent oxygen. Tables B-3c and B-4c present the total capital and annualized cost to achieve 2.0 ppmvd corrected to 15 percent oxygen, for $SCONO_x$™ control system.

Comparison of Economic, Environmental, and Energy Impacts

Tables B-5 and B-5b present a comparison of the economic, environmental, and energy impacts associated with the top control alternatives to achieve 3.5 and 2.5 ppmvd corrected to 15 percent oxygen, respectively, when firing gas and 12 ppmvd corrected to 15 percent oxygen when firing oil. Tables B-6 and B-6b, present the potential emissions resulting from the formation of ammonium salts (i.e., particulate matter), ammonia slip and secondary emissions to achieve 3.5 and 2.5 ppmvd corrected to 15 percent oxygen, respectively.

B.2.2 CARBON MONOXIDE

Identification of CO Control Technologies

CO emissions are a result of incomplete or partial combustion of fossil fuel. Combustion design and catalytic oxidation are the control alternatives that are viable for the project. Table B-7 presents a listing of BACT decisions for CO emissions from combustion turbines. Combustion design is the more common control technique used in CTs. Sufficient time, temperature, and turbulence is required within the combustion zone to maximize combustion efficiency and minimize the emissions of CO. Combustion efficiency is dependent upon combustor design.

Catalytic oxidation is a post-combustion control that has been employed in CO nonattainment areas where regulations have required CO emission levels to be less than those associated with combustion controls alone. These installations have been required to use LAER technology and typically have CO limits less than 10 ppmvd (corrected to dry conditions).

Technology Description

In an oxidation catalyst control system, CO emissions are reduced by allowing unburned CO to react with oxygen at the surface of a precious metal catalyst, such as platinum. Combustion of CO starts at about 300°F, with an efficiency of 90 percent occurring at temperatures above 600°F. Catalytic oxidation occurs at temperatures 50 percent lower than that of thermal oxidation, which reduces the amount of thermal energy required. For CTs, the oxidation catalyst can be located directly after the CT. Catalyst size depends upon the exhaust flow, temperature, and desired efficiency.

Oxidation Catalyst Costs

Tables B-8 and B-9 present the capital and annualized cost for an oxidation catalyst installed in the HRSG.

Comparison of Economic, Environmental, and Energy Impacts

Table B-10 presents a comparison of the economic, environmental, and energy impacts associated with the top control alternatives for the combined cycle unit. Table B-11 presents the potential emissions resulting from the formation of ammonium salts (i.e., particulate matter), ammonia slip and secondary emissions. The latter results from generation lost due to the back pressure of the oxidation catalyst. The maximum CO impacts are less than 0.5 percent of the applicable ambient air quality standards. There would also be no secondary benefits, such as reducing acidic deposition, to reducing CO.

Table B-1. Federal NSPS for Electric Utility Stationary Gas Turbines

Pollutant	Emission Limitation[a]
Nitrogen Oxides[b]	0.0075 percent by volume (75 ppm) at 15 percent O_2 on a dry basis adjusted for heat rate and fuel nitrogen

[a] Applicable to electric utility gas turbines with a heat input at peak load of greater than 100×10^6 Btu/hr.

[b] Standard is multiplied by 14.4/Y; where Y is the manufacturer's rated heat rate in kilojoules per watt at rated load or actual measured heat rate based on the lower heating value of fuel measured at actual peak load; Y cannot be greater than 14.4. Standard is adjusted upward (additive) by the percent of nitrogen in the fuel:

Fuel-Bound Nitrogen (percent by weight)	Allowed Increase NO_x Percent by Volume
$N \leq 0.015$	0
$0.015 < N \leq 0.1$	0.04(N)
$0.1 < N \leq 0.25$	0.004+0.0067(N-0.1)
$N > 0.25$	0.005

where: N = the nitrogen content of the fuel (percent by weight).

Source: 40 CFR 60 Subpart GG.

IMAGE QUALITY

AS YOU REVIEW THE NEXT GROUP OF IMAGES, PLEASE NOTE THAT THE ORIGINAL DOCUMENTS WERE OF POOR QUALITY.

Table B-2. Summary of BACT Determinations for NO_x for Combined Cycle CTs, 1998-2002

Facility	State	Final Permit Issued	MW	# of CTs	# of DB	Turbine Model	Fuel	Mode	Hours	NOx Limit	Control Method	Avg. Time	Comments
Kissimmee Utility Authority, Cane Island Power Park -Unit 3	FL	draft permit	250	1	0	GE 7FA (167 MW)	NG; FO	CC	8,760; 720 FO	3.5 ppm NG; 15 ppm FO	SCR		
Duke Energy - New Smyrna Beach	FL	draft permit	500	2	0	GE 7FA (165 MW)	NG	CC	8,760	9 ppm or 6 ppm	DLN or SCR		
Lake Worth Generation	FL	Nov-99	244	1	1	GE 7FA (170 MW)	NG; FO	CC	8,760; 1,000 FO	9 ppm NG; 42 ppm FO	DLN; WI		
Hines Energy (FPC)	FL	project dropped	500	2	0	SW 501F (165 MW)	NG; FO	CC	8,760; 1,000 FO	6 ppm NG - full load; 42 ppm FO	SCR; WI		
Gulf Power - Smith Station	FL	Jul-00	340	2	2	GE 7FA (170 MW)	NG	CC	8,760	82.9 lb/hr w/DB, 113.2 lb/hr w/ DB & SA	DLN	30-day	Netting out of PSD for NO_x and CO; SA = steam augmentation
Florida Power & Light - Sanford	FL	Sep-99	2,200	8	0	GE 7FA (170 MW)	NG, FO	CC	8,760; 500 FO	9 ppm NG; 42 ppm FO	DLN; WI		Repowering, 4 units FO
Gainesville Regional Utilities, Kelly Generating Station	FL	Feb-00	133	1	0	GE 7EA (83 MW)	NG; FO	CC	8,760; 1,000 FO	9 ppm NG; 42 ppm FO	DLN; WI		Netting out of PSD review for NO_x
Calpine Osprey Energy Center	FL	Jul-01	527	2	2	SW 501FD (170 MW)	NG	CC	8,760	3.5 ppm	DLN/SCR	24-hr Block	2,800 hr/yr - Power Aug. mode
Hines Energy (FPC)	FL	Jun-01	530	2	0	SW 501FD (170 MW)	NG; FO	CC	8,760; 1,000 FO	3.5 ppm NG; 12 ppm FO	SCR; WI	24-hr Block	SCONOx - $16,712/ton NO_x; CatOx - $2,130/ton CO
CPV - Gulfcoast	FL	Feb-01	250	1	0	GE 7FA (170 MW)	NG; FO	CC	8,760; 720 FO	3.5 ppm NG; 10 ppm FO	SCR		SCONOx - no cost eval.; CatOx - $4,350/ton CO
TECO Gannon/Bayside	FL	Mar-01	1,728	7	0	GE 7FA (170 MW)	NG; FO	CC	8,760; 876 FO	3.5 ppm NG; 16.4 ppm FO	SCR		Repowering project: netting out of NO_x, CO, PM_{10} and SO_2 review (subject to VOC reveiw)
South Pond Energy Park	FL	draft permit	600	3	0	GE 7FA (170 MW)	NG; FO	SC/CC	3,390/8,760; 720 FO	10 ppm (9 initial)/3.5 ppm NG; 42/15 ppm FO	DLN/SCR; WI	3-hr	2 SC CT and 1 CC CT also capable of operating in SC mode.
North Pond Energy Park	FL	applic. under review	430	2	0	GE 7FA (170 MW)	NG; FO	SC/CC	3,390/8,760; 720 FO	10 ppm (9 initial)/3.5 ppm NG; 42/15 ppm FO	DLN/SCR; WI	3-hr	1 SC CT and 1 CC CT also capable of operating in SC mode.
Calpine Blue Heron Energy Center	FL	draft permit	1,080	4	4	SW 501F (170 MW)	NG	CC	8,760	3.5 ppm	DLN/SCR		base/duct burner/power aug./60-70% load; SCONOx - $9,982/ton NO_x; CatOx - $1,553/ton CO
Jacksonville Electric Authority - Brandy Branch (revision)	FL	draft permit	200	0	2	GE 7FA (170 MW)	NG; FO	CC	8760; 288 FO	3.5 ppm NG; 15 ppm FO	SCR		Conversion of 2 SC units to 2 CC units
CPV - Atlantic Power	FL	May-01	250	1	0	GE 7FA (170 MW)	NG; FO	CC	8,760; 720 FO	3.5 ppm NG; 10 ppm FO	SCR		PA = Power Augmentation
Orlando Utilities - Curtis H Stanton Energy Center	FL	Sep-01	633	2	2	GE 7FA (170 MW)	NG; FO	CC	8,760; 1000 FO	3.5 ppm NG; 10 ppm FO	SCR		
Broward Energy Center	FL	draft permit	775	4	0	GE 7FA (175 MW)	NG	CC/SC	8,760/5,000	3.5 ppm/9 ppm	SCR/DLN	24-hr	* 1 CC w/unfired HRSG & 3 SC; PA = Power Augmentation
Belle Glade Energy Center	FL	draft permit	600	3	0	GE 7FA (175 MW)	NG	CC/SC	8,760/5,000	3.5 ppm/9 ppm	SCR/DLN	24-hr	* 1 CC w/unfired HRSG & 2 SC; PA = Power Augmentation
Manatee Energy Center	FL	draft permit	600	3	0	GE 7FA (175 MW)	NG	CC/SC	8,760/5,000	3.5 ppm/9 ppm	SCR/DLN	24-hr	* 1 CC w/unfired HRSG & 2 SC; PA = Power Augmentation
CPV Pierce Power Generation Facility	FL	Aug-01	250	1	0	GE 7FA (170 MW)	NG; FO	CC	8,760; 720 FO	2.5 ppm NG; 10 ppm FO	SCR	24-hr	PA limited to 2,000 hr/yr
Fort Pierce Repowering Project	FL	draft permit	180	1	1	SW 501F (180 MW)	NG; FO	CC/SC	8,760; 1,000 FO/2,000; 500 FO	3.5 ppm NG; 12 ppm FO/25 ppm NG; 42 ppm FO	SCR/DLN; WI		CT will operate in both CC and SC modes
TECO Bayside Power Station	FL	draft permit	1,032	4	0	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm	SCR		Repowering Project: Netting out of PSD for NO_x, SO_2, VOC, lead and SAM (subject for PM_{10} and CO)
FPL Martin	FL	applic. under review	1,150	4	4	GE 7FA (170 MW)	NG; FO	CC/SC	8,760; 1,000 FO/1,000; 500 FO	2.5 ppm NG; 12 ppm FO/9-15 ppm NG; 42 ppm FO	SCR/DLN; WI		
FPL Manatee	FL	applic. under review	1,150	4	4	GE 7FA (170 MW)	NG	CC/SC	8,760; 1,000 FO/1,000; 500 FO	2.5 ppm CC/9 ppm SC (15 in HPM)	SCR/DLN		HPM = High Power Mode
Georgia Power - Wansley (Oglethorpe Power)	GA	Jul-00	2,280	8	8	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm / 0.013 lb/MMBtu	DLN/SCR	30 day	
Duke Energy Murray, LLC	GA	Feb-01	1,240	4	4	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm	DLN/SCR		
Duke Energy Buffalo Creek, LLC	GA	applic. under review	620	2	2	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm	DLN/SCR		SCONOx - $19,948/ton NO_x; CatOx - $2,469/ton CO
Augusta Energy LLC	GA	draft permit	750	3	3	GE 7FA (170 MW)	NG; FO	CC	8,760; 1,000 FO	3.5 ppm NG; 42 ppm FO	SCR; WI		SCONOx - $17,490/ton NO_x; CatOx - $4,133/ton CO

Table B-2. Summary of BACT Determinations for NO_x for Combined Cycle CTs, 1998-2002

Facility	State	Final Permit Issued	MW	# of CTs	# of DB	Turbine Model	Fuel	Mode	Hours	NOx Limit	Control Method	Avg. Time	Comments
GenPower McIntosh	GA	applic. under review	528	2	2	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm	SCR		
Monroe Power Co.	GA	applic. under review	525	2	0	GE 7FA (170 MW)	NG	SC/CC	8,760	12/3.5 ppm	DLN/SCR		Initially SC, but later converting to CC
Peace Valley Generation Co., LLC	GA	applic. under review	1,550	6	4	F* Class	NG	CC/SC	8,760/2,500	3.5/9 ppm	SCR/DLN;		
Duke Energy Tift	GA	applic. under review	620	2	2	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm	SCR		SCONOx - $16,274/ton NO_x; CatOx - $2,095/ton CO
CPV Terrapin, LLC	GA	applic. under review	800	3	3	GE 7FA (170 MW)	NG; FO	CC	8,760; 720 FO	3.5 ppm NG; 5.4 ppm (NG w/DB); 8.0 ppm FO	SCR		
Kinder Morgan Georgia, LLC - Tift Power	GA	applic. under review	560	7	7	1 - GE 7EA & 6 - LM6000	NG	CC	8,760; 3,760 (part load)	9 ppm & 22 ppm	DLN & WI	annual	
Hartwell Development Co.	GA	applic. under review	564	2	0	GE 7FA (176 MW)	NG	CC	8,760	3.5 ppm	SCR		SCONOx - $35,422/ton NO_x; CatOx - $4,964/ton CO
Live Oak Co., LLC	GA	applic. under review	600	2	2	SW 501FD (170 MW)	NG	CC	8,760	3.5 ppm	SCR		
Baldwin County Energy Center	GA	applic. under review	560	2	2	GE 7FA (176 MW)	NG	CC	8,760	3.5 ppm	SCR		
Kentucky Pioneer Energy	KY	Jun-01	540	2	0	GE 7FA (197 MW)	syngas/NG	CC	8,760	15/20 ppm	Steam Injection	3-hr	
Duke Energy Trimble	KY	applic. under review	1,240	4	4	GE 7FA (160 MW)	NG; FO	CC	8,760; 1,000 FO	3.5 ppm	SCR		
Summer Shade Development Co.	KY	applic. under review	680	4	0	GE 7FA (170 MW)	NG	SC	4,000	9 ppm	DLN		
Duke Energy Hinds, L.L.C.	MS	Apr-00	520	2	0	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm	DLN/SCR		
Duke Energy Attala, L.L.C.	MS	Apr-00	520	2	0	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm	DLN/SCR		
Cogentrix Energy, Southaven Power Project	MS	draft permit	800	3	3	GE 7FA (170 MW)	NG	CC	8,760	4.5 ppm (10.8 ppm w/ DB)	DLN/SCR		
Cogentrix Energy, Caledonia Power Project	MS	Mar-01	800	3	3	GE 7FA (182 MW)	NG	CC	8,760	3.5 ppm (w/DB)	DLN/SCR		revised application to add SCR
GenPower - McAdams LLC	MS	draft permit	528	2	2	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm	DLN/SCR	24-hr	
Lone Oak Energy Center	MS	draft permit	800	3	3	F* Class (180 MW)	NG	CC	8,760	3.5 ppm	SCR		Base/PA/PA+DF/DF
Lee Power Partners	MS	draft permit	1,000	4	4	F* Class (170 MW)	NG	CC	8,760	3.5 ppm	SCR		
LSP-Pike Energy LLC	MS	draft permit	1,100	4	4	F* Class (170 MW)	NG	CC	8,760	4.5 ppm	SCR		
Magnolia Energy	MS	draft permit	900	3	3	F* Class (170 MW)	NG	CC	8,760	3.5 ppm	SCR		
Hines Energy Facility	MS	Jan-00	340	2	7	170 MW each	NG	CC	8,760	3.5 ppm	DLN, SCR		
Reliant Energy - Choctaw Co., LLC	MS	draft permit	844	3	3	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm	DLN, SCR	30-day	SCONOx - $48,663/ton NO_x; CatOx - $3,550/ton CO
Crossroads Energy Center	MS	applic. under review	580	2	2	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm	SCR		SCONOx - $23,400/ton NO_x; CatOx - $11,039/ton CO
Choctaw Gas Generation, LLC	MS	applic. under review	700	2	2	SW 501G (250 MW)	NG	CC	8,760	3.5 ppm	SCR		
Duke Energy Homochitto, LLC	MS	applic. under review	630	2	2	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm	SCR	24-hr	
Granite Power Partners II (Batesville)	MS	applic. under review	300	1	1	SW 501F (230 MW)	NG	CC	8,760	3.5 ppm	SCR		
New Albany Energy Development	MS	applic. under review	566	2	2	GE 7FA (168 MW)	NG	CC	8,760	3.5 ppm	SCR		SCONOx - $26,000/ton NOx; CatOx - $5,100/ton CO
Panada Black Prairie LP	MS	applic. under review	1,040	4	4	F* Class (175 MW)	NG	CC	8,760	3.5 ppm	SCR		GE7FA or SW501F
Carolina Power & Light, Richmond Co. (2nd revision - new configuration)	NC	applic. under review	2,040	9	0	GE 7FA (170 MW)	NG; FO	CC/SC	8,760/2,000; 1,000 FO	3.5/9 ppm NG; 13/42 ppm FO	SCR/DLN; SCR/WI	24-hr	Reconfiguration of facility: 6 CC and 3 SC CTs
Carolina Power & Light, Rowan Co. (revision)	NC	draft permit	1,110	2	0	GE 7FA (170 MW)	NG; FO	CC	8,760; 1,000 FO	9 ppm NG; 42 ppm FO	DLN; WI		Modification of previous permit to switch 2 SC -> CC

Table B-2. Summary of BACT Determinations for NO_x for Combined Cycle CTs, 1998-2002

Facility	State	Final Permit Issued	MW	# of CTs	# of DB	Turbine Model	Fuel	Mode	Hours	NOx Limit	Control Method	Avg. Time	Comments
Butler-Warner Generation Plant	NC	applic. under review	500	2	0	GE 7FA (170 MW)	NG; FO	SC & CC	8,760; 500 FO	9 ppm NG; 42 ppm FO	DLN; WI		
GenPower Earleys, LLC	NC	applic. under review	528	2	2	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm	SCR		SCONOx - $21,942/ton NO_x; CatOx - $3,246ton CO
Mountain Creek - Granville Energy Center	NC	applic. under review	911	3	3	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm	SCR		SCONOx - $22,600/ton NOx; CatOx - $3,560ton CO
Santee Cooper, Rainey Generating Station	SC	Apr-00	870	4	0	GE 7FA (170 MW)	NG, FO	2 CC, 2 SC	8,760; 1,000 FO	9 ppm NG; 42 ppm FO	DLN; WI		
SC Electric & Gas - Urquhart	SC	Sep-00	444	2	0	GE 7FA (150 MW)	NG, FO	CC	8,760; 4,380 FO	45 ppm	DLN		Netted out of NO_x, SO_2 and PM_{10} PSD Review
Columbia Energy	SC	Apr-01	515	2	2	GE 7FA (170 MW)	NG, FO	CC	8,760; 1,000 FO	3.5 ppm NG; 12 ppm FO	DLN/SCR; WI		SCONOx - no analysis; CatOx - $1,611/ton CO
GenPower Anderson	SC	draft permit	640	2	2	GE 7FA (170 MW)	NG	CC	8760	3.5 ppm	DLN/SCR		
Fork Shoals Energy, LLC	SC	applic. under review	1,150	2	2	"F" Class (175 MW)	NG	CC	8,760	3.5 ppm	SCR		
Cherokee Falls Development Co.	SC	applic. under review	340	2	0	GE 7FA (170 MW)	NG	SC	4,300	9 ppm	DLN		Hot SCR - $22,800/ton NOx; CatOx - $10,500/ton CO
GenPower Anderson - revision	SC	applic. under review	340	2	0	GE 7FA (170 MW)	NG	SC	2,928	9 ppm	DLN		Temporary 4 month operating period - *Not Subject to PSD Review for CO, VOC or SO2
Palmetto Energy Center	SC	applic. under review	970	3	3	GE 7FB (180 MW)	NG	CC	8,760	3.5 ppm	SCR		SCONOx - $18,789/ton NOx; CatOx - $2,111/ton CO
Vanderbilt University	TN	May-00	10	2	2	GE PGT5B (5.2 MW)	NG	CC	8,760	25 ppm	DLN		
Memphis Generation LLC	TN	draft permit	1,050	4	0	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm	SCR		Phase I - 1 CT (up to 7% total plant heat input from refinery fuel gas), Phase II - 3 CTs (up to 2% total plant heat input from refinery fuel gas)
Haywood Energy Center (Calpine)	TN	applic. under review	900	3	3	SW, GE 7FA or GE F7B	NG; FO	CC	8,760	3.5 ppm NG; 42 ppm FO	DLN/SCR; WI		
TVA - Franklin	TN	applic. under review	610	2	2	GE 7FA (195 MW)		CC	8,760	3.5 ppm	SCR		
REGION 5													
ABB Energy Ventures - Bartlett	IL	Sep-00	558	2	?	2 at 279 MW	NG; FO	CC	8,760	?	SCR	?	
Constellation Power - Holland Energy - Beecher City	IL	Apr-00	336	2	?	168 MW each	NG; FO	CC	8,760	?	SCR		
Peoples Gas, McDonnell Energy	IL	Dec-98	2,500	10	0	250 MW each	NG, ethane	CC	8,760	4.5 ppm	LNC, SCR	1-hr	BACT; Ox Cat rejected at $3043/ton
LS Power, Kendall Energy	IL	Jun-99	1,000	4	4	250 MW each	NG; FO	CC	8,760	4.5 NG ppm/ 16 FO ppm	DLN, SCR	1-hr	BACT; Ox Cat rejected at $4083/ton
Reliant Energy (Houston Industries), Cardinal Woods Rivery Refinery	IL	Jul-99	633	3	3	211 MW each	NG, RFG	CC	8760, 1300 hrs with duct burners, more if load < 100%.	3.5 ppm NG; 4.5 ppm RFG	SCR	8 hr/1 hr	BACT & LAER (NOx); Co-located with refinery, separate source; Ox Cat rejected at $1993/ton
Mid America, Cordova Energy Center	IL	Sep-99	500	2	0	250 MW each	NG	CC	8,760	4.5 ppm	SCR	1-hr	BACT; Ox Cat rejected at $1307/ton
CILCO - Medinia CoGen - Mossville	IL	May-00	43	3		3 at 14.2 MW each	NG	CC	?	?	DLN		
LS Power, Nelson Project	IL	Jan-00	1,000	4	4	250 MW each	NG; FO	CC	8,760	4.5 ppm NG; 16 ppm FO	SCR	1-hr	BACT; Ox Cat rejected at $3100/ton
Ameren CIPS	IL	Feb-00	600	2	2	300 MW each	NG	CC	8,760	-	DLN, future SCR	-	BACT for CO and VOC only - netting out of NOx, PM and SO2 review; replacing coal boilers; Ox Cat rejected at $3400/ton
Holland Energy	IL	draft permit	680	2	2	680 MW	NG; FO	CC	8,760	4.5 ppm NG (3.5 ppm); 16 ppm FO (10 ppm)	SCR	1 hr (24 hr)	BACT; SCR cost $8,900/ton; Ox Cat rejected at $10,600/ton
Duke Energy - Kankakee	IL	draft permit	620	2	?	620 MW	NG	CC	8,760				
Duke Energy - Cook County	IL	under review	620	2	?	620 MW	NG	CC	8,760				
Constellation Power Univ. Park	IL	May-00	175	2	?	175 MW	NG; FO	CC	?	?	SCR	?	BACT
Parke County	IN	no appl. (10-99)	?	2		225 MW?	NG; FO	CC	8,760	3.5ppm, ?? FO	DLN and SCR	an/hr	BACT

Table B-2. Summary of BACT Determinations for NO_x for Combined Cycle CTs, 1998-2002

Facility	State	Final Permit Issued	MW	# of CTs	# of DB	Turbine Model	Fuel	Mode	Hours	NOx Limit	Control Method	Avg. Time	Comments
Whiting Clean Energy	IN	applic. under review	?	2		GE 7FA (166 MW)	NG	CC	8,760	3 ppm; 4 ppm w/DB	DLN and SCR		LAER
LSP	IN	applic. under review	?	4		200 MW?	NG; FO	EITHER	8,760	3.5 ppm; 4.5 w/DB, 16 FO	DLN/WI and SCR		BACT
Wyandotte Energy	MI	Feb-99	500	2	2	GE 7FA	NG	CC	8,760	4.5 ppm(33 lb/hr) NG/16 ppm FO	SCR	1 hr	LAER; SCR cost $5600/ton * Time frame required by Michigan Law
Sourthern Energy	MI	Mar-00	1,000	4	4	GE 7FA	NG	CC	8,760	3.5 ppm, 0.013 lb/mm btu	SCR	1 hr	BACT
KM Power Co	MI	Jun-00	550	7	7	1GE 7EA and 6 GE LM 6000	NG	CC	7380 and 4780	9 ppm and 22 ppm	DLN	30 day	BACT
Covert Generating Co	MI	Jan-01	1,200	3	3	Mitsubishi 501 G	NG	CC	8,760	2.5	SCR	24 hr	BACT
Indec Niles Energy Center	MI	application under review	1076	4	4	Siemens V84.3A	NG	CC					
Midland Cogeneration Venture	MI	application under review	510	2	0	ABBK 24-1	NG	CC					
Detroit Edison Co	MI	application under review	250	3		GE PG7121(EA)							
LSP-Cottage Grove	MN	Nov-98	245	1	1	Westinghouse 501F (245 MW)	NG; FO	CC	7,060 NG; 1,700 FO	4.5 ppm NG; 16 ppm FO	SCR	1-hr	BACT
Pleasant Valley	MN	draft permit	444	3		SW V.84.3A & 501D5A (155 MW & 134 MW)	NG; FO		8,760	35 ppm NG; 42 ppm FO	DLN, WI		PSD
Xcel Energy (formerly NSP-Black Dog)	MN	Jan-01	290	1	1	Westinghouse 501F (290 MW)	NG	CC	8760; 1500 hr/yr for duct burners	4.5 ppm	DLN, SCR	3-hr	BACT/PSD
Duke Energy Washington, LLC	OH	Jan-01	340	2	2	GE 7EA (170 MW)	NG	CC	4260 W/O DB; 4500 W/DB	3.5 ppm	SCR	1 hr (ann.)	PSD
PS&G Waterford Energy	OH	-	340	2		GE 7EA (170 MW)		CC		3.5 ppm	SCR		
Dresden Energy	OH	-	340	2		GE 7EA (170 MW)		CC		3.5 ppm	SCR		
Jackson Co. Power	OH	-	640	4		GE 7EA (160 MW)	NG	CC		5 ppm	SCR		

Abbreviations:

GE = General Electric
SW = Seimens Westinghouse

NG = Nat. Gas
FO = Fuel Oil
DB = Duct Burner

SC = Simple Cycle
CC = Combined Cycle

DLN = Dry-Low NO_x
WI = Water Injection
SCR = Selective Catalytic Reduction

CatOx = Catalytic Oxidation
GCP = Good Combustion Practices

Source: http://www.epa.gov/region4/air/permits/national_ct_list.xls (2002)

Table B-2. Summary of BACT Determinations for NO_x for Combined Cycle CTs, 1998-2002

Facility	State	Final Permit Issued	MW	# of CTs	# of DB	Turbine Model	Fuel	Mode	Hours	NOx Limit	Control Method	Avg. Time	Comments
REGION 3													
Kelson Ridge	MD		1,650	6		Siemens	NG	CC		2.5 ppm	SCR		Major NSR Review
Dickerson Expansion	MD		425	2		GE 7FA	NG	CC		3.5 ppm	SCR		Modification to existing permit (add 2 turbines, repower 2 turbines)
Tenaska	VA		900	3		GE 7FA	NG - Distillate	CC with duct burners	8,760	4.5 ppm or 7 ppm distillate PROPOSED LIMITS - APP	SCR		PSD
Wythe Energy	VA	applic. under review	620	4		GE 7 FA	NG	CC		3.5 ppm	SCR		
Ontelaunee Energy - PA	PA	Oct-00	544	2		Siemens 501F	NG	CC		2.5 ppm	SCR		
AES Ironwood, LLC	PA	Mar-99	700	2			NG; FO	CC	8760 744 (oil)	4.5/10	ALNB, SCR & WI (oil) (LAER)	?	Load restriction 85%
Liberty Electric - Eddystone PA	PA	May-00	500	2	2	GE 7FA	NG/FO	CC	(NG 2117 mscf/12 month rolling) 8760 hours	3.5 ppm CT and 5.0 ppm CT + DB	SCR	1 hour	12 month rolling limit each turbine NOx 113.4 ton CO 253.7 ton VOC 25.1 ton
SWEC - Falls Township, PA	PA		500	2	2	GE 7FA	NG/FO	CC	720 on fuel oil	3 ppm	SCR	1 hour	EPA comment 4/20/01
Lower Mount Bethel PPL	PA	Expected March 2001	600	2	2	Siemens W501F	ng	CC w/DB		3.5 ppm	Dry LNB + SCR		
REGION 4													
Alabama Power, Plant Barry	AL	Aug-99	200	1	1	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm / 0.013 lb/MMBtu	DLN/SCR		
Mobile Energy, LLC - Hog Bayou	AL	Jan-99	200	1	1	GE 7FA (168 MW)	NG; FO	CC	8,760; 675 FO	3.5 ppm NG; 41 ppm w/ FO	DLN/SCR;WI		
Alabama Power - Theodore Cogeneration Facility	AL	Mar-99	210	1	1	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm/ 0.013 lb/MMBtu	DLN/SCR		
Tenaska Alabama Partners	AL	Nov-99	846	3	3	GE 7FA (170 MW)	NG; FO	CC	8,760; 720 FO	3.95 ppm NG; 11.3 ppm FO	DLN/SCR; WI/SCR		
Georgia Power - Goat Rock	AL	Apr-00	-	8	8	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm/ 0.013 lb/MMBtu	DLN/SCR		
Georgia Power - Goat Rock (revision of above PSD application)	AL	Apr-01	2,460	8	8	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm/ 0.013 lb/MMBtu	DLN/SCR		
Alabama Electric Cooperative - Gantt Plant	AL	Mar-00	500	2	2	SW 501F (166 MW)	NG	CC	8,760	3.5 ppm / 0.013 lb/MMBtu	DLN/SCR		
South Eastern Energy Corp.	AL	Jan-01	1,500	6	6 if CC	GE 7FA or SW 501F	NG	SC or CC	8,760	9 or 25 or 3.5 ppm	DLN if SC/SCR if CC		For NO_x and CO: SC w/GE or SC w/SW501F or CC (either)
Calpine Solutia - Decatur	AL	Jun-00	700	3	3	SW501F (180 MW)	NG	CC	8,760	3.5 ppm/ 0.013 lb/MMBtu	SCR		
Calpine BP Amoco	AL	Jun-00	700	3	3	SW501F (180 MW)	NG	CC	8,760	3.5 ppm/ 0.013 lb/MMBtu	SCR		
Tenaska Alabama II Generating Station	AL	Feb-01	900	3	3	GE 7FA or Mitsubishi M501F	NG; FO	CC	8,760; 720 FO	0.013/0.048 lb/mmbtu NG/FO - GE; 0.013/0.046 lb/mmbtu NG/FO - Mit	SCR/WI		
Hillabee Energy Center	AL	Jan-01	700	2	2	SW501G (229 MW)	NG	CC	8,760	3.5 ppm	DLN/SCR		PA = Power Augmentation, DB= Duct Burning
Duke Energy - Alexander City	AL	Feb-01	1,260	10	2	GE 7FA & 7EA	NG	CC & SC	8,760 CC; 2,500 SC	3.5 ppm (0.013 lb/mmBtu) CC; 9/12 ppm (0.033 lb/mmBtu) SC	SCR - CC, DLN-SC	an/1-hr	8 SC units and 2 CC units
GenPower - Kelly, LLC	AL	Jan-01	1,260	4	4	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm	SCR		
Blount County Energy	AL	Jan-01	800	3	3	"F" Class (170 MW)	NG	CC	8,760	0.013 lb/mmBtu (30.7 lb/hr)	SCR	3-hr	
Alabama Power - Autaugaville	AL	Jan-01	1,260	4	4	"F" Class (170 MW)	NG	CC	8,760	3.5 ppm (0.013 lb/mmBtu)	SCR		
Tenaska Alabama IV Partners	AL	draft permit	1,840	6	6	Mit 501F (170 MW)	NG; FO	CC	8,760; 720 FO	3.5 ppm NG; 12 ppm FO	SCR		SCONOx - $6,145/ton NO_x; CatOx- $1,506/ton CO
Duke Energy Autauga, LLC	AL	applic. under review	630	2	2	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm	SCR		SCONOx - $18760/ton NO_x; CatOx- $5,006/ton CO
Duke Energy Dale, LLC	AL	Dec-01	630	2	2	GE 7FA (170 MW)	NG	CC	8,760	3.5 ppm (0.013 lb/mmbtu)	SCR		SCONOx - $18,403/ton NOX; CatOx- $2,634/ton CO+VOC

Table B-3. Capital Cost for Selective Catalytic Reduction and SCONOx™ for the S/W 501F Combined Cycle Combustion Turbine
(3.5 ppmvd corrected for gas firing)

Cost Component	Costs for SCR	Costs for SCONOx™	Basis of Cost Component
Direct Capital Costs			
Pollution Control Equipment	$1,703,362	$14,750,000	Vendor Estimates
Ammonia Storage Tank	$126,865	$0	$35 per 1,000 lb mass flow developed from vendor quotes
Flue Gas Ductwork	$44,505	$69,725	Vatavauk,1990
Instrumentation	$50,000	$50,000	Additional NO_x Monitor and System
Taxes	$102,202	$885,000	6% of SCR Associated Equipment and Catalyst
Freight	$85,168	$737,500	5% of SCR Associated Equipment
Total Direct Capital Costs (TDCC)	$2,112,102	$16,492,225	
Direct Installation Costs			
Foundation and supports	$168,968	1,319,378	8% of TDCC and RCC;OAQPS Cost Control Manual
Handling & Erection	$295,694	2,308,912	14% of TDCC and RCC;OAQPS Cost Control Manual
Electrical	$84,484	659,689	4% of TDCC and RCC;OAQPS Cost Control Manual
Piping	$42,242	329,845	2% of TDCC and RCC;OAQPS Cost Control Manual
Insulation for ductwork	$21,121	164,922	1% of TDCC and RCC;OAQPS Cost Control Manual
Painting	$21,121	164,922	1% of TDCC and RCC;OAQPS Cost Control Manual
Site Preparation	$5,000	$5,000	Engineering Estimate
Buildings	$15,000	$15,000	Engineering Estimate
Total Direct Installation Costs (TDIC)	$653,631	$4,967,668	
Total Capital Costs (TCC)	$2,765,733	$21,459,893	Sum of TDCC, TDIC and RCC
Indirect Costs			
Engineering	$211,210	$1,649,223	10% of Total DirectCapital Costs; OAQPS Cost Control Manual
PSM/RMP Plan	$50,000	$0	Engineering Estimate
Construction and Field Expense	$105,605	$824,611	5% of TDCC; OAQPS Cost Control Manual
Contractor Fees	$211,210	$1,649,223	10% of TDCC; OAQPS Cost Control Manual
Start-up	$42,242	$329,845	2% of TDCC; OAQPS Cost Control Manual
Performance Tests	$21,121	$164,922	1% of TDCC; OAQPS Cost Control Manual
Contingencies	$63,363	$494,767	3% of TDCC; OAQPS Cost Control Manual
Total Indirect Capital Cost (TInCC)	$704,752	$5,112,590	
Total Direct, Indirect and Capital Costs (TDICC)	$3,470,485	$26,572,482	Sum of TCC and TInCC

Sources: Engelhard 2000. ABB Alstom 2000. EPA 1990, 1992 and 1996 (OAQPS Cost Control Manual). Golder 2000. Vatavuk 1990 (Estimating Costs of Air Pollution Control).

Table B-3b. Capital Cost for Selective Catalytic Reduction and SCONOx™ for the S/W 501F Combined Cycle Combustion Turbine
(2.5 ppmvd corrected for gas firing)

Cost Component	Costs for SCR	Costs for SCONOx™	Basis of Cost Component
Direct Capital Costs			
Pollution Control Equipment	$1,759,493	$14,750,000	Vendor Estimates
Ammonia Storage Tank	$126,865	$0	$35 per 1,000 lb mass flow developed from vendor quotes
Flue Gas Ductwork	$44,505	$69,725	Vatavauk,1990
Instrumentation	$50,000	$50,000	Additional NO_x Monitor and System
Taxes	$105,570	$885,000	6% of SCR Associated Equipment and Catalyst
Freight	$87,975	$737,500	5% of SCR Associated Equipment
Total Direct Capital Costs (TDCC)	$2,174,408	$16,492,225	
Direct Installation Costs			
Foundation and supports	$173,953	1,319,378	8% of TDCC and RCC;OAQPS Cost Control Manual
Handling & Erection	$304,417	2,308,912	14% of TDCC and RCC;OAQPS Cost Control Manual
Electrical	$86,976	659,689	4% of TDCC and RCC;OAQPS Cost Control Manual
Piping	$43,488	329,845	2% of TDCC and RCC;OAQPS Cost Control Manual
Insulation for ductwork	$21,744	164,922	1% of TDCC and RCC;OAQPS Cost Control Manual
Painting	$21,744	164,922	1% of TDCC and RCC;OAQPS Cost Control Manual
Site Preparation	$5,000	$5,000	Engineering Estimate
Buildings	$15,000	$15,000	Engineering Estimate
Total Direct Installation Costs (TDIC)	$672,322	$4,967,668	
Total Capital Costs (TCC)	$2,846,730	$21,459,893	Sum of TDCC, TDIC and RCC
Indirect Costs			
Engineering	$217,441	$1,649,223	10% of Total DirectCapital Costs; OAQPS Cost Control Manual
PSM/RMP Plan	$50,000	$0	Engineering Estimate
Construction and Field Expense	$108,720	$824,611	5% of TDCC; OAQPS Cost Control Manual
Contractor Fees	$217,441	$1,649,223	10% of TDCC; OAQPS Cost Control Manual
Start-up	$43,488	$329,845	2% of TDCC; OAQPS Cost Control Manual
Performance Tests	$21,744	$164,922	1% of TDCC; OAQPS Cost Control Manual
Contingencies	$65,232	$494,767	3% of TDCC; OAQPS Cost Control Manual
Total Indirect Capital Cost (TInCC)	$724,066	$5,112,590	
Total Direct, Indirect and Capital Costs (TDICC)	$3,570,797	$26,572,482	Sum of TCC and TInCC

Sources: Engelhard 2000. ABB Alstom 2000. EPA 1990, 1992 and 1996 (OAQPS Cost Control Manual). Golder 2000. Vatavuk 1990 (Estimating Costs of Air Pollution Control).

Table B-4. Annualized Cost for Selective Catalytic Reduction and SCONOX™ for the S/W 501F in Combined Cycle Operation
(3.5 ppmvd corrected for gas firing)

Cost Component	Costs for SCR	Costs for SCONOx™	Basis of Cost Component
Direct Annual Costs			
Operating Personnel	$18,720	$37,440	24 hours/week at $15/hr for SCR; SCONOx 2 times SCR costs
Supervision	$2,808	$5,616	15% of Operating Personnel;OAQPS Cost Control Manual
Ammonia	$287,461	$0	$300 per ton for Aqueous NH_3
PSM/RMP Update	$15,000	$0	Engineering Estimate
Inventory Cost	$43,182	$64,773	Capital Recovery (10.98%) for 1/3 catalyst for SCR; SCONOx 1.5 times SCR
Catalyst Cost	$393,277	$589,916	3 years catalyst life; Based on Vendor Budget Estimate
Contingency	$22,813	$20,932	3% of Direct Annual Costs
Total Direct Annual Costs (TDAC)	$783,262	$718,677	
Energy Costs			
Electrical	$28,032	$70,080	80kW/h for SCR @ $0.04/kWh times Capacity Factor; 200 kW for SCONOx
MW Loss and Heat Rate Penalty	$361,962	$670,645	0.32 % output for SCR; 0.6% for SCONOx; EPA, 1993
Steam Costs for SCONOx	$0	$690,567	17,795 lb/hr 600 °F, 85 psig, steam (1,329 Btu/lb steam); 90% boiler eff.; $3/mmBtu
Natural Gas for SCONOx	$0	$48,737	80 lb/hr; 0.044 lb/scf; 1,020 Btu/scf; $3/mmBtu
Total Energy Costs (TEC)	$389,994	$1,480,029	
Indirect Annual Costs			
Overhead	185,393	25,834	60% of Operating/Supervision Labor and Ammonia
Property Taxes	34,705	265,725	1% of Total Capital Costs
Insurance	34,705	265,725	1% of Total Capital Costs
Annualized Total Direct Capital	381,059	2,917,659	10.98% Capital Recovery Factor of 7% over 15 years times sum of TDICC
Total Indirect Annual Costs (TIAC)	$635,862	$3,474,942	
Total Annualized Costs	$1,809,118	$5,673,648	Sum of TDAC, TEC and TIAC
Total Cost Effectiveness (25 to 3.5)	$2,741	$8,597	per ton of NO_x Removed
Incremental Cost Effectiveness (25 to 3.5)	$2,741	$8,597	per incremental ton of NO_x Removed
	659.98	659.98	tons NOx removed /year; 3.5 ppmvd corrected to 15% oxygen

Source: Golder 2002, EPA 1993 (Alternative Control Techniques Document--NOx Emissions from Stationary Gas Turbines, Page 6-20)

Table B-4b. Annualized Cost for Selective Catalytic Reduction and SCONOx™ for the GE Frame 7FA in Combined Cycle Operation
(2.5 ppmvd corrected for gas firing)

Cost Component	Costs for SCR	Costs for SCONOx™	Basis of Cost Component
Direct Annual Costs			
Operating Personnel	$31,200	$62,400	24 hours/week at $15/hr for SCR; SCONOx 2 times SCR costs
Supervision	$4,680	$9,360	15% of Operating Personnel;OAQPS Cost Control Manual
Ammonia	$298,615	$0	$300 per ton for Aqueous NH_3
PSM/RMP Update	$15,000	$0	Engineering Estimate
Inventory Cost	$45,197	$67,795	Capital Recovery (10.98%) for 1/3 catalyst for SCR; SCONOx 1.5 times SCR
Catalyst Cost	$411,628	$617,442	3 years catalyst life; Based on Vendor Budget Estimate
Contingency	$24,190	$22,710	3% of Direct Annual Costs
Total Direct Annual Costs (TDAC)	$830,509	$779,707	
Energy Costs			
Electrical	$28,032	$70,080	80kW/h for SCR @ $0.04/kWh times Capacity Factor; 200 kW for SCONOx
MW Loss and Heat Rate Penalty	$376,440	$670,645	0.34 % output for SCR; 0.6% for SCONOx; EPA, 1993
Steam Costs for SCONOx	$0	$690,567	17,795 lb/hr 600 °F, 85 psig, steam (1,329 Btu/lb steam); 90% boiler eff.; $3/n
Natural Gas for SCONOx	$0	$48,737	80 lb/hr; 0.044 lb/scf; 1,020 Btu/scf; $3/mmBtu
Total Energy Costs (TEC)	$404,472	$1,480,029	
Indirect Annual Costs			
Overhead	200,697	43,056	60% of Operating/Supervision Labor and Ammonia
Property Taxes	35,708	265,725	1% of Total Capital Costs
Insurance	35,708	265,725	1% of Total Capital Costs
Annualized Total Direct Capital	392,073	2,917,659	10.98% Capital Recovery Factor of 7% over 15 years times sum of TDICC
Total Indirect Annual Costs (TIAC)	$664,186	$3,492,164	
Total Annualized Costs	$1,899,167	$5,751,900	Sum of TDAC, TEC and TIAC
Total Cost Effectiveness (25 to 3.0)	$2,770	$8,390	per ton of NO_x Removed
Incremental Cost Effectiveness (3.5 to 2.5)	$3,516	$3,056	per incremental ton of NO_x Removed
	685.59	685.59	tons NOx removed /year; 3.0 ppmvd corrected to 15% oxygen

Source: Golder 2002. EPA 1993 (Alternative Control Techniques Document--NOx Emissions from Stationary Gas Turbines, Page 6-20)

Table B-5. Comparison of Alternative BACT Control Technologies for NOx on One CT/HRSG

	Alternative BACT Control Technologies		
	DLN Only	DLN with SCR (3.5 ppmvd corrected)	DLN with SCONOx™ (3.5 ppmvd corrected)
Technical Assessment	Feasible	Available, Feasible and Demonstrated	Not Demonstrated
Economic Impact[a]			
Capital Costs	included	$3,470,485	$26,572,482
Annualized Costs	included	$1,809,118	$5,673,648
Cost Effectiveness (per ton of Nox removed)			
Total	NA	$2,741	$8,597
Environmental Impact[b]			
Total NOx (TPY)	793	133.4	133.4
NOx Reduction (TPY)	NA	-660	-660
Ammonia Emissions (TPY)	0	113	0
PM Emissions (TPY)	0	9.9	0
Secondary Emissions (TPY)	0	6.7	41.0
Net Emission Reduction (TPY)	NA	-531	-619
Addition Greenhouse Gas (as CO2; tons/year)	0	3,735	22,701
Energy Impacts[c]			
Energy Use (kWh/yr) - Total	0	5,856,360	35,597,336
Energy Use (kWh/yr) - Back Pressure	0	5,155,560	9,552,254
Energy Use (kWh/yr) - Other	0	700,800	26,045,082
Energy Use (Equivalent Residential Customers/year)	0	488	2,966
Energy Use (mmBtu/yr) at 10,000 Btu/kWh	0	58,970	358,441
Energy Use (mmcf/yr) at 1,000 Btu/cf for natural gas	0	59	358
Energy Use (percent of combustion turbine output)	0	0.37%	2.24%

[a] See Tables B-3, B-4, and B-5 for detailed development of capital costs (including recurring costs) and annualized costs.

[b] See emission data presented in Table B-7.

[c] Energy impacts are estimated due to the lost energy from heat rate penalty and electrical usage for the SCR operation at 8,760 hours per year. Lost energy for SCR is based on 0.3 percent of 181 MW. SCR electrical usage is based on 0.080 MWh per SCR system. Lost Energy for SCONOx™ includes 0.6 percent of turbine output and steam usage. SCONOx™ electrical usage based on 0.2 MW/hr per system.

Table B-5b. Comparison of Alternative BACT Control Technologies for NOx on One CT/HRSG

	Alternative BACT Control Technologies		
	DLN Only	DLN with SCR (2.5 ppmvd corrected)	DLN with SCONOx™ (2.5 ppmvd corrected)
Technical Assessment	Feasible	Available, Feasible and Demonstrat	Not Demonstrated
Economic Impact[a]			
Capital Costs	included	$3,570,797	$26,572,482
Annualized Costs	included	$1,899,167	$5,751,900
Cost Effectiveness (per ton of Nox removed)			
Incremental from 2.5 ppm	NA	$3,516	$3,056
Environmental Impact[b]			
Total NOx (TPY)	793	0.0	0.0
NOx Reduction (TPY)	NA	686	686
Ammonia Emissions (TPY)	0	113	0
PM Emissions (TPY)	0	10.1	0
Secondary Emissions (TPY)	0	7.0	41.0
Net Emission Reduction (TPY)	NA	-556	-645
Additional Greenhouse Gas (as CO_2; tons/year)	0	3,866	22,701
Energy Impacts[c]			
Energy Use (kWh/yr)	0	6,062,582	35,597,336
Energy Use (kWh/yr) - Back Pressure	0	5,361,782	9,552,254
Energy Use (kWh/yr) - Other	0	700,800	24,643,482
Energy Use (Equivalent Residential Customers/year)	0	505	2,966
Energy Use (mmBtu/yr) at 10,000 Btu/kWh	0	61,046	358,441
Energy Use (mmcf/yr) at 1,000 Btu/cf for natural gas	0	61	358
Energy Use (percent of combustion turbine output)	0	0.38%	2.24%

[a] See Tables B-3b, B-4b, and B-5b for detailed development of capital costs (including recurring costs) and annualized costs.

[b] See emission data presented in Table B-7.

[c] Energy impacts are estimated due to the lost energy from heat rate penalty and electrical usage for the SCR operation at 8,760 hours per year. Lost energy for SCR is based on 0.34 percent of 181 MW. SCR electrical usage is based on 0.080 MWh per SCR system. Lost Energy for SCONOx™ includes 0.6 percent of turbine output and steam usage. SCONOx™ electrical usage based on 0.2 MW/hr per system.

Table B-6. Maximum Potential Incremental Emissions (TPY) with Selective Catalytic Reduction (SCR) and SCONOx™

Pollutants	Incremental Emissions (tons/year) of SCR			Incremental Emissions (tons/year) of SCONOx™		
	Primary	Secondary	Total	Primary	Secondary	Total
Particulate	9.86	0.21	10.07		1.30	1.30
Sulfur Dioxide		0.08	0.08		0.49	0.49
Nitrogen Oxides	-659.98	3.93	-656.05	-659.98	23.90	-636.09
Carbon Monoxide		2.36	2.36		14.34	14.34
Volatile Organic Compounds		0.15	0.15		0.94	0.94
Ammonia	112.75					
Total:	-537.38	6.74	-530.64	-659.98	40.96	-619.02
Carbon Dioxide (all energy requirements)		3,734.74	3,734.74		22,701.28	22,701.28

Basis:	SCR	SCONOx™	SCONOx™
Lost Energy (mmBtu/year)	58,970	358,441 total	245,607 steam and natural gas only
Secondary Emissions (lb/mmBtu): Assumes natural gas firing in NOx controlled steam unit.			
Particulate	0.0072		
Sulfur Dioxide	0.0027		
Nitrogen Oxides w/LNB	0.1333		
Carbon Monoxide	0.0800		
Volatile Organic Compounds	0.0052		

(Note: Seconary emissions of criteria pollutants for SCONOx based on the total lost energy minus steam and natural gas since emissions of these pollutants will be controlled in the proposed unit. Emissions of CO_2 will result for all uses.)

Reference: Table 1.4-1 and 1.4-2, AP-42, Version 2/98

Table B-6b. Maximum Potential Incremental Emissions (TPY) with Selective Catalytic Reduction (SCR)
(2.0 ppm)

Pollutants	Incremental Emissions (tons/year) of SCR					
	Primary	Secondary	Total	Primary	Secondary	Total
Particulate	9.86	0.22	10.08		1.30	1.30
Sulfur Dioxide		0.08	0.08		0.49	0.49
Nitrogen Oxides	-685.59	4.07	-681.52	-685.59	23.90	-661.69
Carbon Monoxide		2.44	2.44		14.34	14.34
Volatile Organic Compounds		0.16	0.16		0.94	0.94
Ammonia	112.75					
Total:	-562.99	6.98	-556.01	-685.59	40.96	-644.63
Carbon Dioxide (all energy requirements)		3,866.26	3,866.26		22,701.28	22,701.28

Basis:	SCR	SCONOx™	SCONOx™
Lost Energy (mmBtu/year)	61,046	358,441 total	245,607 steam and natural gas only
Secondary Emissions (lb/mmBtu): Assumes natural gas firing in NOx controlled steam unit.			
Particulate	0.0072		
Sulfur Dioxide	0.0027		
Nitrogen Oxides w/LNB	0.1333		
Carbon Monoxide	0.0800		
Volatile Organic Compounds	0.0052		

(Note: Seconary emissions of criteria pollutants for SCONOx based on the total lost energy minus steam and natural gas since emissions of these pollutants will be controlled in the proposed unit. Emissions of CO_2 will result for all uses.)

Reference: Table 1.4-1 and 1.4-2, AP-42, Version 2/98

Table B-7. Summary of BACT Determinations for CO for Combined Cycle CTs, 1999-2002

Facility	State	Final Permit Issued	# of New MW	# of CTs	# of DB	Turbine Model	Fuel	Mode	Hours	CO Limit	Control Method	Avg. Time	Comments
Calpine Solutia - Decatur	AL	Jun-00	700	3	3	SW501F (180 MW)	NG	CC	8,760	0.117 lb/mmBtu	GCP		
Calpine BP Amoco	AL	Jun-00	700	3	3	SW501F (180 MW)	NG	CC	8,760	0.117 lb/mmBtu	GCP		
Tenaska Alabama II Generating Station	AL	Feb-01	900	3	3	GE 7FA or Mitsubishi M501F	NG; FO	CC	8,760; 720 FO	[illegible] (base/PA/FO) - GE; 0.088/0.116/0.35 lb/mmbtu [illegible]	GCP		
Hillabee Energy Center	AL	Jan-01	700	2	2	SW501G (229 MW)	NG	CC	8,760	0.023/0.076 lb/mmBtu (w/PA and/or DB)	GCP		PA = Power Augmentation, DB= Duct Burning
Duke Energy - Alexander City	AL	Feb-01	1,260	10	2	GE 7FA & 7EA	NG	CC & SC	8,760 CC; 2,500 SC	0.059 lb/mmBtu (130 lb/hr) CC; 0.09 lb/mmBtu (80 lb/hr) SC	GCP		8 SC units and 2 CC units
GenPower - Kelly, LLC	AL	Jan-01	1,260	4	4	GE 7FA (170 MW)	NG	CC	8,760	9 ppm, 14 ppm (w/DB)	GCP		
Blount County Energy	AL	Jan-01	800	3	3	"F" Class (170 MW)	NG	CC	8,760	0.033 lb/mmBtu (77.7 lb/hr)	GCP		
Alabama Power - Autaugaville	AL	Jan-01	1,260	4	4	"F" Class (170 MW)	NG	CC	8,760	0.035 lb/mmBtu	GCP		
Tenaska Alabama IV Partners	AL	draft permit	1,840	6	6	Mit 501F (170 MW)	NG; FO	CC	8,760; 720 FO	0.088 lb/mmBtu NG (0.115 w/PA & DB); 0.35 lb/mmBtu FO	GCP		SCONOx - $6,145/ton NO_x; CatOx- $1,506/ton CO
Duke Energy Autauga, LLC	AL	applic. under review	630	2	2	GE 7FA (170 MW)	NG	CC	8,760	15 ppm	GCP		SCONOx - $18760/ton NO_x; CatOx- $5,006/ton CO
Duke Energy Dale, LLC	AL	applic. under review	630	2	2	GE 7FA (170 MW)	NG	CC	8,760	0.033 lb/mmbtu	GCP		SCONOx - $18,403/ton NOX; CatOx- $2,634/ton CO+VOC
Kissimmee Utility Authority, Cane Island Power Park -Unit 3	FL	draft permit	250	1	0	GE 7FA (167 MW)	NG; FO	CC	8,760; 720 FO	12 ppm, 20 ppm w/ DB NG; 30 ppm FO	GCP		
Duke Energy - New Smyrna Beach	FL	draft permit	500	2	0	GE 7FA (165 MW)	NG	CC	8,760	12 ppm	GCP		
Lake Worth Generation	FL	Nov-99	244	1	1	GE 7FA (170 MW)	NG; FO	CC	8,760; 1,000 FO	12 ppm NG; 20 ppm FO	GCP		
Hines Energy (FPC)	FL	project dropped	500	2	0	SW 501F (165 MW)	NG; FO	CC	8,760; 1,000 FO	25 ppm NG - full load; 30 ppm FO	GCP		
Gulf Power - Smith Station	FL	Jul-00	340	2	2	GE 7FA (170 MW)	NG	CC	8,760	16 ppm w/ DB, 23 ppm w/ DB & SA	GCP		Netting out of PSD for NO_x and CO; SA = steam augmentation
Florida Power & Light - Sanford	FL	Sep-99	2,200	8	0	GE 7FA (170 MW)	NG, FO	CC	8,760; 500 FO	12 ppm NG; 20 ppm FO	GCP		Repowering, 4 units FO
Gainesville Regional Utilities, Kelly Generating Station	FL	Feb-00	133	1	0	GE 7EA (83 MW)	NG; FO	CC	8,760; 1,000 FO	20 ppm NG; 20 ppm FO	GCP		Netting out of PSD review for NO_x
Calpine Osprey Energy Center	FL	Jul-01	527	2	2	SW 501FD (170 MW)	NG	CC	8,760	10 ppm (17 ppm w/DB or PA)	GCP	24-hr Block	2,800 hr/yr - Power Aug. mode
Hines Energy (FPC)	FL	Jun-01	530	2	0	SW 501FD (170 MW)	NG; FO	CC	8,760; 1,000 FO	16 ppm NG; 30 ppm FO	GCP	24-hr Block	SCONOx - $16,712/ton NO_x; CatOx - $2,130/ton CO
CPV - Gulfcoast	FL	Feb-01	250	1	0	GE 7FA (170 MW)	NG; FO	CC	8,760; 720 FO	9 ppm NG; 20 ppm FO	GCP		SCONOx - no cost eval.; CatOx - $4,350/ton CO
TECO Gannon/Bayside	FL	Mar-01	1,728	7	0	GE 7FA (170 MW)	NG; FO	CC	8,760; 876 FO	7.2 ppm NG; 14.2 ppm FO	GCP		Repowering project: netting out of NO_x, CO, PM_{10} and SO_2 review (subject to VOC reveiw)
South Pond Energy Park	FL	draft permit	600	3	0	GE 7FA (170 MW)	NG; FO	SC/CC	3,390/8,760; 720 FO	9 ppm NG; 20 ppm FO	GCP		2 SC CT and 1 CC CT also capable of operating in SC mode.
North Pond Energy Park	FL	applic. under review	430	2	0	GE 7FA (170 MW)	NG; FO	SC/CC	3,390/8,760; 720 FO	9 ppm NG; 20 ppm FO	GCP		1 SC CT and 1 CC CT also capable of operating in SC mode.
Calpine Blue Heron Energy Center	FL	draft permit	1,080	4	4	SW 501F (170 MW)	NG	CC	8,760	10/15.6/38.5/50 ppm	GCP		base/duct burner/power aug./60-70% load; SCONOx - $9,982/ton NO_x; CatOx - $1,553/ton CO
Jacksonville Electric Authority - Brandy Branch (revision)	FL	draft permit	200	0	2	GE 7FA (170 MW)	NG; FO	CC	8760; 288 FO	12.21/14.17 ppm	GCP		Conversion of 2 SC units to 2 CC units
CPV - Atlantic Power	FL	May-01	250	1	0	GE 7FA (170 MW)	NG; FO	CC	8,760; 720 FO	9 ppm NG (15 ppm w/PA) ; 20 ppm FO	GCP		PA = Power Augmentation
Orlando Utilities - Curtis H Stanton Energy Center	FL	Sep-01	633	2	2	GE 7FA (170 MW)	NG; FO	CC	8,760; 1000 FO	18.1 ppm NG (26.3 w/PA); 14.3 ppm FO	GCP		
Broward Energy Center	FL	draft permit	775	4	0	GE 7FA (175 MW)	NG	CC/SC	8,760/5,000	8 ppm (SC); 12 ppm (CC w/PA); 8 ppm (CC)	GCP	24-hr	* 1 CC w/unfired HRSG & 3 SC; PA = Power Augmentation
Belle Glade Energy Center	FL	draft permit	600	3	0	GE 7FA (175 MW)	NG	CC/SC	8,760/5,000	8 ppm (SC); 12 ppm (CC w/PA); 8 ppm (CC)	GCP	24-hr	* 1 CC w/unfired HRSG & 2 SC; PA = Power Augmentation
Manatee Energy Center	FL	draft permit	600	3	0	GE 7FA (175 MW)	NG	CC/SC	8,760/5,000	8 ppm (SC); 12 ppm (CC w/PA); 8 ppm (CC)	GCP	24-hr	* 1 CC w/unfired HRSG & 2 SC; PA = Power Augmentation
CPV Pierce Power Generation Facility	FL	Aug-01	250	1	0	GE 7FA (170 MW)	NG; FO	CC	8,760; 720 FO	8 ppm NG (13 ppm w/PA) ; 17 ppm FO (19 ppm 76-89% load, 26 ppm 50-75% load)	GCP	24-hr	PA limited to 2,000 hr/yr

Table B-7. Summary of BACT Determinations for CO for Combined Cycle CTs, 1999-2002

Facility	State	Final Permit Issued	# of New MW	# of CTs	# of DB	Turbine Model	Fuel	Mode	Hours	CO Limit	Control Method	Avg. Time	Comments
Choctaw Gas Generation, LLC	MS	applic. under review	700	2	2	SW 501G (250 MW)	NG	CC	8,760	23 ppm	GCP		
Duke Energy Homochitto, LLC	MS	applic. under review	630	2	2	GE 7FA (170 MW)	NG	CC	8,760	20.4 ppm	GCP	24-hr	
Granite Power Partners II (Batesville)	MS	applic. under review	300	1	1	SW 501F (230 MW)	NG	CC	8,760	25 ppm	GCP		
New Albany Energy Development	MS	applic. under review	566	2	2	GE 7FA (168 MW)	NG	CC	8,760	13.1 ppm	GCP	annual	SCONOx - $26,000/ton NOx; CatOx - $5,100/ton CO
Panada Black Prairie LP	MS	applic. under review	1,040	4	4	F* Class (175 MW)	NG	CC	8,760	7.6 ppm or 80 ppm	GCP		GE7FA or SW501F
Carolina Power & Light, Richmond Co. (2nd revision - new configuration)	NC	applic. under review	2,040	9	0	GE 7FA (170 MW)	NG; FO	CC/SC	8,760/2,000; 1,000 FO	9 ppm NG; 20 ppm FO	GCP		Reconfiguration of facility: 6 CC and 3 SC CTs
Carolina Power & Light, Rowan Co. (revision)	NC	draft permit	1,110	2	0	GE 7FA (170 MW)	NG; FO	CC	8,760; 1,000 FO	15 ppm NG; 20 ppm FO	GCP		Modification of previous permit to switch 2 SC -> CC
Butler-Warner Generation Plant	NC	applic. under review	500	2	0	GE 7FA (170 MW)	NG; FO	SC & CC	8,760; 500 FO	9 ppm NG; 41 ppm FO	GCP		
GenPower Earleys, LLC	NC	applic. under review	528	2	2	GE 7FA (170 MW)	NG	CC	8,760	9 ppm (14 ppm w/DB)	GCP		SCONOx - $21,942/ton NO_x; CatOx - $3,246ton CO
Mountain Creek - Granville Energy Center	NC	applic. under review	911	3	3	GE 7FA (170 MW)	NG	CC	8,760	9 ppm (24.3 ppm w/DB)	GCP		SCONOx - $22,600/ton NOx; CatOx - $3,560ton CO
Santee Cooper, Rainey Generating Station	SC	Apr-00	870	4	0	GE 7FA (170 MW)	NG, FO	2 CC, 2 SC	8,760; 1,000 FO	9 ppm NG; 20 ppm FO	GCP		
SC Electric & Gas - Urquhart	SC	Sep-00	444	2	0	GE 7FA (150 MW)	NG, FO	CC	8,760; 4,380 FO	12 ppm NG; 20 ppm FO	GCP		Netted out of NO_x, SO_2 and PM_{10} PSD Review
Columbia Energy	SC	Apr-01	515	2	2	GE 7FA (170 MW)	NG, FO	CC	8,760; 1,000 FO	17.4 ppm NG; 37 pm FO	GCP		SCONOx - no analysis; CatOx - $1,611/ton CO
GenPower Anderson	SC	draft permit	640	2	2	GE 7FA (170 MW)	NG	CC	8760	11.7 ppm	GCP		
Fork Shoals Energy, LLC	SC	applic. under review	1,150	2	2	"F" Class (175 MW)	NG	CC	8,760	14 ppm (GE7FA/16 ppm (SW501F)	GCP	24-hr	
Cherokee Falls Development Co.	SC	applic. under review	340	2	0	GE 7FA (170 MW)	NG	SC	4,300	9 ppm	GCP		Hot SCR - $22,800/ton NOx; CatOx - $10,500/ton CO
GenPower Anderson - revision	SC	applic. under review	340	2	0	GE 7FA (170 MW)	NG	SC	2,928	9 ppm*	GCP		Temporary 4 month operating period - Not Subject to PSD Review for CO, VOC or [illegible]
Palmetto Energy Center	SC	applic. under review	970	3	3	GE 7FB (180 MW)	NG	CC	8,760	15 ppm (31 ppm w/DB)	GCP		SCONOx - $18,789/ton NOx; CatOx - $2,111/ton CO
Vanderbilt University	TN	May-00	10	2	2	GE PGT5B (5.2 MW)	NG	CC	8,760	25 ppm	GCP		
Memphis Generation LLC	TN	draft permit	1,050	4	0	GE 7FA (170 MW)	NG	CC	8,760	0.03 lb/mmBtu	GCP		Phase I - 1 CT (up to 7% total plant heat input from refinery fuel gas), Phase II - 3 CTs (up to 2% total plant heat input from refinery fuel gas)
Haywood Energy Center (Calpine)	TN	applic. under review	900	3	3	SW, GE 7FA or GE F7B	NG; FO	CC	8,760	varies from 7.4 to 50 ppm depending on CT type and load	GCP		
TVA - Franklin	TN	applic. under review	610	2	2	GE 7FA (195 MW)		CC	8,760	25 ppm	GCP		
REGION 5													
ABB Energy Ventures - Bartlett	IL	Sep-00	558	2	?	2 at 279 MW	NG; FO	CC	8,760	?			
Constellation Power - Holland Energy - Beecher City	IL	Apr-00	336	2	?	168 MW each	NG; FO	CC	8,760				
Peoples Gas, McDonnell Energy	IL	Dec-98	2,500	10	0	250 MW each	NG, ethane	CC	8,760	15 ppm, 0.031 lb/mmBtu	GCP		BACT; Ox Cat rejected at $3043/ton
LS Power, Kendall Energy	IL	Jun-99	1,000	4	4	250 MW each	NG; FO	CC	8,760	33.1 ppm NG/49.6 ppm FO, 0.0626 w/DB, 0.0511no DB; >75% load	GCP		BACT; Ox Cat rejected at $4083/ton
Reliant Energy (Houston Industries), Cardinal Woods Rivery Refinery	IL	Jul-99	633	3	3	211 MW each	NG, RFG	CC	8760, 1300 hrs with duct burners, more if load < 100%.	0.0472 lb/mmBtu	GCP		BACT & LAER (NOx); Co-located with refinery, separate source; Ox Cat rejected at $1993/ton
Mid America, Cordova Energy Center	IL	Sep-99	500	2	0	250 MW each	NG	CC	8,760	.0547 lb/mmBtu: loads > 75%, after 9/2001	GCP		BACT; Ox Cat rejected at $1307/ton
CILCO - Medinia CoGen - Mossville	IL	May-00	43	3		3 at 14.2 MW each	NG	CC	?				
LS Power, Nelson Project	IL	Jan-00	1,000	4	4	250 MW each	NG; FO	CC	8,760	0.0626 w/DB, 0.0511no DB; >75% load	GCP		BACT; Ox Cat rejected at $3100/ton
Ameren CIPS	IL	Feb-00	600	2	2	300 MW each	NG	CC	8,760	0.06 lb/mmBtu	GCP	3 hr	BACT for CO and VOC only - netting out of NOx, PM and SO2 review; replacing coal boilers; Ox Cat rejected at $3400/ton

Table B-7. Summary of BACT Determinations for CO for Combined Cycle CTs, 1999-2002

Facility	State	Final Permit Issued	# of New MW	# of CTs	# of DB	Turbine Model	Fuel	Mode	Hours	CO Limit	Control Method	Avg. Time	Comments
Fort Pierce Repowering Project	FL	draft permit	180	1	1	SW 501F (180 MW)	NG; FO	CC/SC	8,760; 1,000 FO/2,000; 500 FO	3.5 ppm NG; 10 ppm FO/ 16 ppm NG; 50 ppm FO	GCP		CT will operate in both CC and SC modes
TECO Bayside Power Station	FL	draft permit	1,032	4	0	GE 7FA (170 MW)	NG	CC	8,760	9 ppm (7.8 ppm)	GCP	24-hr (3-hr test)	Repowering Project: Netting out of PSD for NO_x, SO_2, VOC, lead and SAM (subject for PM_{10} and CO)
FPL Martin	FL	applic. under review	1,150	4	0	GE 7FA (170 MW)	NG; FO	CC/SC	8,760; 1,000 FO/1,000; 500 FO	9-15 ppm NG (29.5 ppm w/DB); 20 ppm FO	GCP		
FPL Manatee	FL	applic. under review	1,150	4	4	GE 7FA (170 MW)	NG	CC/SC	8,760; 1,000 FO/1,000; 500 FO	29.5 ppm CC/9 ppm SC (15 in HPM)	GCP		HPM = High Power Mode
Georgia Power - Wansley (Oglethorpe Power)	GA	Jul-00	2,280	8	8	GE 7FA (170 MW)	NG	CC	8,760	29.5 ppm/0.066 lb/MMBtu	GCP		
Duke Energy Murray, LLC	GA	Feb-01	1,240	4	4	GE 7FA (170 MW)	NG	CC	8,760	21.8 ppm	GCP		
Duke Energy Buffalo Creek, LLC	GA	applic. under review	620	2	2	GE 7FA (170 MW)	NG	CC	8,760	21.9 ppm	GCP		SCONOx - $19,948/ton NO_x; CatOx - $2,469/ton CO
Augusta Energy LLC	GA	draft permit	750	3	3	GE 7FA (170 MW)	NG; FO	CC	8,760; 1,000 FO	17.4 ppm NG; 20 ppm FO	GCP		SCONOx - $17,490/ton NO_x; CatOx - $4,133/ton CO
GenPower McIntosh	GA	applic. under review	528	2	2	GE 7FA (170 MW)	NG	CC	8,760	9 ppm/14 (w/DB) ppm	GCP		
Monroe Power Co.	GA	applic. under review	525	2	0	GE 7FA (170 MW)	NG	SC/CC	8,760	9 ppm	GCP		Initially SC, but later converting to CC
Peace Valley Generation Co., LLC	GA	applic. under review	1,550	6	4	F* Class	NG	CC/SC	8,760/2,500	10.6 ppm (25 ppm w/DB)	GCP		
Duke Energy Tift	GA	applic. under review	620	2	2	GE 7FA (170 MW)	NG	CC	8,760	24.1 ppm	GCP		SCONOx - $16,274/ton NO_x; CatOx - $2,095/ton CO
CPV Terrapin, LLC	GA	applic. under review	800	3	3	GE 7FA (170 MW)	NG; FO	CC	8,760; 720 FO	9 ppm NG; 13.6 ppm (NG w/DB); 24 ppm FO	GCP	24-hr rolling	
Kinder Morgan Georgia, LLC - Tift Power	GA	applic. under review	560	7	7	1 - GE 7EA & 6 - LM6000	NG	CC	8,760; 3,760 (part load)	158.5 lb/hr & 141.0 lb/hr	GCP		
Hartwell Development Co.	GA	applic. under review	564	2	0	GE 7FA (176 MW)	NG	CC	8,760	7.4 ppm	GCP		SCONOx - $35,422/ton NO_x; CatOx - $4,964/ton CO
Live Oak Co., LLC	GA	applic. under review	600	2	2	SW 501FD (170 MW)	NG	CC	8,760	10 ppm (17 ppm w/DB or PA)	GCP		
Baldwin County Energy Center	GA	applic. under review	560	2	2	GE 7FA (176 MW)	NG	CC	8,760	9 ppm (24 ppm w/DB)	GCP		
Kentucky Pioneer Energy	KY	Jun-01	540	2	0	GE 7FA (197 MW)	syngas/ NG	CC	8,760	15/20 ppm	GCP	3-hr	
Duke Energy Trimble	KY	applic. under review	1,240	4	4	GE 7FA (160 MW)	NG; FO	CC	8,760; 1,000 FO	9/13.9/20 ppm	GCP		
Summer Shade Development Co.	KY	applic. under review	680	4	0	GE 7FA (170 MW)	NG	SC	4,000	9 ppm	GCP		
Duke Energy Hinds, L.L.C.	MS	Apr-00	520	2	0	GE 7FA (170 MW)	NG	CC	8,760	20 ppm	GCP		
Duke Energy Attala, L.L.C.	MS	Apr-00	520	2	0	GE 7FA (170 MW)	NG	CC	8,760	20 ppm	GCP		
Cogentrix Energy, Southaven Power Project	MS	draft permit	800	3	3	GE 7FA (170 MW)	NG	CC	8,760	9 ppm, 18 ppm w/ DB	GCP		
Cogentrix Energy, Caledonia Power Project	MS	Mar-01	800	3	3	GE 7FA (182 MW)	NG	CC	8,760	9 ppm	GCP		revised application to add SCR
GenPower - McAdams LLC	MS	draft permit	528	2	2	GE 7FA (170 MW)	NG	CC	8,760	7-8 ppm/13 ppm (w/DB)	GCP	24-hr	
Lone Oak Energy Center	MS	draft permit	800	3	3	F* Class (180 MW)	NG	CC	8,760	10/25/30/17 ppm	GCP		Base/PA/PA+DF/DF
Lee Power Partners	MS	draft permit	1,000	4	4	F* Class (170 MW)	NG	CC	8,760	25 ppm	GCP		
LSP-Pike Energy LLC	MS	draft permit	1,100	4	4	F* Class (170 MW)	NG	CC	8,760	33.1 ppm (0.15 lb/mmBTU)	GCP		
Magnolia Energy	MS	draft permit	900	3	3	F* Class (170 MW)	NG	CC	8,760	25 ppm	GCP		
Hines Energy Facility	MS	Jan-00	340	2	?	170 MW each	NG	CC	8,760	20 ppm	GCP		
Reliant Energy - Choctaw Co., LLC	MS	draft permit	844	3	3	GE 7FA (170 MW)	NG	CC	8,760	18.36 ppm	GCP		SCONOx - $48,663/ton NO_x; CatOx - $3,550/ton CO
Crossroads Energy Center	MS	applic. under review	580	2	2	GE 7FA (170 MW)	NG	CC	8,760	10.4 ppm	GCP		SCONOx - $23,400/ton NO_x; CatOx - $11,039/ton CO

Table B-7. Summary of BACT Determinations for CO for Combined Cycle CTs, 1999-2002

Facility	State	Final Permit Issued	# of New MW	# of CTs	# of DB	Turbine Model	Fuel	Mode	Hours	CO Limit	Control Method	Avg. Time	Comments
REGION 3													
Kelson Ridge	MD		1,650	6		Siemens	NG	CC			Cat Ox proposed		Major NSR Review
Perryman Expansion	MD		280				NG	Conversi on to CC				Expansion at existing plant	Modification to existing permit
Dickerson Expansion	MD		425	2		GE 7FA	NG	CC					Modification to existing permit (add 2 turbines, repower 2 turbines)
Duke Energy Point of Rocks	MD		620				NG	CC					Major NSR
AES Cumberland	MD		180				Coal	?					Major NSR
Tenaska	VA	]	900	3		GE 7FA	NG - Distillate	CC with duct burners	8,760	21 ppm proposed in application	GCP		PSD
Cogentrix - henry County	VA		1,600	6				CC					PSD Review
Competitive Power Ventures Fluvanna County	VA		530	4				CC					_____Cancelled ____
Wythe Energy	VA		620	4	yes	GE 7 FA	NG	CC			State comments Cat OX		
ODEC - Faquier County	VA		500										Synthetic Minor - 249 Tons/Nox
Ontelaunee Energy - PA	PA	Oct-00	544	2		Siemens 501F	NG	CC		10 ppm	GCP		
AES Ironwood, LLC	PA # 32-50109	Mar-99	700	2			NG; FO	CC	8760 744 (oil)	5/10	Entristic high thermodyn amic eff.	?	Load restriction 85%
Liberty Electric - Eddystone PA	PA	May-00	500	2	2	GE 7FA	NG/FO	CC	(NG 2117 mscf/12 month rolling) 8760 hours	9ppm CT + 20 ppm CT + DB0	GCP	1 hour	12 month rolling limit each turbine NOx 113.4 ton CO 253.7 ton VOC 25.1 ton
Panda Perkiomen - Montgomery Co., PA	PA	applic. under review	1,000			LM 6000		CC					Strong Public Opposition and Water reuse issues
SWEC - Falls Township, PA	PA		500	2	2	GE 7FA	NG/FO	CC	720 on fuel oil	3 ppm	cat ox	1 hour	EPA comment 4/20/01
FPL - Marcus Hook, PA	PA	applic. under review	750			GE 7FB		CC					
Limerick - Limerick, PA	PA	applic. under review	500					CC					
Connectiv - Lancaster	PA		500										
Connectiv - Delta Project - York County	PA		1,100	6		Siemens V84.2		CC			GCP proposed		
Connectiv - Indiana County	PA		1,000	6		Siemens V84.2		SC and CC					
Sithe	PA		1,600										
Lower Mount Bethel PPL	PA	Expected March 2001	600	2	2	Siemens W501F	ng	CC w/DB		6 PPM	Cat Ox		
Reliant Upper Mount Bethel	PA		560	2	2	Siemens		CC			Cat ox proposed		
Panda	WV		1,000				NG	CC					
Anker	WV		1,000				Coal	CFB					
REGION 4													
Alabama Power, Plant Barry	AL	Aug-99	200	1	1	GE 7FA (170 MW)	NG	CC	8,760	0.060 lb/MMBtu	GCP		
Mobile Energy, LLC - Hog Bayou	AL	Jan-99	200	1	1	GE 7FA (168 MW)	NG; FO	CC	8,760; 675 FO	0.040 lb/MMBtu NG; 0.058 lb/mmBtu FO	GCP		
Alabama Power - Theodore Cogeneration Facility	AL	Mar-99	210	1	1	GE 7FA (170 MW)	NG	CC	8,760	0.086 lb/MMBtu	GCP		
Tenaska Alabama Partners	AL	Nov-99	846	3	3	GE 7FA (170 MW)	NG; FO	CC	8,760; 720 FO	32.9 ppm NG; 46.7 ppm NG/FO	GCP		
Georgia Power - Goat Rock	AL	Apr-00	-	8	8	GE 7FA (170 MW)	NG	CC	8,760	0.086 lb/MMBtu	GCP		
Georgia Power - Goat Rock (revision of above PSD application)	AL	Apr-01	2,460	8	8	GE 7FA (170 MW)	NG	CC	8,760	0.086 lb/MMBtu	GCP		
Alabama Electric Cooperative - Gantt Plant	AL	Mar-00	500	2	2	SW 501F (166 MW)	NG	CC	8,760	0.057 lb/MMBtu	GCP		
South Eastern Energy Corp.	AL	Jan-01	1,500	6	6 if CC	GE 7FA or SW 501F	NG	SC or CC	8,760	9 or 19 or 22 ppm	GCP		For NO_x and CO: SC w/GE or SC w/SW501F or CC (either)

Table B-7. Summary of BACT Determinations for CO for Combined Cycle CTs, 1999-2002

Facility	State	Final Permit Issued	# of New MW	# of CTs	# of DB	Turbine Model	Fuel	Mode	Hours	CO Limit	Control Method	Avg. Time	Comments
Holland Energy	IL	draft permit	680	2	2	680 MW	NG; FO	CC	8,760	0.02, 0.04 FO, 0.12 NG w/DB	GCP	1-hr	BACT; SCR cost $8,900/ton; Ox Cat rejected at $10,600/ton
Duke Energy - Kankakee	IL	draft permit	620	2	?	620 MW	NG	CC	8,760				
Duke Energy - Cook County	IL	under review	620	2	?	620 MW	NG	CC	8,760				
Constellation Power Univ. Park	IL	May-00	175	2	?	175 MW	NG; FO	CC	?				BACT
Parke County	IN	no appl. (10-99)	?	2		225 MW?	NG; FO	CC	8,760	unknown			BACT
Whiting Clean Energy	IN	applic. under review	?	2		GE 7FA (168 MW)	NG	CC	8,760	9 ppm; <19 ppm w/duct burners	GCP		LAER
LSP	IN	applic. under review	?	4		200 MW?	NG; FO	EITHER	8,760	33.1 ppm - 234.3 (50% load); 49.6 ppm - 168 ppm (50% load) FO	GCP		BACT
Wyandotte Energy	MI	Feb-99	500	2	2	GE 7FA	NG	CC	8,760	3 ppm (LAER)	Cat Ox	1 hr	LAER; SCR cost $5600/ton * Time frame required by Michigan Law
Sourthern Energy	MI	Mar-00	1,000	4	4	GE 7FA	NG	CC	8,760	0.042 lb/mm btu	GCP	1 hr	BACT
KM Power Co	MI	Jun-00	550	7	7	1GE 7EA and 6 GE LM 6000	NG	CC	7380 and 4780	79 lb/hr and 132 lb/hr	GCP	1 hr	BACT
Covert Generating Co	MI	Jan-01	1,200	3	3	Mitsubishi 501 G	NG	CC	8,760	33.7 lb/hr	Cat Ox	24 hr	BACT
Indec Niles Energy Center	MI	application under review	1076	4	4	Siemens V84.3A	NG	CC					
Midland Cogeneration Venture	MI	application under review	510	2	0	ABBK 24-1	NG	CC					
Detroit Edison Co	MI	application under review	250	3		GE PG7121(EA)							
LSP-Cottage Grove	MN	Nov-98	245	1	1	Westinghouse 501F (245 MW)	NG; FO	CC	7,060 NG; 1,700 FO	1200 lb/hr, 1200 lb/hr FO	Cat Ox	1-hr	BACT
Pleasant Valley	MN	draft permit	444	3		SW V.84.3A & 501D5A (155 MW & 134 MW)	NG; FO		8,760	35 ppm NG; 35 ppm FO	GCP		PSD
Xcel Energy (formerly NSP-Black Dog)	MN	Jan-01	290	1	1	Westinghouse 501F (290 MW)	NG	CC	8760; 1500 hr/yr for duct burners	18 ppm; 25 ppm when duct burners operating; 400 tpy	GCP	3-hr	BACT/PSD
Duke Energy Washington, LLC	OH	Jan-01	340	2	2	GE 7EA (170 MW)	NG	CC	4260 W/O DB; 4500 W/DB	10 ppm w/o DB; 114 w/ DB	GCP	hr/an	PSD
PS&G Waterford Energy	OH	-	340	2		GE 7EA (170 MW)		CC					
Dresden Energy	OH	-	340	2		GE 7EA (170 MW)		CC					
Jackson Co. Power	OH	-	640	4		GE 7EA (160 MW)	NG	CC					

Abbreviations:
GE = General Electric
SW = Seimens Westinghouse

NG = Nat. Gas
FO = Fuel Oil
DB = Duct Burner

SC = Simple Cycle
CC = Combined Cycle

DLN = Dry-Low NO_x
WI = Water Injection
SCR = Selective Catalytic Reduction

CatOx = Catalytic Oxidation
GCP = Good Combustion Practices

Source: http://www.epa.gov/region4/air/permits/national_ct_list.xls (2002)

Table B-8. Direct and Indirect Capital Costs for CO Catalyst, GE Frame 7FA in Combined Cycle Combustion Turbine

Cost Component	Costs	Basis of Cost Component
Direct Capital Costs		
CO Associated Equipment	$758,000	Vendor Quote
Flue Gas Ductwork	$44,505	Vatavauk,1990
Instrumentation	$75,800	10% of SCR Associated Equipment
Sales Tax	$45,480	6% of SCR Associated Equipment/Catalyst
Freight	$37,900	5% of SCR Associated Equipment/Catalyst
Total Direct Capital Costs (TDCC)	$961,685	
Direct Installation Costs		
Foundation and supports	$76,935	8% of TDCC and RCC;OAQPS Cost Control Manual
Handling & Erection	$134,636	14% of TDCC and RCC;OAQPS Cost Control Manual
Electrical	$38,467	4% of TDCC and RCC;OAQPS Cost Control Manual
Piping	$19,234	2% of TDCC and RCC;OAQPS Cost Control Manual
Insulation for ductwork	$9,617	1% of TDCC and RCC;OAQPS Cost Control Manual
Painting	$9,617	1% of TDCC and RCC;OAQPS Cost Control Manual
Site Preparation	$5,000	Engineering Estimate
Buildings	$0	
Total Direct Installation Costs (TDIC)	$293,506	
Total Capital Costs	$1,255,191	Sum of TDCC, TDIC and RCC
Indirect Costs		
Engineering	$125,519	10% of Total Capital Costs; OAQPS Cost Control Manual
Construction and Field Expense	$62,760	5% of Total Capital Costs; OAQPS Cost Control Manual
Contractor Fees	$125,519	10% of Total Capital Costs; OAQPS Cost Control Manual
Start-up	$25,104	2% of Total Capital Costs; OAQPS Cost Control Manual
Performance Tests	$12,552	1% of Total Capital Costs; OAQPS Cost Control Manual
Contingencies	$37,656	3% of Total Capital Costs; OAQPS Cost Control Manual
Total Indirect Capital Cost (TInDC)	$389,109	
Total Direct, Indirect and Capital Costs (TDICC)	$1,644,300	Sum of TCC and TInCC

Table B-9. Annualized Cost for CO Catalyst GE Frame 7FA in Combined Cycle Combustion Turbine

Cost Component	Cost	Basis of Cost Estimate
Diirect Annual Costs		
Operating Personnel	$6,240	8 hours/week at $15/hr
Supervision	$936	15% of Operating Personnel;OAQPS Cost Control Manual
Catalyst Replacement	$219,667	3 year catalyst life; base on Vendor Budget Quote
Inventory Cost	$24,668	Capital Recovery (10.98%) for 1/3 catalyst
Contingency	$7,545	3% of Direct Annual Costs
Total Direct Annual Costs (TDAC)	$259,056	
Energy Costs		
Heat Rate Penalty	$223,548	0.2% of MW output; EPA, 1993 (Page 6-20) and $3/mmBtu addl fuel costs
Total Energy Costs (TDEC)	$223,548	
Indirect Annual Costs		
Overhead	$4,306	60% of Operating/Supervision Labor
Property Taxes	$16,443	1% of Total Capital Costs
Insurance	$16,443	1% of Total Capital Costs
Annualized Total Direct Capital	$180,544	10.98% Capital Recovery Factor of 7% over 15 yrs times sum of TDICC
Total Indirect Annual Costs	$217,736	
Total Annualized Costs	$700,340	Sum of TDAC, TEC and TIAC
Cost Effectiveness	$3,773	per ton of CO Removed
	$4,070	per ton of Net Emission Reduction

Table B-10. Comparison of Alternative BACT Control Technologies with Installing OC in HRSG

	Alternative BACT Control Technologies	
	DLN Only	DLN with OC
Technical Assessment	Feasible	Available, Feasible and Demonstrated
Economic Impact [a]		
Capital Costs	included	$1,644,300
Annualized Costs	included	$700,340
Cost Effectiveness		
CO Removed (per ton of CO)	NA	$3,773
Environmental Impact [b]		
Total CO (TPY)	216	30
CO Reduction (TPY)	NA	-184
Net Pollutant Reduction	NA	-172
Additional Greenhouse Gas (CO2; tons/yr)	--	2,031
Energy Impacts [c]		
Energy Use (kWh/yr)	0	3,184,085
Energy Use (Equivalent Residential Customers/year)	0	265
Energy Use (mmBtu/yr) at 10,000 Btu/kWh	0	32,062
Energy Use (mmcf/yr) at 1,000 Btu/cf for natural gas	0	32

[a] See Tables B-8 and B-9 for detailed development of capital costs (including recurring costs) and annualized costs.

[b] See emission data presented in Table B-11.

[c] Energy impacts are estimated due to the lost energy from heat rate penalty for 8,760 hours per year. Lost energy is based on 0.2 percent of 166 MW.

Table B-11. Maximum Potential Incremental Emissions (TPY) with Oxidation Catalyst

Pollutants	Incremental Emissions (tons/year) of SCR		
	Primary	Secondary	Total
Particulate	9.86	0.12	9.97
Sulfur Dioxide		0.04	0.04
Nitrogen Oxides	0.00	2.14	2.14
Carbon Monoxide	-185.6	1.28	-184.3
Volatile Organic Compounds		0.08	0.08
Total:	-175.8	3.66	-172.1
Carbon Dioxide (additional from gas firing)		2,030.6	2,030.6

Basis:

Lost Energy (mmBtu/year)	32,062
Secondary Emissions (lb/mmBtu): Assumes natural gas firing in NOx controlled steam unit.	
Particulate	0.0072
Sulfur Dioxide	0.0027
Nitrogen Oxides w/LNB	0.1333
Carbon Monoxide	0.0800
Volatile Organic Compounds	0.0052

Reference: Table 1.4-1 and 1.4-2, AP-42, Version 2/98

APPENDIX C

APPENDIX C - CALPUFF MODEL DESCRIPTION AND METHODOLOGY

C.1 INTRODUCTION

As part of the new source review requirements under Prevention of Significant Deterioration (PSD) regulations, new sources are required to address air quality impacts at PSD Class I areas. As part of the PSD analysis report submitted to the Florida Department of Environmental Protection (DEP), the air quality impacts due to the potential emissions of the proposed Hines Energy Complex Power Block 3 are required to be addressed at the PSD Class I area of the Chassahowitzka National Wilderness Area (NWA). The Chassahowitzka NWA is located approximately 118 km north-northwest of the facility site and is the only PSD Class I area within 200 km of the facility.

The evaluation of air quality impacts are not only concerned with determining compliance with PSD Class I increments but also assessing a source's impact on Air Quality Related Values (AQRVs), such as regional haze. Further, compliance with PSD Class I increments can be evaluated by determining if the source's impacts are less than the proposed U.S. Environmental Protection Agency (EPA) Class I significant impact levels. The significant impact levels are threshold levels that are used to determine the type of air impact analyses needed for the facility. If the new source's impacts are predicted to be less than significant, then the source's impacts are assumed not to have a significant adverse affect on air quality and additional modeling with other sources is not required. However, if the source's impacts are predicted to be greater than the significant impact levels, additional modeling with other sources is required to demonstrate compliance with Class I increments.

Currently there are several air quality modeling approaches recommended by the Interagency Workgroup on Air Quality Models (IWAQM) to perform these analyses. The IWAQM consists of EPA and Federal Land Managers (FLM) of Class I areas who are responsible for ensuring that AQRVs are not adversely impacted by new and existing sources.
These recommendations have been summarized in two documents:

- *Interagency Workgroup on Air Quality Models (IWAQM), Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts* (EPA, 1998), referred to as the IWAQM Phase 2 report.

- *Federal Land Managers' Air Quality Related Values Workgroup (FLAG), Phase I Report,* USFS, NPS, USFWS (12/00), referred to as the FLAG document.

For the proposed project, air quality analyses were performed that assess the facility's impacts in the PSD Class I area of the ENP using the refined modeling approach from the IWAQM Phase 2 report for:

- Significant impact analysis
- SO_2 PSD Class I increment analysis; and
- Regional haze analysis

The refined analysis approach was used instead of the screening analysis approach since the air quality impacts are based on generally more realistic assumptions, include more detailed meteorological data, and are estimated at locations at the Class I area.

C.2 GENERAL AIR MODELING APPROACH

The general modeling approach was based on using the long-range transport model, California Puff model (CALPUFF, Version 5.5). At distances beyond 50 km, the ISCST3 model is considered to over-predict air quality impacts, because it is a steady-state model. At those distances, the CALPUFF model is recommended for use. Recently, the FLM have requested that air quality impacts, such as for regional haze, for a source located more than 50 km from a Class I area be predicted using the CALPUFF model. The Florida DEP has also recommended that the CALPUFF model be used to assess if the source has a significant impact at a Class I area located beyond 50 km from the source. As a result, a significant impact and regional haze analyses were performed using the CALPUFF model to assess the facility's impacts at the Chassahowitzka NWA.

The methods and assumptions used in the CALPUFF model were based on the latest recommendations for a refined analysis as presented in the IWAQM Phase 2 Summary Report and the FLAG document.

A regional haze analysis was performed to determine the affect that the facility's emissions will have on background regional haze levels at the Chassahowitzka NWA. In the regional haze analysis, the change in visual range, as calculated by a deciview change, was estimated for the facility in accordance with the IWAQM recommendations. Based on those recommendations, the CALPUFF model is used to predict the maximum 24-hour average sulfate (SO_4), nitrate (NO_3), and fine particulate (PM_{10}) concentrations as well as ammonium sulfate [$(NH_4)_2 SO_4$] and ammonium nitrate (NH_4NO_3) concentrations. The change in visibility due to a source, estimated as a percentage, is then calculated based on the change from background data.

The following sections present the methods and assumptions used to assess the refined significant impact and regional haze analyses performed for the Proposed Project. The results of these analyses are presented in Sections 7.0 and 8.0 of the PSD report.

C.3 MODEL SELECTION AND SETTINGS

The California Puff (CALPUFF, version 5.5) air modeling system was used to model to assess the Proposed Project's impacts at the PSD Class I area for comparison to the PSD Class I significant impact levels and to the regional haze visibility criteria. CALPUFF is a non-steady state Lagrangian Gaussian puff long-range transport model that includes algorithms for building downwash effects as well as chemical transformations (important for visibility controlling pollutants), and wet/dry deposition. The CALPUFF meteorological and geophysical data preprocessor (CALMET, Version 5.2), a preprocessor to

CALPUFF, is a diagnostic meteorological model that produces a three-dimensional field of wind and temperature and a two-dimensional field of other meteorological parameters. CALMET was designed to process raw meteorological, terrain and land-use databases to be used in the air modeling analysis. The CALPUFF modeling system uses a number of FORTRAN preprocessor programs that extract data from large databases and converts the data into formats suitable for input to CALMET. The processed data produced from CALMET was input to CALPUFF to assess the pollutant specific impact. Both CALMET and CALPUFF were used in a manner that is recommended by the IWAQM Phase 2 and FLAG reports.

C.3.1 CALPUFF MODEL APPROACHES AND SETTINGS

The IWAQM has recommended approaches for performing a Phase 2 refined modeling analyses that are presented in Table 1. These approaches involve use of meteorological data, selection of receptors and dispersion conditions, and processing of model output.

The specific settings used in the CALPUFF model are presented in Table 2.

C.3.2 EMISSION INVENTORY AND BUILDING WAKE EFFECTS

The CALPUFF model included the facility's emission, stack, and operating data as well as building dimensions to account for the effects of building-induced downwash on the emission sources. Dimensions for all significant building structures were processed with the Building Profile Input Program (BPIP), Version 95086, and were included in the CALPUFF model input. The PSD Analysis Report presents a listing of the facility's emissions and structures included in the analysis.

C.4 RECEPTOR LOCATIONS

For the refined analyses, pollutant concentrations were predicted in an array of 13 discrete receptors located at the Chassahowitzka NWA.

C.5 METEOROLOGICAL DATA

C.5.1 REFINED ANALYSIS

CALMET was used to develop the gridded parameter fields required for the refined modeling analyses. The follow sections discuss the specific data used and processed in the CALMET model.

C.5.2 CALMET SETTINGS

The CALMET settings contained in Table 3 were used for the refined modeling analysis. With the exception of hourly precipitation data files, all input data files needed for CALMET were developed by the FDEP staff.

C.5.3 MODELING DOMAIN

A rectangular modeling domain extending 350 km in the east-west (x) direction and 375 km in the north-south (y) direction was used for the refined modeling analysis. The southwest corner of the domain is the origin and is located at 27.0 degrees north latitude and 83.5 degrees west longitude. This location is in the Gulf of Mexico approximately 110 km west of Venice, Florida. For the processing of meteorological and geophysical data, the domain contains 70 grid cells in the x-direction and 75 grid cells in the y-direction. The domain grid resolution is 5 km. The air modeling analysis was performed in the UTM coordinate system.

C.5.4 MESOSCALE MODEL – GENERATION 4 (MM4) DATA

Pennsylvania State University in conjunction with the NCAR Assessment Laboratory developed the MM4 data set, a prognostic wind field or "guess" field, for the United States. The hourly meteorological variables used to create this data set (wind, temperature, dew point depression, and geopotential height for eight standard levels and up to 15 significant levels) are extensive and only allow for one database set for the year 1990. The analysis used the MM4 data to initialize the CALMET wind field. The MM4 data have a horizontal spacing of 80 km and are used to simulate atmospheric variables within the modeling domain.

The MM4 subset domain was provided by FDEP and consisted of a 8 x 7- cell rectangle, with 80 km grid resolution, extending from the MM4 grid points (49,10) to (56,16). These data were processed to create a MM4.DAT file, for input to the CALMET model.

The MM4 data set used in the CALMET, although advanced, lacks the fine detail of specific temporal and spatial meteorological variables and geophysical data. These variables were processed into the appropriate format and introduced into the CALMET model through the additional data files obtained from the following sources.

C.5.5 SURFACE DATA STATIONS AND PROCESSING

The surface station data processed for the CALPUFF analyses consisted of data from six NWS stations or Federal Aviation Administration (FAA) Flight Service stations for Orlando, Fort Myers, Daytona Beach, Vero Beach, Tampa, and Gainesville. A summary of the surface station information and locations are presented in Table 4. The surface station parameters include wind speed, wind direction, cloud ceiling height, opaque cloud cover, dry bulb temperature, relative humidity, station pressure, and a precipitation code that is based on current weather conditions. The surface station data were processed into a SURF.DAT file format for CALMET input.

Because the modeling domain extends largely over water, C-Man station data from Venice was obtained. These data were processed by Florida DEP into an over-water surface station format (i.e., SEA*.DAT) for input to CALMET. The over-water station data include wind direction, wind speed and air temperature.

C.5.6 UPPER AIR DATA STATIONS AND PROCESSING

The analysis included three upper air NWS stations located in Ruskin, Apalachicola, and West Palm Beach. Data for each station were obtained from the Florida DEP in a format for CALMET input. The data and locations for the upper air stations are presented in Table 4.

C.5.7 PRECIPITATION DATA STATIONS AND PROCESSING

Precipitation data were processed from a network of hourly precipitation data files collected from primary and secondary NWS precipitation-recording stations located within the latitude and longitudinal limits of the modeling domain. Data for 27 stations were obtained in NCDC TD-3240 variable format and converted into a fixed-length format. The utility programs PXTRACT and PMERGE were then used to process the data into the format for the PRECIP.DAT file that is used by CALMET. A listing of the precipitation stations used for the modeling analysis is presented in Table 5.

C.5.8 GEOPHYSICAL DATA PROCESSING

Terrain elevations for each grid cell of the modeling domain were obtained from 1-degree Digital Elevation Model (DEM) files obtained from the U.S. Geographical Survey (USGS) internet website. The DEM data was extracted for the modeling domain grid using the utility program TERREL. Land-use data were also extracted from 1-degree USGS files and processed using utility programs CTGCOMP and CTGPROC. Both the terrain and land use files were combined into a GEO.DAT file for input to CALMET with the MAKEGEO utility program.

Table 1. Refined Modeling Analyses Recommendations [a]

Model Input/Output	Description
Meteorology	Use CALMET (minimum 6 to 10 layers in the vertical; top layer must extend above the maximum mixing depth expected); horizontal domain extends 50 to 80 km beyond outer receptors and sources being modeled; terrain elevation and land-use data is resolved for the situation.
Receptors	Within Class I area(s) of concern; obtain regulatory concurrence on coverage.
Dispersion	1. CALPUFF with default dispersion settings. 2. Use MESOPUFF II chemistry with wet and dry deposition. 3. Define background values for ozone and ammonia for area.
Processing	1. For PSD increments: use highest, second highest 3-hour and 24-hour average SO_2 concentrations; highest, second highest 24-hour average PM_{10} concentrations; and highest annual average SO_2, PM_{10} and NO_x concentrations. 2. For haze: process, on a 24-hour basis, compute the source extinction from the maximum increase in emissions of SO_2, NO_x and PM_{10}; compute the daily relative humidity factor [f(RH)], provided from an external disk file; and compute the maximum percent change in extinction using the FLM supplied background extinction data in the FLAG document. 3. For significant impact analysis: use highest annual and highest short-term averaging time concentrations for SO_2, PM_{10} and NO_x.

[a] IWAQM Phase II report (December, 1998) and FLAG document (December, 2000)

Table 2. CALPUFF Model Settings

Parameter	Setting
Pollutant Species	SO_2, SO_4, NO_x, HNO_3, NO_3, PM_{10}
Chemical Transformation	MESOPUFF II scheme, hourly ozone data
Deposition	Include both dry and wet deposition, plume depletion
Meteorological/Land Use Input	CALMET
Plume Rise	Transitional, Stack-tip downwash, Partial plume penetration
Dispersion	Puff plume element, PG /MP coefficients, rural mode, ISC building downwash scheme
Terrain Effects	Partial plume path adjustment
Output	Create binary concentration file including output species for SO_4, NO_3, PM_{10}, SO_2, and NO_x; process for visibility change using Method 2 and FLAG background extinctions
Model Processing	For haze: highest predicted 24-hour extinction change (%) for the year For deposition: annual average deposition rate For significant impact analysis: highest predicted annual and highest short-term averaging time concentrations for SO_2, NO_x, and PM_{10}.
Background Values	Ozone: 80 ppb; Ammonia: 0.5 ppb

[a] Recommended values by the Florida DEP.

Table 3. CALMET Settings

Parameter	Setting
Horizontal Grid Dimensions	350 by 375 km, 5 km grid resolution
Vertical Grid	9 layers
Weather Station Data Inputs	6 surface, 3 upper air, 27 precipitation stations
Wind model options	Diagnostic wind model, no kinematic effects
Prognostic wind field model	MM4 data, 80 km resolution, 8 x 7 grid, used for wind field initialization
Output	Binary hourly gridded meteorological data file for CALPUFF input

Table 4. Surface and Upper Air Stations Used in the CALPUFF Analysis

Station Name	Station Symbol	WBAN Number	UTM Coordinates Easting (km)	UTM Coordinates Northing (km)	Zone	Anemometer Height (m)
<u>Surface Stations</u>						
Tampa	TPA	12842	349.20	3094.25	17	6.7
Daytona Beach	DAB	12834	495.14	3228.05	17	9.1
Orlando	ORL	12815	468.96	3146.88	17	10.1
Vero Beach	VER	12843	557.52	3058.36	17	6.7
Fort Myers	FMY	12835	413.65	2940.38	17	6.1
Gainesville	GNV	12816	377.40	3284.12	17	6.7
<u>Upper Air Stations</u>						
Ruskin	TBW	12842	349.20	3094.28	17	NA
West Palm Beach	PBI	12844	587.87	2951.42	17	NA
Apalachicola	AQQ	12832	110.00[a]	3296.00	16	NA

[a] Equivalent coordinate for Zone 17.

Table 5. Hourly Precipitation Stations Used in the CALPUFF Analysis

Station Name	Station Number	UTM Coordinate		
		Easting (km)	Northing (km)	Zone
Belle Glade HRCN GT 4	80616	528.190	2953.034	17
Branford	80975	315.606	3315.955	17
Brooksville 7 SSW	81048	358.029	3149.545	17
Canal Point Gate 5	81271	536.428	2971.514	17
Daytona Beach WSO AP	82158	494.165	3227.413	17
Deland 1 SSE	82229	470.780	3209.660	17
Fort Myers FAA/AP	83186	413.992	2940.710	17
Gainesville 11 WNW	83322	355.411	3284.205	17
Inglis 3 E	84273	342.631	3211.652	17
Lakeland	84797	409.871	3099.178	17
Lisbon	85076	423.594	2193.256	17
Lynne	85237	409.255	3230.295	17
Marineland	85391	479.193	3282.030	17
Melbourne	85612	534.381	3109.967	17
Moore Haven Lock 1	85895	491.608	2967.803	17
Orlando WSO McCoy	86628	468.169	3145.102	17
Ortona Lock 2	86657	470.17	2962.27	17
Parrish	86880	366.99	3054.39	17
Port Mayaca S l Canal	87293	538.04	2984.44	17
Saint Leo	87851	376.483	3135.086	17
St Lucie New Lock 1	87859	571.04	2999.35	17
St Petersburg	87886	339.61	3071.99	17
Tampa WSCMO AP	88788	348.48	3093.67	17
Venice	89176	357.59	2998.18	17
Venus	89184	467.27	3001.22	17
Vero Beach 4 W	89219	554.27	3056.50	17
West Palm Beach Int AP	89525	589.61	2951.63	17

NOV 1990
TAMPA, FL
NWS CONTRACT MET OBS
P.O. BOX 30100 RM214 HANGER ONE

ISSN 0198-1420

LOCAL CLIMATOLOGICAL DATA

Monthly Summary

INTERNATIONAL AIRPORT

LATITUDE 27° 58'N LONGITUDE 82° 32'W ELEVATION (GROUND) 19 FEET TIME ZONE EASTERN 12842

NOV 1990
TAMPA, FL

DATE	TEMPERATURE °F MAXIMUM	MINIMUM	AVERAGE	DEPARTURE FROM NORMAL	AVERAGE DEW POINT	DEGREE DAYS BASE 65°F HEATING (SEASON BEGINS WITH JUL)	COOLING (SEASON BEGINS WITH JAN)	WEATHER TYPES 1 FOG 2 HEAVY FOG 3 THUNDERSTORM 4 ICE PELLETS 5 HAIL 6 GLAZE 7 DUSTSTORM 8 SMOKE, HAZE 9 BLOWING SNOW	SNOW ICE PELLETS OR ICE ON GROUND AT 0700 INCHES	PRECIPITATION WATER EQUIVALENT (INCHES)	PRECIPITATION SNOW, ICE PELLETS (INCHES)	AVERAGE STATION PRESSURE IN INCHES ELEV. 11 FEET ABOVE M.S.L.	WIND (M.P.H.) RESULTANT DIR.	RESULTANT SPEED	AVERAGE SPEED	PEAK GUST SPEED	PEAK GUST DIRECTION	FASTEST 1-MIN SPEED	FASTEST 1-MIN DIRECTION	SUNSHINE MINUTES	SUNSHINE PERCENT OF TOTAL POSSIBLE	SKY COVER (TENTHS) SUNRISE TO SUNSET	SKY COVER (TENTHS) MIDNIGHT TO MIDNIGHT
1	2	3	4	5	6	7A	7B	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
01	84	62	73	3	61	0	8		0	0.00	0.0	30.120	06	8.5	8.7	22	E	15	08	576	87	1	3
02	85	68	77	7	63	0	12		0	0.00	0.0	30.120	07	8.9	9.2	23	E	14	10	562	85	3	4
03	85	64	75	5	62	0	10		0	0.00	0.0	30.100	07	8.3	8.4	18	E	15	08	434	66	3	1
04	88	66	77	8	65	0	12		0	0.00	0.0	29.990	07	7.1	7.2	16	E	12	08	453	69	3	5
05	83	61	72	3	64	0	7		0	0.00	0.0	29.880	27	2.0	5.4	15	W	12	27	538	82	1	1
06	85	61	73	4	68	0	8	1	0	0.03	0.0	29.920	29	3.4	6.4	15	N	13	28	353	54	5	5
07	82	59	71	2	65	0	6	1 8	0	0.00	0.0	30.000	34	2.5	5.9	15	N	12	28	443	68	5	3
08	88*	65	77	9	65	0	12	2 8	0	0.00	0.0	29.980	08	6.9	7.7	18	E	12	08	367	56	4	5
09	85	69	77	9	72	0	12	1 3	0	0.23	0.0	29.860	15	9.1	11.4	28	S	17	12	46	7	9	9
10	76	60	68	0	60	0	3		0	0.00	0.0	29.915	30	14.6	16.0	30	W	22	29	339	52	5	6
11	74	48*	61*	-7	44	4	0		0	0.00	0.0	30.210	04	7.6	8.1	25	N	14	04	620	95	0	0
12	80	50	65	-2	46	0	0		0	0.00	0.0	30.250	01	5.0	5.7	17	NW	14	02	587	90	4	3
13	82	53	68	1	54	0	3		0	0.00	0.0	30.190	02	4.7	5.6	17	E	10	07	461	71	9	7
14	82	59	71	4	57	0	6		0	0.00	0.0	30.250	06	9.5	9.8	21	E	15	06	512	79	3	3
15	83	61	72	5	58	0	7		0	0.00	0.0	30.285	07	8.7	9.0	22	E	15	08	501	78	2	1
16	81	59	70	4	59	0	5		0	0.00	0.0	30.190	06	5.9	6.0	17	E	12	04	375	58	3	4
17	79	57	68	2	57	0	3		0	0.00	0.0	30.050	34	7.8	8.8	24	N	16	33	507	79	1	1
18	76	51	64	-2	46	1	0		0	0.00	0.0	30.070	01	6.9	7.9	17	N	13	36	643	100	1	1
19	76	49	63	-3	49	2	0		0	0.00	0.0	30.130	34	5.2	6.3	13	N	10	31	641	100	1	0
20	77	50	64	-2	51	1	0		0	0.00	0.0	30.165	35	5.5	6.7	15	NW	10	36	584	91	1	1
21	81	54	68	3	53	0	3		0	0.00	0.0	30.170	02	3.9	5.4	14	NW	8	28	495	77	3	2
22	82	55	69	4	59	0	4	2	0	0.00	0.0	30.100	07	3.4	4.5	10	NE	8	05	276	43	6	5
23	78	59	69	4	62	0	4	1 8	0	0.19	0.0	30.010	27	3.4	4.5	14	NW	9	29	420	66	9	8
24	78	63	71	6	67	0	6	1	0	0.14	0.0	30.020	22	2.9	5.0	14	SW	8	27	194	31	9	7
25	81	58	70	5	63	0	5	2 8	0	0.00	0.0	30.130	35	1.5	3.9	13	N	8	01	532	84	3	2
26	85	59	72	8	63	0	7	2 8	0	0.00	0.0	30.160	05	1.6	5.0			10	12	543	86	3	1
27	86	65	76	12	69	0	11	1 3	0	0.05	0.0	30.140	12	4.6	6.5	20	S	13	14	218	34	7	5
28	86	73	80*	16	73	0	15	1	0	0.02	0.0	30.160	12	4.2	7.2	17	SE	12	13	259	41	8	8
29	83	61	72	8	66	0	7	2 8	0	0.00	0.0	30.195	34	3.9	8.9	26	N	16	36	370	59	6	6
30	74	49	62	-2	44	3	0		0	0.00	0.0	30.290	05	12.8	13.6	33	E	24	07	518	82	3	2
	SUM 2445	SUM 1768				TOTAL 11	TOTAL 176	NUMBER OF DAYS		TOTAL 0.66	TOTAL 0.0	FOR THE MONTH: 30.100	04	3.4	7.5	33	E	24	07	TOTAL 13367	%	SUM 121	SUM 109
	AVG. 81.5	AVG. 58.9	AVG. 70.2	DEP. 3.5	AVG. 59.4	DEP. -54	DEP. 60	PRECIPITATION ≥ .01 INCH. 6		DEP. -1.21						DATE:30		DATE: 30		POSSIBLE 19394	MONTH 69	AVG. 4.0	AVG. 3.6

NUMBER OF DAYS				SEASON TO DATE		SNOW, ICE PELLETS		GREATEST IN 24 HOURS AND DATES			GREATEST DEPTH ON GROUND OF SNOW, ICE PELLETS OR ICE AND DATE
MAXIMUM TEMP.		MINIMUM TEMP.		TOTAL	TOTAL	≥ 1.0 INCH 0		PRECIPITATION	SNOW, ICE PELLETS		
≥ 90°	≤ 32°	≤ 32°	≤ 0°	DEP.	DEP.	THUNDERSTORMS	2	0.33	23-24	0.0	0
0	0	0	0	-47	672	HEAVY FOG	5	CLEAR 17	PARTLY CLOUDY 8	CLOUDY 5	

* EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE.
T TRACE AMOUNT.
+ ALSO ON EARLIER DATE(S).
HEAVY FOG: VISIBILITY 1/4 MILE OR LESS.
BLANK ENTRIES DENOTE MISSING OR UNREPORTED DATA.

DATA IN COLS 6 AND 12-15 ARE BASED ON 21 OR MORE OBSERVATIONS AT HOURLY INTERVALS. RESULTANT WIND IS THE VECTOR SUM OF WIND SPEEDS AND DIRECTIONS DIVIDED BY THE NUMBER OF OBSERVATIONS. COLS 16 & 17: PEAK GUST - HIGHEST INSTANTANEOUS WIND SPEED. ONE OF TWO WIND SPEEDS IS GIVEN UNDER COLS 18 & 19: FASTEST MILE - HIGHEST RECORDED SPEED FOR WHICH A MILE OF WIND PASSES STATION (DIRECTION IN COMPASS POINTS). FASTEST OBSERVED ONE MINUTE WIND - HIGHEST ONE MINUTE SPEED (DIRECTION IN TENS OF DEGREES). ERRORS WILL BE CORRECTED IN SUBSEQUENT PUBLICATIONS.

I CERTIFY THAT THIS IS AN OFFICIAL PUBLICATION OF THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, AND IS COMPILED FROM RECORDS ON FILE AT THE NATIONAL CLIMATIC DATA CENTER

noaa NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION | NATIONAL ENVIRONMENTAL SATELLITE, DATA AND INFORMATION SERVICE | NATIONAL CLIMATIC DATA CENTER ASHEVILLE NORTH CAROLINA

Kenneth D. Hadeen
DIRECTOR
NATIONAL CLIMATIC DATA CENTER

OBSERVATIONS AT 3-HOUR INTERVALS

NOV 1990 TAMPA, FL 12842

HOUR L.S.T.	SKY COVER (TENTHS)	CEILING IN HUNDREDS OF FEET	VISIBILITY WHOLE MILES	VISIBILITY 16THS MILE	WEATHER	TEMPERATURE AIR °F	TEMPERATURE WET BULB °F	TEMPERATURE DEW POINT °F	REL HUMIDITY %	WIND DIRECTION	WIND SPEED (KNOTS)
NOV 1st											
01	2	UNL	12			65	64	63	93	03	5
04	0	UNL	10			63	62	62	97	04	5
07	0	UNL	10			62	61	60	93	06	4
10	1	UNL	15			77	68	62	60	07	8
13	1	UNL	15			82	67	58	44	07	9
16	3	UNL	20			82	67	58	44	07	9
19	9	70	15			76	66	60	58	07	9
22	8	75	15			73	66	61	66	06	8
NOV 2nd											
01	10	55	15			70	66	64	81	08	5
04	8	80	15			69	67	65	87	08	5
07	7	100	15			68	65	63	84	05	7
10	4	UNL	15			80	71	66	63	07	8
13	3	UNL	15			84	70	62	48	08	12
16	3	UNL	15			84	68	58	41	08	8
19	0	UNL	15			76	67	61	60	07	6
22	1	UNL	15			72	66	63	73	06	7
NOV 3rd											
01	0	UNL	15			67	64	62	84	06	5
04	0	UNL	12			65	63	61	87	05	5
07	0	UNL	8			65	64	63	93	04	6
10	9	70	10			73	67	64	74	07	9
13	2	UNL	10			83	71	64	53	08	10
16	1	UNL	15			84	68	58	41	07	10
19	0	UNL	15			73	65	60	64	06	5
22	0	UNL	15			71	66	63	76	07	6
NOV 4th											
01	0	UNL	15			69	67	66	90	06	8
04	8	90	12			68	67	66	93	08	5
07	2	UNL	12			66	65	65	97	06	4
10	0	UNL	15			80	72	68	67	05	5
13	4	UNL	15			85	72	65	51	06	8
16	7	48	15			82	70	64	55	08	10
19	8	55	15			76	69	65	69	06	5
22	9	90	15			74	68	64	71	07	4
NOV 5th											
01	3	UNL	15			69	65	63	81	07	5
04	2	UNL	15			65	63	62	90	09	3
07	3	UNL	12			62	61	61	97	05	3
10	0	UNL	10			79	69	63	58	03	4
13	1	UNL	15			82	69	62	51	26	6
16	0	UNL	15			81	69	63	54	27	10
19	0	UNL	15			71	68	66	84	28	5
22	0	UNL	15			71	70	69	93	21	3
NOV 6th											
01	9	60	10			73	72	72	97	18	4
04	10	55	10			74	73	72	94	21	5
07	9	37	12			72	71	71	97	36	3
10	4	UNL	15			78	74	72	82	24	4
13	3	UNL	15			83	74	70	65	26	9
16	1	UNL	15			81	70	64	56	28	10
19	0	UNL	15			69	65	63	81	31	6
22	0	UNL	12			64	62	60	87	01	6
NOV 7th											
01	1	UNL	10			60	59	59	97	00	0
04	9	4	8			62	61	61	97	00	4
07	10	3	2		F	66	65	65	97	07	4
10	8	7	2		F	72	69	67	84	10	4
13	2	UNL	6		H	80	73	69	69	25	5
16	2	UNL	10			80	71	67	65	28	9
19	0	UNL	10			71	67	65	81	34	7
22	0	UNL	8			68	67	66	93	01	5
NOV 8th											
01	0	UNL	8			65	64	64	97	04	3
04	8	6	4		F	66	65	65	97	05	5
07	10	0	0	2	F	68	68	68	100	07	5
10	0	UNL	6		H	78	72	69	74	10	6
13	4	UNL	9			86	71	63	46	13	7
16	4	UNL	12			83	69	61	48	09	6
19	6	250	12			77	69	65	67	09	9
22	7	80	12			72	67	64	76	06	9
NOV 9th											
01	7	90	12			70	67	65	84	07	6
04	9	95	12			71	68	67	87	10	8
07	9	100	10			73	70	68	84	12	10
10	8	100	15			81	75	72	74	14	14
13	10	50	15			84	76	73	70	13	9
16	10	32	3		BWF	78	77	76	94	18	12
19	10	19	7		TRW	79	76	75	88	19	14
22	8	250	7			77	76	75	94	21	10
NOV 10th											
01	9	35	7			76	75	74	94	24	8
04	10	25	7			72	69	67	84	28	18
07	5	UNL	10			71	64	59	66	29	16
10	5	UNL	15			75	66	61	62	31	12
13	6	50	15			72	64	59	64	29	19
16	3	UNL	15			70	61	55	59	29	17
19	4	UNL	15			64	59	56	75	31	12
22	4	UNL	15			62	58	54	75	35	10
NOV 11th											
01	0	UNL	15			56	52	49	78	03	10
04	0	UNL	15			53	50	46	77	03	8
07	0	UNL	12			48	46	44	86	01	6
10	0	UNL	12			59	52	46	62	03	9
13	1	UNL	12			71	58	46	41	01	9
16	1	UNL	20			72	55	39	30	07	11
19	1	UNL	20			62	52	42	48	06	5
22	0	UNL	20			58	51	44	60	06	3
NOV 12th											
01	0	UNL	15			54	50	46	75	00	0
04	0	UNL	15			51	49	46	83	02	6
07	2	UNL	15			51	46	41	69	10	3
10	4	UNL	20			71	57	44	38	01	9
13	6	UNL	20			78	59	44	39	01	7
16	3	UNL	20			79	59	43	28	34	7
19	2	UNL	20			63	56	51	65	32	4
22	5	UNL	20			58	56	54	87	35	3
NOV 13th											
01	2	UNL	15			58	57	56	93	00	0
04	2	UNL	15			56	56	55	97	00	0
07	7	250	10			53	53	53	100	00	0
10	8	UNL	15			69	60	53	57	06	4
13	9	UNL	15			80	64	52	38	06	6
16	9	UNL	15			79	63	52	39	34	8
19	8	250	15			66	59	54	65	01	7
22	10	250	10			65	60	57	76	07	9
NOV 14th											
01	6	UNL	10			61	58	56	84	03	7
04	3	UNL	10			59	57	55	87	06	6
07	5	UNL	10			60	58	56	87	04	6
10	2	UNL	15			74	65	59	60	08	11
13	2	UNL	15			80	67	58	47	06	11
16	2	UNL	15			81	65	55	41	05	10
19	1	UNL	15			72	64	58	62	08	9
22	0	UNL	15			66	62	59	78	06	6
NOV 15th											
01	0	UNL	15			64	60	57	78	06	7
04	0	UNL	10			62	60	58	87	07	5
07	0	UNL	10			62	60	59	90	06	7
10	0	UNL	15			76	66	60	58	08	12
13	3	UNL	15			81	66	57	44	09	11
16	2	UNL	12			80	67	58	47	05	7
19	2	UNL	12			71	62	56	59	07	5
22	0	UNL	12			66	62	60	81	06	6
NOV 16th											
01	1	UNL	10			64	62	60	87	07	6
04	0	UNL	8			60	59	59	97	06	3
07	10	70	8			63	61	60	90	05	5
10	1	UNL	15			75	67	62	64	06	9
13	4	UNL	15			80	66	57	45	04	7
16	1	UNL	15			79	65	56	45	07	9
19	2	UNL	15			68	61	56	66	05	4
22	3	UNL	15			66	61	58	76	00	0
NOV 17th											
01	8	80	12			64	61	59	84	35	5
04	3	UNL	12			62	61	60	93	08	0
07	2	UNL	7			62	62	62	100	32	6
10	0	UNL	15			74	67	62	66	35	9
13	0	UNL	15			78	63	53	42	34	11
16	0	UNL	15			75	65	58	56	31	12
19	0	UNL	15			63	59	55	75	32	6
22	0	UNL	15			61	54	47	60	03	10
NOV 18th											
01	0	UNL	12			56	52	48	75	05	6
04	0	UNL	12			53	48	43	69	05	6
07	0	UNL	12			52	48	43	72	06	5
10	0	UNL	15			65	55	47	52	36	11
13	0	UNL	15			74	59	47	38	35	9
16	3	UNL	20			74	57	42	32	36	9
19	0	UNL	15			62	53	45	54	36	4
22	1	UNL	15			59	53	48	67	35	6

WEATHER CODES

*	TORNADO	ZL	FREEZING DRIZZLE	IPW	ICE PELLET SHOWERS	BN	BLOWING SAND
T	THUNDERSTORM	S	SNOW	A	HAIL	BS	BLOWING SNOW
Q	SQUALL	SH	SNOW SHOWERS	F	FOG	BY	BLOWING SPRAY
R	RAIN	SG	SNOW GRAINS	IF	ICE FOG	K	SMOKE
RW	RAIN SHOWERS	SP	SNOW PELLETS	GF	GROUND FOG	H	HAZE
ZR	FREEZING RAIN	IC	ICE CRYSTALS	BD	BLOWING DUST	D	DUST
L	DRIZZLE	IP	ICE PELLETS				

CEILING: UNL INDICATES UNLIMITED
WIND DIRECTION: DIRECTIONS ARE THOSE FROM WHICH THE WIND BLOWS, INDICATED IN TENS OF DEGREES FROM TRUE NORTH: I.E., 09 FOR EAST, 18 FOR SOUTH, 27 FOR WEST. AN ENTRY OF 00 INDICATES CALM
SPEED: THE OBSERVED AVERAGE ONE-MINUTE VALUE, EXPRESSED IN KNOTS (MPH=KNOTS X 1.15).

PAGE 2

OBSERVATIONS AT 3-HOUR INTERVALS

NOV 1990
TAMPA, FL

12842

HOUR L.S.T.	SKY COVER (TENTHS)	CEILING IN HUNDREDS OF FEET	VISIBILITY WHOLE MILES	VISIBILITY 16THS MILE	WEATHER	TEMPERATURE AIR °F	TEMPERATURE WET BULB °F	TEMPERATURE DEW POINT °F	REL HUMIDITY %	WIND DIRECTION	WIND SPEED (KNOTS)
					NOV 19th						
01	0	UNL	15			54	51	48	80	01	6
04	0	UNL	15			52	50	48	86	36	6
07	0	UNL	12			49	49	48	96	36	5
10	0	UNL	15			67	58	50	55	36	6
13	1	UNL	15			76	61	49	39	29	6
16	3	UNL	15			73	60	50	45	27	9
19	0	UNL	15			62	55	48	60	33	7
22	0	UNL	15			57	53	49	75	36	3
					NOV 20th						
01	0	UNL	15			54	50	47	77	01	6
04	0	UNL	15			51	49	47	86	36	4
07	0	UNL	12			51	50	49	93	01	4
10	0	UNL	10			68	58	49	51	36	9
13	0	UNL	14			77	64	55	47	36	4
16	2	UNL	15			75	63	54	48	27	8
19	6	55	15			67	58	50	55	34	7
22	0	UNL	10			62	56	50	65	03	6
					NOV 21st						
01	0	UNL	12			56	54	52	87	02	4
04	1	UNL	12			55	53	52	90	04	5
07	3	UNL	7			54	53	52	93	05	5
10	3	UNL	9			69	61	56	63	06	6
13	4	UNL	12			80	65	54	41	01	4
16	4	UNL	15			77	64	55	47	28	7
19	3	UNL	15			67	60	54	63	34	5
22	0	UNL	15			61	57	53	75	35	3
					NOV 22nd						
01	0	UNL	12			57	55	53	87	06	4
04	0	UNL	9			58	57	57	97	08	5
07	9	75	2	8	F	58	58	58	100	06	4
10	10	70	10			68	64	61	78	05	5
13	1	UNL	15			80	68	60	51	13	5
16	5	UNL	15			80	66	57	45	03	3
19	3	UNL	15			69	64	60	73	06	3
22	6	75	6		F	66	64	63	90	12	3
					NOV 23rd						
01	10	80	7			65	64	63	93	00	0
04	2	UNL	7			61	60	60	97	00	0
07	3	UNL	2		F	60	60	60	100	00	0
10	10	UNL	5		H	74	68	64	71	27	4
13	10	UNL	12			77	68	62	60	26	5
16	10	80	15			75	62	53	46	29	8
19	10	75	15			71	64	60	68	26	6
22	10	49	9		R	69	67	65	87	27	4
					NOV 24th						
01	10	40	3		RF	66	66	66	100	22	4
04	8	55	2		F	66	66	66	100	17	5
07	9	80	3		F	67	66	66	97	15	5
10	10	48	3		RF	69	69	69	100	20	6
13	8	65	20			76	71	69	79	26	5
16	10	55	15			76	71	68	76	26	7
19	2	UNL	10			68	67	66	93	30	5
22	1	UNL	6		GF	64	63	63	97	01	4
					NOV 25th						
01	0	UNL	6		F	61	61	61	100	00	0
04	2	UNL	2		F	60	60	60	100	00	0
07	0	UNL	5		F	58	58	58	100	01	3
10	3	UNL	3		F	68	66	64	87	01	6
13	2	UNL	6		H	75	69	66	74	36	4
16	1	UNL	7			79	71	67	67	21	6
19	0	UNL	10			69	67	66	90	27	5
22	0	UNL	8			64	63	63	97	36	3
					NOV 26th						
01	0	UNL	7			62	62	62	100	36	4
04	0	UNL	7			60	60	60	100	01	4
07	0	UNL	3		F	60	60	60	100	36	3
10	0	UNL	4		H	76	70	67	74	28	5
13	2	UNL	9			82	69	62	51	34	7
16	4	UNL	15			84	70	63	49	09	5
19	0	UNL	15			73	66	61	66	12	4
22	0	UNL	15			72	68	65	79	10	8
					NOV 27th						
01	0	UNL	15			69	67	66	90	12	7
04	0	UNL	6		F	65	64	64	97	09	5
07	2	UNL	5		F	65	64	64	97	08	4
10	10	65	7			75	72	70	85	08	7
13	3	UNL	15			84	75	71	65	13	8
16	5	UNL	15			84	75	71	65	25	6
19	8	33	15			75	73	72	90	19	6
22	8	250	10			73	72	72	97	11	4
					NOV 28th						
01	3	UNL	7			73	72	72	97	12	5
04	10	3	1	8	F	73	73	73	100	11	8
07	10	4	1	8	F	74	73	73	97	12	6
10	10	14	7			77	74	73	88	14	9
13	7	UNL	12			85	76	72	65	14	8
16	7	UNL	15			84	75	71	65	28	6
19	9	40	15			79	74	72	79	02	7
22	9	40	8			74	73	73	97	11	4
					NOV 29th						
01	8	65	9			75	74	73	94	14	5
04	3	UNL	8			73	72	72	97	13	4
07	9	2	1		F	70	70	70	100	08	3
10	1	UNL	3		H	79	75	73	82	18	3
13	3	UNL	10			83	75	71	67	24	7
16	6	55	12			77	72	70	79	32	11
19	7	55	15			71	67	65	81	35	9
22	8	75	15			67	55	44	44	01	12
					NOV 30th						
01	2	UNL	15			59	49	37	44	36	11
04	5	UNL	15			52	42	27	38	03	12
07	4	UNL	15			49	42	33	54	04	10
10	0	UNL	15			63	54	45	52	05	16
13	0	UNL	15			73	61	51	46	06	15
16	8	UNL	15			70	58	49	47	07	21
19	2	UNL	15			64	57	51	63	08	10
22	2	UNL	15			58	54	51	78	05	5

SUMMARY BY HOURS

HOUR L.S.T	AVERAGES SKY COVER (TENTHS)	AVERAGES STATION PRESSURE (INCHES)	AVERAGES TEMPERATURE AIR TEMP °F	AVERAGES TEMPERATURE WET BULB °F	AVERAGES TEMPERATURE DEW POINT °F	AVERAGES REL HUMIDITY %	AVERAGES WIND SPEED (MPH)	RESULTANT WIND DIRECTION	RESULTANT WIND SPEED (MPH)
01	3	30.100	64	61	59	87	5.6	05	3.4
04	3	30.090	62	60	59	90	5.9	05	3.3
07	4	30.110	61	60	58	91	5.8	05	3.7
10	4	30.145	73	66	61	68	8.8	05	4.8
13	3	30.090	80	68	60	52	9.3	04	2.9
16	4	30.060	79	66	59	52	10.4	35	2.8
19	3	30.090	70	64	59	70	7.5	01	2.8
22	3	30.120	66	62	59	79	6.5	04	4.1

HOURLY PRECIPITATION (WATER EQUIVALENT IN INCHES) NOV 1990 TAMPA, FL 12842

DATE	A.M. HOUR ENDING AT												P.M. HOUR ENDING AT												DATE
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
01																									01
02																									02
03																									03
04																									04
05																									05
06					0.02	0.01																			06
07																									07
08																									08
09														T	0.01	0.10	0.07	0.01	0.01	0.03					09
10																									10
11																									11
12																									12
13																									13
14																									14
15																									15
16																									16
17																									17
18																									18
19																									19
20																									20
21																									21
22																									22
23																						T	0.13	0.06	23
24	0.04	T							T	0.10															24
25																									25
26																									26
27																		T							27
28																				0.02	0.05				28
29																									29
30																									30

MAXIMUM SHORT DURATION PRECIPITATION

TIME PERIOD (MINUTES)	5	10	15	20	30	45	60	80	100	120	150	180
PRECIPITATION (INCHES)	0.07	0.09	0.09	0.12	0.12	0.14	0.16	0.18	0.19	0.19	0.19	0.23
ENDED: DATE	09	09	09	09	23	23	23	23	23	23	23	24
ENDED: TIME	1549	1555	1601	1604	2309	2309	2309	2319	2340	2340	2340	0059

THE PRECIPITATION AMOUNTS FOR THE INDICATED TIME INTERVALS MAY OCCUR AT ANY TIME DURING THE MONTH. THE TIME INDICATED IS THE ENDING TIME OF THE INTERVAL. DATE AND TIME ARE NOT ENTERED FOR TRACE AMOUNTS.

VALIDATED BY:
MATTHEW BODOSKY

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BUILDING PARAMETER INPUT PROGRAM

(BPIP)

INPUT AND OUTPUT FILES

BPIP INPUT FILE

```
'D:\FPL Hines 3\bpip\hines3.bpv'
'ST'
'Meters'  1.00000000
'UTMN'  0.0000
2
'HRSG3A'  1          0.000
   4       24.000
          -285.280       56.390
          -276.640       56.390
          -276.640       34.000
          -285.280       34.000
'BLDG2'  1         0.000
   4       24.000
          -244.110       56.390
          -235.480       56.390
          -235.480       34.000
          -244.110       34.000
2
'HINES3A'        0.000       38.100      -280.890       29.000
'HINES3B'        0.000       38.100      -239.740       29.000
```

BPIP OUTPUT FILE

BPIP (Dated: 95086)
DATE : 8/21/ 2
TIME : 9:35: 8
D:\FPL Hines 3\bpip\hines3.bpv

==========

BPIP PROCESSING INFORMATION:

==========

The ST flag has been set for processing for an ISCST2 run.

Inputs entered in Meters will be converted to meters using
a conversion factor of 1.0000. Output will be in meters.

UTMP is set to UTMN. The input is assumed to be in a local
X-Y coordinate system as opposed to a UTM coordinate system.
True North is in the positive Y direction.

Plant north is set to 0.00 degrees with respect to True North.

D:\FPL Hines 3\bpip\hines3.bpv

PRELIMINARY* GEP STACK HEIGHT RESULTS TABLE
(Output Units: meters)

Stack Name	Stack Height	Stack-Building Base Elevation Differences	Preliminary* GEP** EQN1	GEP Stack Height Value

HINES3A	38.10	0.00	59.99	65.00
HINES3B	38.10	0.00	60.00	65.00

* Results are based on Determinants 1 & 2 on pages 1 & 2 of the GEP Technical Support Document. Determinant 3 may be investigated for additional stack height credit. Final values result after Determinant 3 has been taken into consideration.

** Results were derived from Equation 1 on page 6 of GEP Technical Support Document. Values have been adjusted for any stack-building base elevation differences.

Note: Criteria for determining stack heights for modeling emission limitations for a source can be found in Table 3.1 of the GEP Technical Support Document.

BPIP (Dated: 95086)

DATE : 8/21/ 2

TIME : 9:35: 8

D:\FPL Hines 3\bpip\hines3.bpv

BPIP output is in meters

SO BUILDHGT HINES3A 24.00 24.00 24.00 24.00 24.00 24.00
SO BUILDHGT HINES3A 24.00 24.00 24.00 24.00 24.00 24.00
SO BUILDHGT HINES3A 24.00 24.00 24.00 24.00 24.00 24.00
SO BUILDHGT HINES3A 24.00 24.00 24.00 24.00 24.00 24.00
SO BUILDHGT HINES3A 24.00 24.00 24.00 24.00 24.00 24.00
SO BUILDWID HINES3A 12.40 15.78 18.68 21.01 22.71 23.71
SO BUILDWID HINES3A 23.99 23.55 22.39 23.55 23.99 23.71
SO BUILDWID HINES3A 22.71 21.01 18.68 15.78 12.40 8.64

SO BUILDWID HINES3A	12.40	15.78	18.68	21.01	22.71	23.71
SO BUILDWID HINES3A	23.99	23.55	22.39	23.55	23.99	23.71
SO BUILDWID HINES3A	22.71	21.01	18.68	15.78	12.40	8.64
SO BUILDHGT HINES3B	24.00	24.00	24.00	24.00	24.00	24.00
SO BUILDHGT HINES3B	24.00	24.00	24.00	24.00	24.00	24.00
SO BUILDHGT HINES3B	24.00	24.00	24.00	24.00	24.00	24.00
SO BUILDHGT HINES3B	24.00	24.00	24.00	24.00	24.00	24.00
SO BUILDHGT HINES3B	24.00	24.00	24.00	24.00	24.00	24.00
SO BUILDHGT HINES3B	24.00	24.00	24.00	24.00	24.00	24.00
SO BUILDWID HINES3B	12.39	15.77	18.67	21.00	22.70	23.71
SO BUILDWID HINES3B	23.99	23.55	22.39	23.55	23.99	23.71
SO BUILDWID HINES3B	22.71	21.00	18.67	15.77	12.39	8.63
SO BUILDWID HINES3B	12.39	15.77	18.67	21.00	22.70	23.71
SO BUILDWID HINES3B	23.99	23.55	22.39	23.55	23.99	23.71
SO BUILDWID HINES3B	22.71	21.00	18.67	15.77	12.39	8.63

APPENDIX D

Table D-1. Maximum Pollutant Concentrations Predicted for One Combustion Turbine in Combined Cycle Operation Firing Natural Fuel and Distillate Fuel Oil
Based on Modeled Generic Emission Rate

	Maximum Emission Rates (lb/hr) by Operating Load and Air Temperature										Maximum Predicted Concentrations (ug/m³) by Operating Load and Air Temperature (1)								
	Base Load			80% Load			60% (NG) /65% Load(FO)			Averaging	Base Load			80% Load			60% (NG) /65% Load(FO)		
Pollutant	20°F	59°F	90°F(NG)/ 105°F (FO)	20°F	59°F	90°F(NG)/ 105°F (FO)	20°F	59°F	90°F(NG)/ 105°F (FO)	Time	20°F	59°F	90°F(NG)/ 105°F (FO)	20°F	59°F	90°F(NG)/ 105°F (FO)	20°F	59°F	90°F(NG)/ 105°F (FO)
Natural Gas																			
Generic (10 g/s)	79.37	79.37	79.37	79.37	79.37	79.37	79.37	79.37	79.37	Annual	0.1242	0.1350	0.1456	0.1407	0.1494	0.1614	0.1871	0.1963	0.2065
										24-Hour	2.2174	2.4209	2.6103	2.5221	2.6835	2.8574	3.2016	3.3437	3.4683
										8-Hour	4.7269	5.1214	5.4855	5.3163	5.6255	5.9564	6.6051	6.8708	7.1701
										3-Hour	9.3077	10.1234	10.8782	10.5273	11.1687	11.8562	13.2072	13.7613	14.2452
										1-Hour	15.9973	16.9928	17.8914	17.4763	18.2320	19.0268	20.5467	21.1554	21.6804
SO_2	5.6	5.1	4.8	4.3	4.3	4.0	3.8	3.6	3.3	Annual	0.00881	0.00871	0.00876	0.00762	0.00808	0.00808	0.00889	0.00886	0.00857
										24-Hour	0.1573	0.1562	0.1570	0.1367	0.1452	0.1430	0.1520	0.1509	0.1440
										3-Hour	0.660	0.653	0.654	0.571	0.604	0.593	0.627	0.621	0.592
PM10	8.5	7.9	7.2	7.5	7.1	6.3	6.1	5.8	5.5	Annual	0.0132	0.0134	0.0132	0.0133	0.0133	0.0129	0.0143	0.0144	0.0143
										24-Hour	0.2364	0.2396	0.2363	0.2379	0.2396	0.2275	0.2452	0.2460	0.2395
NO_x	25.0	23.1	21.2	20.6	19.1	17.7	16.8	15.9	14.6	Annual	0.039	0.039	0.039	0.037	0.036	0.036	0.040	0.039	0.038
CO	46.0	42.0	37.0	38.0	35.0	33.0	154.0	146.0	134.0	8-Hour	2.74	2.71	2.56	2.55	2.48	2.48	12.82	12.64	12.11
										1-Hour	9.27	8.99	8.34	8.37	8.04	7.91	39.87	38.92	36.61
Distillate Fuel Oil																			
Generic (10 g/s)	79.37	79.37	79.37	79.37	79.37	79.37	79.37	79.37	79.37	Annual	0.0704	0.0737	0.0839	0.0712	0.0760	0.0872	0.0795	0.0844	0.0922
										24-Hour	1.5221	1.6108	1.8741	1.5438	1.6693	1.9441	1.7555	1.8879	2.0782
										8-Hour	3.3258	3.5043	4.0286	3.3694	3.6215	4.1668	3.7933	4.0558	4.4300
										3-Hour	6.4214	6.7851	7.8577	6.5102	7.0243	8.1413	7.3757	7.9135	8.6827
										1-Hour	12.0110	12.5090	13.9334	12.1334	12.8322	14.2999	13.3011	14.0058	14.9889
SO_2	105.60	97.13	86.00	85.60	79.36	71.03 #	72.00	68.00	62.00	Annual	0.094	0.090	0.091	0.077	0.076	0.078	0.072	0.072	0.072
										24-Hour	2.03	1.97	2.03	1.67	1.67	1.74	1.59	1.62	1.62
										3-Hour	8.54	8.30	8.51	7.02	7.02	7.29	6.69	6.78	6.78
PM10	64.8	59.6	52.5	52.4	48.6	44.3	43.5	40.9	37.2	Annual	0.0574	0.0554	0.0555	0.0470	0.0465	0.0487	0.0435	0.0435	0.0432
										24-Hour	1.242	1.210	1.240	1.018	1.022	1.086	0.962	0.974	0.974
NO_x	116.9	109.4	96.7	96.6	89.4	80.0	81.2	76.0	69.3	Annual	0.104	0.102	0.102	0.087	0.086	0.088	0.081	0.081	0.081
CO	112.0	106.0	91.0	111.0	103.0	89.0	101.0	94.0	86.0	8-Hour	4.69	4.68	4.62	4.71	4.70	4.67	4.83	4.80	4.80
										1-Hour	16.95	16.71	15.98	16.97	16.65	16.04	16.93	16.59	16.24

Note: NG= natural gas; FO= fuel oil

(1) Concentrations are based on highest predicted concentrations using five years of meteorological for 1991 to 1995 of surface and upper air data from the National Weather Service stations at Tampa International Airport and Ruskin, respectively.

Pollutant concentrations were based on a modeled or generic concentration predicted using a modeled emission rate of 79.37 lb/hr (10 g/s). Specific pollutant concentrations were estimated by multiplying the modeled concentration (at 10 g/s) by the ratio of the specific pollutant emission rate to the modeled emission rate of 10 g/s.

Table D-2. Maximum Pollutant Concentrations Predicted for Two Combined-Cycle Combustion Turbines Firing Natural Gas and Distillate Fuel Oil by Operating Load and Inlet Ambient Temperature

Pollutant	Averaging Time	Maximum Predicted Concentrations (ug/m^3) by Operating Load and Air Temperature (1)								
		Base Load			80% Load			60% (NG) /65% Load(FO)		
		20°F	59°F	90°F(NG)/ 105°F (FO)	20°F	59°F	90°F(NG)/ 105°F (FO)	20°F	59°F	90°F(NG)/ 105°F (FO)
Natural Gas										
SO_2	Annual	0.018	0.017	0.018	0.015	0.016	0.016	0.018	0.018	0.017
	24-Hour	0.315	0.312	0.314	0.273	0.290	0.286	0.304	0.302	0.288
	3-Hour	1.32	1.31	1.31	1.14	1.21	1.19	1.25	1.24	1.18
PM10	Annual	0.0265	0.0267	0.0264	0.0265	0.0267	0.0257	0.0287	0.0289	0.0285
	24-Hour	0.473	0.479	0.473	0.476	0.479	0.455	0.490	0.492	0.479
NO_x	Annual	0.078	0.079	0.078	0.073	0.072	0.072	0.079	0.079	0.076
CO	8-Hour	5.48	5.42	5.11	5.09	4.96	4.95	25.6	25.3	24.2
	1-Hour	18.5	18.0	16.7	16.7	16.1	15.8	80	78	73
Distillate Fuel Oil										
SO_2	Annual	0.187	0.180	0.182	0.154	0.152	0.156	0.144	0.145	0.144
	24-Hour	4.05	3.94	4.06	3.33	3.34	3.48	3.19	3.24	3.25
	3-Hour	17.1	16.6	17.0	14.0	14.0	14.6	13.4	13.6	13.6
PM10	Annual	0.115	0.111	0.111	0.0940	0.0930	0.0975	0.0871	0.0871	0.0864
	24-Hour	2.48	2.42	2.48	2.04	2.04	2.17	1.92	1.95	1.95
NO_x	Annual	0.21	0.20	0.20	0.17	0.17	0.18	0.16	0.16	0.16
CO	8-Hour	9.39	9.36	9.24	9.42	9.40	9.3	9.7	9.6	9.6
	1-Hour	33.9	33.4	32.0	33.9	33.3	32.1	33.9	33.2	32.5

Note: NG= natural gas; FO= fuel oil

(1) Concentrations are based on highest predicted concentrations using five years of meteorological for 1991 to 1995 of surface and upper air data from the National Weather Service stations at Tampa International Airport and Ruskin, respectively.

Table D-3. Summary of Maximum Pollutant Concentrations Predicted for Two Combined-Cycle Combustion Turbines Compared to the EPA Class II Significant Impact Levels, PSD Class II Increments, and AAQS

Pollutant	Averaging Time	Maximum Concentration (ug/m3)			EPA Class II Significant Impact Levels (ug/m^3)	PSD Class II Increments (ug/m^3)	AAQS (ug/m^3)
		Natural Gas	Fuel Oil	Natural Gas/ Fuel Oil Annual (1)			
SO_2	Annual	0.018	0.19	0.037	1	25	60
	24-Hour	0.31	4.1	NA	5	91	260
	3-Hour	1.3	17.1	NA	25	512	1,300
PM10	Annual	0.029	0.11	0.039	1	17	50
	24-Hour	0.49	2.5	NA	5	30	150
NO_x	Annual	0.079	0.21	0.094	1	25	100
CO	8-Hour	25.6	9.7	NA	500	NA	10,000
	1-Hour	80	33.9	NA	2,000	NA	40,000

NA= not applicable

(1) Based on firing natural gas and fuel oil for the following hours:

Natural gas	7,760 hours
Fuel Oil	1,000 hours
	8,760 hours

10.1.6 Coastal Zone Management Certification

There are no federal licenses, permits or activities required for Power Block 3 that are subject to federal consistency review and affect land or water use. This section is therefore not applicable.

10.2 ZONING DESCRIPTIONS

Zoning was addressed as part of the 1994 Certification preceding; therefore, this section is not applicable. For further information, refer to Section 10.2 of the 1992 SCA.

10.3 LAND USE DESCRIPTION

Land use was addressed as part of the 1994 Certification preceding; therefore, this section is not applicable. For further information, refer to Section 10.3 of the 1992 SCA.

10.4 EXISTING STATE PERMITS OR APPLICATIONS

Per DEP Siting guidelines, this section is not required for supplemental application submissions. State permits or certifications which are applicable to the Hines Energy Complex will be made available upon request.

10.5 MONITORING PROGRAMS

No additional monitoring above that previously conducted, or on going because of the initial certification of the site for full buildout is anticipated to be conducted in conjunction with Power Block 3.